

REPORT OF THE WORKING GROUP ON CEMENT INDUSTRY FOR XII FIVE YEAR PLAN (2012-17)



सत्यमेव जयते

**DEPARTMENT OF INDUSTRIAL POLICY AND PROMOTION
MINISTRY OF COMMERCE AND INDUSTRY
(DECEMBER 2011)**

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Secretary to the Government of India

PREFACE

A Working Group on Cement Industry for the Twelfth Five Year Plan was constituted by the Planning commission vide Notification No. I & M – 3 (7) / 2011 dated 29th April 2011, under the Chairmanship of the Secretary, Department of Industrial Policy and Promotion. The Working Group had representatives from Planning commission, Ministries of Urban Development, Housing and Poverty Alleviation, Rural Development, Coal, Shipping, Road Transport & Highways, Indian Bureau of Mines, Industrial Development Bank of India, National Council for Applied Economic Research, Railway Board, Cement Manufacturer's Association, Indian Institute of Technology, Delhi; National Council for Cement and Building Materials, All India Mini Cement Manufacturers' Association, Central Building Research Institute, Central Road Research Institute, Federation of Indian Chamber of Commerce & Industry and Confederation of Indian Industry.

2. As decided in the first meeting of the Working Group held on 19th May 2011, the following sub-groups were constituted to look into the various aspects of the Cement Industry.

Sub Group I : Macro overview of Cement Industry and Measures for Demand Stimulation in Housing, Infrastructure and Concrete Roads.

Sub Group II : Productivity, Technology, Environment, Sustainability, Standards, Skill Development and Research and Development (R&D)

Sub Group III : Taxes and Capital Funding

Sub Group IV : Logistics including Railways and Issues related to Raw Materials, Fuel, Fly ash, Minerals Rights and Land Acquisition.

3. The Chairman and Members of the Sub Groups were from the Cement Industry, Government Departments and Certain Specialized Institutions. The Sub-Groups examined the various related issues in detail and put up their specific findings and recommendations for the consideration of the Working Group.

4. The Working Group finalized the report after detailed deliberations on all the aspects of the Cement Industry.

5. I would like to place on record my appreciation for the efforts put in by the Chairpersons and Members of the different Sub-Groups in the preparation of this report. I believe the report would help the policy makers significantly in framing the guidelines for the growth of the Cement sector during the 12th Five Year Plan.

P. K. Chaudhery
Chairman, Working Group
on cement industry for the XII Plan

Dated: December, 2011
New Delhi

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EXECUTIVE SUMMARY
FINDINGS AND RECOMMENDATIONS

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FINDINGS AND RECOMMENDATIONS

INTRODUCTION

Overview of Cement Industry

1. Global Cement Production has continued to be expanding at an average rate of 6.4% in the last five years from 2568 million tonnes in 2006 to 3294 million tonnes in 2010. Around 56% of production originates in China. China (with an average annual growth of 11.4%) and India (with an average annual growth of 9.8%) have been the drivers of the growth in global cement output.
2. India is the second largest cement producer in world after China. Except India and China, other major producers are in the range of 45 - 65 million tonnes production (as against 52 - 86 million tonnes in 2008).
3. Today cement industry comprises of 183 large cement plants and more than 360 mini cement plants. Large producers contribute about 97% to the installed capacity while mini plants account for the rest. Among these, 98% of the capacity is in the private sector and the rest in public sector.
4. The turnover of the cement industry has been estimated at US \$ 25 billion in 2010-11. The installed capacity has increased at a compound annual growth rate (CAGR) of 8.8 percent during 2001-2011 and matched the growth in production, which averaged 8.7 per cent. However, during the last five years (2006 – 2011), while installed capacity increased at an average annual rate of 13.6 per cent, production witnessed an increase of 9.1 per cent during this period.
5. Total capacity that is expected to be created / commissioned at the end of Eleventh Five Year Plan by 2011-12 is 331 million tonnes, about 10 per cent higher than the plan target. Since there has been a moderation in GDP growth and the demand for cement, particularly in 2009 - 2012, this additional capacity was reflected in lower capacity utilization. Capacity utilization came down from 94% during 2006 - 07 and to 88% during 2008 - 09 and further to 84 % during 2009 - 10 and is expected at around 75% now on account of higher capacity and lower demand.
6. Cement being a low value high volume output has a very limited international trade. In 2010, international trade was 151 million tonnes and just 5% of the

global cement output. Bangladesh, Nigeria, USA, Iraq, Afghanistan and Singapore were the major importers. The major exporting countries of cement were Turkey, China, Thailand, Japan, Pakistan, Germany and India.

7. The modern Indian cement plants are comparable with state-of-the-art plants elsewhere in the world. The average installed capacity per plant is 1.7 MTPA as compared to more than 2.1 MTPA in Japan.
8. The industry's average energy consumption is estimated to be about 725 kcal/kg clinker thermal energy and 80 kWh/t cement electrical energy. The best thermal and electrical energy consumption presently achieved by the Indian cement industry is about 667 kcal/kg clinker and 67 kWh/t cement which are comparable to the best reported figures of 660 kcal/kg clinker and 65 kWh/t cement in a developed country like Japan.
9. Ministry of Environment and Forests has notified the emission standards for cement plants in the year 1987, which was subsequently revised in February, 2006. In India, the permissible stack dust emissions from various sources for existing cement plants is 150 mg/Nm³ and 100 mg/Nm³ for plants located in critically polluted areas. However, the limit for new plants in our country is 50 mg/Nm³ which is at par with some of the developed countries. All large plants have provided necessary air pollution control equipments to control dust emissions.
10. Cement plants in India utilized about 27 % of fly ash generated by thermal power plants and almost all the granulated slag generated by steel plants in 2010 - 11.
11. The R&D expenditure in India as a percentage of Gross Domestic Product (GDP) is around 0.8% which is one of the lowest as compared to most of the developed countries, which spend between 1.23% to 3% of their GDP on research and development.

Constitution of Working Group for Cement Industry for 12th Five Year Plan

12. Keeping in view the need to identify the various issues and formulation of recommendations for achieving the projected targets related to the industry and to focus on bringing out programs and their financial implications, a working group on cement industry for 12th Five Year Plan was constituted by the Planning Commission. It was also expected that the report will also indicate milestones to be achieved during the 12th Plan period. Accordingly, the Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry constituted following four Sub Groups comprising of

representatives from various Ministries/Govt. Departments, Industry Representatives, R&D Institutions, Industry Associations etc. :

Sub-Group-I : Macro Overview of Cement Industry and Measures for Demand Stimulation in Housing, Infrastructure and Concrete Roads

Sub-Group-II : Productivity, Technology, Environment, Sustainability, Standards, Skill Development and Research and Development (R&D)

Sub-Group-III : Taxes and Capital Funding

Sub-Group-IV : Logistics including Railways and Issues related to Raw Materials, Fuel, Fly ash, Minerals Rights and Land Acquisition

Terms of Reference and composition of the Working Group for 12th Five Year Plan

13. The terms of reference and composition of the working group constituted by the Planning Commission vide office order no: I&M-3(7)/2011 (Industry Division) dated 29th April 2011 (see **Annexure – 1**).

Terms of Reference and composition of Sub Groups

14. The Four Sub Groups constituted by Department of Industrial Policy and Promotion (DIPP) vide their Office Order No. 5(7)/2011-Cement dated 17th June, 2011 as decided in the First meeting of the Working Group held on 19th May, 2011 (see **Annexure – 2**),
 - a. The Sub Groups were expected to look into the various aspects of the industry and to make suitable findings and recommendations in the above areas for achieving the targets during 12th Five Year Plan period.
 - b. The Sub Groups deliberated upon the present status, various issues, projected targets to be achieved during 12th Plan as per the terms of reference and finalized their findings and recommendations for consideration of the Working Group.
 - c. The findings and recommendations made by various Sub Groups in their

Reports have been consolidated and are listed in the subsequent para's group-wise:

I. MACRO OVERVIEW OF CEMENT INDUSTRY AND MEASURES FOR DEMAND STIMULATION IN HOUSING, INFRASTRUCTURE AND CONCRETE ROADS

Future Projections

15. The Government of India plans to increase its investment in infrastructure to US \$ 1 trillion in the Twelfth Five Year Plan (2012-17) as compared to US \$ 514 billion expected to be spent on infrastructure development under the Eleventh Five Year Plan (2007-12). Further, infrastructure projects such as the dedicated freight corridors, upgraded and new airports and ports are expected to enhance the scale of economic activity, leading to a substantial increase in cement demand. Housing sector and road also provide significant opportunities. The cement demand is likely to be sensitive to the growth in these sectors and also the policy initiatives. Further, capacity addition in cement would continue to preferably front loaded. It may be desirable to create some excess capacity rather than operating with shortages or supply bottlenecks.

Additional Capacity Requirement

16. In view of the demand and installed capacity growth projections, the additional installed capacity requirement during the next 15 years (up to 2027) would be approx. 1035 million tonnes as indicated below:

Table: Additional Capacity Creation

(in million tonnes)

Ending March	Base Line	Base line+ Concrete Roads	Base line+ Roads+ Housing	Base line+ Road+ Housing+ Fiscal Support	Cumulative Capacity Creation			
					1	2	3	4
Scenario	1	2	3	4				
2012	12.9	12.9	12.9	12.9				
2013	13.4	13.4	13.4	13.4	10.0	10.0	10.0	10.0
2014	13.5	20.2	23.6	25.3	23.5	30.2	33.6	35.3
2015	23.0	27.1	29.1	30.2	46.5	57.3	62.7	65.5
2016	27.2	31.8	34.3	35.5	73.7	89.1	97.0	101.0
2017	29.2	34.5	37.3	38.7	102.9	123.7	134.3	139.7
2022	249.8	295.1	319.5	332.1	352.7	418.7	453.8	471.9
2027	391.7	484.0	535.9	563.4	744.4	902.7	989.7	1035.3

Note - For 2017-22 and 2022-27, the next two Five Year Plans, GDP growth is assumed at 10 per cent, which results an increase in growth.

Export

17. For encouraging exports, it may be desirable to consider:

- a. Classification of cement for rail freight is reduced from 150 as of today to 140. Differential classification of goods for domestic and export purposes is already in vogue for iron ore, where transportation for export purposes attracts a higher classification. In case of cement, the classification for export purposes is proposed to be reduced.
- b. The royalty paid on lime stone should be neutralized for export of cement. This is consistent with the approach that domestic taxes are not exported

Mini Cement Plants

18. Since the cement production is an energy intensive process with very high emission, it has to use state of art equipment to have energy efficiency and meet environmental standards. It may, therefore, be desirable not to have any separate strategy for the mini cement plants.

Support to Cement Industry

19. Stimulus to the sectors which are major users of cement

- a. Fiscal support to housing and roads could accelerate the demand for cement quite substantially. Given the housing shortages in rural and urban areas and given the increase in the cost of affordable house income tax relief for the interest paid on the house building loans may be extended from Rs 1.5 lakh to Rs. 4 lakh per annum.
- b. With a view to creating a world-class road infrastructure in the country for the rapid and inclusive growth of the economy, the Working Group recommends that:
 - i) All new expansions in the National and State Highways may be made of cement concrete as a Policy. To begin with, this percentage could be 30% of the total allocations.
 - ii) All existing bitumen National and State Highways where strengthening is required should be replaced with concrete surface, by adopting the technology of concrete overlays, popularly known as White Topping.

- iii) Use of PPC may be made mandatory in the construction of roads as a policy not only for National and State Highways but also in the construction of roads by all agencies including CPWD, State PWDs etc. This has already been permitted by the Indian Roads Congress (IRC).
- iv) All existing city roads having bitumen surface be converted gradually to cement concrete and new ones should preferably be constructed with cement concrete technology.
- v) All connecting roads in villages must be done with cement concrete technology.

20. Addressing the excise (CENVAT) duty structure for cement

- a. Cement is highly taxed commodity in India. The overall rate of tax on cement was estimated to 30% compared to 19% in China and almost negligible in Thailand. Therefore tax burden on cement industry be lowered suitably.
- b. Excise duty on cement is currently being levied at mixed rates i.e. ad-valorem (on transaction value) plus specific (specific rate to be charged on the basis of MRP).
- c. Levy of Excise Duty on Cement should be simplified i.e. specific rate or as a per cent to Retail Sale Price with suitable abatement as is available in other commodities.
- d. There is no import duty for import of Cement into the country. This tax anomaly puts domestic manufacturers at a disadvantage. Thus such differences in tax treatment need to be removed to offer a level playing field to domestic production vis-à-vis imports. The import of cement should also be with a duty of 5 per cent along with the applicable CVD.

II. PRODUCTIVITY, TECHNOLOGY, ENVIRONMENT, SUSTAINABILITY, STANDARDS, SKILL DEVELOPMENT, RESEARCH AND DEVELOPMENT IN CEMENT INDUSTRY

Technology Status

- 21. Although the modern cement plants have incorporated the latest technology, yet there is scope for further improvement in the areas of in-pit crushing and conveying, pipe conveyors, co-processing of waste derived / hazardous

combustible wastes as fuel, neurofuzzy expert system, cogeneration of power, multi chamber/dome silos, bulk transport of cement, palletizing and shrink wrapping for packing & despatch.

Technology Up-gradation of inefficient plants

22. Technology up-gradation measures for the Pre-1990 era cement plants would result in :

a.	Increase in capacity	:	25-30 MTPA
b.	Reduction in thermal energy consumption	:	15-20 kcal/kg clinker
c.	Reduction in electrical energy consumption	:	5-10 units/t
d.	Reduction in cost of production of cement	:	5-10% because of above initiatives
e.	Reduction in energy costs through co-processing	:	10-15%
f.	Reduction in the CO ₂ emissions (Through blended cements and energy conservation)	:	20%

23. This will entail an investment of Rs.6000 crores for technology up-gradation and capacity increase.

Energy

24. The industry's average energy consumption is estimated to be about 725 kcal/kg clinker thermal energy and 80 kWh/t cement electrical energy. It is expected that the industry's average thermal energy consumption by the end of XIIth Plan (Year 2016 - 17) will come down to about 710 kcal/kg clinker and the average electrical energy consumption will come down to 78 kWh/t cement with continued efforts by all concerned.

Alternate Energy Sources

25. The following fuels are considered to have good potential in the present context of Indian economics to either partially or fully substitute coal in cement manufacture in the coming years:
- Pet coke
 - Lignite
 - Natural gas
 - Bio-mass wastes including fruit of Jatropha Carcus, Pongamia and Algae.

26. The cement industry in India has the potential to utilize the entire hazardous waste generation of the country, if found suitable. For co-processing, following support is required:
 - a. A cement plant which fulfils the co-processing prequalification criteria should be issued a permit to co-process all types of waste, while remaining within maximum permissible emission norms.
 - b. Cement plants should be permitted to move waste from other states with minimum restrictions if they are following standing guidelines.
27. Ministry of Environment and Forests (MoEF) should formulate guidelines for:
 - a. Implementing the principle of 'Polluter to pay' for disposal of wastes.
 - b. Treatment, storage and disposal facilities for cost effective co-processing of combustible industrial wastes in cement kilns as an alternative to incineration.

Cogeneration of Power through Waste Heat Recovery

28. This technology has a very high potential to utilize waste heat to generate power and thus resulting in significant energy savings as well as reduction in equivalent carbon dioxide emissions. The total industry potential may be to the tune of more than 600 MW through cogeneration.
29. Large-scale adoption of this technology will, however, require suitable government schemes of incentives including capital subsidy and tax exemption. Moreover, this technology should be granted 'Renewable Energy' status for issuance of RE certificates.

Environmental issues and Pollution Control

National Clean Energy Fund

30. For creating a National Clean Energy Fund, an energy cess has been levied on coal and lignite produced and imported at the rate of Rs.50 per tonne. The coal consumption in Indian Cement Industry is about 4.5% of the total coal consumption in India. The funding from this corpus for cement sector may be provided on following account: Modernization of cement plants, alternate fuels - used tyres, biomass, hazardous waste, municipal solid waste, CETP sludge etc., renewable energy - wind, solar energy, carbon sequestration, projects related to GHG reduction measures etc.

Use of Industrial Wastes

31. Cement plants in India utilized about 27% of fly ash generated by thermal power plants and almost all the granulated slag generated by steel plants in 2010-11. Fly ash activation by chemical, thermal and mechanical means shall result in utilization of non conforming fly ashes as well as increased utilization of conforming fly ashes.
32. Portland Limestone Cement (PLC's) and multi-component blends are being produced at various plants across the American and European Countries. PLC's have strong positive environmental credentials. Up to 35% limestone addition is allowed in PLC's in Europe. This cement type is accounted for more than 40% of the European cement market. These cements have not been produced in Indian cement industries because there is no IS specification for Portland limestone cement in the country which needs to be looked into.
33. Development of Indian standards for Composite cements by BIS would be helpful in enhancing the sustainability of cement industry.

Nano Technology

34. The application of nanotechnology to cement and concrete is expected to result in development of eco-friendly, high performance cements/ binders and concrete with improved durability characteristics. R&D efforts to develop new technologies and improved cements and concrete based on nanotechnology need to be further strengthened in India.

Research and Development

35. Following Thrust Areas of R&D have been identified for taking up specific projects:
 - a. Research for newer methods of manufacturing such as application of Nanotechnology to cement and concrete.
 - b. Synthesis/ generation of nano-particles and investigations on their role in improving cement and concrete performance.
 - c. Investigations on cement nano-composites
 - d. Investigations for geo-polymeric cements, Portland Limestone Cement
 - e. Improved Refractory engineering practices
 - f. Bench marking of quality parameters in Indian Cement Industry.
 - g. Processing of fly ash for enhanced use in cement/concrete.
 - h. R & D work to identify new pozzolanic materials for use as additives in cement.

- i. Multi modal transportation of cement including bulk transportation.
 - j. Development of cost effective model housing for urban and rural areas.
 - k. Development and finalization of standards for composite cement for utilizing all types of pozzolanic materials to clinker for cement making.
 - l. R & D studies for reduction of green house gases (GHG's) in cement manufacture such as adaptation of best available Technology for reduction of NO_x and SO₂; and sequestration of carbon-dioxide in Algae culture.
 - m. R & D studies for use of Alternate Source of Energy/ fuels and raw materials.
 - n. Studies for exploration / identification of new limestone reserves for Greenfield Cement plants and up-gradation of low grade limestone and mines rejects for cement manufacture.
 - o. Use of high performance concrete to enhance durability and reduce use of cement and other materials.
36. The R&D expenditure in India as a percentage of Gross Domestic Product (GDP) is around 0.8%. However for a comparison, most of the developed countries spend between 1.23% to 3% of their GDP on research and development.
37. The cement cess collected for R&D purposes from cement plants is partially allocated by the government. This gap in the capital investment on R&D needs to be bridged because R&D can bring manifold returns to the industry and is important for a sustainable development.
38. The NCCBM being primarily an R&D organization would need additional infrastructure like buildings, equipment facilities in laboratories as well as for in-plant studies and manpower. Being a non-profit service provider, NCCBM will require enhanced annual grant to the extent of Rs 30 crores (total Rs. 150 crores for five years by the end of XII Plan) for meeting part of its revenue expenditure. In addition, a capital investment of about Rs. 60 crores has also to be made during the XII Plan under plan grant.
39. There is a need for creating facilities for R&D in cement plant machinery design at national level and to evolve appropriate mechanisms for transfer of technologies to the industry whether developed indigenously or imported.
40. There is a need for creating capabilities for manufacture of cement plant machinery indigenously.

Skill Development

41. To attain the targeted capacity addition, the industry would require 66000 additional technical personnel, including 23000 engineers & supervisors by the end of the XII plan period. Adequate training facilities need to be created to cater to the above requirement.

III. CAPITAL FUNDING AND TAXATION

Capital funding required for increasing the production during 12th plan

42. The Capital Investment during the 12th Five Year Plan (2012-2017) is thus estimated as under: -

Particulars	Base Line	Base line+ Roads	Base line+ Roads+ Housing	Base line+ Road+ Housing+ Fiscal Support
Additional Capacity (MTPA)	119.2	139.9	150.6	156
Capital Cost	71520	83940	90360	93600
<i>Of which Debt</i>	47680	55960	60240	62400
<i>Equity</i>	23840	27980	30120	31200

43. The following measures are suggested to meet the funding requirements:
- Cement is a necessary constituent of infrastructure development and a key raw material for the construction industry. It may be worthwhile to consider according infrastructure status to the industry.
 - The low capacity utilizations and high interest rates have forced the players to defer their expansion plans. To meet the requirements, concessional funding is required to attract investments till the interest rates stabilize. The industry may be given interest subvention to enable raising debt at 10% per annum for the next 2 years.
 - Special dispensation may be given to the Industry for raising ECBs.
 - There is a need for suitable policy formulation for increased Foreign Direct Investment (FDI) in the sector.

Export of Cement/Clinker

44. To make the Indian Cement/Clinker competitive in the International Market and with a view to giving afresh boost to the Export of Cement and Clinker it is recommended that:
- a. To enhance global competitiveness of Indian cement producer, 50% freight subsidy may be considered for cement/clinker logistic cost up to the port/jetty from the manufacturing unit, as most plants are located in hinterland.
 - b. As of now, Cement /clinker export is subject to high customs/port/bunker charges. Exemption from these charges will give a fillip for exports.
 - c. Investment in private jetties / ports for export of cement / clinker result in de-congesting our National ports. Therefore, the investments made for the creation of such assets should be allowed a higher rate of depreciation.
 - d. Royalty on Limestone be included as part of Drawback.
45. Limestone is the main raw material for manufacturing Cement Clinker. Royalty on Limestone is one of the levies for which credit is not allowed at present. This results in cascading effect as various taxes get levied on this element also at every stage and as a result, the ultimate burden of taxes is increased. The Govt. has already acknowledged that levies and duties should not be exported. In line with this principle, it is recommended that the Government may consider to include the element of royalty in the calculation of Drawback rates. It may be pointed out that royalty on limestone alone constitutes around 3.5% of cement value and 5% of clinker value. Inclusion of the same in Drawback rates would go a long way in encouraging international competitiveness for the Indian Cement Industry or alternatively exemption from Royalty on Limestone may be allowed on the Cement/Clinker manufacture for export.

Taxes/Levies on Cement

Excise Duty on Cement

46. To encourage cement industry and bring it at par with other core and infrastructure industries, it is necessary to rationalize the excise duty rate from 10% to 6 - 8%

VAT

47. Two major materials needed for construction of any infrastructure are Cement and Steel. However, the rate of VAT charged on Cement and Steel differs vastly. While VAT on Steel is only 4%, it is charged @ 12.5% even up to 15% in some of the States on Cement and Clinker.
48. Current rate of VAT on cement and clinker, be brought in line with similar important construction material like Steel at 4%. This would make cement more affordable

Zero Import Duty on Coal, Pet Coke, & Other inputs

49. Import Duty on Coal, Pet Coke and Gypsum be abolished to be in line with the established principle that “Import Duty on Inputs should not be higher than on the finished product.” Further it is also recommended that Cenvat Credit be allowed on Clean Energy Cess.

Electricity Duty and Water Cess

- 50.. Electricity Duty & Water Cess be withdrawn.

IV LOGISTICS INCLUDING RAILWAYS AND ISSUES RELATED TO RAW MATERIALS, FUEL, FLY ASH, MINERALS RIGHTS AND LAND ACQUISITION

Logistics – Rail Transport

Cement

51. Railways should target attaining minimum 50% share of the total dispatches of cement and clinker.
52. **Wagon Supply Agreement** - Railways should enter into annual agreements with cement manufacturers where it should commit to certain number of month-wise supplies of wagons during the year.
53. **On demand availability of two point and three point combinations of rakes:** This facility shall help cement companies wherein single rake can be used to service two-three markets (especially with the deployment of larger tonnage capacity Bogey Covered New Metric High Axle Load (BCNHL) wagons carrying 4000 tonnes in comparison to 2300 tonnes capacity of regular BCN wagon rakes).

53. **Resolution of Operational Problems**

- a. **Revising downward the loading capacity of BCNHL wagons from 68 tonnes to 62 tonnes:** Since loading of 68 tonnes is technically neither practical nor feasible. The Railway, therefore, needs to find possible solutions with the help of technical experts to enable full loading of wagons to their stated capacity. Till such time the solution is found, realistic carrying capacity of 62 tonnes per wagon be permitted due to safety reasons of the labours also.
- b. **Permitting Additional free time for loading/unloading of BCNHL rakes** - In comparison to regular BCN rakes, BCNHL rakes have larger number of wagons and thus have higher tonnage loading capacity. Thus it is proposed that the free loading/unloading time for BCNHL wagons be increased from current 9 hrs to 13 hrs.

54. **Clinker**

- a. Long-term contract at concessional rates for Clinker Movement
- b. Development of special infrastructures for Clinker handling at Rail terminals

55. **Railway Terminal**

- a. Development of new Goods sheds outside of major cities
- b. Infrastructure facilities at Terminals and Goods Sheds handling cement be created of world class standard like approach roads, platforms, lights etc. for faster evacuation of materials and thereby turn round of wagons.

56. **Policy Matters**

- a. Incentive Policies should not be framed only for incremental traffic, retention of traffic is equally important.
- b. Consistency in Policy: The duration of policy for various schemes announced by Railways from time to time should be at least for 3-5 years to make them consistent
- c. Need for Customer Friendly Private Wagon Procurement

- d. Railway must ensure that the policies announced by them should be simple, clear and transparent to avoid any chances of their misinterpretation at zonal / field levels.
- e. Bulk movement of cement and fly ash be encouraged through a conscious policy.

Need for Establishment of a Regulatory Mechanism

- 57. A suitable Rail Traffic Regulatory Mechanism may be established to resolve all rail matters including tariff and demurrages. Such a mechanism shall help in removing distortion and in evolving tariff on a sound economic basis.

Logistics - Road Transport

Increasing load carrying capacity of Trucks:

- 58. Due to the Multi-axle feature of new generation trucks, the carrying capacity of trucks has increased significantly. Also the multi-axle feature reduces the wear and tear impact on roads due to its uniform load distribution ability.
- 59. Thus government needs to amend the Motor Vehicles Act to increase the loading capacity allowance of trucks and take into account the axle load of a truck to be 13 tonnes instead of the current 9 tonnes. This shall aid in adding economies and efficiencies to road transport of cement which remains the major share-bearer of cement transport.

Logistics - Inland Water-ways

- 60. Inland Water Transport (IWT) is a fuel efficient, environment friendly and cost effective mode of transport. Accordingly, the following aspects may be considered while formulating the policy / program for IWT promotion:
 - a. Necessary infrastructure needs to be created at the identified IWT terminals / jetties so as to integrate with other modes of transportations viz. Road and Rail.
 - b. Wherever cargo specific / mode specific concession is applicable, the same may be made for IWT at par with the other modes.
 - c. If the waterway passes through more than one State, taxes/cess/duties etc. needs to be rationalized and collected at a single point.

- d. Wherever Port-Hinterland connectivity exists through waterways, Multi-Modal transportation concept may be followed up to the Riverine Ports/terminals.
- e. Wherever waterway advantage exists, Ro-Ro facility may be encouraged to de-congest the cities (e.g. Kolkata, Mumbai etc.)

Limestone Availability for Future Growth

- 61. As per IBM data the Total cement grade Limestone Reserve available to meet the industry requirements is 89.86 Billion Tonnes. Based on the expected growth and consumption pattern, the current reserves are expected to last only for another 35 - 41 years.
- 62. There is a need to streamline and simplify the procedures related to limestone mining leases approval / renewal.
- 63. There is a need to provide incentives like lower royalty rate, excise rebate for usage of marginal and low grade limestone.
- 64. In order to ensure systematic mining operation for better recovery, there is need to integrate small mining leases in a limestone belt.
- 65. Strict compliance of three years should be ensured for setting up a cement plant after granting mining lease to discourage the merchant mining by the lease holders.
- 66. In order to encourage utilization of limestone deposits located in remote areas; there is a need to offer incentives like Road Freight subsidy, lower royalty/excise rates etc.
- 67. It is to be ensured that the systematic mining is carried out as per approved mining plan. The IBM guidelines, statutory provisions and latest technology has to be adopted for optimal utilization of available resources.

Fuel / Coal Requirement and Availability

- 68. **Coal Requirement:** The range of coal requirement for the cement industry during the different years of 12th plan period is assessed to be in the range of 63-96 million tonnes (46-70 million tonnes for cement production and 18-27 million tonnes for captive power).

69. **Increasing supply of coal under Linkage for Cement:** Post 2007, no new linkage has been granted to any cement manufacturer. Even in cases where linkage has been granted, actual supply against such linkages is poor. Thus, unless the linkage coal is quickly increased the fuel supply gap shall put upward pressure on cement production costs.
70. **Equal priority in grant of Coal linkage vis-a-vis other sectors:** Priority linkage needs to be provided for 100% requirement to all cement players at administrative price.
71. **Reserving sufficient coal blocks for cement industry:** Out of total coal reserve blocks, a proportion of high grade coal blocks should be reserved exclusively for cement sector keeping its current production capacity and future expansion into consideration.
72. In addition, the following observations/recommendations are made for the long term planning and availability of coal to cement sector:
73. The strategic plan of the Ministry of Coal reveals that the coal sector, inter alia, is currently facing the following challenges:
- a. Poor quality of thermal coal available in India, mostly E and F grade coal.
 - b. Inadequate extractable reserves of coking coal.
 - c. Low productivity in coal mines operated by CIL.
 - d. Coal sector is yet not truly open up for commercial mining.
 - e. Problems and constraints in underground mining – use of old technology and labour intensive processes for mining and safety issues.
73. The coal sector remains highly regulated under government control, is monopolistic in nature, faces mining and exploration bottlenecks, particularly in underground mining, has attracted low levels of private investments over the years, and faces logistical bottlenecks and technological obsolescence. As such, it is proposed that the possibilities of unbundling the various operations of the coal sector under a regulator with Public Private Partnership be seriously explored by revisiting the Coal Mines (Nationalisation) Act, 1973. This will enable private participation in a competitive manner in a regulated environment in areas which is their core competency. The various operations in the supply chain of coal such as mining and exploration, supply of mined coal and distribution and logistics can be unbundled for attracting technology and

investments by the private sector at various points in the value chain resulting in increase in efficiency and productivity.

74. The Mines and Minerals (Development and Regulation) Amendment Act provides for allocation of coal and lignite blocks through competitive bidding route. This was notified on 9.9.2010. As is the case with other minerals, it is imperative that the quality and quantity of coal deposits in a specified coal block placed for competitive bidding for captive use is determined with reasonable accuracy to avoid speculative bidding – whether the reserves are proven reserves, probabilistic reserves or inferred reserves as per acceptable international norms. The basis of bidding should provide complete information on mineral reserves after full exploration. It is, therefore, proposed that coal blocks should be placed for competitive bidding for captive use only after detailed exploration. This will help in avoiding speculative bidding because of incorrect initial valuations.
75. It is also recommended that all requisite clearances as may be practicable should be obtained by Coal India Ltd. before putting the Coal blocks for competitive bidding in order to streamline the process and reduce delays. This will also improve the realization from the bidding process as it will reduce the uncertainty about when the block can come into production.
76. **Coal Mining:** It is recommended that mining should be done in accordance with a pre-approved mining plan and a close monitoring of the mining activity throughout the mining period should be carried out through the deployment of latest technology.

Availability of Fly Ash to cement plants

- 77.. Information about fly ash generation, utilization and its stock be made public by the Ministry of Environment and Central Electricity Authority. At the same time it should also be made mandatory for each power plant to display complete information about the plant level ash generation, its stock and disposal at their respective websites including pricing if any on a regular basis.
78. Cement industry be exempted from MOEF notification of 3rd November 2009 which makes it mandatory for cement industry, having captive power plants to provide 20% of fly ash generated by them as free to the small brick / tile manufacturers within 100 Km vicinity of their plants, which otherwise would have been utilized by cement plants for their own consumption.
79. Railways to provide attractive Freight rebate for the entire life of the wagons if Industry is supposed to procure Special Purpose Wagons for movement of fly

ash and also to create necessary infrastructure facilities for unloading at their respective plants.

Land Acquisition

80. The On-Line availability of revenue / land records should be ensured.
81. The allotment of Govt. Land should also be prompt and the NOC from Gram Panchayat should be required, only in cases where it is essentially required like Charagah Land / Water Body etc.
82. Land conversion / diversion process should be made simple in some time bound manner for avoiding delay in execution of the projects.
83. In most of the cases there are encroachments on the Govt. land, hence, Government must ensure to provide peaceful possession of the land is allotted to a corporate / company.
85. Many times it is found that a road or electrical line of similar facility passes through the mining lease area which makes the use of mineral lying beneath such facility unusable. Therefore such facilities should be allowed to be shifted to some other suitable area, may be on cost to the company.

XXXXX

SUB-GROUP - I

MACRO OVERVIEW OF CEMENT INDUSTRY AND
MEASURES FOR DEMAND STIMULATION IN HOUSING,
INFRASTRUCTURE AND CONCRETE ROADS



SUB GROUP - I

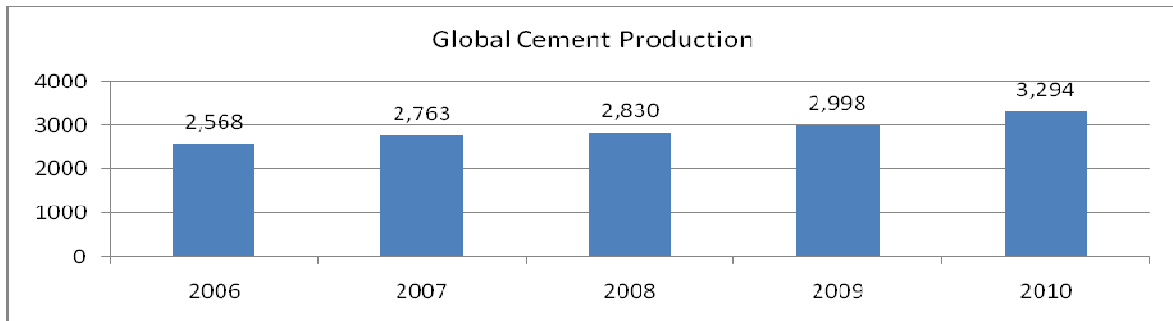
1.0 MACRO OVERVIEW OF CEMENT INDUSTRY AND MEASURES FOR DEMAND STIMULATION IN HOUSING, INFRASTRUCTURE AND CONCRETE ROADS

1.1 Indian Cement Industry - Status and Growth

1.1.1 Portland cement, the basic ingredient in concrete, was first produced and patented in 1824 by a British stone mason. Today over 3,000 million tonnes of cement is used every year globally, with different types manufactured to meet various chemical and physical requirements. The origin of Indian cement industry can be traced back to 1914 when the first unit was set-up at Porbandar with a capacity of 1000 tonnes, thus making it a century old industry in the country. Today cement industry comprises 183 large cement plants and more than 360 mini cement plants. Large producers contribute about 97% to the installed capacity while mini plants account for the rest. Among these, 98% of the capacity is in the private sector and the rest in public sector.

1.1.2 Cement industry in India has also made great progress in technological up-gradation and assimilation of latest technology. Presently, about 97 per cent of the total capacity in the industry is based on modern and environment-friendly dry process technology. Partial decontrol (1982-1988) and then total decontrol (1989) have contributed to the growth of the cement sector and its adoption of the state-of-the-art technologies. All new capacity to be added in future is likely to be of dry process and even some of the existing units may also change the process to become competitive. As such, the share of cement capacity using dry process would further increase in future. The induction of advanced technology has helped the industry immensely to conserve energy and fuel and to save materials substantially. Indian cement industry has also acquired technical capability to produce different types of cement like Ordinary Portland Cement (OPC), Portland Pozzolana Cement (PPC), Portland Blast Furnace Slag Cement (PBFS), Oil Well Cement, Rapid Hardening Portland Cement, Sulphate Resisting Portland Cement, White Cement etc.

1.1.3. Global Cement Production has continued to expand at an average rate of 6.4% in the last five years from 2568 million tonnes in 2006 to 3294 million tonnes in 2010. Around 56% of production originates in China. China (with an average annual growth of 11.4%) and India (with an average annual growth of 9.8%) have been the drivers of the growth in global cement output, with increase in production in rest of countries remaining virtually stable (with an average annual growth of 0.2%).¹



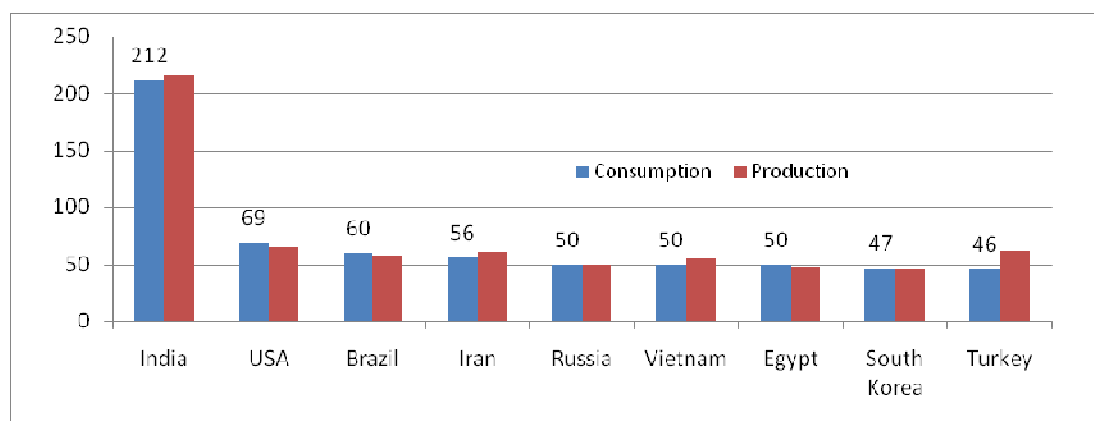
Source: Global cement report (9th Edition)

1.1.4. India is the second largest cement producer in world after China. Except India and China, other major producers are in the range of 45-65 million tonnes production (as against 52-86 in 2008)². Right from concrete bricks to flyovers, the Indian cement industry has shown a bright future. Domestic demand for cement has been increasing at a fast pace in India. Among the states, Maharashtra has the highest share in consumption at 12.2%, followed by Uttar Pradesh, while in terms of production; Andhra Pradesh is leading with 14.7% of total production followed by Rajasthan. Some of the major clusters of cement industry in India are: Satna (Madhya Pradesh), Chandrapur (Maharashtra), Gulbarga (Karnataka), Yerranguntla (Andhra Pradesh), Nalgonda (Andhra Pradesh), Bilaspur (Chattisgarh), and Chandoria (Rajasthan).

¹ Global Cement Report and DIPP

² Global Cement Report 2010

Figure 2: Cement Production and Consumption in major economies in 2009



Source: Global Cement Report, 2010

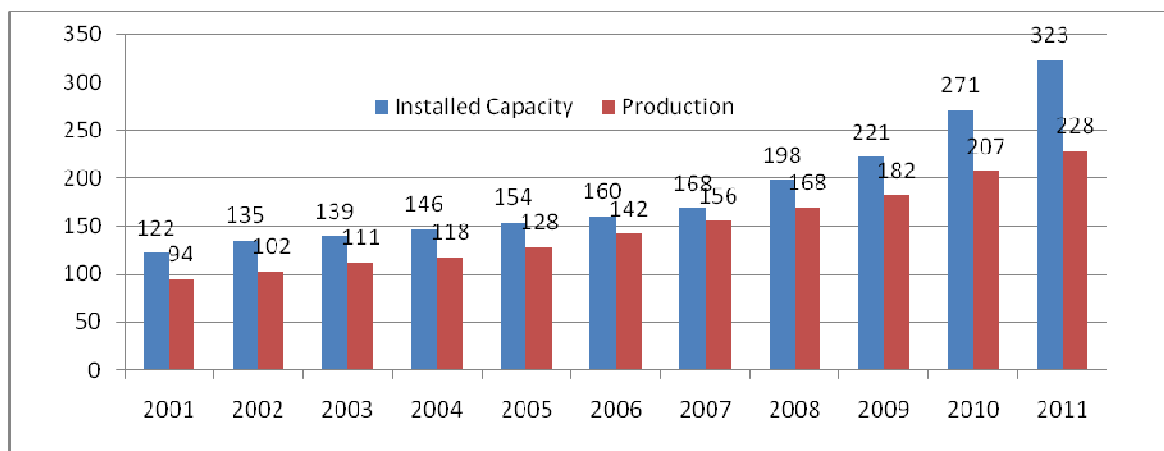
1.1.5. The cement industry is one of the major beneficiaries of the infrastructure boom. With rising demand and adequate supply, the industry has a bright future. The turnover of the cement industry has been estimated at US \$ 25 billion in 2010-11³. The installed capacity has increased at a compound annual growth rate (CAGR) of 8.8 percent during 2001-2011 and matched the growth in production, which averaged 8.7 per cent. However, in last five years, during 2006-2011, while installed capacity increased at an average annual rate of 13.6 per cent, production witnessed an increase of 9.1 per cent during this period.

1.1.6. The production of cement increased from 100.1 million tonnes in 2000-01 to 228.3 million tonnes in 2010-11⁴. Growth in production was generally range bound during this period. A significantly higher growth of 13.8 per cent was recorded in 2009-10 and a sharp moderation in growth occurred (5 per cent) in 2010-11. Stimulus package to counter the adverse fall out of the global economic meltdown facilitated this boost in growth. Moderation in growth in 2010-11 was largely due to a moderation in the growth of fixed capital formation. The sector provided direct employment to more than 1.4 lakh people during 2009. Installed capacity in the cement sector, capacity utilization and production since 2000-01 is summarized below:

³ As per CMIE, the market size of cement industry increased from Rs 29,358 crore in 2004-05 to Rs 83,068 crore in 2010-11.

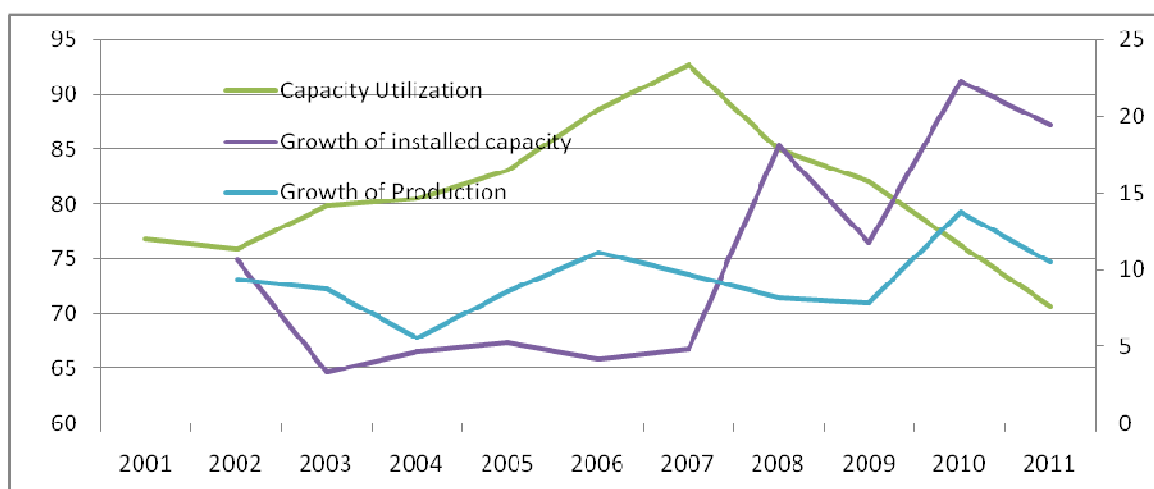
⁴ Inclusive of the production of mini cement plants

Fig 3: Installed Capacity and production of Cement (in million tonnes)



Source: CMA, DIPP and the Office of Economic Adviser

Fig 4: Capacity Utilization (per cent) and growth of Installed capacity and Production



Source: CMA and Cement Manufacturers non-members of CMA

1.1.7. The Eleventh Five Year Plan had estimated domestic demand of the cement to grow from 152 million tonnes in 2006-07 to 257.6 million tonnes in 2011-12 at an average rate of 11.1 per cent per annum, giving an income elasticity of demand of 1.23⁵. With export of the cement estimated to be generally stable at 10-11 million tonnes, rate of growth of production was expected to average 10.6 per cent. The total installed capacity in this sector was to increase from 180

⁵ Report of the Task Force for the 11th Plan

million tonnes in 2006-07 to 298.5 million tonnes in 2011-12. These estimates were based on an optimistic scenario of a GDP growth of 9 per cent and a substantial step up in cement demand for infrastructure and housing sector. It was considered desirable that cement should front load capacity addition to meet the expected demand. The sector did create capacity, in fact, in excess of what was envisaged in the optimistic scenario of the Eleventh Five Year Plan. Total capacity that is expected to be created / commissioned by 2011-12 is 331 million tonnes, about 10 per cent higher than the plan target. Since there has been a moderation in GDP growth and the demand for cement, particularly in 2009-2012, this additional capacity was reflected in lower utilization. Capacity utilization came down from 94% during 2006-07 and to 88% during 2008-09 and further to 84 % during 2009-10 and is expected at around 75% now on account of higher capacity and lower demand.

1.2 Structure of Indian Cement industry

1.2.1. Cement Sector globally has same characteristics which makes it different from other industries. The structure of the market in cement sector tends to be generally dominated by large plants. Some major global players like La'Farage (199 million tonnes), Holcim (212 million tonnes), Heidelberg (112 million tonnes), Cemex (97 million tonnes), Italcementi (81 million tonnes) together account for nearly 25 per cent of the global capacity⁶. Though it is not a patent dependent industry, initial investment in setting up a plant is very large. The initial capital for setting up a cement plant of economically viable size of 2.5 million tonne capacity is more than Rs. 1500 crore (over US \$ 300 million). The high fixed cost requires a minimum efficient scale of production. Cement industry is highly asset-specific as the asset required to produce cement cannot be utilized in any other industry⁷. As a low value, high volume output, it has high degree of resource intensity and high transportation and handling costs. Availability of materials closer to a unit or some linkages with the raw materials provides significant advantage to the cement units. The inter-se cost differences between units with these linkages and otherwise could be significant. Cement has virtually no substitutes and there is hardly any credible threat to the sector from other products with similar uses.

⁶ Global Cement Report (9th Edition)

⁷ This is also true for other capital intensive industries. However, exit option for an individual operator exists because an increasing demand brings in new players in the market for both green field and brown field investments.

1.2.2. Indian cement industry, on the other hand, is structurally different. With a presence of almost 40 large players as members of CMA, about 15 non-members of CMA (about 70 players are reported in CMIE dataset) in addition to a large number of mini plants provides a range of suppliers to choose from. In fact in almost all the States, the buyers have a choice to select among several brands offering a range of products and prices. The Herfindahl- Hirschman Index (“HHI”) at national level considering the production by large plants alone is well below 10 on a scale of 1-100, which is a sign of a highly competitive market⁸.

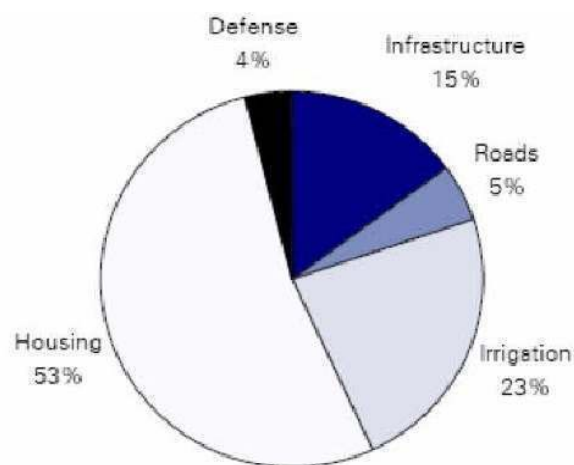
1.2.3. Indian cement industry is dominated by 20 companies which account for over 70% of the market. Individually no company accounts for over 12% of the market. The major players like ACC, Ultra Tech, Jaiprakash Associates, Ambuja Cements and India Cements have been quite successful in narrowing the gap between demand and supply. Private housing sector is the major consumer of cement (53%) followed by the government infrastructure sector.

1.2.4. Because of low value, high density product, cement movement is normally restricted to nearby markets. However, cement Companies move cement to longer distances also (Rajasthan based plants supplying to markets like Bihar, West Bengal and similarly, Karnataka and Andhra Pradesh Plants supplying to markets of Gujarat as well as Orissa and West Bengal). As far as marketing of cement by the Cement Companies is concerned, there is no limit or zoning. However, for the purpose of data analysis, the cement industry in India is generally seen as divided into five geographical regions – North, South, East, West and Central.

1.2.5. The demand for cement in India has been influenced mainly by the housing, infrastructure and irrigation etc⁹. The following pie diagram displays the contribution of the important demand driven factors:

⁸Herfindahl- Hirschman Index of concentration as per CMIE was in the range of 4.6 to 5.7 during 2004-05 to 2009-10.

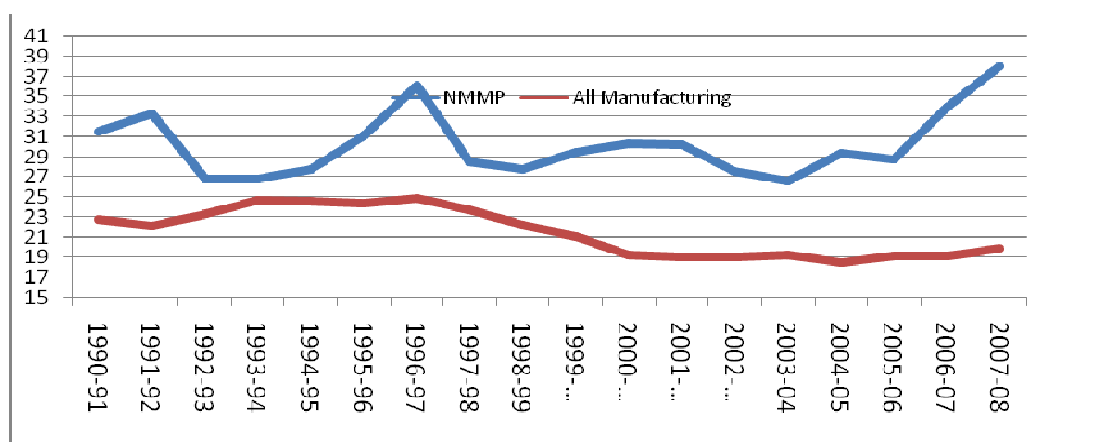
⁹ Different sources provide different shares of the major user of cement. Housing, irrigation and infrastructure, however, are the dominant user sectors accounting for over 90 per cent of domestic demand.



1.3 Some stylized facts of the cement industry

1.3.1. Annual Survey of Industries (ASI) provides information about the organized manufacturing sector in India employing 10 or more workers. At the 2 digit National Industrial Classification of Industries, cement and other building materials (bricks, marbles, granite, glass, etc.) are the major sub sectors in the broad group Non metallic mineral products (NMMP). NMMP has a low resource intensity compared to the other manufacturing sector. Gross-value added to output ratio in this sector increased from 31.1% in 1990-91 to 38.02% in 2007-08. This is in contrast to a decline in the ratio of gross value added to output in organized manufacturing which during this period decelerated from 22.8% to 19.9%.

Fig 5: Resource intensity of NMMP and Overall Manufacturing of ASI Sector

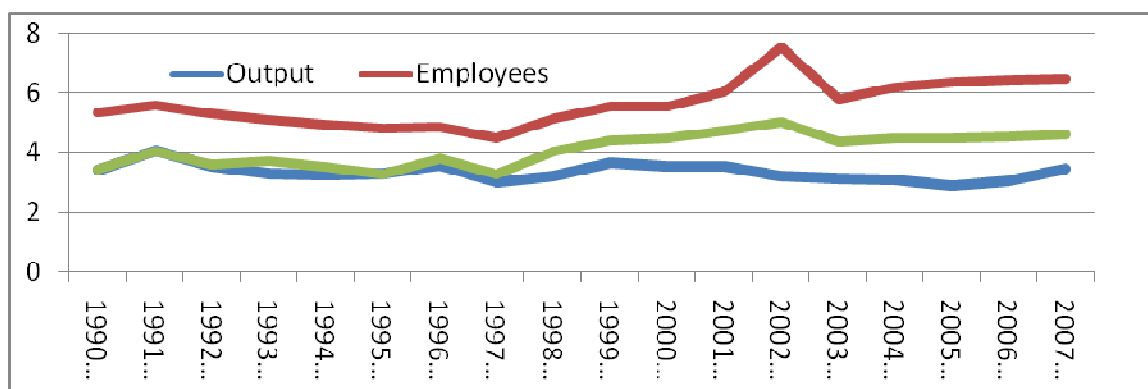


Source- Annual Survey of Industries- Various Issues¹⁰

¹⁰ Annual Survey of Industries cover all factories in the manufacturing sector employing 10 or more workers.

1.3.2. The total value of output in NMMP as a proportion of total value of output in the organized manufacturing virtually was stable at around 3%. However, the share in total number of persons engaged in this sector was higher. This share also witnessed a moderate increase.

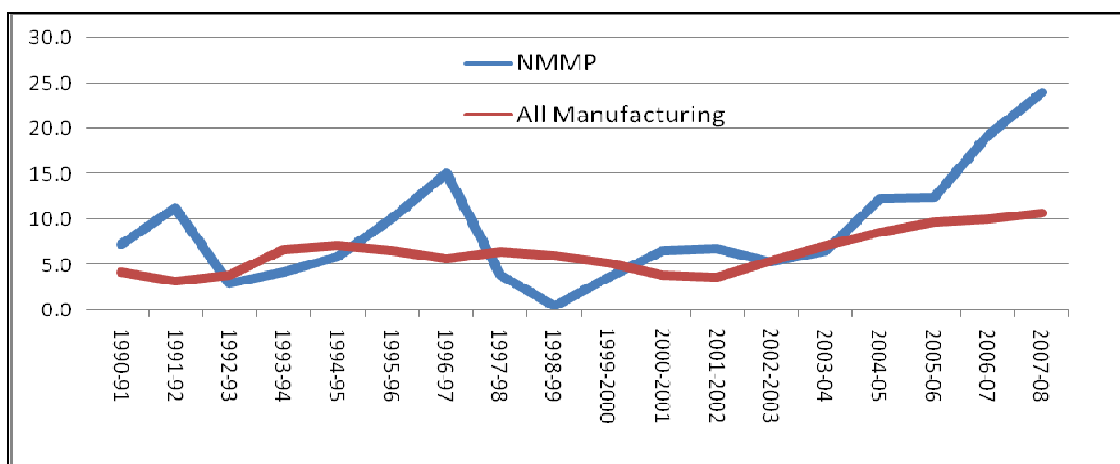
Fig 6: Share of NMMP sector in total Output, Emoluments and Employess in ASI Sector (percent)



Source: Annual Survey of Industries- Various Issues

1.3.3. NMMP sector has been highly profitable. Though the overall profitability measured as the ratio of profit to the value of output fluctuated, but as has been observed from ASI data from 1998-99 to 2007-08, the rate of profit (as a ratio of profit to value of output) in NMMP sector was nearly double the ratio in the overall organized manufacturing sector. The higher internal accruals had facilitated the capacity expansion during this period.

Fig 7: Ratio of Profit to Output in NMMP and All Manufacturing (per cent)



Source- Annual Survey of Industries- Various Issues

1.3.4 Profitability of this sector has considerably eroded in the last two years with a moderation in demand, low capacity utilization and increase in wages. As per CMIE data base, rate of growth of profit after tax turned negative in 2010-11 and as percentage to income, this ratio declined from a peak of 17.8% in 2006-2008 to 7.4% in 2010-11¹¹.

Table: Sales and Profitability of the Cement Companies

Indicator/March ending	2005	2006	2007	2008	2009	2010	2011
Sales Growth of Cement Companies	15.6	18.5	41.5	18.6	12.4	12.9	11.6
PAT Growth of Cement Companies	327.3	42.5	163.2	20.8	-12.4	14.7	-40.4
PAT Margin of Cement Companies	6.5	9.6	17.8	17.8	14.0	14.3	7.4

1.4. The Future Projections

1.4.1 The Government of India plans to increase its investment in infrastructure to US \$ 1 trillion in the Twelfth Five Year Plan (2012-17) as compared to US \$ 514 billion expected to be spent on infrastructure development under the Eleventh Five Year Plan (2007-12). Further, infrastructure projects such as the dedicated freight corridors, upgraded and new airports and ports are expected to enhance the scale of economic activity, leading to a substantial increase in cement demand. Housing sector and road also provide significant opportunities. The cement demand is likely to be sensitive to the growth in these sectors and also the policy initiatives. Further, capacity addition in cement would continue to be preferably front loaded. It may be desirable to create some excess capacity rather than operate with shortages or supply bottlenecks.

1.4.2 Keeping in view the factors responsible for the increasing demand for the sector and the assumptions mentioned below, four lines of projection in the demand for cement up to next 25 years (2027) have been given. The annual average growth in the demand, production and installed capacity of the cement during the period could be within the range of 10 to 11.75%. The production of cement would be sensitive to the GDP growth and the growth of sectors which are major users of cement. A step up in demand of these sectors could provide some stimulus to the cement sector as well.

¹¹ CMIE data base

Table: Cement Domestic Consumption - Projections and Assumptions

(in million tonnes)

Ending March	Base Line	Base line+ Concrete Roads	Base line+ Roads+ Housing	Base line+ Road+ Housing+ Fiscal Support	Assumed Rate of Growth			
Scenario	1	2	3	4	1	2	3	4
2011	226.0	226.0	226.0	226.0				
2012	241.8	241.8	241.8	241.8	7.00	7.00	7.00	7.00
2013	261.2	263.6	264.8	265.4	8.00	9.00	9.50	9.75
2014	283.4	288.6	291.3	292.6	8.50	9.50	10.00	10.25
2015	308.9	317.5	321.9	324.1	9.00	10.00	10.50	10.75
2016	336.7	349.2	355.7	358.9	9.00	10.00	10.50	10.75
2017	367.0	384.2	393.0	397.5	9.00	10.00	10.50	10.75
2022	591.0	647.3	677.3	692.7	10.00	11.00	11.50	11.75
2027	951.8	1090.8	1167.2	1207.2	10.00	11.00	11.50	11.75

Note - For 2017-22 and 2022-27, the next two Five Year Plans, GDP growth is assumed at 10 per cent, which results in an increase in growth.

Assumptions

- Base line growth from 2014-15 is kept at assumed GDP growth, or an elasticity of 1.0
- The growth is expected to increase by 1 per cent above the base line in scenario 2 assuming NH and SH to be initially covered¹².
- In scenario 3, assuming a further increase in growth by 0.5% and in scenario 4 growth is scaled up further by 0.25%.
- Base Growth kept a little lower than GDP growth in first three years because of pickup in demand may take some time.
- With all the three expectations being met, growth improves to 10.75% or with an assumed elasticity of roughly 1.2, as against observed elasticity of 1.07 during 12th Plan and further to 11.75% in the next 10 years. Elasticity tapers off to 1.175.

¹² The Task Force for the 11th Plan for the Cement sector also mentioned that the concrete roads, besides providing an excellent surface, enjoy a lower life cycle cost. In the current scenario, however, concrete roads enjoy an initial cost advantage as well.

Table: Cement Production - Projections and Assumptions

(in million tonnes)

Ending March	Base Line	Base line+ Concrete Roads	Base line+ Roads+ Housing	Base line+ Road+ Housing+ Fiscal Support	Assumed Rate of growth (in per cent)			
Scenario	1	2	3	4	1	2	3	4
2011	228.3	228.3	228.3	228.3				
2012	246.7	246.7	246.7	246.7	8.04	8.04	8.04	8.04
2013	267.7	270.2	271.4	272.0	8.53	9.53	10.04	10.29
2014	290.4	295.8	298.6	299.9	8.50	9.50	10.00	10.25
2015	316.6	325.4	329.9	332.2	9.00	10.00	10.50	10.75
2016	345.1	358.0	364.5	367.9	9.00	10.00	10.50	10.75
2017	376.1	393.8	402.8	407.4	9.00	10.00	10.50	10.75
2022	605.8	663.5	694.2	710.0	10.00	11.00	11.50	11.75
2027	975.6	1118.1	1196.4	1237.4	10.00	11.00	11.50	11.75

Note - For 2017-22 and 2022-27, the next two Five Year Plans, GDP growth is assumed at 10 per cent, which results an increase in growth.

1.4.3 Domestic production is expected to be higher than domestic consumption to provide for inventories and exports. Current export equivalent to cement is close to 4.0% (it has in fact been declining as a share of production). But the cement exports have averaged at 6 million tonnes of cement equivalent. In view of this a 5% annual export expectation may be difficult to realise. It is, therefore, assumed a production of roughly 102.5 per cent of domestic consumption. It is considered better to have the inventories and exports as a combined factor, one acting as a cushion for the other. Domestic output is, therefore, 1.025 times of the domestic demand from 2012-13 (the first year of the 12th Plan) onwards.

Table: Cement-Installed Capacity - Projection and Assumptions

(in million tonnes)

Ending March	Base Line	Base line+ Concrete Roads	Base line+ Roads+ Housing	Base line+ Road+ Housing+ Fiscal Support	Assumed Rate of growth (per cent)			
Scenario	1	2	3	4	1	2	3	4
2011	323.2	323.2	323.2	323.2				
2012	336.1	336.1	336.1	336.1	4.0	4.0	4.0	4.0
2013	349.6	349.6	349.6	349.6	4.0	4.0	4.0	4.0
2014	363.1	369.8	373.2	374.9	3.9	5.8	6.8	7.2
2015	386.1	396.9	402.3	405.1	6.3	7.3	7.8	8.0
2016	413.3	428.7	436.6	440.6	7.0	8.0	8.5	8.8
2017	442.5	463.3	473.9	479.3	7.1	8.1	8.5	8.8
2022	692.3	758.3	793.4	811.4	9.4	10.4	10.9	11.1
2027	1084.0	1242.3	1329.3	1374.9	9.4	10.4	10.9	11.1

Note - For 2017-22 and 2022-27, the next two Five Year Plans, GDP growth is assumed at 10 per cent, which results an increase in growth.

1.4.3.1 Assumptions

- a. The existing installed capacity is higher than the demand would have required the sector to create. The existing plants and plants in the pipe line indicate that excess capacity will continue. In fact, based on demand projections, additional capacity creation becomes necessary from 2013-14 only.
- b. For the first two years, it is, therefore, assumed that the existing capacity will be operationalized. In 2013-14, it is assumed utilization to reach a level of 80 per cent and gradually increase to reach 85% level in 2016-17. Capacity, therefore, is higher than domestic production by that factor. Capacity utilization is projected to improve further in next 10 years to an average of 87.5% during 2017-2022 and 90% during 2022-2027.

1.5 Additional Capacity Requirement

1.5.1. In view of the demand and installed capacity growth projections, the additional installed capacity requirement during the next 15 years (up to 2027) would be approx. 1035 million tonnes as indicated below:

Table: Additional Capacity Creation

(in million tonnes)

Ending March	Base Line	Base line+ Concrete Roads	Base line+ Roads+ Housing	Base line+ Road+ Housing+ Fiscal Support	Cumulative Capacity Creation			
Scenario	1	2	3	4	1	2	3	4
2012	12.9	12.9	12.9	12.9				
2013	13.4	13.4	13.4	13.4	10.0	10.0	10.0	10.0
2014	13.5	20.2	23.6	25.3	23.5	30.2	33.6	35.3
2015	23.0	27.1	29.1	30.2	46.5	57.3	62.7	65.5
2016	27.2	31.8	34.3	35.5	73.7	89.1	97.0	101.0
2017	29.2	34.5	37.3	38.7	102.9	123.7	134.3	139.7
2022	249.8	295.1	319.5	332.1	352.7	418.7	453.8	471.9
2027	391.7	484.0	535.9	563.4	744.4	902.7	989.7	1035.3

Note - For 2017-22 and 2022-27, the next two Five Year Plans, GDP growth is assumed at 10 per cent, which results an increase in growth.

1.6 Opportunities and Concerns

1.6.1. Some of the major opportunities in the cement sector are expected to be the following:

- a. The Government of India plans to increase its investment in infrastructure to US \$ 1 trillion in the Twelfth Five year Plan.
- b. Formal approval granted to 577 SEZ proposals.
- c. Infrastructure projects in the pipeline such as dedicated freight corridors, development of new industrial cities under the Delhi Mumbai Industrial Corridor, National Investment and Manufacturing Zones under the National Manufacturing Policy, up gradation of the existing and the new ports and airports.

- d. Growth in tourism sector fuelling the increase in the construction of hotels in the country.
- e. The expectation of real estate sector to reach a size of US \$ 180 billion by 2020.
- f. Upcoming industrial clusters and infrastructure development in emerging tier-II and tier III cities.
- g. The growing population and increased urbanization in the country.
- h. Housing demand to meet the current shortages and future growth.

1.6.2. Cement production is one of the world's most energy intensive industries. On an average, 850 kg of carbon dioxide is emitted for every tonne of cement produced during calcinations adding to the environmental burden, approximately half coming from the chemical processes involved. Recent decades have, however have seen enormous progress in reducing environmental impact and this work continues. Cement industry has so far been quite conscious and have been using state-of-the-art equipment to improve energy efficiency, formulating products to reduce manufacturing energy consumption and the use of natural resources and developing new applications for cement and concrete that improve energy efficiency and durability.

1.6.3. Cement Industry is in a way a scavenging industry and has been burning alternative fuels in the kiln, waste materials such as, residue derived fuel, municipal sewage wastes, agro wastes, plastic and polythene wastes, paint sludge, shredded tyres etc. that might otherwise go to landfill and thus helping in conserving fossil fuels. The economics are also advantageous in providing further impetus for change. Alternative materials can also be profitably used to reduce environmental impact when employed as a replacement for clinker in the final product. Portland blast furnace slag contains up to 60% ground granulated slag from steel production processes, while Portland fly-ash cement contains up to 30% replacement material. Use of these waste streams reduces fresh clinker content, thereby decreasing energy consumption and carbon dioxide emissions per tonne of cement.

1.7. Trends of Exports:

1.7.1. Cement being a low value high volume output has a very limited international trade. In 2010, international trade was 151 million tonnes and just 5% of the global cement output. Bangladesh, Nigeria, USA, Iraq, Afghanistan and Singapore were the major importers. The major exporting countries of cement were Turkey, China, Thailand, Japan, Pakistan, Germany and India. It is a commodity which is freely traded and there are no restrictions on its trade in most of the key trading countries.

Table: Cement/clinker Production and Export

(Million Tonnes)

Year	Production		Export		%age Share (export/production)	
	Cement	Clinker	Cement	Clinker	Cement	Clinker
2006-07	155.64	121.75	5.89	3.11	3.78	2.55
2007-08	168.31	129.73	3.65	2.37	2.17	1.83
2008-09	181.60	138.78	3.20	2.90	1.76	2.09
2009-10 (*)	160.75	128.25	1.59	3.12	0.99	2.43
2010-11 (*)	168.29	131.69	1.52	2.63	0.90	2.00

(*) – The data from 2009-10 onwards excludes two cement companies, who discontinued their membership from CMA

1.7.2. Though India has been an exporter, the share of exports in its domestic production in the last five years has actually witnessed a decline. In the long run also, cement exports are likely to remain range bound to around 2 to 3 percent of the domestic production. India, however, could have advantages in terms of the current and likely demand - supply gap that exists in Bangladesh. The nearness of the market provides it with the positive cost differential and it could be developed as a long term destination of Indian cement. For encouraging exports, it may be desirable to consider:

- Classification of cement for rail freight is reduced from 150 as of today to 140. Differential classification of goods for domestic and export purposes is already in vogue for iron ore, where transportation for export purposes attracts a higher classification. In case of cement, the classification for export purposes is proposed to be reduced.
- The royalty paid on lime stone should be neutralized for export of cement. This is consistent with the approach that domestic taxes are not exported.

1.8. Mini Cement Plants

1.8.1. More than 97% of cement is produced by the major cement producers and the rest (around 3%) is being produced by mini cement plants. Given the technology, it is expected that the share of the major plants in cement production will continue to increase. Mini cement plants are likely to have a production capacity which would remain nearly static. Since the cement production is one of the world's most energy intensive processes with very high emission, it has to use state-of-the-art equipment to have energy efficiency and meet environmental standards. It may, therefore, be desirable not to have any separate strategy for the mini cement plants.

1.9. Support to Cement Industry **Stimulus to the sectors which are major users of cement**

1.9.1 Cement sector growth critically depends on three important factors. Fiscal support to housing and roads could accelerate the demand for cement quite substantially. Given the housing shortages in rural and urban areas and given the increase in the cost of affordable housing, income tax relief for the interest paid on the house building loans may be extended from Rs 1.5 lakh to Rs. 4 lakh per annum. Working Group recommends that a mandatory portion, say 30 per cent of National and State Highways be constructed with cement concrete to boost cement production. Currently even at the stage of construction, cement-concrete roads are cost effective. Their life cycle cost and other advantages to infrastructure have already been established. It is also now accepted that continued thrust on concrete roads offers additional benefits like saving of precious foreign exchange (concrete roads reduce diesel consumption which is a major import item) etc.

1.9.2. Planning Commission has identified Roads as one of the thrust areas for infrastructure development and creation of a sound and durable road infrastructure in the country. Even after this, the condition of our roads network is poor. One of the reasons for the poor road conditions is the adoption of conventional 'Bitumen Roads', which results in numerous problems during operation, particularly after rains. Consequently, a substantial amount of expenditure is to be incurred repeatedly on maintaining these roads every year, entailing extra costs. A better option to solve this problem is opting for techno-economically superior cement concrete roads and thus ensuring a quality network of roads, which need almost no maintenance throughout their life, apart from generating fuel savings, being environment friendly and facilitating free and smooth flow of traffic. If

construction of cement concrete road is made mandatory, the Government and the road users would get major advantages, which are as under:

- a. No expenditure on maintenance of the roads for 30-40 years. The money thus saved can be utilized for construction of new roads.
- b. Substantial saving of fuel - about 14% of fuel presently consumed by heavy vehicles plying on bitumen roads.
- c. Significant foreign exchange saving is also possible due to consumption of cement, an indigenous product, whereas bitumen used in road construction is obtained only from imported crude.
- d. Help in tackling the menace of fly ash – an environmental hazard, as Cement roads constructed using PPC can utilize upto 35% of fly ash.
- e. Cement roads would avoid disastrous impact on human health and environment being created by the Hot Mix Plants used for construction of conventional bitumen roads.
- f. Enabling smooth and safe ride throughout the year due to absence of potholes, even during rainy season.
- g. Considerable saving in journey time to reach destination
- h. Substantial saving due to negligible wear and tear of vehicles.

1.9.3. Thus with a view to creating a world-class road infrastructure in the country for the rapid and inclusive growth of the economy, the Working Group recommends that:

- a. All new expansions in the National and State Highways may be made of cement concrete as a Policy. To begin with, this percentage could be 30% of the total allocations.
- b. All existing National and State Highways constructed by using bitumen should be replaced with concrete surface wherever strengthening is required, by adopting the technology of concrete overlays, popularly known as White Topping.
- c. Use of PPC may be made mandatory in the construction of roads as a policy not only for National and State Highways but also in the construction of roads by all agencies including CPWD, State PWDs etc. This has already been permitted by the Indian Roads Congress (IRC).
- d. All existing city roads having bitumen surface be converted gradually to cement concrete and new ones should preferably be constructed with cement concrete technology.
- e. All connecting roads in villages must be done with cement concrete technology.

1.10. Addressing the excise (CENVAT) duty structure for cement

1.10.1 The Task Force for the 11th Five Year Plan had mentioned that cement is a highly taxed commodity in India. The overall rate of tax on cement was estimated to 30% compared to 19% in China and almost negligible in Thailand. Because of such a heavy burden of tax the cement pricing remains higher than international levels for the domestic consumers. A reduction in the tax on the cement industry would stimulate demand making it even more affordable. The tax benefits could be passed on to the consumers and it could reduce the effective cost of infrastructure, housing and buildings in the manufacturing sector. Excise duty on cement is currently being levied at mixed rates i.e. ad-valorem (on transaction value) plus specific (specific rate to be charged on the basis of MRP). In this regime, determination of transaction value for different sales becomes very cumbersome. Besides, it results in different value of duties on the same commodity from the same manufacturer on any given day, depending on value of each transaction. It is, therefore, desirable that levy of Excise Duty on Cement should be simplified i.e. Specific rate or as a per cent to Retail Sale Price with suitable abatement as is available in other commodities.

1.10.2 Besides the excise duty structure, cement industry should be provided with access to inputs, particularly coal, pet coke and gypsum at nil rates of customs duty and CVD. While Cement is highly taxed commodity in India, there is no import duty for import of Cement into the country. This tax anomaly puts domestic manufacturers at a disadvantage. Thus such differences in tax treatment need to be removed to offer a level playing field to domestic production vis-a-vis imports. The import of cement should also have a duty of 5 per cent along with the applicable CVD.

1.11. Availability of Fly-Ash to cement plants

1.11.1. One of the major contributions of cement industry to society is in the form of absorption of industrial waste generated by other sectors, particularly the power sector and plastics. The power generation in India is coal intensive which generates huge amounts of ash and enormous areas of land are used to store it. According to the 2007 report of a committee constituted by the Central Electricity Authority to assess land requirements for power plants, 196 million tonnes of ash would be generated every year by the end of 11th five year plan. Assuming land requirement of 0.4 acre per megawatt capacity, about 50,000 acres of land would be required every year to store ash if it is not consumed. These numbers would

increase further with increasing power plants. The ash ponds have adverse effect on water bodies and agriculture land. In order to conserve top soil and prevent the dumping and disposal of fly ash from coal or lignite based thermal power plants, Ministry of Environment & Forests has issued directions through Gazette notification number S.O.763 (E), [14/9/1999] - Dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land with two amendments, one in 2003 and the other in 2009. The statute requires all coal and, or lignite based thermal power stations and, or expansion units in operation before the date of this notification to achieve a target of 100 per cent utilization of fly ash within five years of issue of the notification. However, utilization of fly ash is still less than 60 per cent of generated quantity. Cement industry with about 38 per cent share in utilization of fly ash plays an important role in evacuation and fruitful utilization of this harmful waste.

1.11.2. Utilization of fly ash is not a costless process. It requires establishment of a proper processing infrastructure at the power plant site in the form of dry fly ash collection system and dedicated system of transport to the grinding unit. However, after government allowed free sale of ash, several power plants have started putting price on fly ash even if evacuation is not 100 per cent. In fact, it appears that there is lack of transparency in the disposal process of fly ash which is revealed by the fact that no information is available in public domain about the amount of stock of fly ash, the amount of generation at each location and the amount of fly ash disposed of to various sectors. The Central Pollution Control Board of Pollution Control (CPCB) is supposed to collect all this information but nothing is made public either through its website or otherwise. It is very much essential that the information about fly ash generation, utilization and its stock is made public by the Ministry of Environment and Forests and Central Electricity Authority. At the same time it should also be made mandatory for each power plant to display complete information about the plant level ash generation, its stock and disposal at their respective websites including pricing if any on a regular basis.

1.11.3. With priced fly ash, the cement manufacturers have to compare costing between use of lime stone and fly ash and it is likely to put pressure on extraction of more lime stone as well as the final price of cement. Utilization of fly ash for manufacturing cement means (1) saving of natural resource of lime stone and coal for future generations; (2) maintaining the quality of land around power plants and thus reducing the misery of farmers, local residents and the flora and fauna; (3) availability of cement at relatively lower prices on account of lower capital

requirement as also lower lime stone requirement; and (4) availability of power at relatively lower price to the extent that power plants will be able to save the cost of disposing fly ash to the ash ponds and maintaining large inventory of land for this purpose.

1.12. Availability of long term funds for capacity installation

1.12.1. It has always been considered desirable that capacity addition in cement sector should be ahead of the demand. However, currently, when the rate of interest is fairly high and there are expectations of it getting moderated in next one to two years, creation of additional capacities in a capital intensive sector like cement creates long term viability concerns. The cement sector creates excess capacity and bears its cost in anticipation of a future demand. If there was expectation of the interest rates to remain at higher levels, there may not have been any inter temporal problems. But in a situation where interest rates are expected to get moderated, it may result in postponement of capacity addition. It may be desirable to provide some concessions in interests to cement industry so as to ensure availability of funds for capacity addition at a reasonable rate of interest. In the first two years the cement industry could be provided funds at around 10% rates of interest.

1.12.2. Power to the Cement Industry

1.12.2.1 Cement is an energy intensive industry. It is also an important component of all construction activities. Higher costs of cement have a cascading effect on all construction related activities. Power to the cement industry, therefore, could be provided at global rates. This industry may be exempted from bearing the cost on account of cross subsidization of power. The cost savings could be passed on to the consumers.

SUB-GROUP - II

PRODUCTIVITY, TECHNOLOGY, ENVIRONMENT,
SUSTAINABILITY, STANDARDS, SKILL DEVELOPMENT, RESEARCH &
DEVELOPMENT IN CEMENT INDUSTRY



SUB GROUP - II

2.0 PRODUCTIVITY, TECHNOLOGY, ENVIRONMENT, SUSTAINABILITY, STANDARDS, SKILL DEVELOPMENT, RESEARCH and DEVELOPMENT IN CEMENT INDUSTRY

2.1. Introduction

2.1.1 The Indian cement industry is the second largest producer in the world comprising of 183 large cement plants and 360 mini cement plants. The installed capacity and production during the year 2010-11 are 323 million tonnes and 228 million tonnes respectively (as per data available from CMA). 93 large cement plants have ISO-9000 (Quality Management System) certification, 64 plants ISO-14000 (Environmental Management System) certification and 44 plants OHSAS-18000 (Occupational Health and Safety Management System) certification. Large number of cement plants are taking steps for getting these certifications.

2.1.2 Modernization and technology up-gradation is a continuous process for any growing industry and is equally true for the cement industry. The Indian cement industry today is by and large comparable to the best in the world in respect of quality standards, fuel & power consumption, environmental norms for new cement plants, use of latest technology and capacity. The productivity parameters are now nearing the theoretical bests and alternate means, like alternate fuels and raw materials have to be found to ensure further improvement in productivity and reduction in production costs.

2.1.3 Cement industry being energy intensive, the energy conservation and alternate cheaper, renewable and environment friendly sources of energy have assumed greater importance for improving productivity. Some of the major challenges the cement industry confronting, are insecurity in indigenous fuel availability, perennial constraints like higher ash content, erratic variations in quality of indigenous coal and inconsistent power supply with unpredicted power cuts. Keeping these challenges in view, the efforts by the industry towards energy conservation and finding alternate cheaper, renewable and environment friendly sources of energy must continue.

2.1.4 Today's Indian cement industry is on the threshold of a new era of energy efficient and pollution-free activities. The time has come for every cement plant to improve both their energy consumption as well as environmental aspects. Indian cement industry is proactive and taking voluntary steps like use of alternate fuel, modernization of Air Pollution Control Equipment (APCE), reduction of water consumption and rain water harvesting in used mines and use of treated water for dust suppression and green belt development. Some of the cement plants have incorporated waste heat recovery plants to generate energy from the waste heat of gases from the pyro-processing unit. There are a number of environmental issues related with the cement sector like reduction of Green House Gases (GHG), control of fugitive dust & gaseous emissions, utilization of hazardous wastes as alternate fuels and conservation of natural resources. In India, the permissible stack dust emissions from various sources for existing cement plants is 150 mg/Nm³ and 100 mg/Nm³ for plants located in critically polluted areas. However, the limit for new plants in our country is 50 mg/Nm³ which is at par with some of the developed countries. Incentives for non polluting cement plants should be provided, which are adopting newer technologies and pollution abatement techniques/devices. There are so far 26 CDM Projects Registered from Indian cement companies with the CDM Executive Board. The Finance Bill 2010-11 provided for creation of a corpus called National Clean Energy Fund for funding research and Innovative projects in the field of clean energy technologies. To build the corpus of the National Clean Energy Fund, an energy cess has been levied on coal and lignite produced and imported in our country at a nominal rate of Rs.50 per tonne.

2.1.5 The application of nanotechnology to cement and concrete is expected to result in development of eco-friendly, high performance cements / binders and concrete with improved durability characteristics. It would also help in achieving the goal of sustainable development. Concrete has a nano scale structure comprising of hydrates of cement, additives and aggregates. The cementitious phase that holds concrete together is calcium-silicate-hydrate (C-S-H). The nanostructure of C-S-H is still not understood completely. A better understanding of nanostructure of cementitious systems would provide a greater capability to control and manipulate the properties and behaviour of cements and concrete. Nano particles, such as silicon dioxide, have been found to be a very effective additive for achieving high-performance and self-compacting concrete with improved workability and strength. Reinforcement of cementitious binders with nano diameter fibers and rods can result in higher performance of cementitious

materials by impeding crack formation and growth. R&D efforts to develop new technologies and improved cements and concrete based on nanotechnology are already under progress globally.

2.1.6 Industrial and mineral wastes from mineral processing industries, such as metallurgy, petrochemicals, power, chemicals, paper and pulp account for more than 200 million tonnes per annum in India. The important wastes from these industries from the view point of use in cement, concrete and building materials are fly ash from thermal power plants, slag from steel industry, press mud from sugar industry, paper sludge from pulp and paper industry, phospho- chalk and phospho-gypsum from fertilizer industry, carbide sludge from the acetylene industry, calcium carbonate sludge from soda ash and chrome sludge from sodium chromate industry, red mud from aluminium industry and metallurgical slags from non-ferrous industry, etc. Use of these materials have been associated with the benefits such as saving in energy and reduction in GHG emission, reduced cost, cleaner environment and so on and create a win-win situation for both, the producer and the user. A more systematic R&D approach is required to harness the maximum benefits in the areas such as Exploring the newer engineering characteristics of fly ash at finer level and further increasing its utilization levels and avenues, Use of mine wastes in the manufacture of masonry cement and sand-lime bricks, Utilization of lime sludges for the manufacture of building lime of different grades and lime fly ash bricks/ blocks, Use of red mud as a pozzolana for the manufacture of PPC and for making floor tiles etc., Use of steel slag in road construction, Use of Jerosite, a waste from zinc industry, as a set retarder in the manufacture of cement, Utilization of kimberlite, a waste from mining industry, as a raw material in cement, glass and ceramic products and road construction, Activated slag cement and tiles/ bricks/ blocks from slag.

2.1.7 The role of R&D in the growth of cement industry cannot be overlooked. However, data reveal that the expenditure on R&D activities related to cement in India is much lower compared to some of the developed countries and is progressively dwindling. The virtual absence of any R&D infrastructure for plant and machinery design is significant, considering that India is the second largest cement producer in the world, next to China. China has three flourishing Research and Design Institutes for cement plant and machinery catering. Besides China, these Institutes are helping to a host of developing countries in meeting their needs of lower-cost cement capacity enhancement. This wide gap needs to be bridged by strengthening R&D base particularly on identifying and introducing the alternate cheaper, renewable and environment friendly sources of energy and

design of state-of-the-art energy efficient and environment friendly process and up-gradation of plant machinery and equipment.

2.1.8 Indian cement Industry mostly depends on the imported technology in spite of significant domestic demand of machinery unlike China which has developed strong capabilities. It has made significant investments not only to cater its own requirement but is now competing with the European giants by providing the technology at cheaper costs. This is possible through increased investments in R&D efforts which at present is mostly funded by the industry, in order to create capabilities for cement machinery manufacturing technology, indigenously.

2.1.9 Human resources base and skill development of employees to cope up with the quantitative and qualitative demands of a fast expanding industry and changing technologies need continuous up-gradation at all levels. The projected fast-track cement capacity growth by 2016-17 faces a threat of acute shortage of skilled and technical manpower, if one goes by the present trends of their availability and slow incremental growth in India. To fulfil this objective, organizations like NCCBM at national level and RTCs at regional levels have to augment and diversify their HRD capability manifold through investments in infrastructure, HRD development packages and services. With the influx of new technologies and initiatives to provide alternate sources of energy and raw materials, the rules of the game shall be dynamic, and both management and engineering skills shall need up-gradation at the engineering and management levels.

2.2 Review of Technological Status

2.2.1 *Process Profile*

2.2.1.1 The Cement Industry today comprises mostly of Dry Suspension Preheater and Dry Precaliner plants and a few old wet process and semi-dry process plants. Till late 70's the Cement Industry had a major share of production through the inefficient wet process technology. The scenario changed to more efficient large size dry process technology since early eighties. Today, there are 178 kilns in operation comprising 165 dry process kilns, 9 wet process kilns and 4 semi-dry process kilns as shown in Table 1.

Table 1: Changing Process Profile of Indian Cement Industry

Item	1950	1960	1970	1983	1995	2001	2006	2010
Wet Process								
Number of Kilns	32	70	93	95	61	32	26	9
Capacity (TPD)	9151	25011	38441	39641	25746	13910	11420	5950
% of Total	97.3	94.4	69.5	41.1	12	5	3	1
Dry Process								
Number of Kilns		1	18	50	97	117	128	165
Capacity (TPD)		300	11865	51265	188435	282486	375968	579961
% of Total		1.1	21.5	53.2	86	93	96	99
Semi-Dry Process								
Number of Kilns	1	3	8	9	8	8	8	4
Capacity (TPD)	250	1200	5000	5500	5244	5260	4195	2320
% of Total	2.7	4.5	9	5.7	2	2	1	-
Total Kilns	33	74	119	154	166	157	162	178
Capacity (TPD)	9401	26511	55306	96406	219425	310706	391583	588221
Average Kiln Capacity (TPD)	285	358	465	626	1322	1921	2417	3305

Source: CMA data book 2011, Data from ACC and Ambuja Cement

Note : The above does not include data / information from other cement plants which are neither members of CMA nor belongs to ACC and Ambuja Cement group.

2.2.2 *Kiln Capacity and Size*

2.2.2.1 The economic unit capacity for cement plants in India till early sixties was about 300 TPD. In mid sixties this was standardized at around 600 TPD for both wet and dry process plants. About a decade later, i.e. from mid seventies, the new plants installed were of 1200 TPD capacity. The advent of precalciner technology in mid eighties provided an opportunity to the industry to modernize and increase the capacity of existing dry process plants, to convert plants from wet to dry process as well as to set up large capacity plants incorporating the latest technological advancements. This led to installation of single line kilns of 3000 TPD (1 MTPA) capacity and more. The present trend indicates the preference of still larger kilns of about 6000 TPD capacity and above. Already there are nine kilns of 8000 tpd capacity in operation and three kilns of capacity 10000 – 12000 TPD are under installation. The liberalization of imports and lowering of customs tariffs in recent years have opened up further avenues of inducting state-of-the-art-technology and equipment in cement plants. The green-field plants being installed now are based on most advanced and the best available technology.

2.2.2.2 Plants with a total capacity of two million tonnes and above at a single location, numbering 55, are having a total capacity of 158.75 MTPA accounting for 54% of installed capacity of large plants, whereas plants with a capacity between 1 to 2 million tonnes, numbering 58 are having a total capacity of 77 MTPA, accounting for 26% of installed capacity. Remaining 59 plants are of capacity less than 1 MTPA, having a total capacity of 57 MTPA, accounting for 20% of total installed capacity of cement plants.

2.2.2.3 Average annual installed capacity per plant in India is about 1.7 MTPA as against more than 2.1 MTPA in Japan. This is due to a blend of small and large plants coming up at various stages and still operating in India as against smaller plants having been decommissioned in Japan.

2.3 Present Status of Technology

2.3a A comparison of the status of the modernization in equipment and also the technologies absorbed or implemented by the Indian cement industry along with status of Global Technology is given in Table 2:

Table2: Present Status of Technology

	Pre 1970 plants	1970-1990 plants	1990 onwards plants	Global Technology
Mining & Material Handling	Conventional	Conventional	Computer aided and surface miners	Computer aided and surface miners
Crushing	Two stage	Two stage	Two stage In-pit crushing & conveying	In-pit crushing & conveying
Conveying of Limestone	Dumpers/Ropeway/ Tippers	Belt conveyors	Belt conveyors, Pipe conveyors	Pipe conveyors, Belt conveyors
Grinding	Ball Mills with/without conventional classifier	Ball Mills, VRM's, Roller Presses with static/ dynamic classifier	Ball mill with improved classifier, VRM's, Roll Presses, with conventional and dynamic classifier,	Ball mill with improved classifier, VRM's, Roll Presses, Horo Mills with dynamic classifier
Pyro Processing	Wet - Single channel burner	Wet Semi Dry Dry - 4 stage preheater - Conventional cooler - Single channel burner	Dry - 5/6 stage preheater - High Efficiency Cooler - Multi Channel Burner - Co-generation of power - Co-processing of WDF	Dry - 5/6 stage preheater - High Efficiency Cooler - Multi Channel Burner - low no _x calciner - Co-generation of power - Co-processing of WDF - Low NO _x /SO ₂ emission technologies
Blending & Storage	Pre-blending Batch-Blending silos	Pre-blending	- Continuous Blending - Multi-Chamber Silos	- Continuous Blending - Multi-Chamber - Silos Dome silos
Packing & Despatch	Bag	- Bag	- Bag - Bulk	- Mostly Bulk - Palletizing & Shrink Wrapping
Process Control	Relay Logic / Hard Wired	- Fuzzy Logic control system - PLC	- Micro processor based - DDC - Neurofuzzy expert system	- Micro processor based - DDC - Neurofuzzy expert system
Plant Size, TPD	300 -600	600-3000	3000-12000	6000-12000

Source: NCCBM study

2.3b. The directions in which the modernization activities are proceeding are as illustrated below:

2.3.1 Mining

2.3.1.1 For rational exploitation of the raw material source, a systematic mine plan is developed by cement plants. Computer-aided techniques for raw material deposit assessment to arrive at proper extraction sequence of mining blocks, keeping in view the blending operational requirements, are envisaged and put to use in number of units.

2.3.2 Crushing

2.3.2.1 Wobblers are being used for pre-screening the undersized material of ROM which does not require crushing, thus increasing throughput from crusher and saving power consumption. Mobile crushers have come in use in some of the newer plants, keeping in view the split location of limestone deposits and long conveying distances. The mobile crushing plant is stationed at the mine itself and raw material is crushed at the recovery site.

2.3.3 Grinding

2.3.3.1 Vertical Roller Mills (VRM) have given the real breakthrough in the area of grinding. The VRM draws 20-30% less electrical energy as compared to the corresponding ball mill system, apart from its ability to give much higher drying capacity. These mills can accept larger feed size and hence can mostly be used with single stage crushing. VRMs are now being used in clinker and slag grinding and also as pre-grinder to existing grinding installations.

2.3.3.2 Another breakthrough that has come with the application of high pressure grinding rolls (HPGR) which have been widely adopted in Indian cement industry. The HPGR is being used as pre-grinder for upgrading the existing ball mill systems. Different modes of operating HPGR in open circuit, pre-treatment with circulation, pre-treatment with de-agglomeration and recirculation and closed circuit are in operation. Such installations could achieve an increase in capacity up to 200% and savings in power consumption to the extent of 30 to 40% as compared to ball mills.

2.3.3.3 High efficiency separators are now widely used for better classification of product and help in increasing the mill capacity besides reducing the specific power consumption. The new classifier designs include two stage separation integrating primary and secondary separation. High efficiency separators are also used now with VRM's for further improvement in their performance.

2.3.3.4 A new mill system called Horizontal roller mill has been developed which is capable of producing uniform raw meal and has advantages in processing raw materials containing higher percentage of quartz. However, this technology system is yet to be adopted in the Indian Cement Industry.

2.3.4 Pyro-processing

2.3.4.1 The introduction of precalciner technology has increased the production from the kiln by 2.0 to 2.5 times and enabled utilization of high ash coals with lower calorific value, as well as various agricultural and industrial combustible wastes. Systems have been developed to use fuels like lignite and pet coke and various alternate fuels.

2.3.4.2 The advantages of economy of scale are fully exploited by the cement industry through the precalciner technology. Many single kilns capable of producing more than 6000 tpd capacity have already been installed and are operating with state-of-the-art technology.

2.3.4.3 Many cement plants have some excess capacity both upstream and downstream, which could be utilized economically if the kiln output can be increased at modest costs. Traditionally, the kilns have been designed with specific volumetric loading of 1.5 to 2.2 tpd/m³ for SP kilns and 3.0 to 4.0 tpd/m³ for precalciner kilns. The corresponding thermal loads in burning zone for such kilns have remained between 3.5 to 4.5 x 10⁶ Kcal/m²/hr. Many cement plants have gradually increased the specific volumetric loading upto 7-7.5 tpd/m³, ensuring much higher output than originally designed.

2.3.4.4 The introduction of high efficiency and low pressure-drop-cyclones have led to conversion of conventional 4-stage cyclone preheaters to 5-stage and even 6-stage cyclone preheaters with improved thermal efficiency.

2.3.4.5 The latest development like controlled flow grate clinker cooler system and cross bar cooler ensure better clinker distribution, increase in cooler heat recuperation efficiency, decrease in clinker exit temperature and reduced maintenance costs.

2.3.4.6 The limitations of the conventional straight pipe burner have been overcome by use of highly flexible multi-channel burner. The multi-channel burner enables easy and sensitive flame shape adjustment as well as gives rise to

better entrainment of secondary air leading to improved combustion efficiency and reduction of heat consumption.

2.3.4.7 High Alumina refractory bricks which were mostly used in pre-heating/pre-calcining zone in the past are now replaced by light weight high strength insulating bricks. The Aluminum-Zirconium-Silicate bricks with coating repellent properties are also in use now in transition zones. With the new improved refractory bricks, it is possible to increase the refractory lining life and reduce the radiation losses in the kiln. Greater use of monolithic refractories in pre-heater, pre-calcinator, cooler, kiln outlet zone etc. is in practice now.

2.3.4.8 Conventional analog instrumentation is gradually being replaced with digital instrumentation. The large mimic diagrams used of late are being replaced by cathode ray tube (CRT) display. Motor control by relay sequence is being changed to programmable logic controllers. Analog PID controllers are being replaced with multi-loop digital controllers. Due to the advent of microprocessors, a variety of advanced control concepts like adaptive control, self-tuning control, feed forward control, etc. have been introduced in the Indian cement industry.

2.3.4.9 As a corollary to automation, quality is also maintained by continuous monitoring of the raw mix composition with the help of X-ray analyzer and automatic proportioning of raw mix components. New type of on-line bulk material analyzers have also been developed based on Prompt-Gamma-ray Neutron Activation Analysis (PGNAA) for giving maximum control over raw mix. The analyzer quickly and reliably analyses the entire flow-on-line providing real time results. The latest trends in on-line quality control include computers and industrial robots for complete elemental analysis by X-ray fluorescence, on-line free lime detection and particle size analysis by latest instrumental methods and x-ray diffraction techniques respectively.

2.3.4.10 It is also important to phase out the manual sampling systems especially so when the super high capacity plants are being installed, and the stakes are high. Auto sampler technology should be dovetailed into the plants for ensuring disciplined sampling and control.

2.4. Up-gradation of Technology of in-efficient Cement Plants

2.4.1 The technological spectrum in the industry is very wide. At one end of the spectrum are the old wet process plants, while at the other end, are the new state-of-the-art technology plants presently being built by the Industry. In between

these two extremes, are the large number of dry process plants built prior to 90s. These plants could not fully modernise or upgrade side by side with advent of newer technologies and had thus remained at intermediate technology level. Also, the level of technology is not the same at all the plants built during the same period.

2.4.1a Majority of the cement plants in the country in the capacity range of 0.4 to 1.0 MTPA were set up more than 15-20 years ago i.e. before 1990's. They were based on state-of-the-art technology at that time. Since then, numerous developments have taken place in the cement manufacturing technology.

2.4.1b Though some of the old plants have been modernized to a limited extent by retrofitting the new technologies, substantial scope still exists for adopting the state-of-the-art technologies and bringing the old plants at par with world-class plants in terms of productivity, energy efficiency and environment friendliness, leading to cost competitiveness.

2.4.1c Moreover, the emission norms are likely to become more stringent in future and at the same time, the cement plants will be required to utilize waste derived raw materials and fuels to a large extent. The modifications of old plants to comply with these future requirements will also become inevitable. Therefore, there is a need to carry out a comprehensive assessment of all the earlier generation plants including wet process and semi-dry process plants in the country to identify the extent of modernization required by upgrading them to efficient dry process to improve their all round efficiency and enable them to meet the future criteria of viability, competitiveness and compliance with regard to energy consumption enabling them to comply with the provision of the Energy Conservation Act 2001.

2.4.2 Perceived Benefits of Technology Up-gradation

2.4.2.1 It is envisaged that the technology up-gradation measures for the Pre-1990 era cement plants would result in :

a.	Increase in capacity	:	25-30 MTPA
b.	Reduction in thermal energy consumption	:	15-20 kcal/kg clinker
c.	Reduction in electrical energy consumption	:	5-10 units/t
d.	Reduction in cost of production of cement	:	5-10% because of above initiatives
e.	Reduction in energy costs through co-processing	:	10–15%
f.	Reduction in the CO ₂ emissions (Through blended cements and energy conservation)	:	20%

2.4.2.2 This will entail an investment of Rs.6000 crores for technology up-gradation and capacity increase.

2.4.3 Future Modernization needs of the Indian Cement Industry

2.4.3.1 Although the industry has largely set up plants with energy efficient equipment, there are still some areas for further improvements like:

- a. Appropriate pre-blending facilities for raw materials.
- b. Fully automatic process control and monitoring facilities including auto samplers and controls.
- c. Appropriate co-processing technologies for use of hazardous and non-hazardous wastes.
- d. Interactive standard software expert packages for process and operation control with technical consultancy back-up.
- e. Energy efficient equipment for auxiliary/minor operations.
- f. Mechanized cement loading operations, palletization/shrink wrapping.

- g. Bulk loading and transportation, pneumatic cement transport.
- h. Low NO_x/SO₂ combustion systems and precalciners.
- i. Standards for making composite cement so that all the fly ash and other industrial wastes viz. slag etc are fully used.
- j. Co-generation of power through cost-effective waste heat recovery system (Eleven units having a total capacity of around 90 MW in operation).
- k. Horizontal roller mills (Horo Mills) for raw material and cement grinding.
- l. Advanced computerized kiln control system based on artificial intelligence.

2.4.3.2 To motivate the industry to adopt state-of-the-art equipment and technologies for further improving the environmental performance and energy efficiency, suitable incentives or rebate in duties for import should be given.

2.5. Energy Management

2.5.1 Energy Performance Scenario:

2.5.1a The industry's weighted average energy consumption is estimated to be about 725 kcal/kg clinker thermal energy and 80 kWh/t cement electrical energy. The industry has given significant focus on improving energy efficiency in plant operation over the years and it is an ongoing process. It is expected that the industry's average thermal energy consumption by the end of XIIth Plan (Year 2016-17) will come down to about 710 kcal/kg clinker and the average electrical energy consumption will come down to 78 kWh/t cement.

2.5.1b The best thermal and electrical energy consumption presently achieved by the Indian cement industry is about 667 kcal/kg clinker and 67 kWh/t cement which are comparable to the best reported figures of 660 kcal/kg clinker and 65 kWh/t cement in a developed country like Japan.

2.5.1c The major focus areas contributing to improvement in energy performance of cement industry are:

- a. Retrofitting and adoption of energy efficient equipment in existing plants, such as; vertical roller mill, roller press, improved grate cooler, improved precalciner, low pressure-drop preheater cyclone, improved separator, improved burner, efficient motor etc.
- b. Better operational control, process optimization as well as laboratory advancement.
- c. Up-gradation of process control instrumentation.
- d. Better monitoring and Management Information System.
- e. Training and active participation of employees and their continued exposure in energy conservation efforts etc.
- f. Commissioning of new state-of-the-art Greenfield cement plants.
- g. Regular energy audit of the plants including increased focus on micro-level energy optimization areas.

2.5.1.1 Issues and future thrust areas:

2.5.1.1a The issues and thrust areas to further improve energy efficiency in the cement industry are:

- a. Cogeneration of Power through waste heat recovery in more plants. This will, however require suitable government schemes of incentives including capital subsidy and tax exemption.
- b. Detailed plant-wise assessment of technology gaps and identification of suitable modernization plan of optimum technology at minimum cost.
- c. Detailed assessment on collection, processing, delivery and utilisation of alternate fuels including agricultural wastes, industrial wastes, municipal wastes etc.
- d. Technical health audit of plants including condition monitoring.
- e. Further technology innovation and up-gradation.

2.5.1.2. Energy Conservation Act – Baseline Energy Audit under PAT:

2.5.1.2a The Ministry of Power and Bureau of Energy Efficiency (BEE) have initiated implementation of the National Mission on Enhanced Energy Efficiency (NMEEE) under National Action Plan on Climate Change (NAPCC). This mission has a component which deals with the market based mechanism to improve the energy efficiency in energy intensive large industries and facilities by certification of energy savings, which could be traded. This scheme known as Perform, Achieve and Trade (PAT) is expected to save about 10 million metric tonne of oil equivalent (mMtoe) by 2013-14. Eight industrial sectors namely Power, Iron & Steel, Fertilizer, Cement, Aluminium, Pulp & Paper, Textile and Chlor-alkali have been included in this scheme where in about 700 industries (known as designated consumers (DCs)) are covered.

2.5.1.2b In the ensuing PAT scheme, all the DCs will be required to achieve a reduction of Specific Energy Consumption (SEC) from their baseline SEC within 3 years time (2011-12 to 2013-14). BEE has started the process of establishing the baseline SEC of each DC as per the reported data from the industry through mandatory reporting. In order to justify the target set in the industry the potential evaluation needs to be done. Therefore BEE has started the “Baseline Energy Audit” in each DC. In the proposed baseline energy audit, more technical information like efficiency and energy performance of major equipment, process and subsystems inside plant boundary etc. will be obtained. Apart from this, comparison of operating data with design data or Performance Guaranteed (PG) reports etc, energy balance of the entire plant will also be done. The audit will also come out with various energy efficiency options implemented in the plant and indicate the actual saving potential available in the plant. The target setting of the plant may be based on statistical analysis of the historical data and potential available in the plant.

2.5.2. Cogeneration of Power through Waste Heat Recovery in Cement Industry – Recommendation to Grant it Renewable Energy Status

2.5.2.1 *Present Status*

2.5.2.1a The cogeneration of power through waste heat recovery is presently installed in only eleven cement plants in India. This technology has a very high potential to utilize waste heat to generate power thereby reducing burden on National grid and thus resulting in significant energy savings as well as indirect saving in coal consumption thereby achieving reduction in equivalent carbon

dioxide. The potential exists in almost all cement plants having kiln capacity 3000 tpd (1 mtpa) and more. In view of the existence of a large number of cement plants of one mtpa and more capacity at single location having a total capacity of 220 million tonne, the total industry potential may be to the tune of more than 600 MW through cogeneration assuming that on an average about 3 MW power can be generated from a plant of 1 mtpa capacity.

2.5.2.1b Moreover, with the improvement in its technology over the years, this system is now proving to be a successful one with low maintenance and operating costs.

2.5.2.1c Presently, the Ministry of New and Renewable Energy (MNRE), Government of India does not consider the cogeneration of power through waste heat recovery in cement industry as Renewable Energy.

2.5.2.2 *Barrier for Large-scale Adoption*

2.5.2.2a The main barrier for the large-scale adoption of the cogeneration technology in Indian cement industry is the high investment cost of about Rs. 10 crore per MW as compared to Rs. 4 to 5 crore/MW for CPP (Thermal) and even lesser for CPP (Diesel).

2.5.2.3 *Benefits by Granting Renewable Energy Status*

2.5.2.3a If recognized as Renewable Energy (RE), the overall project cost of cogeneration system in cement industry, including the capital cost and operating cost, is expected to reduce considerably, making it a very attractive techno-economically feasible project. The project cost is expected to reduce through the following:

- a. MNRE schemes of accelerated depreciation benefits, tax benefits, generation based incentives and capital subsidy to the renewable energy projects.
- b. Financial gains through Renewable Energy Certificates (REC).
- c. Financial gains through Energy Saving Certificates (Escerts) issued under Perform Achieve and Trade Scheme of Bureau of Energy Efficiency (BEE), Ministry of Power.
- d. CDM schemes.

2.5.2.4 Eligibility as Renewable Energy

2.5.2.4a Though the MNRE presently does not grant it Renewable Energy (RE) status, there are favourable arguments to consider this technology as RE.

2.5.2.4b The term ‘renewable energy’ carries a broad meaning, and in general, it covers all sources of energy, which could be replenished over a period of time. There has been difference of opinion among the various stakeholders for the energy sources that should be covered under the definition of ‘renewable energy’. In India, the wind, small hydro projects up to 25 MW, biomass, bagasse cogeneration, MSW, solar PV and solar thermal etc. have been described as renewable energy sources. The coverage of all these sources is based on the guidelines specified by the Ministry of New and Renewable Energy from time to time.

2.5.2.4c ‘**Waste to Power**’ is one of the approved terminology of MNRE for renewable energy. Under this category, presently, biomass and municipal solid waste are considered approved. The excess heat in flue gases is not considered as ‘waste to power’. However, it is understood that in some other countries, the excess heat in flue gases of power plants, when used as **Combined heat and power (CHP) system**, are approved as RE. The waste heat in cement kiln flue gases can also be regarded as RE in the same rationale.

2.5.2.4d Also, the National Electricity Policy, which was notified by Central Government in February 2005, states under its provisions of Section 3 of EA 2003 - Clause 5.12, several conditions in respect of promotion and harnessing of renewable energy sources. The salient features of the said provisions of NEP, with respect to ‘waste to power’ are as follows:

“5.12.3: Industries in which both process heat and electricity are needed are well suited for cogeneration of electricity. A significant potential for cogeneration exists in the country, particularly in the sugar industry. SERCs may promote arrangements between the co-generator and the concerned distribution licensee for purchase of surplus power from such plants. Cogeneration system also needs to be encouraged in the overall interest of energy efficiency and also grid stability.

2.5.2.4e *In view of the above, it is recommended that cogeneration of power through waste heat recovery in cement plants should be accorded the status of renewable energy by the MNRE.*

2.5.3 Use of Alternate Sources of Energy

2.5.3a Cement manufacturing is a highly energy intensive process. Thermal Energy itself accounts for 20-25% of the cost of cement production. The increasing costs of conventional fuels besides environment considerations for conservation of non-renewable fossil fuels have drawn major attention of Indian manufacturers to substitute them with alternate/waste derived fuels (WDF) including hazardous combustible wastes (HCW) and cut down the energy costs. Further, for minimizing dependence on coal, it is necessary to use alternate fuels of sufficient combustible value to the extent possible. Use of alternate/high grade fuel depending upon their availability, costs, logistics etc., therefore becomes imperative.

2.5.3b While the use of alternate fuels/WDF by cement industry primarily began for economic reasons, it eventually proved to be more beneficial in relation to ecological objectives. The utilization of alternate fuels/WDF by the cement industry is expected to reduce green house emissions. The practice of using WDF/HCW has been evolving and growing over the past two decades in the cement industry in several countries abroad. Scrapped tyres, ETP sludge, waste plastics, paint sludge, MSW fluff, refinery tank bottom sludge, oil contaminated soil, drill cuttings waste of oil exploration are the most commonly used combustible wastes in the cement industry throughout the world, substituting fossil fuels (coal/fuel/oil/natural gas) upto 60% and higher in some cases. The second largest used alternate fuel in cement manufacture is waste oil. Waste plastics, refinery sludge, sewage sludge, animal bone meal, wood waste, saw dust, coconut shells, rice husk, paper etc. have also been widely used.

2.5.3c Co-processing in cement kilns is considered as technically feasible and economically viable option not only for treatment of wastes having combustible value, but also a better and a cost effective option for co-processing other hazardous wastes too, owing to the wide range of temperature levels from 800⁰ C to 1600-1700⁰ C with a wide spectrum of residence times upto 3 minutes, and the biggest advantage of the complete absorption of the ash in the cement complex compounds. With this wide range of temperature and residence times almost all types of hazardous, non hazardous, combustible wastes can be co-processed in the

cement kilns. Alkaline combustion environment and oxidizing atmosphere in the kiln help in complete destruction of toxic/hazardous organic components of HCW. Thus, co-processing of wastes compared to methods of their disposal through landfills or incineration in dedicated waste incinerators. In latter methods of treatment for wastes, energy is not recovered. The use of combustible wastes in cement kilns is regarded as “energy recovery” unlike “disposal” if land-filled or incinerated.

2.5.3.1 Advantages of co-processing in Cement Rotary Kiln

2.5.3.1a The direct and indirect benefits accrued through co-processing of combustible wastes and secondary fuels in cement kilns are:

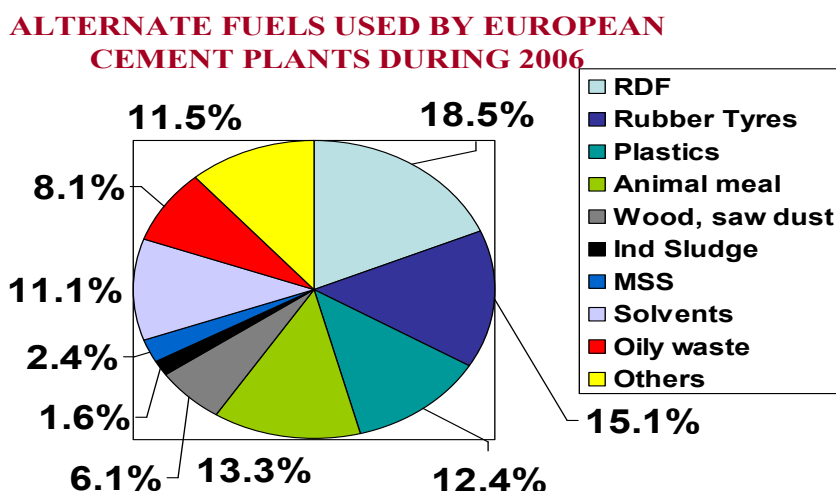
- a. Conservation of fossil (non-renewable) fuel.
- b. Reduction in energy costs
- c. Effective method of waste disposal resulting in elimination of incineration and land filled residues due to their absorption in clinker
- d. Reduction in green house gas emissions and global warming alleviation
- e. Minimizing environment impact due to reduced load on coal mining

2.5.3.2 Experiences of using WDF in Overseas Cement Plants

2.5.3.2a A host of hazardous combustible wastes derived from a variety of industries are regularly recycled by cement plants in EU countries. Cut tyres are already being burnt as a partial replacement of main fuel in UK cement plants. Once authorized for the trials, cement plants are subjected to a rigorous programme of monitoring of emission levels and testing of samples. One of the most comprehensive trials with tyres as secondary fuel at BCC’s Westbury plant demonstrated a 27% reduction in the works overall impact on the local environment. Emission results showed an increase of sulphur dioxide (SO₂), whilst still remaining 30 percent below permissible limits, 43 percent reduction in emissions of dioxins and furans without significant change in the emissions of heavy metals.

2.5.3.2b Based on above results, the above plant has been granted permission by the Environmental agency to use tyres substituting conventional fuels upto 25%.

2.5.3.2c The varieties of WDF including RDF used by European Cement Plants is shown in figure below:



Source: NCCBM Study.

2.5.3.2d Some of the cement plants have replaced the main fuel up to as high 83% as shown in Table 3 below.

Table 3: Substitution of fossil fuel by HCW and WDF in various countries.

<i>SUBSTITUTION OF FOSSIL FUELS BY HCW AND WASTE DERIVED FUELS</i>	
COUNTRY	SUBSTITUTION (%)
AUSTRIA	46
GERMANY	42
FRANCE	34
NETHERLAND	83
SWITZERLAND	48
NORWAY	45

Source: NCCBM Study

2.5.3.2.1 Emission limits by European Commission

2.5.3.2.1a The emissions limits for cement kilns utilizing WDF prescribed by European Commission (Directive 2000/76/EC) are shown in Table 4 below:

Table 4: Emission limits prescribed by European Commission

Component	Limit value (mg/m ³)
Dust	30
NO _x	800 (existing plants); 500 (new plants)
SO ₂	50
Total organic compounds	10
HCl	10
HF	1
Dioxins and furans	0.1
Cadmium + Thallium	0.05
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	0.5
Mercury	0.05

Source: NCB Study.

2.5.3.2.1b However in India, there are emission limits only for particulate matter (dust). The emission limits for NO_x and SO₂ are being evolved by CPCB. The data generation work has been entrusted to NCB.

2.5.3.3 Initiatives on co-processing of WDF in India

2.5.3.3a Use of hazardous and refuse derived combustible and Municipal solid waste (MSW) as fuel is common in countries like Canada, EU, Japan and Korea. Encouraged by the successful implementation and benefits achieved from waste utilization using best available techniques in other countries, a few cement plants in India have also attempted to co-process the WDF. The ETP sludge, waste tyres etc. is now being co processed in Indian cement plants. Trial runs with some of these materials have been taken and emission measurements as well as clinker quality was monitored to study the environmental impact. Waste oils, paint sludge and bio-mass are other attractive alternate sources of energy, which are drawing the attention of Indian cement industry.

2.5.3.3b CPCB is actively engaged in plant level trial run in respect of wastes viz. used tyres, refinery sludge, paint sludge, waste plastics, effluent treatment plant (ETP) sludge and toluene Di-Isocyanate (TDI) tar waste from petroleum industries. The guidelines on co processing of wastes in cement kiln have been formulated by CPCB in 2010.

2.5.3.3c NCB has carried out a techno-economic feasibility study on the use of waste rubber tyre chips as partial substitution for coal in a cement rotary kiln. The study included various aspects such as (i) characterization (ii) impact on kiln operation, clinker quality and environment (iii) extent of coal substitution by tyre chips (iv) system for handling, feeding and firing (v) cost economics etc.

2.5.3.3d NCB was actively associated during plant trials with ETP sludge from BASF India and CETP sludge from textile industry by CPCB for cement plants in Karnataka and Rajasthan. The results were encouraging with no adverse impact on clinker quality, kiln performance and environment.

2.5.3.3e On the initiative of CPCB, a trial run was conducted for co processing of distilleries spent wash in cement kiln. NCB has conducted a technical feasibility study on use of spent wash, a waste from distillery industry, in a cement kiln. Based on detailed characterization of spent wash, DTA & TGA studies, it was proposed to substitute coal up to 5% and plant trial was undertaken with spent wash in a cement plant Karnataka for five weeks to study its impact on kiln operation, clinker quality and environment. Due to high chloride content up to 3%, the spent wash could substitute coal up to 3.5% without adversely affecting the kiln performance and clinker quality remained unaffected.

2.5.3.3f The use of industrial wastes can provide twin benefits-energy conservation and environmental protection. However, various factors such as availability, characteristics, economics and effects on the kiln operation, refractory lining and product quality etc. need to be assessed, prior to its use in cement manufacture. Permission is to be taken from regulatory authorities for co processing of wastes in cement kiln, as prescribed in the guidelines.

2.5.3.3g Shredded tyres typically have a sulphur content of 1-2%. They contain chlorine, metals such as cadmium, chromium, zinc and benzene compounds. In modern kiln system with calciner and high precalcination rate, the use of complete tyres through kiln inlet is restricted to a relatively small amount of 5% of fuel requirement. To use higher proportion in calciner, size reduction to pieces of maximum 50x50 mm in size is necessary.

2.5.3.3.1 Refuse derived fuel (RDF) Municipal solid wastes:

2.5.3.3.1a The generation of municipal solid wastes (MSW) in the country is estimated around 55 MTPA during 2010. Presently, more than 10 MTPA of MSW are generated per year in 23 large cities/metros. New Delhi and Mumbai generate about 4500 tpd (1.5MTPA) and around 6000 tpd (2.0 MTPA) of MSW respectively. The safe disposal of municipal solid wastes has become an environmental problem and a health hazard because of pollution in the surrounding environmental of the garbage dumping yards. These dumps constantly produce and release methane gas, which contributes to global warming. The advanced technologies can be adopted for converting MSW to RDF, which is a rational approach of solving the disposal of MSW. However, necessary permissions are to be taken from regulatory authorities.

2.5.3.3.2 Natural gas

2.5.3.3.2a An excellent fuel for effective utilization of marginal grade limestone and conserve higher grade limestone for future needs. Natural gas reserves in the country are estimated at 718 billion cubic meters (BCM). Out of these, 253 BCM are on the on-shore and remaining 465 BCM on the off-shore. Assam (on-shore) has the maximum reserves of 156 BCM followed by Gujarat (on-shore) with 93 BCM. The major gas fields in India are western (off-shore) Krishana-Godavari(off & on-shore) Cauvery (on-shore) Assam (on-shore) and Jaisalmer (on-shore).

2.5.3.3.2b The gas marketing companies should make provision to allocate natural gas at subsidized rate particularly to plants having low grade limestone for effective utilization of large low grade limestone deposits available along the natural gas grid.

2.5.3.3.3. Other Potential alternate fuels in India

2.5.3.3.3a A few cement plants have already started using pet coke in substantial quantities, lignite and several combustible wastes like rice husk, bamboo dust etc. Presently a number of cement plants are utilizing pet coke to the extent of 60-100% and agricultural wastes such as rice husk and bamboo dust to the extent 10-15%. Natural gas is considered as a promising fuel in the near future for cement industry particularly for those plants located in the vicinity of natural gas sources, or far from the coal deposits or using low/marginal grade limestone, which otherwise cannot be utilized rationally. However, availability of gas for cement industry is still a remote possibility because of its high costs, limited availability due to large dependency on OPEC countries and high cost of laying pipelines for the transportation of gas.

2.5.3.3.3b The following fuels are considered to have good potential in the present context of Indian economics to either partially or fully substitute coal in cement manufacture in the coming years.

- a. Pet coke
- b. Lignite
- c. Natural gas
- d. Bio-mass wastes including fruit of *Jatropha*, *Carcus*, *Pongamia* & Algae.

2.5.3.3.1 Pet coke:

2.5.3.3.1a A residual product from oil refinery with relatively low volatile matter, insignificant ash content and high calorific value, but often with high sulphur content as compared to Indian coal. Pet coke production in India is presently around 6 MTPA, out of which about 4 MTPA is used by major Indian cement plants. Pet coke has been successfully used in kiln firing up to 100%. However, a few cement plants are using pet coke also in the precalciner along with coal to a large extent.

2.3.3.3.2 Lignite:

2.3.3.3.2a A fossil fuel with low ash content and high volatile matter being the early stage of formation of sub-bituminous coal is considered a promising alternate source of fuel for cement plants particularly located in the vicinity of lignite deposits. The important known deposits of lignite in India are in Tamil Nadu, Rajasthan, Gujarat, J&K and Kerala. The total geological reserves of lignite have been assessed at over 24000 million tonnes. About 90% of these occur in Tamil Nadu alone.

2.5.3.3.4. Bio-mass wastes:

2.5.3.3.4a The following Biomass is widely used in Indian cement plants depending upon the location and availability of the same.

- a. Ground nut shell
- b. Coconut shell
- c. Mustard stem
- d. Coir waste
- e. Wood waste
- f. Rice husk
- g. Cashew shell
- h. Bagasse
- i. Parthenium grass
- j. Saw dust

2.5.3.3.4b The availability of agricultural wastes is seasonal and, therefore, cement plants cannot be assured of continuous supply round the year.

2.5.3.3.4c Currently there is a National Drive towards generation of Bio-Diesel. It is widely discussed that Bio-Diesel can reduce India's dependence on fossil fuel for its energy needs and simultaneously it would reduce global warming & greenhouse gases. Bio-diesel is an eco-friendly; alternative diesel fuel prepared from domestic renewable resources i.e. vegetable oil and is produced by trans-esterification of vegetable oil with methanol or ethanol. Trans-esterification is a reaction of oil (Triglycerides) with alcohol to form ester and glycerol.

2.5.3.3.4d Another very important biomass plant which can be grown in the water bodies is Algae. Algae have calorific value as good as coal. The algae (Genera Amphora, Cymbella, Nitzschia, etc.) and green algae (chlorophyceae & genera chlorella in particular) have an oil density of about 50% by weight. It is recorded that algae can under controlled conditions produce 15,000 gallons of oil per acre per annum. The algae are harvested daily, and a combustible vegetable oil is squeezed out, which can be used as bio-diesel for automobiles. The dried green flakes that remain can be further reprocessed to create ethanol. The calorific value of algae oil is 9572 Kcal/Kg approx. and the algae bio mass (50% oil content) is 4786 Kcal/Kg approx.

2.5.3.3.4e Algae are a carbon dioxide gobbling plant, and thrive on it in the presence of water and sunlight. Algae farms would be based on the use of open, shallow ponds in which some source of waste SO_2 could be efficiently bubbled into the ponds and captured by the algae. It is understood that SO_2 – gobbling algae technology has been developed that uses a screen-like algal filter, capable of handling 140 cubic meters of fuel gas per minute-equal to exhaust from 50 cars or a 3 MW power plant. The same technology can be used in the stacks of power plant and cement kiln to reduce SO_2 emission and produce bio mass for replacing coal. This would be a fine example of using the natural growing algae, as a SO_2 recycling agent to produce coal equivalent fuel. Algae are like a breath mint for smoke stacks and will reduce SO_2 emissions too.

2.5.3.4 Issues for consideration

- a. Formulation of norms for emissions
- b. Change in public belief
- c. Comprehensive monitoring of emissions
- d. Adoption of best practices
- e. Trans-Boundary movements
- f. Incentives (polluter pay principle) for disposal through co processing in cement kilns
- g. Stringent Penalty for wild dumping/Illegal land filling

2.5.3.5 Future outlook

- a. Training in the area of operational practices of using WDF in developed countries including waste treatment and impact of deleterious components on kiln operation, product quality and environment.
- b. Identification of Best Available Techniques (BAT) practices for adoption in Indian Cement plants.

2.6 Environmental issues and Pollution Control

2.6a Environment is an integral element of nature, wherever the nature is disturbed environment gets disturbed. Rapidly growing economies are discovering the costs and its relevant impact on their business: current industrialization practices need for increasing energy, mineral and water resources and related emissions to air and water bodies, which ultimately effects the own life supporting ecosystems. But, in the 21st century, industry can only successfully operate by integrating environmental, economical and social values.

2.6b Today's Indian cement industry is on the threshold of a new era of energy efficient and pollution-free activities. Indian cement industry has come a long way in achieving technological up gradation, enhanced production, higher energy efficiency and improved environmental condition. It has not lagged behind in preserving ecological balance during mining of limestone, by creating green belts and harvesting rainwater and reducing dust emission. Especially over the last decade, the importance of environmental impact has been well recognized by industry, now it has been closely understood that improvement of environment is everybody's business. Cement industry consumes huge amount of raw materials and energy that are from non-renewable sources; extracts limestone by mining which changes land use and ecology. The depleting energy resources clubbed with rising cost of energy have compelled the industry to develop and up-grade modern techniques and methodologies on a continuous basis. Cement being one of the six core sector industries, plays a vital role in infrastructure development especially in a developing country like India. Sustainable growth of the industry for enabling sustainable growth of infrastructure calls for leveraging pollution control measures with rapid growth of the industry.

2.6c The time has come for every cement plant to improve their energy consumption and environmental aspects as well. For India to be global player in cement manufacturing, it needs to adopt various environmental improvement measures for its sustainability. It will be helpful in identifying areas for further improvement on continuous basis in terms of environment and energy. Therefore, it is important to gain an insight into different types of environmental management practices. Indian cement industry is proactive and taking voluntary steps like use of alternate fuel, modernization of APCE, reduction of water consumption and rain water harvesting in used mines and treated waste water used for dust suppression and green belt development. Some of the cement plants have incorporated waste heat recovery plants to generate energy from the waste heat of gases from the pyro-processing unit.

2.6d There are number of environmental issues related with the cement sector like reduction of Green House Gases (GHG), control of fugitive dust & gaseous emissions, utilization of hazardous wastes as alternate fuels and conservation of natural resources. Notably, unlike in most chemical, agro-industrial and metallurgical industries, cement manufacture does not significantly generate any toxic or hazardous pollutants.

2.6.1 Point Source Emissions

2.6.1.1 Green House Gases (GHG) Reduction

2.6.1.1a Emissions of green house gas like CO₂, generated from decomposition of the carbonate raw material (calcination of limestone), burning of fossil or alternate fuel (coal, lignite etc) and use of grid or captive power is a major environmental issue related with cement industry. Indian cement industry has been working on the issue of its GHG emissions and has brought down the CO₂ emission level from 1.05 tonne of CO₂ / tonne of cement in 1994 to 0.82 tonne of CO₂ / tonne of cement in 2007. The approximate contributions of each of the 3 main sources of CO₂ emissions are calcinations 50 to 55%, fuel combustion 40 to 50% and electricity upto 10%. CO₂ emission from cement production in some major cement producing countries in 2007 is as under:

Country	Cement Production (Mn.t.)	CO₂ Emission (Mn.t.)	Emission Factor (tonne of CO₂ /tonne of cement)
China	1354.0	1543.56	1.14
India	171.0	140.22	0.82
Japan	71.4	52.55	0.74

2.6.1.1b The mitigation measures for reduction of GHG emissions are

- a. Production of Blended Cement by substitution of clinker by fly ash and blast furnace slag
- b. Use of Alternate Fuels and raw materials
- c. Improving Energy Efficiency
- d. Waste Heat Recovery
- e. Carbon Sequestration
- f. Use of Solar and Wind Energy

2.6.1.2 Particulate Matter (PM)

2.6.1.2a The point source emissions such as particulate matter particularly occur from various stacks of kiln, cooler, crusher, raw mills, cement mill, coal mills and packaging house. Cement plants have provided APCEs like ESP, glass bag house with PTFE membranes and ESPs modified with bag filters – Hybrid filters. As per information from CPCB, there are 11 major cement plants and 8 mini cement plants which are not complying with the emission standards. Directions have been issued to these units by SPCB/CPCB/MoEF. These cement industries have submitted the time bound action plans to comply with the norms.

2.6.1.3 Gaseous Emissions - NO_x and SO₂

2.6.1.3a Emissions of NO_x from cement plants are mainly due to excess of primary air, fuel and burning process at higher temperature during clinkerization. At present for Indian cement industry, there are no emission standards for NO_x and SO₂ emissions. CPCB and NCB are in the process of developing emission norms for the cement plants. The mitigating measures adopted for reduction of NO_x emissions are optimization of the clinker burning process with computer based high level expert control system, installation of Low NO_x Burner, low NO_x calciner, multi stage combustion etc. In Indian Cement plants, there are no significant SO₂ emissions from clinkerization but it may be generated by use of high Sulphur content limestone and also by use of high sulphur coal from North-east India. The mitigating measures for control of SO₂ emissions are scrubbers, blending of fuel and raw material with low sulphur fuel/raw material, addition of slaked lime (Ca (OH)₂) to the kiln feed of pre-heater kilns.

2.6.2 Fugitive Emissions

2.6.2a Mostly attention has been paid to control dust emissions from point source by installing APCEs. But there is fugitive dust due to various transfer and handling of materials in the plant. These are of two types, one is process related like material handling, size reduction operations etc. and the other is non-process related like vehicular traffic inside the plant. Fugitive emissions also occur from limestone excavations in mines. However, cement plants are taking various measures to reduce fugitive emissions comparable to the “best practice” elsewhere in the world. CPCB has developed guidelines for prevention and control of fugitive dust emissions in cement plants, which are available on CPCB website. The mitigating measures for reducing fugitive dust emissions are

At Mines:

- a. Transfer of material by covered belt conveyor or pipe conveyor
- b. Use of surface miners at soft limestone deposits
- c. Drilling machines should be provided with dust extractor and water injection system
- d. Road transportation should be minimized
 - i. Dust suppression by water sprinkling
 - ii. Green belt development along haulage roads, mine boundaries.

At plant:

- a. Construction of concrete pavements in cement plant
- b. Water sprinkling for dust suppression
- c. Green belt development
- d. Transfer points should be provided with Bag Filters
- e. Covered sheds and closed storage for raw materials and additives
- f. Silo for storage of clinker and fly ash
- g. Transportation of fly ash in dedicated containers
- h. Frequent vacuum cleaning
- i. Proper maintenance of APCE
- j. Transfer of material by closed or pipe conveyor

2.6.3 Utilization of Industrial Wastes in India**2.6.3.1 Blending Materials**

2.6.3.1a. Indian cement industry can consume up to 35% and 70% of suitable fly ash and blast furnace slag respectively directly substituting the clinker as blending material. Addition of fly ash and slag significantly improves the quality & durability characteristics of resulting concrete. In India, at present blended cement production is around 75% of total cement production. However there is scope of further consumption of more fly ash and granulated slag in order to enhance the total production of cement. Thermal power plants should make available required quality of fly ash in order to consume it as blending material for cement industry in India. At present cement industry utilized about 27% of fly ash generated by power plants & 100% of granulated slag generated by steel plants, as compared to almost 100% fly ash and 84% of granulated slag in the Japanese cement industry.

2.6.3.2 Utilization of Alternate Fuels

2.6.3.2a The increasing costs of conventional fuels besides need for conservation of non-renewable fossil fuels have drawn major attention of Indian cement manufacturers to substitute them with alternate fuels including hazardous combustible wastes (HCW) and cut down the energy costs. CPCB has taken proactive role for initiating the concept of co processing of waste in cement kiln. Using waste as alternative fuel is also an environmentally safe method to dispose of hazardous waste because of good residence times and high temperatures in the kiln burning zone (1450°C). While the use of alternate fuels by cement industry primarily supports best disposable option for waste derived fuels in comparison to incineration method, it eventually proved to be more beneficial with respect to ecological objectives. The utilization of alternate fuels by the cement sector is expected to reduce green house emissions. Scrapped tyres, common effluent treatment plant (CETP) sludge, municipal solid wastes (MSW), spent wash, plastic waste, paint sludge, bio-fuels are some of the combustible wastes used as alternate fuels in the Indian cement industry. The low quantity and poor calorific value of the alternate fuels remains a hurdle for some of HCW. The fossil fuels (coal) can be substituted with different percentages of the alternate fuel depending upon calorific value and availability of the fuel.

2.6.4 Emission Levels- Standards and Practices

2.6.4a In India, environment issues are dealt both by central and state pollution control boards. SPCB regularly inspects the cement plants for verification of compliance of emission norms. CPCB also inspects the cement plants to check the compliance of emission standards under environmental surveillance squad activities. It has been observed that most of the major cement plants are having efficient air pollution control devices. However, as per information from CPCB, 11 major cement plants and 8 mini plants are not complying with the emission standards. Directions have been issued to these units by SPCB/CPCB/MoEF. These cement industries have submitted the time bound action plans to comply with the norms.

2.6.4b Ministry of Environment and Forests has notified the emission standards for cement plants in the year 1987, which was subsequently revised in February 2006. The emission standards are given below:

Large Cement Plants:

Existing plants:

- a. 100 mg/Nm³- for cement plants. Including grinding units, located in critically polluted or urban areas with a population of one lakh and above (including 5km distance outside urban boundary)
- b. 150mg/Nm³-for plants other than (a),

New Plants:

50 mg/Nm³

Mini Cement Plants:

400 mg/Nm³

(However, SPCBs can make the emission standards more stringent depending upon the local requirement).

2.6.5 Constraints faced by the industry

2.6.5a There are few constraints faced by the cement industry. Some of them beyond its control (external) like poor quality of coal and power supply etc., which need to be tackled at the national level; and internal ones, such as:

- a. Constraints of layout to accommodate new dust collection equipment within the existing space.
- b. Adverse situations arising out of using low calorific value and high ash coal, many cement plants have switched over to imported coal/pet coke and are going for Captive Thermal Power Plant to fulfil its power requirement.
- c. Allocation of coal of better quality and consistency to cement plants and also speeding up privatization of collieries for captive consumption of cement plants should be considered.
- d. Import duty on coal to be brought down along with freight subsidy for land locked plants.

2.6.6 Incentive Policy for Environment Improvement

2.6.6a Incentives for non polluting cement plants should be provided, which are adopting newer technologies and pollution abatement techniques / devices such as

- a. Waste Heat Recovery (WHR)
- b. Utilization of hazardous wastes as alternate fuels and materials.

2.6.7 Clean Development Mechanism (CDM) and Carbon Trading

2.6.7a Over the last few years, CDM linked carbon trading has drawn Indian cement industry into hectic activity for carbon trading through reduction of GHG emission and trading the emission reduction termed as Certified Emission Reduction (CER) in the International Market. All CDM projects must result in a net GHG reduction, as in the case of energy efficiency improvement, renewable energy generation, or carbon sequestration through afforestation and reforestation. Typical CDM projects fall into the following categories:

- a. Renewable energy
- b. Fuel switching (in industry, transport, residential sector, etc.)
- c. Solid waste management
- d. Advanced coal-based power generation technologies
- e. Renovation and modernization
- f. Demand-side management
- g. Industrial energy efficiency improvement

2.6.7.1 CDM projects of Indian Cement Sector

2.6.7.1a Keeping in view the confusion and arbitrariness in the CDM trading activities and complaints received from different quarters, the Government of India decided to set up an agency to help Indian applicants including industries for CDM project.

2.6.7.1b CDM-India was established in August 2003, through an agreement between GTZ (German Technical Cooperation) and the Bureau of Energy Efficiency (Ministry of Power), Government of India, under the Indo-German Energy Programme (IGEN) (Component 3) as the capacity building facility that can help reduce transaction costs in the early market development process. Its

objective is to foster high quality CDM projects that will successfully complete the project cycle and provide experience through “learning by doing”. These projects should serve as models for adoption by others. Capacity building and support to public and private sector institutions for preparation and implementation of internationally acceptable projects under the Clean Development Mechanism is its primary aim, It actively cooperates with the Designated National Authority (DNA). The DNA in India is the Secretary, Ministry of Environment and Forests (MOEF) for institutionalizing CDM projects from India.

2.6.7.1c. Certain projects in Indian Cement Industry which now seem to have high potential for CDM related Carbon Credits are waste heat recovery (WHR), Alternate Fuels, Blended Cements and Energy Efficiency.

Status of CDM Projects: Indian Cement Industry Sector

Company / Validator	Unit	Project / Annual Average Carbon Credit (tCO₂e)
Registered by CDM Executive Board		
Gujarat Ambuja / [TUVNORD] (17.12.2005)	Ropar (Punjab)	Biomass for Power (24 MW) / 25937
Shree Cements Limited / [SGS] (20.02.2006)	Beawar (Rajasthan)	Blended Cement / 68014
JK Cement Works (Unit of JK Cement Limited) [TUVSUD] (15.05.2006)	Nimbahera, Chittorgarh, Rajasthan	Waste Heat Recovery / 70796
Shree Cements Limited / [SGS] (18.05.2006)	Beawar (Rajasthan)	Alternate Fuels / 107074
ACC Ltd. / [SGS] (21.05.2006)	New Wadi, Tikaria, Chanda, Kymore, Lakheri, Chaibasa	Blended cement / 405314
Birla Corporation Ltd. / [DNV] (26.05.2006)	Raebareli	Blended cement / 26415
Grasim Ind Ltd., GIL-CDS / [DNV] (29.05.2006)	Reddipalayam (Tamilnadu)	Alternate Fuels / 51932
Binani Cement Limited / [SGS] (18.06.2006)	Binanigram (Rajasthan)	Blended cement / 21961
Ultra Tech Cement Ltd. / [DNV] (28.07.2006)	Tadipatri (A.P.) and Arakkonam (Tamil Nadu)	Blended cement / 41838
Orient Cement / [DNV] (27.08.2006)	Devapur (AP) and Jalgaon (Mah.)	Blended cement / 83208

Company / Validator	Unit	Project / Annual Average Carbon Credit (t CO₂e)
OCL India / [DNV] (11.09.2006)	Rajgangpur (Orissa)	Blended cement / 12554
Birla Corporation Ltd. / [SGS] (02.10.2006)	Durgapur Cement	Energy Efficiency / 2645
Century Textiles & Industries Ltd / [TUVSUD] (26.10.2006)	Century, Manikgarh, Maihar	Blended cement / 153078
OCL, India / [DNV] (13.11.2006)	Rajgangpur, Sundergarh (Orissa)	Blended cement / 42346
India Cements / [SGS] (06.01.2007)	Vishnupuram (A.P.)	Waste Heat Recovery / 51527
GACL / [DNV] (08.01.2007)	Maratha, Gujarat, Himachal, Bhatinda, Ropar, Rabriyawas	Blended Cement / 551829
Mysore Cements Limited / [DNV] (13.01.2007)	Tumkur (Karnataka)	Blended cement / 35806
Lafarge India Pvt. Ltd. / [DNV] (11.02.2007)	Arasmata	Blended Cement / 69359
Dalmia Cement (Bharat) Limited (DCBL) / [SGS] (18.02.2007)	Dalmiapuram; Tamil Nadu	Blended cement / 32658
Grasim Cement / [SGS] (03.03.2007)	Raipur (Chattisgarh)	Energy Efficiency / 15157
JK Lakshmi Cement Limited / [SGS] (29.04.2007)	Sirohi, Rajasthan	Alternate Fuels / 183152
Vikram Cement / [SGS] (08.06.2007)	Neemuch (MP)	Energy efficiency / 20949
Binani Cement Limited / [SGS] (22.06.2007)	Binanigram (Rajasthan)	Energy efficiency / 12438
Ultra Tech Cement Ltd. / [DNV] (19.10.2007)	A.P.	Waste Heat Recovery / 16871
Vikram Cement (VC) / [TUVNORD] (30.11.2007)	Neemuch (MP)	Alternate Fuel / 86772
The KCP Limited (Cement Unit), India / [TUVNORD] (19.11.2008)	Guntur (A.P.)	Waste Heat Recovery / 7766
Total CERs : 2197397, or about 2.19 mns		

Source: CDM Division, UNFCCC, www.jges.or.jp/en/cdm/reports-cdm.total

Total CERs for the entire crediting period of 10 years
= (10*2197397), or 21973970 (i.e. about 21.9 millions).

Notes:

1. There are so far 26 CDM Projects Registered from Indian cement companies with the CDM Executive Board.

2. Of the above, types of projects registered are as under:

- Waste Heat Recovery (WHR) - 4 nos.,
- Alternate Fuels (AF) - 5 nos.,
- Blended Cement (BC) – 13 nos.,
- Energy Efficiency (EE) - 4 nos.,

3. VALIDATORS

TUVNORD – 3 projects (1 WHR of KCP; 2 AF, one each of Gujarat Ambuja and Vikram Cement)

TUV-SUD- 2 projects (1 WHR of JK Cement, 1 BC of Century Textiles and Industries)

SGS- 11 Projects (2 AF, 4 BC, 4 EF, 1 WHR) (2 AF, 1 each of JK Lakshmi and Shree Cements and 4 BC, 1 each of Binani Cements, ACC, Shree Cement and Dalmia Cement; 4 EF, one each of Binani, Birla Corporation, 6 Grasim and Vikram Cements and 1 WHR of India Cements)

DNV – 10 Projects (BC 8, 2 from OCL, one each of Orient Cement, GACL, Birla, Lafarge, MCL, UTCL; 1 WHR of UTCL and 1 AF of Grasim)

2.6.8 National Clean Energy Fund

2.6.8.1 In accordance with the principle of "polluter pays" as the guiding criteria for pollution management, the Finance Bill 2010-11 provided for creation of a corpus called National Clean Energy Fund for funding research and Innovative projects in the field of clean energy technologies. To build the corpus of the National Clean Energy Fund, an energy cess has been levied on coal and lignite produced and imported in our country at a nominal rate of Rs.50 per tonne. Subsequent to the budget announcement, the Central Board of Excise & Customs (CBEC) issued a notification dated June 22, 2010 to notify the Clean Energy Cess Rules, 2010. During 2010-11, Rs. 3124 crores were collected from cess on coal and lignite, the total corpus is expected to swell to over Rs. 6500 crores in

2011-12. The coal consumption in Indian Cement Industry is about 4.5% of the total coal consumption in India. Hence, it is expected that Rs 292.5 crores should be available from NCEF for projects/schemes to adapt to Clean Energy Technology and Research & Development in the field of Cement sector for 11th Five Year Plan. The coal requirement for the 12th plan period considering 7.5% increase per annum in coal consumption, is expected to be 4346 million tonnes, out of which Indian Cement Energy may require 195.5 million tonnes of coal. Hence, a total of Rs. 977.9 crores may be available for innovative research and clean energy ventures in Indian cement industry. Government assistance for any project under the NCEF will be maximum 40% of the total project cost.

Sl. No.	Plan Period	NCEF expected Cumulative Corpus (in Rs. crores)	Contribution to NCEF by Cement Sector (in Rs. crores)
1	11 th Plan Period	6500	292.5
2	12 th Plan Period (E)	21732	977.9

E : Estimated @ 7.5% increase per annum

2.6.8.2 The funding from this corpus for cement sector may be provided in the cement sector on following account: Modernization of cement plants, alternate fuels - used tyres, biomass, hazardous waste, municipal solid waste, CETP sludge etc., renewable energy - wind, solar energy, carbon sequestration, projects related to GHG reduction measures etc.

2.7 Utilisation of Wastes in Cement Manufacture

2.7a Industrial and mineral wastes from mineral processing industries, such as metallurgy, petrochemicals, chemicals, paper and pulp account for more than 200 million tonnes per annum or more in India. The important wastes from these industries from the view point of use in cement, concrete and building materials are fly ash from thermal power plants, slag from steel industry, press mud from sugar industry, paper sludge from pulp and paper industry, phosphor-chalk and phosphor-gypsum from fertilizer industry, carbide sludge from the acetylene industry, calcium carbonate sludge from soda ash and chrome sludge from sodium chromate industry, red mud from aluminium industry and metallurgical slag from non-ferrous industry, etc.

2.7.1 Status of Fly ash Generation and its Utilisation

2.7.1a Thermal power plants using pulverized coal as fuel generate about 160 million tonnes of ash per year and the figure is likely to increase manifolds in future, posing serious disposal and ecological problems in addition to occupying large tracts of scarce cultivable land. The ash can be classified mainly into two categories; bottom ash and fly ash. The latter is potentially more valuable for the construction industry. Out of the current generation of 160 million tonnes per annum only 65 million tonne fly ash is being presently used in cement, construction industries and other industries thus leaving a vast scope for maximizing its use.

2.7.1b Therefore, the major identifiable applications of fly ash in building materials industry are : Portland pozzolana cement, as a raw material for the manufacture of ordinary Portland cement, low heat cement, pozzolana metallurgical, masonry, slag-fly ash activated and oil well cements, sintered fly ash light weight aggregates and concrete, cement/silicate bonded fly ash/clay fly ash building bricks, pre-cast fly ash concrete building units, cellular concrete, bricks and blocks, lime and cement fly ash concrete, structural fill for roads, construction sites, land reclamation etc., as a filler in mines, as a filler in bituminous concrete and manufacture of insulating and semi-insulating bricks, as a plastisizer and a pumping aid, as a water reducer in concrete, sulphate resisting concrete and as a filler in paints and pigments. While fly ash can find usage in many other areas as well, the use in PPC production level reaching to 100.15 million tonnes during 2009-10 amounting to 62.30 percent of total cement production in India.

2.7.1c Fly Ash is used as the blending component in the manufacture of Portland Pozzollana Cement (up to 35% max) as per IS:1489 (part I) 1991 and the fly ash has to conform its quality as per IS: 3812 (part I) 2003. The role of fly ash in PPC is attributed to the Pozzolanic action leading to contribution towards strength development. On the other hand, there is no limit for addition of fly ash as mineral admixture in concrete which entirely depend upon the quality of fly ash and its economical availability.

2.7.2 Status of Other Wastes Generation and their Utilization

2.7.2a Granulated blast furnace slag is a latently hydraulic material and is glassy in nature. Around 10.0 million tonnes blast furnace slag is currently generated in our country from Iron & Steel industry. Depending upon the quality,

the slag is used in the range and therefore, the newer and unexplored engineering characteristics of slag and fly ash has to be investigated. The slag from non ferrous industries such as Copper and Zinc can be investigated for manufacture of slag cement. As per the existing knowledge, the use of finer fly ash can have following impact on engineering properties of cement, mortar and concretes:

- a. Well-dispersed finer particles increase the viscosity of the liquid phase helping to suspend the cement grains and aggregates, improving the segregation resistance and workability of the system;
- b. Finer particles fill the voids between cement grains, resulting in the immobilization of “free” water (“filler” effect);
- c. Well-dispersed finer particles act as centers of crystallization of cement hydrates, therefore accelerating the hydration;
- d. Finer SiO_2 participates in the pozzolanic reactions, resulting in the consumption of Ca(OH)_2 and formation of extra C-S-H;
- e. Finer particles improve the structure of the aggregates’ contact zone, resulting in a better bond between aggregates and cement paste;
- f. Crack arrest and interlocking effects between the slip planes provided by finer particles improve the toughness, shear, tensile and flexural strength of cement based materials.

2.7.3 Expected Benefits of Future Research on various wastes Generated in India.

2.7.3a The benefits expected from the increased level of waste utilization to cement, building materials and concrete are:

- a. Improvement in performance characteristics through development of newer materials and cements with improved characteristics
- b. Enhanced utilization of wastes
- c. Savings in natural raw materials
- d. Reduced environmental emissions

2.7.4 Potential Research Areas for Future

2.7.4a Some of the prominent areas which need further exploitation are:

- a. Exploring the newer engineering characteristics of fly ash at finer level and further increasing its utilization levels and avenues
- b. Use of mine wastes in the manufacture of masonry cement and sand-lime bricks
- c. Utilization of lime sludges for the manufacture of building lime of different grades and lime fly ash bricks/blocks
- d. Use of red mud as a pozzolana for the manufacture of PPC and for making floor tiles etc
- e. Use of steel slag in road construction
- f. Use of non-conventional slags from different metallurgical industries in the manufacture of cement.
- g. Use of jerosite, a waste from zinc industry, as a set retarder in the manufacture of cement
- h. Utilization of kimberlite, a waste from mining industry, as a raw material in cement, glass and ceramic products and road construction
- i. Activated slag cement and tiles/bricks/blocks from slag

2.7.5 Other Logistics Barriers and Issues related to Policy Initiatives

2.7.5a For various wastes in general, the promotional efforts for their bulk utilization in cement, concrete and building materials such as availability of the wastes in dry state, variation in the quality of the wastes to the minimum level and a package of measures such as tax relief and waste utilization subsidy will go a long way in promoting their utilization.

2.7.5b For fly ash in particular, the barriers related to logistics and policy initiatives are summarized as under:

- a. Since bulk of fly ash is being disposed off in wet state, arrangements have to be made for extraction and supply of fly ash in dry state for such uses, which cannot use wet fly ash.
- b. Provision of transportation of dry fly ash in closed wagons because otherwise transit losses are high as it is a fine power.
- c. Provision of marketing of standard quality fly ash in bags or any other packing including drums.
- d. Plant engineering of commercial size plants for manufacturing new materials based on fly ash.
- e. Need for modifications of existing standards and codes consequent upon the acceptance of different uses of fly ash and formulation of new standards whenever necessary.
- f. Limitation in distance over which the ash can be commercially transported.
- g. Variation in the quality of fly ash is a one of the major problems related to its bulk utilization.
- h. Unawareness of consumers towards quality of fly ash based products along with confidence of builders in the conventional building materials.

2.7.6 Newer Challenges

2.7.6a The world today face the gravest challenge in terms of ever increasing level of Green house gas emission and its impact on Global warming. The Fly ash utilization has a potential to play a significant role by using fly ash in various applications to its maximum extent, thereby reducing the carbon footprints due to cement, construction and building materials. Therefore exploring the newer avenues and maximization of utilization levels in the existing avenues of fly ash are the biggest challenge.

2.7.6b The normal cement produced in India has average particle size in the range of 50 to 80 micron in which considerable amount is below 45 micron also going as fine as 1 micron. Particles below 10 micron play a very important role in early strength development characteristics of cement. As reported in the literature, Ultrafine cement contain substantial amount of particle less than 20 micron size. Ultrafine cement has unique characteristics in terms of extremely high early strengths, very low permeability in concrete. Ultrafine fly ash as reported in literature has increased pozzolanic activity and flow properties. It is reportedly used in a variety of high end applications, including grouts, high strength pre-cast concrete and also as replacement for silica fume in high strength concretes. 25-70% in the manufacture of Portland Cement (PSC). BOF slag, commonly known as steel slag is another waste from iron and steel industry. It has shown potential for use as a raw mix component up to 10 percent in the manufacture of cement clinker. Steel slag can also replace granulated blast furnace slag up to 10 percent in the manufacture of Portland Slag Cement (PSC). Red mud is a by-product generated from aluminium industry. An estimated quantity of 3.75 million tonnes of red mud is generated per annum. Around 8 percent of it can be gainfully utilized as a raw mix component in the manufacture of cement clinker. Red mud can also be used for making bricks/blocks and tiles. Lime sludge are generated from paper, acetylene, sugar, fertilizer, sodium chromate, soda ash and other chemical industries. About more than 5.0 million tonnes of sludges in total are generated annually from these industries.

2.7.7. Technological Barriers in Maximising Use of Fly ash Utilisation

2.7.7a Out of various types of wastes generated in India, fly ash now has been established as the most sought after material of today in Cement, Construction and related Building Material Industries. Samples used in studies carried out on Indian fly ash have indicated that the range of glass content varies between 15-45 percent and the LR between 2.0-7.0 MPa. Laboratory investigations carried out on the activation of a representative Indian fly ash showed that the enhancement of reactivity was due to the dissolution of crystalline phases, e.g. quartz, hematite, mullite, etc. The fine fractions of fly ash below 45 micron is major portion in general and contributes predominantly in performance of cement. This particular aspect of Fly ash is very important with a view to enhance the percentage of use of fly ash in cement and concrete and needs thorough and systematic investigations to arrive at certain adoptable methodologies at still finer levels.

2.7.7b The effect of the fly ash in concrete depends on combinations of paste enhancement, water reduction and pozzolanic reactivity, resulting in pore refinement in the paste fraction of the concrete. The main beneficial effect of fly ash is related to the refinement of pore structure by pozzolanic reaction reducing diffusion rate and electric conductivity of concrete. In recent times, the use of fly ash in concrete have gone up and the construction industry is going for high volume fly ash concrete to take maximum benefits from its usages.

2.7.7c The utilization level of fly ash in India remains still low as compared to developed nations. The technical reasons are summarized as under:

- a. Poor quality of Indian fly ash in terms of
 - i. Lime reactivity
 - ii. Low lime content
 - iii. Low glass content
 - iv. High carbon content
 - v. Varying fineness
 - vi. Inconsistent quality of fly ashes

2.7.7d Therefore there is an urgent need to understand the fly ash as an engineering material and more so its behaviour and characteristics are still at finger levels.

2.8. Development and Adoption of Nanotechnology Practices

2.8a Investigations on development and adoption of nanotechnology practices to cement and concrete are presently being pursued globally. The application of nanotechnology to cement and concrete is expected to result in development of eco-friendly, high performance cements/binders and concrete with improved durability characteristics. It would also help in achieving the goal of sustainable development. The major developments are expected along the following lines:

- a. Cements/binders modified by nano-particles and produced with substantially reduced volume of Portland cement component
- b. Cements/binders reinforced with nano-rods, nano-tubes, nano-nets, or nano-springs
- c. Cements/binders based on the alternative systems (MgO, phosphate, geopolymers, gypsum)

- d. Cements/binders modified by nano-sized polymer particles, their emulsions or polymeric nano-films
- e. Grinding aids for superfine grinding and mechano-chemical activation of cements
- f. Cement based composites reinforced with new fibers containing nano-tubes as well as with fibers covered by nano-layers (to enhance the bond, corrosion resistance or introducing the new properties, like electrical conductivity etc.)
- g. Next generation of super plasticizers for “total workability control” and supreme water reduction
- h. Cement based materials with supreme tensile and flexural strength, ductility and toughness
- i. Cement based materials with engineered nano and micro-structures exhibiting supreme durability
- j. Materials with self-cleaning/air-purifying features based on photo catalyst technology

2.8.1 Nanostructure of Cement/Concrete

2.8.1a Concrete has a nanoscale structure comprising of hydrates of cement, additives and aggregates. The cementitious phase that holds concrete together is calcium-silicate-hydrate, the main hydration product of Portland cement. Calcium-silicate-hydrate consists of a gel composed of colloidal particles in the 1 to 100nm range and the pores present in calcium-silicate-hydrate are also of nanometer-scale. These nanoscale pores together with the ‘type / morphology of gel’ control the properties of C-S-H. The properties of hydrated cement and concrete can be modified & controlled by manipulating their nanostructure.

2.8.1b The nanostructure of C-S-H is still not understood completely. A better understanding of nanostructure of cementations systems would provide a greater capability to control and manipulate the properties and behaviour of cements and concrete. Nanotechnology is now providing the ability to observe the structure at its atomic level and measure the strength and hardness of micro and nanoscopic phases of cementitious materials. Nanotechnology is providing a close-up look at the hydration of cement grains and the nanostructure of cement reactivity. Nano-engineered polymers have been found to act as highly efficient superplasticizers for concrete. Nanoparticles, such as silicon dioxide, have been found to be a very

effective for achieving high-performance and self-compacting concrete with improved workability and strength. Reinforcement of cementitious binders with nanodiameter fibres and rods can result in higher performance of cementitious materials in general, by impeding crack formation and growth. It is expected that the addition of nano-particles to concrete will improve the control of concrete microstructure beyond what is possible today with existing technologies, therefore the product should be more durable in terms of its resistance and lifespan.

2.8.2 Beneficial Action of Nano-Particles on the Microstructure and performance of Cement-Based Materials

2.8.2a For the decades, major developments in concrete performance were achieved with application of super-fine particles: fly ash, silica fume, and now, nanosilica. Beneficial action of nano-particles on the microstructure and performance of cement-based materials arises from the following factors:

- a. Well dispersed nano-particles improve the segregation resistance and workability of the system
- b. Nano-particles fill the voids between the cement grains, resulting in the immobilization of “free water” (filler effect)
- c. Well dispersed nano-particles act as centres of crystallization of cement hydrates, therefore accelerating the hydration
- d. Nano-particles favour the formation of small sized crystals (such as Ca(OH)_2 and Afm) and small-sized uniform clusters of C-S-H
- e. Nano- SiO_2 participates in the pozzolanic reactions, resulting in the consumption of Ca(OH)_2 and formation of extra C-S-H
- f. Nano-particles improve the structure of the aggregates contact zone resulting in a better bond between aggregates and cement paste
- g. Nanoparticles improve the toughness, shear, tensile and flexural strength of cement based materials.

2.8.3 Expected Benefits of Nanotechnology

2.8.3a The benefits expected from application of nanotechnology to cement & concrete include:

- a. Improvement in performance characteristics through development of newer binders and cementations composites.
- b. Savings in energy through development of low energy cements
- c. Enhanced utilization of wastes
- d. Savings in raw materials
- e. Reduced environmental emissions
- f. Longer service life of structures

2.8.3b Development of efficient nucleating agents and low energy cements will contribute to increased use of supplementary cementing materials. Such as fly ash and slag while making concrete production more environmentally sustainable.

2.8.4 Research Objectives for adoption of Nano Technology practices

2.8.4a The research objectives for development and adoption of nanotechnology practices to cement and concrete have been formulated so as to take the lead in this field to provide cutting-edge nanotechnology-based materials for the construction industry. The identified research objectives are listed below.

- a. To develop new technologies and products based on nanotechnology, with an emphasis on cements, cement-based products, admixtures and concretes.
- b. Synthesis and use of reactive/nonreactive nanoparticles.
- c. Investigations on role of nanoparticles in cement binders.
- d. Investigating new approaches to reinforcement of cement based materials using nano-rods, nano-tubes, nano-nets etc.

2.8.4b The achievement of above research objectives would require a collaborative approach and pooling of resources. Efforts will be required to identify the institutions at national and international level having similar interest and capability for taking up projects to meet the above objectives. The focus will be on the following research areas:

- a. Characterization of nano-particles for physical and chemical properties.
- b. Dispersion behaviour in cement.
- c. Effect on hydration chemistry and development of hydration products.

2.8.5 Policy Initiatives:

- a. Promoting collaborative research involving national laboratories as well as laboratories abroad especially on technologies to produce nano-particles and the latest characterization techniques used for elucidation of nanostructure.
- b. Establishing a well equipped Centre of Excellence for development and adoption of nanotechnology practices to cement and concrete.
- c. Arranging and earmarking resources for implementing above mentioned policy initiatives.

2.9. Standards on cement

2.9.1 The number of Indian Standards covering the specifications of various types of cement is presently fifteen. In addition to these, Indian Standards for fly ash, calcined clay pozzolana, granulated blast furnace slag, silica fume, etc. are also available and used by cement and concrete industries.

2.9.2 Indian standards, including the standards for cement, concrete and their testing methods, are normally reviewed once in five years with a view to reaffirming, revising, declaring of obsolescence or withdrawing the same. These revisions take into consideration the latest technological and product developments, findings on quality and performance, environmental concerns, sustainability related issues and other relevant aspects. Formulation of new standards is taken up from time to time to accommodate the emerging requirements of consumers and industry. Expert bodies like NCCBM, CPWD,

IITs, industry associations and consumer bodies contribute to both formulations of new standards as well as revision of existing standards. The formulation of new standards may also require fresh R&D inputs in many cases. The potential of including metallurgical slags from other non-ferrous industries such as copper, lead and zinc etc. as mineral additives in cement manufacture is also under consideration.

2.9.3 The new standards which have been taken up for formulation at BIS include standard for composite cements and standard for clinker. R&D data on composite cements has already been provided by NCCBM to BIS. Preliminary draft for specifications for clinker has also been formulated and is in the process of finalization. The preliminary draft for standard specifications for metakaolin for use as mineral admixture in hydraulic cement system has been prepared and the finalization of specifications for metakaolin is under progress at BIS.

2.9.4 The fourth revision of specifications of fly ash (IS 3812, Pt. 1 and Pt. 2) is currently under progress. Some of the other standards which have been proposed to be taken up for a comprehensive revision include IS 1727 (Method of test for pozzolanic materials) and IS 4032 (Chemical Method of Analysis for Hydraulic Cement). IS 4032 revision is also proposed to take into account alignment with the corresponding ISO standard.

2.9.5 An expert group has been constituted for development of specifications for ground granulated slag for use in concrete making and other applications. To provide the users of cement, necessary guidance for effective and correct utilization of different types of cement depending on their suitability for different end applications, a separate Indian Standard in the form of guidelines is proposed to be formulated and an expert group has been constituted to prepare a draft on the subject.

2.10. Human Resource Development

2.10a There has been tremendous growth of activities in the Indian Cement Industry in terms of setting up of new green field plants, brown field expansions besides modernization and up gradation of existing cement plants. During the XII Five Year Plan period, the production capacity of the cement industry is expected to increase by about 150 million tonnes.

2.10b In order to keep pace with such modernization / expansion due to technological developments, a strong manpower base equipped with latest development has to be built within Cement Industry. However, the availability of trained manpower is one of the major challenges faced by the cement industry presently. There is a big shortfall between the availability of trained manpower and demand. A number of Greenfield and Brownfield projects are to be set in the XII Five Year Plan to realize the targeted enhancement of the cement production capacity. But the trained manpower is not available as per their requirements. Further the technological changes are taking place in every department of cement manufacture at a rapid pace. Consequently, the skills of manpower already employed in existing cement plants has to be upgraded in areas such as the operation of state-of-the-art pre-processing technologies, utilization of alternate and unconventional raw materials and fuels, energy conservation, quality control, pollution control and sustainable development.

2.10c The cement industry provides direct employment for around 1,40,000 persons while creating indirect employment through process machinery manufacture, raw materials and other sources. It is estimated that one million tonne of cement production provides employment to around 50,000 persons downstream.

2.10d Generally, in a one million tonne per annum (1 MTPA) modern cement plant, around 400 skilled technical manpower is required. Out of 400 trained manpower, around 150 will be at managerial and supervisory levels. The cement industry will require a total of 43,000 skilled technical manpower for about 108 million tonnes Greenfield expansion, 17000 skilled technical manpower for about 42 million tonnes brownfield expansion and 6000 skilled technical manpower for 3000 MW captive power plant operation. Accordingly, a total of about 66000 additional technical manpower, including 23000 engineers & supervisors, will be required to attain the targeted capacity additions. In addition, the industry would require about 50000 unskilled workers. This does not include the replacement demand of personnel that would arise in the plants already in existence.

2.10e The basic qualifications for the different categories of manpower required by cement plant is as under:

Engineering Graduates	Graduate in Chemical / Mechanical / Geology / Mining/ Electrical / Civil / Electronics & Instrumentation
Engineering Diploma Holders	Diploma in Chemical / Mechanical / Electrical / Civil Engg. , Diploma in Mining
Science Graduates	Chemistry / Physics / Mathematics
Skilled Workers	ITI trade passed in the disciplines of Fitter / Welder / Auto Mechanic / Draftsman / Electrician/mason

2.10f The training needs for various categories of manpower for cement plants are elaborated as under:

2.10.1 Worker Level Staff

2.10.1.1 Onsite practical training programmes for the workers will have to be organized at cement plants. The cement industry has Regional Training Centres (RTCs) located in different regions of the country. The RTCs are to be entrusted to organize Workers' training programmes at regular intervals. However, the training activities of the RTCs will have to be expanded in terms of trained trainer and interactive Computer Based Training (CBT) programmes, with the technical support of research and consultancy organizations such as NCB. The Computer based training packages need to be developed for specific subjects for training the workers on regular basis. ITI trade passed skilled workers shall be trained for 3 months in various disciplines at RTCs before they join the cement plants.

2.10.2 Managerial and & Supervisory Level Staff

2.10.2.1 In this category fresh engineering graduates & diploma holders and science graduates numbering about 23000 will enter the industry. As such, they will need detailed orientation courses in cement technology before they actually start working.

2.10.2.2 The new green-field projects coming up will be based on high capacity kilns (up to 10,000 tonnes/day), state-of-the-art technology including computerized operating and control systems. To operate such plants efficiently, the operators need simulator based training. The Ballabgarh and Hyderabad units of NCCBM now have versatile state-of-the art computer operated simulator trainer

for imparting hands-on-training in the operation of modern pyro-processing and grinding systems. NCCBM conducts simulator based training programmes at regular intervals as per its annual calendar.

2.10.2.3 In order to cater to the growing requirements of the cement industry, there is a need to start degree/post graduate degree level programmes at universities/ other institutional level dedicated to cement manufacturing technology.

2.10.3 Training facilities for Indian Cement Industry

2.10.3.1 NCB is the only organization in the country which has been catering to training needs of the Indian Cement industry both for entry levels as well as working professionals successfully, though a limited extent, for nearly four decades. In the present scenario of growing demand of trained manpower and regular updating of technical skills of existing professionals, NCCBM is an ideal organization to fully assume the role of “trainers to the cement industry in India”. To match the requirement of training facilities of the Indian cement industry, NCCBM’s training capabilities are needed to be further strengthening, especially in terms of the following:

- a. Additional teaching manpower of 25 in total, covering all major areas of cement manufacture along with supporting staff of 10 for its Ballabgarh and Hyderabad Units
- b. Additional lodging and boarding facility at Ballabgarh unit
- c. Development of Computer based training packages
- d. Up gradation of lecture halls at Ballabgarh unit and equipping them with state-of-art training aids like computers, interactive boards and LCD projectors

2.10.3.2 NCCBM will include the following training modules:

- a. Certificate courses in individual areas of cement technology of 2 to 3 months duration
- b. Computer based training programmes for operators and technicians
- c. Distance Learning Programme - one year Post Graduate Diploma in cement technology
- d. Refresher courses on specific subject of cement manufacturing of 5 to 30 days

ISSUES:

- a. The production capacity of the cement industry is expected to increase by about 150 million tonnes during XIIth Five Year Plan.
- b. The availability of trained manpower is one of the major challenges faced by the cement industry presently. There is a big shortfall between the availability of trained manpower and demand.
- c. It is estimated that about 66000 additional technical manpower, including 23000 engineers & supervisors, will be required to attain the targeted capacity additions.
- d. A large number of newly recruited employees including fresh engineering graduates, diploma holders and science graduates numbering will need detailed orientation courses in cement technology before they actually start working.

THRUST AREAS:

- a. The training activities of the Regional Training Centres (RTCs) of the cement industry are needed to be expanded in terms of trained trainer and interactive Computer Based Training (CBT) programmes, with the technical support of research and consultancy organizations such as NCB.
- b. ITI trade passed skilled workers are to be trained for about three months in various disciplines at RTCs before they are put on actual operations of the cement plant.
- c. Newly recruited fresh engineers and graduates need detailed orientation courses in cement technology including hands-on training on cement plant simulator before they actually start working.
- d. To match the requirement of training facilities of the Indian cement industry, training capabilities of National Council for Cement and Building Materials (NCB) to be further strengthened in terms of additional manpower, additional lodging and boarding facility at Ballabgarh unit, development of computer based training (CBTs) packages, up gradation of lecture halls at Ballabgarh unit and equipping them with state-of-art training aids like computers, interactive boards and LCD projectors etc

3.11. Thrust areas of future research

2.11.1 Development of norms for composite cements

2.11.1.1 There is a need to increase the utilization of industrial wastes to the fullest extent. Development of norms for composite cement in line with the European Standard EN will allow combination of various supplementary cementitious materials such as GBFS, fly ash, silica fume, natural and calcined pozzolona, burnt shale, lime stone etc. in cement. This provides avenue for better utilization of various kinds of wastes. Non availability of standards for composite cements in India prevents cement manufacturers from utilizing materials such as fly ash and slag together in one cement when both are available in sufficient quantity at the same place.

2.11.2 Carbon dioxide capturing and storage (CCS)

2.11.2.1 Presently, Indian cement industry is emitting around 5% of total anthropogenic CO₂ from all industrial sectors with nearly 0.8 tonne of CO₂ for every tonne of cement produced. Stabilizing atmospheric concentrations of green house gases requires addressing this important emissions source. Reduction in energy intensity can be achieved by a variety of strategies such as energy efficiency improvements through acquisition of state of the art technologies, lower in the clinker to cement factor by manufacture of more blended cements utilizing larger industrial wastes and cogeneration of power etc.

2.11.2.2 Other options are switching to fuels with lower carbon content, biomass etc. Advanced CO₂ management approaches include technologies and alternative products to be developed for their acceptability include carbon dioxide capture and storage. Approximately, 80% of CO₂ emissions from the cement plants could be potentially be captured, transported and stored in suitable geologic formations. The potential for CCS in emission mitigation is necessary dependent on the availability of suitable reservoirs and transportation. There is a need to develop a comprehensive management strategy for the cement industry.

2.11.3 Chemico-mechanical activation for cement manufacture

2.11.3.1 Conventionally, raw materials including limestone and additives are ground to a specified fineness and pyro-processed at higher temperature of 1400-1450⁰C to include the hydraulic properties. The clinker so produced after burning the raw materials at above temperature in granulated form is again finely ground

along with gypsum to manufacture cement. It is learnt that the hydraulic properties required in the cement can also be induced by directly grinding the raw materials to ultra fineness levels thus bypassing the pyro-processing route. This eliminates the need for fossil fuel required for clinkerisation resulting in substantial saving on thermal energy consumption as well as mitigating CO₂ emission intensity. Some initial work has been done by IIT, Mumbai or Chennai with support from CII.

2.11.4 Algal farming

2.11.4.1 Micro-algae are capable of producing 30 times the amount of oil per unit area of land, compared to various oil seed crops. Micro-algae grow suspended in water and convert CO₂ into O₂ and biomass in the presence of sunlight. CO₂ capture from the flue gases of kiln stack of cement plant will help in reducing of CO₂ emissions to atmosphere and generate bio-mass to be used as alternate fuel in kiln.

2.11.4.2 There is an urgent need to develop the mechanism for higher growth of algal and demonstration unit on pilot scale set up for CO₂ absorption in a cement plant.

2.11.5 Non / low Limestone based Cementitious Binders

2.11.5.1 Portland cement concrete is the most widely used construction material in the world. Each year, the concrete industry produces approximately 12 billion tonnes of concrete and uses about 1.6 billion tonnes of Portland cement worldwide. Besides, consuming considerable amount of natural resources (limestone and sand) and energy for producing each tonne of Portland cement, it also releases one tonne of carbon dioxide (CO₂) into the environment. There are concerns for the sustainable development in the cement and concrete industries and need for development of suitable technologies.

2.11.5.2 One of the emerging concrete technologies for sustainable development is, to use “green” materials for construction. The “green” materials are considered as materials that use less natural resources and energy and generate less CO₂. They are durable and recyclable and require less maintenance. The materials which have potential for exploration are mine rejects, low grade materials, industrial wastes, etc.

2.11.5.3 One such areas of exploration could be cementitious systems based on Magnesium. Magnesium phosphate cements develop considerably greater compressive and tensile strengths compared to Portland cement, and it takes less energy to produce it.

2.11.5.4 Another advantage (which is much pertinent in today's perspective) of Magnesium-based cements is that they have a natural affinity for cellulose; so you can actually use wood chips as an aggregate to achieve lighter weight and more insulative products. Magnesium oxide when combined with clay and cellulose creates cements that breathe water vapour; they never rot because they always expel moisture. MgO cements do not conduct electricity, nor heat and cold. Considering these advantages, the detailed and systematic investigations are needed to establish the technical advantages and suitability of such systems.

2.11.6 Low Energy Cements

2.11.6.1 Cement industries all over the world make efforts in reducing their energy consumption by using waste materials as alternative fuel thus contributing to lower overall CO₂ emissions and by respecting environmental legislations. The time has come when drastic reductions in energy consumptions are needed to have useful impact.

2.11.6.2 New classes of cements have to be explored which can be synthesized at substantially very low temperatures. Hydrothermal synthesis route is one such route which needs to be explored for its technical suitability both for commercial production and end use. Such cements are produced by forming calcium silicate hydrates in a hydrothermal reaction at temperatures between 150 and 200⁰C. In a second step the autoclaved material is co-milled with a SiO₂-rich material, such as Quartz-Sand.

2.11.6.3 Another low energy cement as reported by Karlsruhe Institute of Technology (KIT) namely Celitement has the potential to reduce both energy use and CO₂ by up to 50%. During hydration, Celitement transforms to calcium silicate hydrate gel. This material is the cement hydrate, which defines the mechanical strength and stability of traditional concrete. Thus material properties of test samples made with Celitement, such as strength development and final compressive strength (up to 80 MPa) resemble those of samples made with OPC.

2.11.6.4 The production of cement clinker minerals by precipitation from a molten salt solvent is yet another potential route to energy reduction in cement manufacture. Molten salt synthesis of the major cement compounds β -di-calcium silicate (β -Ca₂SiO₄, β -C₂S) and tri-calcium silicate (Ca₃SiO₅, C₃S) has been attempted in fused sodium chloride (NaCl). The synthesis of β -Ca₂SiO₄ was carried out by the reaction of CaCO₃ with SiO₂ in molten NaCl. The product was characterized by powder X-ray diffraction, Raman scattering and scanning electron microscopy. In all cases β -Ca₂SiO₄ was the principal product, with the CaO phase still present and (if any) only small quantities of Ca₃SiO₅.

2.11.6.5 Considering the need for reducing carbon foot prints, it would be worthwhile to investigate newer systems which are consuming lower energies for their synthesis.

2.11.7 Other Areas of Developments in Cement

2.11.7.1 Low Lime Cements

2.11.7.1a Cement such as belite and sulfoaluminate (C₄A₃S) type have been reported on commercial scale particularly in countries such as China, Japan and Russia. The cements are manufactured in smaller batch type process kilns and are found suitable for applications in coastal areas owing to their sulphate resistance. These have potential for utilization of low grade limestone and industrial wastes.

2.11.7.2 Special Cements

2.11.7.2a Diversifications in the use of raw materials, fuel, industrial wastes and basic research findings to conserve energy in cement manufacture and generate special properties have resulted in development of jet set fluoro-aluminate, expansive, oil well, alkaline, dental, nuclear and photo chromic cements. These developments were based on modifications or additions in the chemistry of Portland cement. Fluoro-aluminate cement are class of jet set cement excellent for rush repairs owing to rapid hardening due to presence of CaF₂C₁₁A₇. Expansive or shrinkage compensating cements were developed to prevent shrinkage cracking and impart dimensional stability for structures in pavements, runways, water tanks, rail road etc. Oil well cement development to meet the conditions prevailing in the oil wells were based on modifying the properties of Portland cement by controlling consistency and setting properties through changes in mineral phase composition and use of admixtures.

2.11.7.3 Composite Cements

2.11.7.3.1 The blended cements, which are produced using more than one mineral addition, are known as composite cement. BIS, presently, has no standard for composite cements. Hydraulic cements specified by Bureau of Indian Standards include OPC (33, 43 & 53 Grades), PPC, PSC and various special purpose cements. Fly ash conforming to IS 3812 (Part 1): 2003 and granulated blast furnace slag conforming to IS 12089: 1987 are used in the manufacture of PPC and PSC respectively. However, use of both these materials simultaneously in manufacture of cement is not included in current BIS specifications.

2.11.7.3.2 In comparison to BIS, European Standards specify composite cements as well as some other cement types where use of fly ash and slag and in some types other mineral admixture as well is permitted simultaneously. Use of greater number of mineral additives with wider quantitative range, in hydraulic cements would be useful for resource conservation, enhanced waste utilization and improved control over cement performance. To facilitate manufacture and use of composite cement in India, it is required to formulate the standards for composite cements. Manufacture and use of composite cement is desirable for maximizing the utilization of waste materials and for better control over cement properties. Investigations on performance and durability characteristics of composite cements prepared from indigenous materials and tested as per BIS specifications would be required to generate enough data to enable formulation of standards on composite cements.

2.11.7.4 Geo-polymer Cements

2.11.7.4.1 Alkali activated alumina-silicate cements are known as geo-polymeric cements because of similarity of their structure with the structure of silicate and alumina-silicate minerals. Geo-polymeric cements are eco-friendly binders and are produced from non-limestone bearing raw materials and wastes such as fly ash and slag. Geo-polymeric cements include alkali activated slag cement, alkali activated metakolinitic cement and alkali activated fly ash cement.

2.11.7.4.2 Physical properties and durability characteristics of these cementitious systems depend on compositional parameters such as water content, type and quantity of alkaline activator used the quality and mineralogy of alumina-silicate material, e.g., fineness and glass content of fly ash and curing conditions. The compressive strength is increased with the decrease of water content as well as with the increase of sodium silicate in the synthesis of geo-polymers. Optimization of compositional, quality and processing parameters has yielded geo-polymeric materials with compressive strengths higher than 40 MPa.

2.11.7.4.3 Cement and silicate research findings have shown a path of maintaining ecological balance by providing avenues to produce blended and composite cement. The rise in production and consumption of blended cement reduces need for Portland cement clinker production. This in turn reduces the CO₂ generation and also spares large land area occupied by these waste materials for alternate uses. Maximizing the recycling of these wastes in the form of eco-friendly cements is, therefore, a challenge for future research. Products like Pyrament and Brecem reported for special applications have also shown potentials of recycling industrial wastes into development of value added cementing materials. The other such cements developed in different countries are Australia (Geocem), China (Calstar), USA (Geoconcrete), UK (Cenin), Canada (Calix), Germany (Celite).

2.11.7.5 Portland Limestone Cement

2.11.7.5.1 Environmental aspect of building materials has become a matter of concern. Among the strategies to reduce the energy consumption and CO₂ emission, the production of Portland Limestone Cement (PLC) is described as a fast, economical and technical solution for cement industry around the world. Developed in France, PLC was adopted by European standard allowing up to 35% of limestone filler (LF). Today, the production of these cements is extended around the world. Negative impacts of incorporation of large amount of LF in cement are centred on the durability aspects, especially due to increased susceptibility to sulphate attack and thaumasite formation.

2.11.8. Exploration of Limestone Reserves

2.11.8.1 Limestone exploration work should be intensified to increase limestone availability for Greenfield plants.

2.12. Research and Development

2.12.1 In the present day context, the role of R & D in the growth of any industry cannot be over looked. Same is true for cement industry in India. Accordingly, for achieving the desired objectives, the research areas need to be

properly identified and focused taking into consideration the requirements of the cement industry. The research efforts could be directed towards:

- a. Technological developments in the process of cement manufacture and related plant and machinery and system design.
- b. R & D work to identify new pozzolanic materials for use as additives in cement.
- c. Research for newer methods of manufacturing such as application of Nanotechnology to cement and concrete.
- d. Development and finalization of standards for composite cement for utilizing all types of pozzolanic materials to clinker for cement making.
- e. R & D studies for reduction of green house gases (GHG's) in cement manufacture such as adaptation of best available Technology for reduction of NO_x and SO₂; and sequestration of carbon-dioxide in Algae culture.
- f. R & D studies for use of Alternate Source of Energy/ fuels and raw materials.
- g. Studies for exploration / identification of new limestone reserves for Greenfield Cement plants and up-gradation of low grade limestone and mines rejects for cement manufacture.

2.12.2 During the past, a number of cement companies have developed their in-house R & D units and today there are 8 units dedicated to R & D on cement in India. Out of these two organizations namely National Council for Cement and Building Materials and ACC Ltd are fully devoted to research and development activities. Cement plants with R&D establishments at plant site are:

- a. Dalmia Institute of Scientific & Industrial Research.
- b. India Cements Ltd.
- c. Ultra Tech Cement Ltd.
- d. Madras Cement Ltd.
- e. Ambuja Cement Ltd.
- f. Shree Cement

2.12.3 The R&D expenditure in India as a percentage of gross domestic products (GDP) is around 0.8%. However for a comparison, most of the developed countries spend between 1.23 to 3% of their GDP on research & development. Spending on R&D is seen as a sign of potential healthy growth for firms and progress in technology that helps boost economies and create jobs.

2.12.3a Data indicates that presently expenditure on R&D activities at National level out of the cess collected by the government on cement is only about 0.017% of the sales turnover of the industry which is very low as compared to developed countries viz. China and Japan.

2.12.3b The cement cess collected for R&D purposes from cement plants is partially allocated by the government. This gap in the capital investment on R&D needs to be bridged because R&D can bring manifold returns to the industry and is important for a sustainable development.

2.12.4 A broad listing of suggested areas of R&D during XIIth plan is given in the following Table 5:

Table 5: Thrust Areas of Research & Development – XII Plan

Sl. No.	Area of Research & Development	Expected Benefits
1.	Application of Nanotechnology to cement and concrete.	Improved performance, resource conservation, greater sustainability
2.	Development and Standardization of Composite Cements.	Resource conservation, greater sustainability, lower CO ₂ emission.
3.	Development of Portland Limestone Cement.	Resource conservation, greater sustainability, lower CO ₂ emission.
4.	Development of Geo-polymeric Cements.	Improved performance, resource conservation, greater sustainability, lower CO ₂ emission.
5.	Enhancing use of fly ash/ bottom ash in Cement and Concrete.	Resource conservation, greater sustainability, lower CO ₂ emission
6.	Benchmarking of Refractory Engineering Parameters.	Energy conservation and cost reduction
7.	Adaptation of Best Available Technology (BAT) for reduction of NO _x and SO ₂	Reduction in environmental emissions

Sl. No.	Area of Research & Development	Expected Benefits
8.	Studies on critical Environment Parameters for Sustainable Development of few regions.	Environmental improvement
9.	Sequestration of Carbon Dioxide in algae culture	Environmental improvement
10.	Benchmarking of Quality Parameters in Indian Cement Industry.	Improved quality performance and motivation for improvement.
11.	Up-gradation of low grade Limestone and mines rejects.	Resource conservation
12.	Utilization of Municipal Solid Waste (MSW) in Indian in cement industry.	Conservation of natural resources, integrated solutions to wastes management.
13.	Increased use of local material and minimal use of material for concrete roads (Rigid pavement)	I) Economy in concrete road which is long lasting II) Sustainability
14.	Studies on alternate to natural sand which is in short supply	i. Reduction in cost of sand ii. Conservation of natural resources
15.	Skill development for concrete road construction	Better quality of concrete road will lead to longer life of roads
16.	Multi modal transportation of cement including bulk transportation	i. Reduction in cost of cement ii. Saving in fuel iii. Improvement in environment at construction sites
17.	Use of high performance concrete to enhance durability and reduce the use of cement and other materials. R&D needed on development of design parameters for use of high strength concrete and evaluation of high performance concrete	i. Economy in design ii. Optimum use of materials iii. Enhanced durability/service life of concrete structures
18.	Development of cost effective model housing for urban and rural areas	Increased affordability
19.	Use of steel fibres, synthetic, glass fiber & carbon fibres in concrete construction & for repair/ retrofitting of structure	i. Conservation of building materials ii. Enhanced performance in case of calamity by timely retrofit.

Sl. No.	Area of Research & Development	Expected Benefits
20.	Development of methods for Service Life design of concrete structure including studies on corrosion of steel reinforcement in concrete structures	Service life based design of structure will lead to enhanced service life and bring accountability and systematic maintenance concepts.
21.	Development of alternate reinforcement materials having better resistance to corrosion than normal steel rebar including study on cost factors.	i. Enhanced durability for important structures say even more than 100 years. ii. Optimization in use of scarce & costly alloy metals like stainless steel.

2.12.5 NCCBM's Growth Needs during XII Plan

2.12.5.1 NCCBM's mandate as an R&D and industrial service support organization is to cater to the needs of the cement industry in all areas covering use of raw materials and energy, plant operation and maintenance, quality control, environmental improvement and continuing education, for enabling the industry to enhance its productivity and sustain the same in long term. Having fulfilled its objective for over four decades, NCB on its part will have to gear up in a big way to meet the vastly increased technical needs of the industry.

2.12.5.2 The above scenario specifically requires major addition of infrastructure like buildings, equipment facilities in laboratories as well as for in-plant studies and manpower of about 100 scientists, engineers and supporting staff in NCB during the next 5 years. For this purpose, a capital investment of about Rs. 60 crores has to be made during the XII Plan. Being a non-profit service provider, NCB will also require enhanced annual grant to the extent of Rs 30 crores (total Rs. 150 crores for five years by the end of XII Plan) for meeting part of its revenue expenditure.

SUB-GROUP - III

CAPITAL FUNDING AND TAXATION



SUB GROUP – III

3.0 CAPITAL FUNDING AND TAXATION

3.1 Capital funding required for increasing the production during 12th plan

3.1a The country has witnessed a steady growth of cement industry. India has become the second largest cement producing country in the world after China though the gap is wide. There is an interlinking relation between cement consumption and the growth of economy. The country is on a high growth track and the focus now is on the development of the infrastructure facilities such as, highways, ports, canals, bridges, power-houses etc. Infrastructural development obviously gives rise to increased demand for cement.

3.1b The Cement industry is a highly capital intensive industry with long gestation periods. The total investment in new capacity is more than Rs. 100,000 crore since March, 1999 which is more than in previous 85 years, and equivalent to 10 years' PAT for the sector at the peak of the cycle.

3.1.c Typically the capex is required for setting up the plant, captive power plant and owning a limestone quarry. Cement plants now require an average capital investment of about Rs. 6000 per tonne of cement, which translates into an investment of Rs. 600 crore for 1 Million Tonne Per Annum (MTPA) plant (with Captive Power and waste heat recovery). The costs have increased over the years due to high cost of land, cost of steel, civil construction due to increase in labour and other input costs. The projected increase in installed capacity as deliberated by Sub-Group I and on that basis the required capital investment would be as under:-

Table: Capital Investment required

(Rs. Crore)

Additional Capacity (million tonnes)					Capital investment required			
Ending March	Base Line	Base line+ Roads	Base line+ Roads+ Housing	Base line+ Road+ Housing+ Fiscal Support				
Scenario	1	2	3	4	1	2	3	4
2012	12.9	12.9	12.9	12.9	7740	7740	7740	7740
2013	13.4	13.4	13.4	13.4	8040	8040	8040	8040
2014	13.5	20.2	23.6	25.3	8100	12120	14160	15180
2015	23.0	27.1	29.1	30.2	13800	16260	17460	18120
2016	27.2	31.8	34.3	35.5	16320	19080	20580	21300
2017	29.2	34.5	37.3	38.7	17520	20700	22380	23220
2022	249.8	295.1	319.5	332.1	149880	177060	191700	199260
2027	391.7	484.0	535.9	563.4	235020	290400	321540	338040

3.1.2 The Capital Investment during the 12th Five Year Plan (2012-2017) is thus estimated as under:-

(Rs. Crore)

Particulars	Base Line	Base line+ Roads	Base line+ Roads+ Housing	Base line+ Road+ Housing+ Fiscal Support
Additional Capacity (MTPA)	119.2	139.9	150.6	156
Capital Cost	71520	83940	90360	93600
<i>Of which Debt</i>	47680	55960	60240	62400
<i>Equity</i>	23840	27980	30120	31200

Note: Debt/Equity has been notionally taken at a DER of 2:1.

3.1.3 The outstanding gross bank credit in Cement Sector on last reporting Friday of March 2011 was Rs. 28557 crore which was less than 2% of Gross Bank Credit deployed in Industry (small, medium and large). Thus substantial step up in credit flow to Cement Sector would be required to meet the enhanced credit requirements. Further it would also require equity investments or internal accrual of the existing players to maintain the required DER.

3.1.4 The following measures are suggested to meet the funding requirements:

- a. Cement is a necessary constituent of infrastructure development and a key raw material for the construction industry. It may be worthwhile to consider according infrastructure status to the industry.
- b. The low capacity utilizations and high interest rates have forced the players to defer their expansion plans. To meet the requirements, concessional funding is required to attract investments till the interest rates stabilize. The industry may be given interest subvention to enable raising debt at 10% per annum for the next 2 years.
- c. Special dispensation may be given to the Industry for raising ECBs.
- d. There is a need for suitable policy formulation for increased Foreign Direct Investment (FDI) in the sector.

3.2 Promotion of exports, review of taxes, duties and incentives required

3.2.1 Export of Cement/Clinker

3.2.1.1a After the total decontrol of Cement, the Indian Cement Industry has gradually developed good export market for Cement/Clinker due to its competitiveness and tendency to grow for achieving a technologically sound.

3.2.1.1b Currently, the Cement Industry in India is positioned at number 2 in the world with an installed capacity of 321 million tonnes as on 31.3.2011 and a production of 227 million tonnes during 2010-11. As a result of incorporating modern techniques in the production, the Indian cement industry has not only been able to meet domestic demands but has also served well the international areas.

3.2.1.c Some cement plants have even gone extra mile in their endeavour to launch jetties in order to promote significant quantity by export of cement and clinker.

3.2.1.2 Export by the Cement Industry started with a mere 0.16 million tonnes of cement during 1989-90. Indeed, the Government identified Cement export as an important focus item, the exports of cement/clinker gradually crossed the level of 10 million tonnes during 2004-05.

3.2.1.2a From 2005-06 the declining trend of cement/clinker export started. In 2005-06, the industry had exported 9.17 million tonnes which gradually dropped to 4.15 million tonnes despite sufficient surplus of cement capacity of around 50 million tonnes being available after meeting the entire domestic requirements.

3.2.1.3 The details of cement and clinker exports from 2004-05 onwards are given in the following table:

(Million Tonnes)

Year	Cement Export	Clinker Export	Total Export
2004-05	4.07	5.99	10.06
2005-06	5.98	3.18	9.17
2006-07	5.89	3.11	9.00
2007-08	3.65	2.37	6.02
2008-09	3.20	2.90	6.10
2009-10	2.27	3.12	5.39
2010-11	1.99	2.66	4.65

3.2.2. To make the Indian Cement/Clinker competitive in the International Market and with a view to giving afresh boost to the Export of Cement and Clinker it is recommended that:

- a. To enhance global competitiveness of Indian cement producer, 50% freight subsidy may be considered for cement/clinker logistic cost up to the port/jetty from the manufacturing unit, as most plants are located in hinterland.
- b. As of now, Cement/Clinker export is subject to high customs/port/ bunker charges. Exemption from these charges will give a fillip for exports.
- c. Investment in private jetties/ports for export of cement/clinker results in de-congesting our National ports. Therefore, the investments made for the creation of such assets should be allowed a higher rate of depreciation.
- d. Royalty on Limestone be included as part of Drawback.

3.2.2.1 Limestone is the main raw material for manufacturing Cement Clinker. Royalty on Limestone is one of the levies for which credit is not allowed at present. This results in cascading effect as various taxes are also levied on limestone at every stage and as a result, the ultimate burden of taxes is increased. The Govt. has already acknowledged that levies and duties should not be exported. In line with this principle, it is recommended that:

3.2.2.2 *Government may consider including the element of royalty in the calculation of Drawback rates. It may be pointed out that royalty on limestone alone constitutes around 3.5% of cement value and 5% of clinker value. Inclusion of the same in Drawback rates would go a long way in encouraging international competitiveness for the Indian Cement Industry or alternatively exemption from Royalty on Limestone may be allowed on the Cement/Clinker manufacture for export.*

3.3. Taxes/Levies on Cement

3.3.1. Cement is the most essential infrastructure input. The taxes on cement are the highest among the items required for building infrastructure. The total Government levies and taxes, which include Royalty on Limestone, Royalty on Coal, Electricity Duty, VAT/Sales Tax etc., on cement constitute about 60% or more of the ex-factory price of cement. The levies and taxes on cement in India are far higher compared to those in countries of the Asia Pacific Region. Average tax on cement in the Asia Pacific Region is just 11.4% with the highest levy of 20% being in Sri Lanka.

Sl. No.	Item	Rs./tonne of cement
1	Average Excise Duty	490.00
2	VAT	500.00
3	Royalty and Cess on Limestone	84.00
4	Royalty on Coal	33.00
5	Electricity Duty	23.00
6	Others including Clean Energy Cess on Fuel	30.00
	Total	1160.00

3.3.1a Indian cement industry contributes approximately Rs.32500 - 35000 crore annually to the national exchequer through various taxes and levies.

3.3.2. *Excise Duty on Cement*

3.3.2.1 Till February, 2007, Excise Duty on Cement was generally levied on the basis of Specific Rate per tonne of production, except for a period of 6 years from 1969-1975, when the Excise Duty was on Ad-Valorem basis. However, since the price was fixed and was same on All India basis; excise duty was worked out to specific.

3.3.2.1a Even, when the Excise Duty was on Specific Rate basis, there have been increases from time to time and it was Rs.400/- per tonne till end of February, 2007.

3.3.2.1b In the Union Budget 2007-08, Excise Duty on Cement had been fixed with effect from 1.3.2007 based on Retail Sale Price (RSP) and different Excise Duty for different RSP. Then with effect from 3.5.2007, it was revised which partly included Excise Duty on Ad-Valorem basis.

3.3.2.2. Recently in the Union Budget 2011-12, Excise Duty Rates have been replaced with composite rates having an ad valorem and specific component as follows:-

1	Mini Cement Plant	Duty Rate
	All goods cleared in packaged form:- (i) of retail sale price not exceeding Rs. 190 per 50 kg bag or of per tonne equivalent retail sale price not exceeding Rs. 3800; (ii) of retail sale price exceeding Rs. 190 per 50 kg bag or of per tonne equivalent retail sale price exceeding Rs. 3800; (iii) All goods other than those cleared in packaged form;	10% ad valorem 10% ad valorem + Rs. 30 per MT 10% ad valorem
2	Other than Mini Cement Plant	Duty Rate
	All goods cleared in packaged form:- (iv) of retail sale price not exceeding Rs. 190 per 50 kg bag or of per tonne equivalent retail sale price not exceeding Rs. 3800; (v) of retail sale price exceeding Rs. 190 per 50 kg bag or of per tonne equivalent retail sale price exceeding Rs. 3800; (vi) All goods other than those cleared in packaged form;	10% ad valorem + Rs. 80 per MT 10% ad valorem + Rs. 160 per MT 10% ad valorem
3	Cement Clinker	10% ad valorem + Rs. 200 per MT

3.3.2.2a For the purpose of ad valorem component the transaction value determined under Section 4 of the C.E. Act, 1944 is considered as Value. Cement industry is the only industry where such composite rate of excise duty is applicable.

3.3.2.2b Duty rates on Cement are one of the highest and next only to luxury goods such as cars. Other core industries such as coal, steel attract duty at around 5%. Cement is one of the core infrastructure industries and has limited manufacturing capacity in view of the expected GDP growth and projected demand for cement over the medium to long term.

3.3.2.2c Further, the excise duty structure for both cement as well as cement clinker has become quite complicated in the last few years. Earlier it was at a specific rate per MT. Now, it has become ad-valorem cum specific duty and is further also related to the declared MRP of the product. For example, if MRP of cement is more than Rs.190 per bag, then excise duty is 10% ad-valorem plus Rs.160 per MT. It is strongly recommended that the duty structure be simplified to be either on specific rate per MT or on ad-valorem basis.

3.3.2.2d To encourage cement industry and bring it at par with other core and infrastructure industries, it is necessary to rationalize the excise duty rate from 10% to 6-8%

3.3.3. VAT

3.3.3.1 Two major materials needed for construction of any infrastructure are Cement and Steel. However, the rate of VAT charged on Cement and Steel differs vastly. While VAT on Steel is only 4%, it is charged @ 12.5% even up to 15% in some of the States on Cement and Clinker.

3.3.3.2. It is recommended that the current rate of VAT on cement and clinker, be brought in line with similar important construction material like Steel at 4%. This would make cement more affordable.

3.3.4 Zero Import Duty on Coal, Pet Coke and Other inputs

3.3.4.1 Cement Industry has been experiencing the shortage of Coal, the main fuel, during the last several years. The supply of linked coal was as high as 70% of the total procurement in 2003-04, which has now come down to around 42%.

This has obliged the industry to source more coal from e-auction or import or using pet coke, which not only increases the input cost but also creates an environment of uncertainty. Import of non coking coal and Pet Coke is subject to a duty of 5% and 2.5% respectively while import duty on finished goods i.e., Cement is zero leading to an anomaly as import duty on inputs is higher than the finished product. Gypsum is an input added at the time of grinding clinker to make Cement. With increased capacity additions and poor availability of Gypsum of required quality, the Cement Industry has to depend on Imported Gypsum. Gypsum is subjected to an import duty of 2.5%.

3.3.4.2 From 1.7.2010, Government has also levied Clean Energy Cess @ Rs.50/- per tonne on Coal produced in the country and that imported from outside. On the cess levied as a duty of excise, no Cenvat Credit is being allowed further increasing the cost.

3.3.4.3 It is recommended that Import Duty on Coal, Pet Coke and Gypsum be abolished to be in line with the established principle that “Import Duty on Inputs should not be higher than on the finished product.” Further it is also recommended that Cenvat Credit be allowed on Clean Energy Cess.

3.3.5 Electricity Duty and Water Cess

3.3.5.1 Some of the State Governments have imposed Electricity Duty on Power purchased from Grid and/or Power consumed from Captive Power Generation. Cement Companies are already reeling under steep hike in their energy and other costs. Due to this levy cost of cement production has gone up further.

3.3.5.2 It is recommended that the Electricity Duty and Water Cess be withdrawn.

SUB-GROUP - IV

LOGISTICS INCLUDING RAILWAYS AND ISSUES RELATED TO RAW MATERIALS,
FUEL, FLY ASH, MINERALS RIGHTS AND LAND ACQUISITION



SUB GROUP – IV

4.0 LOGISTICS INCLUDING RAILWAYS AND ISSUES RELATED TO RAW MATERIALS, FUEL, FLY ASH, MINERALS RIGHTS AND LAND ACQUISITION

4.1 INTRODUCTION

4.1.1 The cement industry has grown at a CAGR of 8.96% during the first four years of 11th Five Year Plan. Considering the cement demand growth achieved till September 2011 in FY 2011-12, it is expected that the cement demand growth for this year will be around 7%. Accordingly, the overall growth for 11th Plan will be around 9.3% (CAGR).

4.1.2 As per various announcement made by Planning Commission for 12th Five Year Plan, Indian economy is projected to grow at the rate of 9% during 12th plan period. Keeping in view the Cement demand to GDP growth ratio of 1.1 times achieved over the last decade, the cement can grow at around 10% during 12th Plan. However, looking at the demand growth likely to be achieved in the 11th plan, the cement demand growth projections for the 12th Plan have been set between 8% to 10.75% p.a. For realizing these growth rate in the cement industry, great emphasis needs to be laid on the critical issues of:

- a. Logistics (Railways, Roads, Inland Waterways, Port connectivity)
- b. Raw Materials (Limestone and Gypsum, Alternative Raw materials), including Minerals Rights
- c. Fuel (Coal, Pet coke, Alternative fuels),
- d. Fly Ash,
- e. Land Acquisition.

4.1.3 These issues need to be addressed adequately for ensuring their availability and achieving the growth targets set for the economy and of the cement industry. Further, these constitute important inputs in the overall cost of production of cement and as such influence availability of quality cement at reasonable prices across the country.

4.1.4 Both Raw Materials and finished products in the cement manufacture are voluminous and bulky in nature. Ideally production units are to be located close to the raw material (limestone, fly ash) sources and extent of market coverage from each unit is determined by availability of logistic infrastructure at reasonable costs. As a result, the cement industry operates in a regional manner.

4.1.5 To attract necessary additional investments and ensure sustainable operations of existing and upcoming capacities, sufficient resources of raw material, fuel and fly-ash need to be earmarked and allotted to the industry.

4.1.6 Before we discuss the issues relevant for healthy growth of cement industry during the 12th plan period, it's important to take stock of current cement capacity & demand as well as the projected capacity & demand during the plan period as the projection of limestone inventory, fuel requirement, fly ash requirement and logistics availability etc are dependent on it.

4.2 CEMENT CAPACITY AND DEMAND - CURRENT AND FUTURE PROJECTIONS

4.2a The status of cement capacity, production and dispatches during 2010-11 (as on 31.3.2011) is as under: -

(Figures in MTPA)

Particulars	Capacity as at 31.3.11	Production (2010-11)	Domestic Consumption (2010-11)
A. CMA Members	236.2	168.2	165.6
B. Other than CMA			
1. ACC	27.4	21.3	21.8
2. Ambuja	21.0	20.4	20.4
3. Others (Bharti, Jayajyoti, Sagar, Srichakra, Murli Agro, Adhunik {Meghalya}, NCL Industries, Parasakti, MY Home -Vizag, MCC, Deccan, Bhavya, Keerthi Industries, Jaypee-Bhillai, Shiva) (approx)	27.4	12.4	12.2
Total Large Plants	312.0	222.3	220
Add: Mini Cement Plants (approx)	11.1	6	6
Total	323.2	228.3	226

Source: CMA and Industry Estimates

4.2.1 Future Projections - Capacity and Production

4.2.2 Achievements during XIth Plan period

4.2.2.1 Considering the actual numbers for FY 2007-08 to FY 2010-11 and based on the expected performance during 2011-12 estimated by Sub Group I, the targets and actual performance during 11th Plan is likely to be as under:-

(Million Tonnes)

	Particulars	Target	Actual	Variation
A	Capacity			
1	Capacity at beginning of 11 th plan	180.00		
2	Addition during 11 th plan	118.46	156.1	+ 31.8%
3	Capacity at the end of 11 th plan	298.46	336.1	+ 12.6 %
B	Production *			
	2007-08	178.79	174.29	-2.50%
	2008-09	197.51	187.61	-5.00%
	2009-10	218.38	207.56	-4.95%
	2010-11	242.16	228.30	-5.72%
	2011-12 (Estimated)	268.61	246.70	-8.16%
	Total	1105.45	1044.46	-5.52%
	CAGR	10.7%	8.82%	
C	Consumption (Domestic)			
	2007-08	168.79	170.03	0.73%
	2008-09	187.51	183.98	-1.88%
	2009-10	208.38	204.70	-1.77%
	2010-11	231.66	226.00	-2.44%
	2011-12	257.61	241.80	-6.14%
	Total	1053.95	1026.51	-2.60%
	CAGR	11.6%	9.30%	

* *Production and Consumption figures include contribution of mini cement plants*

* For 2010-11, 2011-12 data for cement plants which are not the members of CMA (other than ACC and Ambuja) has been included in actual figures.

(Million Tonnes)

D	Capacity Utilization							
	Average Capacity						Production	Capacity Utilization (%)
	CMA	ACC	Ambuja	Mini	Others	Total		
2007-08	142.15	19.91	17.05	11		190.11	174.29	91.7
2008-09	165.85	22.41	18.3	11		217.56	187.61	86.2
2009-10	199.21	22.41	18.3	11		250.92	207.56	82.7
2010-11	224.41	26.61	21.3	11	27.64	310.96	228.30	73.4
2011-12	239.21	26.61	21.3	11	27.64	325.78	246.70	75.7

4.2.2.2 Thus cement industry has surpassed the Capacity targets. However, as the demand growth has not materialized as projected, the consumption and consequently the production targets set for the 11th plan period have not been realized.

4.2.2.3 Because of expected low demand growth and high capacity, the capacity utilization during FY2011-12 expected to be 75%. It is evident that Indian cement industry at the end of 11th plan is having excess capacity of 79 mtpa.

4.2.3 Projections for 12th Plan

4.2.3.1 Consumption (Demand) Growth

4.2.3.1a As per the projections made by Sub-Group-I, consumption growth during the 12th plan has been projected under four scenarios:

- Scenario 1 (Base Line) – 8% in Year 1, 8.5% in Year 2 & 9% in Year 3, 4 and 5.
- Scenario II (Base Line + Incentives: Road) – The cement concrete roads, not only have an advantage over life cycle of the road but also on current cost of construction. If 30% of the roads are constructed as cement concrete, the base growth can go up by 1% per annum for respective years i.e. 9% in Year 1, 9.5% in Year 2 & 10% in Year 3, 4 & 5.
- Scenario III (Base Line + Incentives: Road+ Housing)- A boost to realty sector and housing could increase cement demand by another 0.5% per annum for respective years i.e. 9.5% in Year 1, 10% in Year 2 & 10.5% in Year 3, 4 and 5.
- Scenario IV (Base Line + Incentives: Road+ Housing+ Fiscal support) - Cement is heavily taxed sector. Rationalization of duty and interest subvention could not only facilitate additional capacity addition but

make cement even more competitive and cost effective. The base growth could further go up by 0.25% per annum for respective years i.e. 9.75% in Year 1, 10.25% in Year 2 & 10.75% in Year 3, 4 & 5.

Accordingly, the growth in the four scenarios is presented as under:

Scenario	Growth rate (Year 1)	Growth rate (Year 2)	Growth rate (Year 3, 4, 5)
Scenario 1 Base Line	8%	8.5%	9%
Scenario 2 Base Line + Encouragement to concrete roads	9%	9.5%	10%
Scenario 3 Scenario 2 + Housing and Realty sector boost	9.5%	10%	10.5%
Scenario 4 Scenario 3 + Excise duty and interest subvention	9.75%	10.25%	10.75%

4.2.3.2 Cement Consumption:

4.2.3.2a Based on the above demand growth projections, the cement consumption has been worked out as under:

Year	Consumption (Million Tonnes)			
	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	261.1	263.6	264.8	265.4
2013-14	283.3	288.6	291.2	292.6
2014-15	308.8	317.5	321.8	324.0
2015-16	336.6	349.2	355.6	358.9
2016-17	366.9	384.1	393.0	397.4

4.2.3.3 Production Growth

4.2.3.3a Production growth has been considered to be 2.5% higher than the domestic consumption for meeting export demand and inventory requirements.

4.2.3.3b Accordingly the projected production during the 12th plan shall be as under:

Year	Production (Million Tonnes)			
	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	267.7	270.2	271.4	272.0
2013-14	290.4	295.8	298.5	299.9
2014-15	316.6	325.4	329.9	332.1
2015-16	345.1	357.9	364.5	367.8
2016-17	376.1	393.7	402.8	407.4

4.2.3.4 Capacity Growth

4.2.3.4a The existing installed capacity is higher than the demand would have required the sector to create. The existing plants and plants in pipe line indicate excess capacity to continue. In fact, based on demand projection additional capacity creation becomes necessary from 2013-14 only.

4.2.3.4b For the first two years, the operationalisation of the existing capacity and new capacities (at advanced stage in pipeline) has been undertaken. In 2013-14, it is assumed that utilization @ 80% would gradually increase to reach 85% in 2016-17. Capacity, therefore, is higher than domestic production by that factor.

Year	Capacity (Million Tonnes)			
	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	349.6	349.6	349.6	349.6
2013-14	363.1	369.8	373.2	374.9
2014-15	386.1	396.9	402.3	405.1
2015-16	413.3	428.7	436.6	440.6
2016-17	442.5	463.3	473.9	479.3

4.2.3.5 Capacity Utilization

4.2.3.5a Based on the estimated production and capacity projection, the capacity utilization has been worked out as under: -

Year	Capacity Utilization, %			
	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	77	77	78	78
2013-14	80	80	80	80
2014-15	82	82	82	82
2015-16	83	83	83	83
2016-17	85	85	85	85

4.2.3.5.b It is evident that even with this small capacity addition in the initial two years of the 12th Plan, the capacity utilization is likely to be below 85%. The average capacity utilization during the 12th plan shall be around 82%.

4.2.3.5.c Based on the above projections, the requirement of various resources has been worked out in the subsequent sections.

4.3 LOGISTICS

4.3.1 Rail Transport

4.3.1.1 Background

4.3.1.1.1 Cement, being a low value and high volume commodity, transportation costs form a significant proportion of its total cost. Thus it is necessary to adopt the most cost effective means of transport and resultantly rail transport emerges as the best choice.

4.3.1.1.2 The long transit distance from production centers (which have to be adjacent to limestone mines, are in remote areas) to the consumption markets further emphasizes dependence of cement transportation on railways.

4.3.1.1.3 To improve market servicing ability and reduce the transportation of fly ash, a lot of split-grinding units have come-up close to key markets and fly ash sources. Thus clinker which is again a bulk natured intermediate product, needs to be transported for long-distances in bulk from the production centers to various grinding units.

4.3.1.1.4 The industry has innovatively adopted hazardous wastes viz. Fly-ash from thermal power plants and Slag from steel plants, as important raw materials. As these materials need to be transported from distant sources and in large quantity; they contribute significantly to overall cement production costs.

4.3.1.1.5 Industry uses coal and other fuels which is around 50-55 million tonnes per annum. For movement of this large quantity of fuel from coal mining points / oil refinery (in case domestic coal / pet coke) and from port (in case of imported coal / imported pet coke) to production centers, long distance transportation is involved.

4.3.1.1.6 Thus using a cost efficient and environment friendly mode of transport for raw material, fuels and finished product is very important.

4.2.3.2 Current Status

4.2.3.2a In the Report of the 11th Five Year Plan (2007-12), a target of 50% movement of cement by Rail was fixed. However, the loading of cement and clinker by Rail instead of improving has been continuously on decline. In 2010-11 the share of railways in cement and clinker transport dropped to 35% and 50% from 38% and 57% respectively in 2007-08. With the increasing number of Grinding Units in the country, the Rail coefficient in respect of cement may even go further down, if corrective measures are not taken on an emergent basis.

Cement and Clinker Dispatches by Rail (Rail Co-efficient)

Year	Rail Co-efficient		
	Cement	Clinker	Cement & Clinker combined
2010-11	35%	50%	37%
2009-10	36%	50%	38%
2008-09	38%	56%	40%
2007-08	38%	57%	41%

(Source: CMA)

4.3.2 Recommendations

4.3.2a The Sub Group recommends that Railways should target attaining minimum 50% share in the total cement and clinker transport by the end of 12th plan and should take the following measures for the same: -

4.3.2.1 Cement

- a. **Wagons availability and related matters:-** Non-availability of sufficient wagons in a timely manner has plagued the cement industry for long. Wagon availability by railways as and when required by cement manufacturers remains unpredictable. During lean season of railways, wagon availability is found to be higher but is of little use for the industry given its seasonal nature. To ensure consistent and regular supply of rakes to the Cement Industry throughout the year, Railways needs to look into the following areas:
- b. **Wagon Supply Agreement:** - At present, Railways does not have any commitment for ensuring timely availability of Wagons in requisite numbers. A committed obligation with financial implications on both parties for failure in meeting the obligations can improve the wagon availability. Therefore, Railways should enter into annual agreements with cement manufacturers where it should commit to certain number of month-wise supplies of wagons during the year. Any party (Railways or customer) slipping in meeting its contractual wagon supply/usage commitment would face financial liabilities. This will help in better planning of availability v/s utilization for both the railways and industry.
- c. **On demand availability of two point and three point combinations of rakes:** - This facility shall help cement companies wherein single rake can be used to service two-three markets (especially with the deployment of larger tonnage capacity BCNHL wagons carrying 4000 tonne in comparison to 2300 tonne capacity of BCN wagon rakes). Accordingly, on demand availability of service of splitting a rake should be facilitated to enable cement Companies to service combination of markets for justifying economic usage of large capacity BCNHL rakes.

- d. **Loading of Mini rakes (20 wagons) within 400 kms:** - With the current practice of allowance of mini rakes for 200-250 Km distance, usability of mini rakes is limited. Thus if the same are allowed for a distance of up to 400 Km rail usage shall increase substantially.
- e. **Temporary restriction on use of certain Railway terminals:** - It has been observed that whenever there is traffic congestion problem, Railways puts periodic temporary restrictions on use of Railway Terminals at specific centers. A number of terminals like Ghaziabad, Shakurbasti (Delhi), Muradabad, Jogeshwari (Mumbai) etc. are put under restriction for use by goods trains on a regular basis. This creates problems in logistics planning for bulk consumers like cement manufacturers. Cement being the 3rd largest revenue earner for Indian railways, preferential treatment must be given to them if restrictions are necessary to be imposed. Railways need to plan for augmentation of traffic handling capabilities at all such terminals to take care of continuously growing rail traffic.
- f. **Revising downward the loading capacity of BCNHL wagons from 68 tonnes to 62 tonnes:-** Due to short height of the door of BCNHL (Bogey Covered New metric High Axle Load) wagons, mechanized loading of cement bags up to the declared carrying capacity of 68 tonnes per wagon is technically neither practical nor feasible. Thus the user has to pay for 68 tonnes per wagon while the actual loading (typically 62 tonnes per wagon) is less than 68 tonnes per wagon. Also in current form, if the BCNHL wagons have to be loaded to full-capacity it poses safety issues for the labourers undertaking loading/unloading. Thus Railway needs to find possible solutions with the help of technical experts to enable full loading of wagons to their stated capacity. Till such time the solution is found, realistic carrying capacity of 62 tonnes per wagon be permitted due to safety reasons of the labourers also.
- g. **Permitting Additional free time for loading/unloading of BCNHL rakes:** - In comparison to regular BCN rakes, BCNHL rakes have larger number of wagons and thus have higher tonnage loading capacity. In spite of this, the free loading time allowed for BCNHL rakes is the same as that of BCN rakes i.e. 9 hrs. In addition to the sheer increase in loading/unloading tonnage; the current design related operational issues (highlighted in above point) loading/unloading of BCNHL wagons is

not possible within 9 hours. It is, therefore, necessary that the free loading/unloading time for BCNHL wagons be increased from current 9 hrs to 13 hrs.

- h. **Restoration of Shunting Time:** - Shunting time is required wherever loading is not being done in one shunt for one full rake. In such cases wagons have to be de-coupled into separate batches of wagons on the loading line and post loading they are to be collected for the formation of a single rake for handing over. Currently no separate shunting time is allowed and the time taken for shunting is considered within the allowed free loading/unloading time. A minimum of 2 hours of shunting time is required to be immediately promulgated by the Indian Railway.

4.3.2.2 Clinker – Clinker which is an intermediate product used for cement manufacturing. Many of the cement Companies having excess Clinker sell the same for which rail transport is used. Further, many Companies have set up split grinding units which require rail transportation. Following measures are suggested to improve operational efficiency for both railways and cement manufacturers.

- a. **Long-term contract for Clinker Movement:** - Transport of clinker in case of split-grinding units has unique characteristics that it is of permanent-long term nature with fixed origin and destination points. This offers a long term assured business to railways. To facilitate this, Railway should enter into long term contracts at concessional rates to ensure efficient transport of such bulk products. This shall be in the interest of the nation from economic, environmental and safety point of view.
- b. **Clinker handling Infrastructure at terminals:** - Special infrastructure for unloading of loose material like clinker needs to be developed at all rail-terminal close to cement grinding units. It has been observed that at many clinker handling terminals, platforms used for unloading are of uneven width and have potholes. This leads to undue loss of clinker on account of spillage out of platform area and loss of material that remains in potholes. Therefore, special efforts are required to ensure that the platforms at all clinker handling terminals are leveled with timely repairs to fill the potholes. This is important to ensure that material transfer losses are minimized which is loss the national resources.

Currently a lot of terminals don't allow handling of loose material like clinker on account of environment and pollution concerns for the neighbouring population centres. Thus, exclusive terminals for handling loose materials like clinker needs to be developed in close radius of all key destinations. This shall aid in better servicing of markets and reduce the current requirement of last leg truck-based movement from far-away terminals to destinations.

4.3.2.3 Fuel

4.3.2.3a Currently a small proportion (less than 50%) of coal consumed by the Indian cement industry is supplied from domestic linkages. Thus the cement manufacturers have to depend on imported fuel. After arrival of fuel at ports, the same needs to be transported to the various plant sites. Railways are the efficient logistics for the same. As the share of imported coal is unlikely to drop in future, the import and subsequent movement of coal from ports to plants shall continue to grow in coming years.

4.3.2.3b In view of the same, Railways should consider the requirement of rail facilities for movement of imported fuel and allocate the requisite quantity of rakes for regular movement of coal from ports to cement plants in a systematic manner.

4.3.2.4 Railway Terminal

- a. **Development of new Goods sheds outside of major cities:** - Goods sheds in major cities / towns (A & B class) are in areas which fall within heart of the cities, hence they face problems of congestion and traffic. Congested approach roads around the sheds make movement of freight in trucks a tough task.

Thus, sheds for new goods should be developed beyond the city limits of A & B class towns as this shall greatly improve efficiency of these sheds. A point in case is the new good-shed developed outside Ghaziabad city. Being 10 Km away from the city, it is able to work very efficiently without facing any evacuation/traffic problems.

- b. **Proper Approach Roads to reach terminals:** - Many of the railway terminals (though not in major cities) are having better Goods sheds but lack proper approach from connected state highway / national highway

to reach such goods shed. These rail terminals should have proper road evacuation system leading up to main highways.

- c. Improving Terminal facilities:** Most of the terminals in the country are open goods-sheds and do not have even the basic infrastructure facilities viz. approach roads, proper light, sheds, etc. Thus cement unloaded at these terminals is exposed to natural elements which lead to undue losses which is a national loss.

Thus all rail terminals need immediate up-gradation with mandatory facilities of:

- i. Covered sheds,
- ii. Mechanized unloading facilities,
- iii. Proper lighting arrangement with continuous electricity supply,
- iv. Good quality approach road to sidings and proper truck parking facilities,
- v. No overhead High Tension Wire lines to be present at any of the terminal sidings,
- vi. All sidings to have compulsory length of 800m as short length of sidings makes unloading time-consuming with additional impact of possible demurrage,
- vii. Number of lines at terminals in cities having more than 10 lacs population need to be increased at the earliest,
- viii. Wherever present, railways need to take swift action to remove any residential encroachment at railway properties as they negatively impact operational efficiencies less usage of rolling stock and extra cost to user i.e. demurrage.
- ix. Development of alternate terminals (in the nearest area) in A & B class cities in view of old terminals falling within walled cities.

All above steps shall facilitate faster evacuation of cement and clinker on a round the clock basis at railway terminals.

- d. **24 x 7 operations at the goods-sheds:** In addition to absence of basic infrastructure facilities at goods-sheds, factors like entry restrictions of Commercial Vehicles during day hours in major cities, Union induced shortage of labourers at sheds make 24 x 7 operations at the goods-sheds not possible. Thus labour and availability of trucks for onward transport from good-sheds needs to be ensured in order to ensure that efficient continuous (24x7) operations can be enforced at all goods-sheds. In addition to helping the railway freight users by improving their efficiency this will also help the railways in better utilization of its rakes on account of shorter turn-around time.
- e. **Demurrage for Parking:** - Earlier, if a Siding had capacity of loading one rake at a time; free timing for the next rake was to start only after completion of the previous rake or expiry of the prescribed free time, whichever was earlier. This was facilitating back-to-back loading whenever overlapping rakes were available and shifted to Siding by way operational convenience. Now the time for the next rake starts immediately on supply even if the free time of the previous rake is not yet over and siding has no capacity to simultaneously take up loading of the succeeding rake. Demurrage is thus paid for parking Railways rolling stock in siding. It's not fair to ask the user to pay for the rake even when it cannot be loaded due to prior occupancy of the available sidings and thus the levy of demurrage for such parking time must be stopped.

4.3.3 Policy Matters

4.3.3.1 Simple policies: -Any Policy that is announced by the Railways should have three basic things i.e. Simple, Clear and Transparent to avoid any chances of its misinterpretation.

4.3.2.2 Incentive Policies should not be framed only for incremental traffic, retention of traffic is equally important: - Railways offers tariff discounts for Low-Traffic routes to attract freight. Based on these discounts cement manufacturers develop market for their brands in distant regions. However in subsequent years these discounts are offered only on the incremental traffic volume. As the manufacturer develops its market based on certain price points (which are feasible only due to discounted freight rates), it is impossible to sustain sales due to non-availability of discounted tariff for base volumes (which are not

incremental over last year). Thus while railways looks for incremental tariff for offering discounted tariffs, the base volume is itself not feasible in absence of discounts and this leads to drop in volume in already low traffic routes of railways. Thus the discounted tariff policy should be for entire traffic and not as currently imposed on incremental traffic basis.

4.3.3.3 Declared policy concessions should be implemented: - Whatever concessions and discounts are declared in policy should be implemented in spirit. e.g. As per policy, cement companies are eligible for concession as per Empty Flow Direction Open wagon scheme but railways has been restricting the availability of scheme by offering only the covered wagons.

4.3.3.4 Consistency in Policy: - The duration of policy for various schemes announced by Railways from time to time should be at least for 3-5 years to make them consistent. Regular changes in policies make it difficult for the investors to take decision based on the same.

4.3.3.5 Need for Customer Friendly Private Wagon Procurement: - Present Investment Schemes both current and proposed seem to be skewed in favour of Railways. Following needs to be looked into: -

4.3.3.5.1 Approval Process : Indian Railways wants to be in picture at all stages, may be for good and valid reasons. But the process of approval takes lot of time and requires regular follow up. Indian Railways does not bind its officers to take decision within a prescribed time frame, whereas Investor has to abide by a fixed time table with attendant penalties.

4.3.3.5.2 Partnership For Life : Indian Railways wants to own all common pool wagons on the expiry of rebate period ranging from 10 Yrs. to 20 Yrs. and does not plan to share gains arising out of post-rebate life of wagons thus procured. Industry looks at its investment in wagons like any other investment where the life of assets thus created continue to give return for the entire operational life and thus expects share in gain beyond the rebate period. The life of the wagons is at least 35 years and thus the gains should be shared for the life of the wagon.

4.3.3.5.3 Costing : Cost of procurement of wagons is limited to the purchase price of Indian Railways whereas the investors may have to pay higher price, though purchased through Indian Railway approved list of manufacturers. Thus actual price paid for wagons should be considered as cost of wagon.

4.3.3.5.4 Recovery Doubtful : Railways determines the cost of wagons taking the interest rate of 9% only on reducing balance though investor may have to incur 11-12% interest rate on its borrowing. There is apprehension that under the schemes with limited rebate-tenure, Investor may not be able to fully recover its investment.

4.3.3.5.5 Limited Guaranteed-Supply : Benefit of guaranteed supply on each rake procured is limited and meagre from the Industry's point of view.

4.3.3.5.6. Escape Route : In case of default in loading by the investor, the opportunity to make up is limited whereas in case of default by Railways, it can make up default even after expiry of the agreement period. Industry therefore has legitimate apprehension that this safety clause will provide an escape route especially when investor shall need wagons most and may be flooded with wagons, say in lean period, when its off-take may be limited.

4.3.3.5.7 Free Time According to Pay Load : In all fairness free time available for existing fleet cannot be applied in case of loading High Capacity Wagons. Further EOL (Engine on Load) timing on existing payload cannot be extended to these rakes, even if Railways could be prepared to give EOL benefits.

4.3.3.5.8 SPW/HCW: A Better Deal Needed : As far as Special Purpose Wagons and High Capacity Wagons, industry will be making huge investments both in land and machinery in developing terminals at both ends, hence merits a more favourable rate of rebate.

4.3.3.5.9 Inclusion of BCN/BCX Wagons : BCN/BCX Wagons which are more customer friendly have lower capital cost. Further, the industry has experience and layout of loading such wagons. Also they are safer for loaders than BCNHL rakes. Pay load is also suitable to the distribution network of industry. Hence in the proposed modified scheme inclusion of BCN/BCX wagons will be more acceptable.

4.3.3.5.10 Need for Establishment of a Regulatory Mechanism : A suitable mechanism may be devised to regulate and rationalize all rail matters including tariff and demurrages.

4.3.3.5.10a This will insulate users from any further arbitrary and frequent revision of the tariff by way of change in classifications by imposing surcharges and cess etc.

4.3.3.5.11 Bulk Transportation : There is a huge untapped opportunity available for transportation of cement in bulk through Special Purpose Wagons. The present Rail movement of bulk cement is about 2% of the total installed capacity in the country. Due to increasing use of Ready Mix Concrete and consumption of Bulk Cement, it is likely to go up in the next few years. To make this possible, Railways need to consider following suggestions of the Industry:

- Make separate tariff classification for bulk cement or alternately the discount structure be based on complete life span of Wagons, which is 35 years.
- The discount/rebate should be based not only on the investments made on the procurement of Wagons but also on the investments made for creation of necessary infrastructure facilities for handling Bulk cement. Further, this discount/rebate structure may be reviewed every alternate year, taking into account the inflation cost and the prevailing freight rates.

4.3.3.5.12 Multi-modal Business: In order to meet the increasing demand of cement in the country, there is a need to encourage multi modal mode of transport i.e. Rail, Road, IWT and Coastal Shipping. In this connection, the concepts of RORO (Roll On - Roll Off- wherein trucks are directly loaded on rail wagons and at destination terminals can be unloaded for last mile road transport). Road Railers on the entire network, double stacking, would be a welcome step, provided all likely operational, technical and infrastructure problems are resolved and also multi-modal transportation be made cost effective. Major initiatives like Dedicated Freight Corridor have already planned for provision of Multi-modal transport and thus such plans should be made part of all other projects of railways.

4.3.4 Road Transport

4.3.4a In the present scenario road carries about 65% of cement freight. Even in case of rail freight, last mile connectivity is ensured by using road transport only. Thus it is paramount to ensure that issues hampering road transport are looked into and addressed as road shall continue to be the back-bone of cement distribution.

4.3.4b A few basic issues which can aid in improving efficiency of road transport are:

- a. Construction of cement concrete roads needs to be encouraged for National Highways, State Highways, District and City roads and under centrally funded projects such as Jawaharlal Nehru Urban Renewal Mission, PMGSY etc.

- b. For last several years, Governments both at centre and at states have been spending thousands of crores of rupees every year seriously to find ways to resolve the problems which are of National importance and hindering the growth of the Economy like, pathetic conditions of roads; increasing fuel (diesel) consumption, colossal outgo of prestigious foreign exchange for import of crude, increasing pollution etc.
- c. In the National interest, if techno-economically superior cement concrete roads are adopted in the country as a Policy, the country will not only get long-lasting and maintenance-free roads for 30-40 years, but also address problems like poor road condition, increasing fuel consumption etc. of the Nation, to a large extent, for the rapid growth of the country.
- d. Thus Ministry of Road Transport and Highways (MORTH) needs to communicate to all state governments and local bodies and take up this task to earmark at least 50% of their total allocation for construction of cement concrete roads.
- e. Due to the Multi-axle feature of new generation trucks, the carrying capacity of trucks has increased significantly. Also the multi-axle feature reduces the wear and tear impact on roads due to its uniform load distribution ability.
- f. Thus government needs to amend the Motor Vehicle Act to increase the loading capacity of new generation trucks having Multi Axle features. This shall aid in adding economies and efficiencies to road transport of cement which remains to be the major share-bearer of cement transport.
- g. To support cement plants being developed in remote locations, government needs to support them by ensuring faster linking of plant areas with key state/national highways. This shall help in faster setting-up of plants and efficient logistics of raw material and finished goods.
- h. With a lot of highways being operated under Toll arrangements, monthly passes scheme need to be developed and implemented for reducing the toll-collection time taken for trucks on such highways. Also lower toll should be made mandatory across all toll roads for return journey happening within 24 hours.

- i. At planning stage of all road projects, it needs to be ensured that at all major city/town crossings elevated path/flyovers are developed to ensure smooth and faster pass-through of trucks with least disturbance to the local population.
- j. Stronger good quality embankments need to be developed along all major roads as this simple step can bring major reduction in time linked deterioration in quality of roads and to avoid road accidents.
- k. Rail terminals should be well connected to highways.
- l. Major highways connecting important areas should have alternate routes to reduce load on a particular highway.

4.3.5 Inland Water-ways

4.3.5a Like sea transport, Inland Water Transport (IWT) also is a cheaper, energy efficient, and environmental friendly mode of transportations. Inland Waterways have the potential to relieve traffic burden on other modes and can be utilized for transportation of bulk cargo like cement. Hence, it would be appropriate to consider inland waterways also with Multi-Modal concept of transportation wherever waterways exist.

4.3.5b Following waterways have been declared as National Waterways:

NW	Stretch of National Waterways	Stretch (kms)
NW-1	Ganga-Bhagirathi-Hooghly river system from Allahabad to Haldia	1620
NW-2	Brahmaputra river from Sadiya to Dhubri	891
NW-3	West Coast Canal from Kottappuram to Kollam along with Champakara and Udyogmandal canals	205
NW-4	Godavari and Krishna rivers and Canals between Kakinada and Puducherry	1095
NW-5	Brahmani river and Mahanadi delta system along with East Coast Canal	623

4.3.5c However as per information received from Inland Waterway Authority of India (IWAI) currently only three viz. NW 1, 2 & 3 are operational. IWAI has further informed that successful trials have been made for transportation of cement by IWT mode. Fly ash is being exported regularly from Kolkata to Bangladesh for use by cement industry through IWT mode.

4.3.5d Inland Water Transport (IWT) is a fuel efficient, environment friendly and cost effective mode of transport as is demonstrated below:

4.3.5.1 Energy efficiency – 1 HP can move approx. 150 kg on road, 500 kg by rail and 4,000 kg by IWT

4.3.5.2 Fuel efficiency – 1 liter of fuel can move 24 tonne/km by road, 85 tonne/km by rail and 105 tonne/km by IWT

4.3.5.3 Environment Friendly – Low air & noise pollution

4.3.5.e Thus, inland water transport (IWT) mode needs to be promoted as an alternative/ supplementary/ complimentary mode in a Multi-modal transport network/ logistic supply chain for cement.

4.3.5f The following aspects may be kept in mind while formulating the policy/program for IWT promotion:

- i. Necessary infrastructure needs to be created at the identified IWT terminals/jetties so as to integrate with other modes of transportations viz. Road and Rail.
- ii. Wherever cargo specific / mode specific concession is applicable, the same may be made for IWT at par with the other modes.
- iii. If the waterway passes through more than one State, taxes/cess/duties etc. needs to be rationalized and collected at a single point.
- iv. Wherever Port-Hinterland connectivity exists through waterways, Multi-Modal transportation concept may be followed up to the Riverine Ports/terminals.
- v. Wherever waterway advantage exists, Ro-Ro facility may be encouraged to de-congest the cities (e.g. Kolkata, Mumbai etc.)

4.4 LIMESTONE AVAILABILITY FOR FUTURE GROWTH

4.4.1 Introduction

4.4.1.1 The growth of cement industry primarily depends on the availability of cement grade limestone, the chief raw material for cement manufacture. India is bestowed with huge resources of limestone, geologically ranging from Achaean to Recent in the stratigraphic sequence and geographically occurring in almost 23 states of India, though the distribution is not uniform.

4.4.1.2 The objective of National Inventory of Cement Grade Limestone is to plan the strategy for the growth of cement industry by updating the availability of limestone resources and to bring into focus the limiting factors affecting the availability of limestone.

4.4.1.3 The geological occurrence of limestone, the extension of deposits, qualitative and quantitative assessment etc. have been carried out through prospecting and exploration by various central and state government agencies such as Geological Survey of India (GSI), State Directorate of Geology and Mining Departments, and Private Companies proposing for cement and other limestone based industries.

4.4.1.4 National Council for Cement and Building Materials (NCCBM) and Indian Bureau of Mines (IBM), Government of India have been carrying out the compilation of the National Inventory of Cement Grade Limestone.

4.4.1.5 The limestone resources are classified as per United Nations Framework Classification (UNFC) system. As per the data provided by IBM, the total cement grade limestone resources is 124,539.551 million tonnes, out of which the total cement grade limestone reserves is 8948.926 million tonnes (UNFC code (111),(121) and (122), and the total remaining resources is 115,590.625 million tonnes.

4.4.2 Availability of Cement Grade Limestone Reserves / Resources

4.4.2.1 Preparation of National Mineral Inventory is one of the functions of the Indian Bureau of Mines, since 1968. Under this activity, reserves/resources are updated after every five years. The data is collected for areas under leasehold and freehold from agencies engaged in exploration and exploitation activities in the country. Thus, the data generated as a result of exploration, feasibility, assessment, economic evaluation, technological adoption, end-use consumption in mineral base industries etc. flow into the mineral inventory. As per the resolve in the country, the reporting system of reserves/resources in the NMI is strictly based on the United Nations Framework Classification (UNFC). As per United Nations Framework Classification (UNFC) the resources are broadly categorized into ‘reserves’ and ‘remaining resources’. These are the result of three dimensional approaches of the activities consisting of geological assessment, feasibility assessment and economic viability. According to the norms of this system, economically mineable part of major and/or indicated mineral resources has been placed under reserve category. Those quantities which have not been found economically viable due to the present techno-economic, environmental, social, legal factors and also the quantities estimated based only geological assessments have been placed under ‘remaining resources’ category. Each figure of the reserves/resources is assigned a three digit code based on the quantum of exploration, feasibility assessment and economic viability. Out of the total resources 90% are reported to be in ‘freehold’ and 10% are in leasehold areas.

4.4.2.2 The total cement grade limestone resources of India as compiled by Indian Bureau of Mines (IBM), Government of India, is 124,539.551 million tonnes as on 1st April 2010. The resources have been classified based on UNFC system of classification. The total cement grade limestone reserves and the remaining resources are 8948.926 million tonnes and 115,590.625 million tonnes respectively (Fig-1).

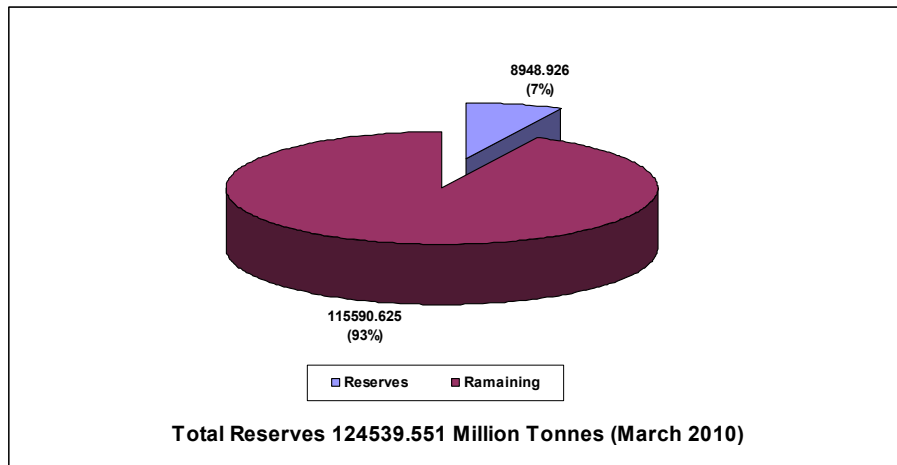


Fig 1: Status of Cement Grade Limestone Resources in India

4.4.2.3 The estimated reserves include all limestone deposits as reported. However, some of the deposits may not be sufficient to cater limestone for large cement plants, and may be suitable for setting up mini cement plants.

4.4.2.4 As per NCCBM's study, 97% of total cement grade limestone resources are concentrated in only 10 states and overall distribution is restricted to 23 states and 2 UTs (Fig-2). The limestone deposits are not reported from states of Punjab, Mizoram, Goa, Sikkim, and Tripura, whereas states/UTs of Haryana, Manipur, West Bengal, Kerala, Andaman and Nicobar Islands, Pondicherry and Diu, have very meagre reserves to be considered as potential. Lakshadweep, though have potential calcium carbonate deposits but environmental rules and regulations restricts for exploitation of the resources.

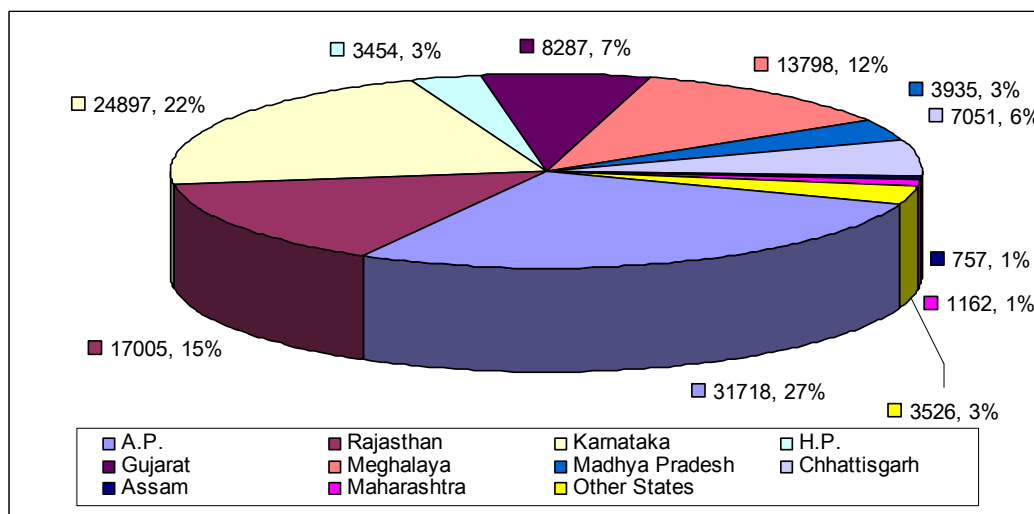


Fig-2: Remaining resources of Cement Grade Limestone as per Indian Bureau of Mines (01.04.2010) Provisional.

4.4.2.5 The zone-wise and state-wise cement grade limestone reserves and resources as compiled by IBM are given in Table-1.

Table-1: State-wise status of cement grade limestone reserves & resources (Provisional) as on 01.04.2010

(Million Tonnes)

Zone / State	Reserves	Remaining Resources	Total Resources
East Zone:-			
Arunachal Pradesh	-	151.500	151.500
Assam	213.024	756.783	969.807
Bihar	11.472	438.282	449.754
Jharkhand	116.055	199.986	316.041
Manipur	-	38.423	38.423
Meghalaya	146.637	13797.798	13944.435
Nagaland	0.825	20.000	20.825
Orissa	534.993	426.627	961.620
West Bengal	-	4.417	4.417
Sub Total	1023.006	15833.816	16856.822
South Zone:-			
Andhra Pradesh	2564.219	31717.544	34281.763
Karnataka	717.732	24896.708	25614.440
Kerala	143.392	2.231	145.623
Pondicherry	-	15.732	15.732
Tamil Nadu	465.288	230.698	695.986
Sub Total	3890.631	56862.913	60753.544
West Zone:-			
Chhattisgarh	852.056	7051.152	7903.208
Gujarat	670.897	8287.222	8958.119
Madhya Pradesh	391.644	3934.656	4326.300
Maharashtra	199.608	1161.636	1361.244
Daman Diu	-	48.840	48.840
Sub Total	2114.205	20483.506	22597.711
North Zone:-			
Haryana	9.675	48.538	58.213
Himachal Pradesh	162.927	3454.293	3617.220
Jammu & Kashmir	90.743	511.189	601.932
Rajasthan	1533.257	17004.643	18537.900
Uttaranchal	1.136	1011.581	1012.717
Uttar Pradesh	123.346	380.146	503.492
Sub Total	1921.084	22410.390	24331.474
Grand Total	8948.926	115590.625	124539.551

4.4.3 Availability of Limestone Reserves for Future Requirements

4.4.3a The total cement grade limestone resources as estimated by Indian Bureau of Mines, Government of India based on the UNFC classification system is at 124,539.551 million tonnes out of which the remaining resources is of 115,590.625 million tonnes as on 01st April 2010. However, approximate 30% of the reserves i.e. 34677.19 million tonnes falls under forest and other regulated area which may not be available for cement manufacture.

Table-2: Availability of Limestone Reserves for Future Requirements

(Million Tonnes)	
Cement Grade Limestone Reserves (a)	8948.926
Remaining Resources (b)	115,590.625
Reserves Restricted: (c)	
Under Forest (22.5%)	26007.89
CRZ & Other Regulated Areas (7.5%)	8669.29
Sub Total	34677.19
Net Available remaining resources for future growth (d=b-c)	80913.435
Total Available Limestone Resources (a+d)	89862.361

4.4.4 Projected Limestone Requirements

4.4.4.1 The requirement of limestone by the industry has been estimated for each of the scenario of cement demand projection as stated earlier, based on the following assumptions: -

Working Assumptions:

1. Limestone required for Clinker production - 1.5 times
2. OPC- 95% clinker, PPC - 70% clinker, PSC- 40% Clinker

4.4.4.2 For estimation of limestone requirement, three different scenarios have been developed viz.

Alternate A	Current proportion of PPC : OPC : PSC ratio - 61 : 32.5 : 6.5
Alternate B	Expected proportion of PPC : OPC : PSC ratio – 55 : 40 : 5
Alternate C	100% OPC

Alternate A: Current proportion of PPC: OPC: PSC ratio - 61: 32.5: 6.5

Limestone Requirement (Million Tonnes)

Year	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	305.8	308.7	310.1	310.8
2013-14	331.8	338.0	341.1	342.7
2014-15	361.7	371.8	376.9	379.5
2015-16	394.3	409.0	416.5	420.3
2016-17	429.8	449.9	460.2	465.5

Alternate B: Expected proportion of PPC: OPC: PSC ratio - 55: 40: 5

Limestone Requirement (Million Tonnes)

Year	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	315.2	318.1	319.6	320.3
2013-14	342.0	348.3	351.5	353.1
2014-15	372.8	383.2	388.4	391.1
2015-16	406.3	421.5	429.2	433.1
2016-17	442.9	463.6	474.3	479.7

Alternate C: 100% OPC

Limestone Requirement (Million Tonnes)

Year	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	401.5	405.2	407.1	408.0
2013-14	435.6	443.7	447.8	449.8
2014-15	474.8	488.1	494.8	498.2
2015-16	517.6	536.9	546.8	551.7
2016-17	564.2	590.6	604.2	611.1

4.4.4.3 Considering cement growth rate at 10%, 11%, 11.5% & 11.75% per annum under Scenario I, II, III & IV respectively for the ten year period post 12th plan (2017-18 to 2026-27) and at 7% per annum in subsequent years, the life of the cement grade limestone resources (as data provided by IBM) at the end of 12th Plan shall be as follows :

Production	Life of Available Limestone Resources (Years)			
	Scenario I	Scenario II	Scenario III	Scenario IV
PPC:OPC:PSC ratio- 61:32.5: 6.5	41.0	39.0	38.25	37.5
PPC:OPC:PSC ratio- 55:40:5	40.5	38.5	38.0	37.0
100% OPC	37.5	36.0	35.25	35.0

4.4.5 Constraints for Limestone Availability

4.4.5a The exploration for the limestone deposits has extensively been carried out in the country but all the available resources cannot be exploited due to various constraints such as quality, poor infrastructure in inaccessible areas, forest cover etc., and are described briefly.

(a) Deposits in Inaccessible Areas :

The limestone deposits located and explored in Jammu and Kashmir, Himachal Pradesh, Uttarakhand and North-Eastern states of Himalayan region are difficult to exploit because of difficult hilly terrain and inaccessibility. Though substantial reserves of cement grade limestone deposits are available in these state, the constraints for large scale mining such as unstable hill slopes and fragile eco-system, high seismicity of the region, procurement of fuel and other raw materials at higher cost of transport from different states etc. adds up to higher cost of production.

(b) Infrastructural Facilities

Lack of infrastructural facilities like rail-road network, power supply, water availability etc. in and around a promising limestone deposit keeps the entrepreneur away. Absorbing infrastructure development cost within cement plant cost may not be economically viable for a particular deposit.

(c) Forest and Human Settlements

The limestone deposits located near the villages, towns, cultivated lands, historical monuments, important civil structures like dams, forest etc. are blocked due to safety regulations and are not available for mining for cement manufacture. The forest conservation regulations by Union government and State governments restrict the mining activities on the some of the promising deposits falling under the reserved forest areas.

(d) Nature of the deposit

Limestone deposits are classified as simple, complex and intricate depending upon their occurrence, geological structure and their frequency of variation in quality. Limestone mining from a simple deposit is cost effective as compared to intricate and complex deposits, where the fluctuations in the grade often lead to the problems in the cement manufactures or require beneficiation before utilization and also require improved fuel with low ash contents. Such deposits get the least priority for green filed projects. Many limestone deposits of uniform quality below a thick cover of over burden have also become uneconomical due to higher cost of production and higher waste handling.

(e) Environmental Constraints

The availability of potential limestone deposits has also been restricted due to environmental constraints, as many of these deposits are located in reserve forests, bio-zones and environmentally sensitive areas, near tourist centres/hill-stations or under thickly populated or cultivated fields. The different environmental acts, rules and regulations of Government of India restrict many cement grade limestone deposit to be exploited for cement manufacture. For example the Environmental Protection Act, 1986 and the Environmental Protection Rules, 1986 declares the coastal stretches as Coastal Regulation Zone (CRZ) and imposing restrictions on industries, operations and process in the CRZ. Setting up of new industries and expansion of existing industries, except those directly related to water front or directly needing foreshore facilities; Mining of sand, rock and other substrata material, except those rare minerals are prohibited under the above rule. Wildlife protection act has restriction of mining in the prescribed limits from wildlife sanctuaries which are notified / modified form time to time. Population growth, rapid urbanization and developmental projects have also led to encroachment of some of the potential limestone deposits. About 30% (Approximate) of the reserves have been restricted due to forest and other constraints.

4.4.6 Recommendations and Suggestions

In order to ensure the availability of cement grade limestone for projected cement production and beyond, appropriate steps have to be taken up. Accordingly following thrust areas have been identified.

- (i) Besides known limestone belts, occurrences in Himalayas, Indo-gangetic plains, desert require special attention through systematic exploration. Exploration Activities as per NCCBM norms or UNFC guidelines needs to be intensified.
- (ii) At present periodic assessment of the captive limestone mines is negligible. The directives may be issued for carrying out statutory exploration/ reassessment of the captive mines to review the future availability of limestone reserves.
- (iii) It is to be ensured that the systematic mining is carried out as per approved mining plan. The IBM guidelines, statutory provisions and latest technology has to be adopted for optimal utilization of available resources.
- (iv) There is a need to streamline the administrative procedures with respect to limestone mining approval / renewal. The issues related to grant of Prospecting License (PL) and Mining Lease (ML) need to be simplified without compromising statutory provisions and guidelines.
- (v) There should be a single-window facility for all PL / ML renewal related matters and the current procedures needs to be made simplified and more transparent.
- (vi) Incentives like lower royalty rate, excise rebate may be considered for usage of marginal and low grade limestone. This will encourage the industry to use marginal/low grade limestone which is currently getting wasted/improperly utilized. This shall also help conserve the current resources of high grade limestone.
- (vii) In order to ensure systematic mining operation for better recovery, there is need to integrate small mining leases in a limestone belt.
- (viii) Strict compliance of three years should be ensured for setting up a cement plant after granting mining lease to discourage the merchant mining by the lease holders.
- (ix) In order to encourage utilization of limestone deposits located in remote areas; there is a need to offer incentives like Road Freight subsidy, lower royalty/excise rates etc.

4.5 FUEL

4.5.1 Current Scenario

4.5.1.1 Cement industry uses coal for cement production as well as for captive power generation. Fuel cost thus contributes significantly to cement production cost.

4.5.1.2 Currently cement sector is not getting fair treatment w.r.t. allocation of coal linkages/ coal blocks. Thus a large no. of players meet their fuel requirement through procurement of market coal (e-auction and pet coke etc.) as well as International coal and alternate fuels.

4.5.1.3 Market coal prices are much higher than the domestic administered prices; so continued dependence on International coal/ market coal is causing significant increase in the cement prices.

4.5.1.4 As cement is a key input in infrastructural development, high fuel cost (due to poor availability of administered price coal by way of linkage) increases its cost and thereby adds to high inflation.

4.5.2 Assessment of Future Coal requirement

4.5.2.1 The requirement of fuel by cement industry during 12th Plan for all the four scenarios of cement demand growth is given in table below:

(a) Fuel required for Cement production

Input assumptions:

Coal consumption volume 170 Kg/Tonne of cement

Based on the four growth scenarios, coal requirement for cement shall be:

Coal Requirement for Cement

(Million Tonnes)

Year	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	45.5	45.9	46.1	46.2
2013-14	49.4	50.3	50.7	51.0
2014-15	53.8	55.3	56.1	56.5
2015-16	58.7	60.8	62.0	62.5
2016-17	63.9	66.9	68.5	69.3

(b) Fuel required for captive power plants

Input assumptions:

Captive Requirement – 85 KWh/Tonnes (14MW/ Million Tonnes)

Coal requirement 6000 Tonnes/MW/annum

Ratio of thermal CPP vis-a-vis other sources including Waste Heat Recovery plants, DG Power and Grid support: 80% of total power requirement.

Projected CPP (thermal) capacity at the end of 12th Plan : 3785 MW to 3973 MW.

Coal Requirement for Captive Power

(Million Tonnes)

Year	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	17.5	17.7	17.7	17.8
2013-14	19.0	19.3	19.5	19.6
2014-15	20.7	21.3	21.6	21.7
2015-16	22.6	23.4	23.8	24.0
2016-17	24.6	25.7	26.3	26.6

(c) Total Fuel required for Cement production and captive power

Total Coal Requirement for Cement & Captive Power

(Million Tonnes)

Year	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	63.0	63.6	63.9	64.0
2013-14	68.4	69.6	70.3	70.6
2014-15	74.5	76.6	77.6	78.2
2015-16	81.2	84.2	85.8	86.6
2016-17	88.5	92.7	94.8	95.9

4.5.3 Recommendations

4.5.3.1 Increasing supply of coal under Linkage for Cement: - Post 2007, no new linkage has been granted to any cement manufacturer. Thus a lot of manufacturers are deprived from getting supplies of linkage based coal.

Further, Captive Power Plants (CPP) of cement industry in a way augment the overall power generation capacity in the country. Thereby they contribute towards meeting overall power requirement of the country and thus need to be treated at par with IPPs in terms of fuel linkage assurance.

Even in cases where linkage has been granted, actual supply against such linkages is poor. Given the current level of linkage supplies being less than 50% of the industry's requirements, it is clear that there is going to be a big deficit between coal requirement and the available administered price coal in the 12th plan. Thus, unless the linkage coal is quickly increased the fuel supply gap shall put upward pressure on cement production costs.

4.5.3.2 Equal priority in grant of Coal linkage vis-a-vis other sectors: - Cement is accorded low priority in allocation of coal linkage vis-a-vis power and fertilizer sector. Since cement is equally important for the growth of the economy, therefore Priority linkage needs to be provided for 100% requirement to all cement players at administrative price. This shall enable all players to have equitable treatment with regard to fuel costs.

4.5.3.3 Reserving sufficient coal blocks for cement industry: - Out of total coal reserve blocks, a proportion of high grade coal blocks should be reserved exclusively for cement sector keeping its current production capacity and future expansion into consideration and blocks closer to the cement producing regions (to minimize transportation costs) should be blocked for this category. Under the proposed bidding format, only cement companies should be eligible as bidders for these blocks. The present fuel requirement of the industry both for cement production & captive power is around 55 Million Tonnes per annum and if this were expected to grow in line with cement demand growth projection till 2026-27 and subsequently at a rate of 7% p.a., the coal reserves

required to meet the next 35 year requirement (post XIIth plan period) shall be around 10.25 Billion tonnes.

4.5.3.4 Rationalization of taxes on imported coal / Pet coke: - Taxes (import duty, CVD etc.) and Entry tax on imported coal/pet coke needs to be rationalized. This shall help the players in controlling imported fuel costs.

4.5.3.5 Incentives for power generated by Waste Heat Recovery Plants: - With aggravating shortages in availability of domestic coal, government should encourage alternative power sources like use of Waste Heat Recovery (WHR) plants in all cement plants. WHR being a capital intensive technology incentives like recognizing it as a RE (Renewable Energy) source shall promote the same by making it eligible for issuance of RE certificates. By getting additional revenue by selling RE attributes of WHR power, cement producers would be able to aggressively develop an alternate power source.

4.5.4 In addition, the following observations/recommendations are made for the long term planning and availability of coal to cement sector. The strategic plan of the Ministry of Coal reveals that the coal sector, inter alia, is currently facing the following challenges:

4.5.4.1 Poor quality of thermal coal available in India, mostly E and F grade coal.

4.5.4.2 Inadequate extractable reserves of coking coal.

4.5.4.3 Low productivity in coal mines operated by CIL.

4.5.4.4 Coal sector is yet not truly open up for commercial mining.

4.5.4.5 Problems and constraints in underground mining – use of old technology and labour intensive processes for mining and safety issues.

4.5.5 The coal sector remains highly regulated under government control, is monopolistic in nature, faces mining and exploration bottlenecks, particularly in underground mining, has attracted low levels of private investments over the years, and faces logistical bottlenecks and technological obsolescence. As such, it is proposed that the possibilities

of unbundling the various operations of the coal sector under a regulator with Public Private Partnership be seriously explored by revisiting the Coal Mines (Nationalization) Act, 1973. This will enable private participation in a competitive manner in a regulated environment in areas which is their core competency. The various operations in the supply chain of coal such as mining and exploration, supply of mined coal and distribution and logistics can be unbundled for attracting technology and investments by the private sector at various points in the value chain resulting in increase in efficiency and productivity.

- 4.5.6 The Mines and Minerals (Development and Regulation) Amendment Act provides for allocation of coal and lignite blocks through competitive bidding route. This was notified on 9.9.2010. As is the case with other minerals, it is imperative that the quality and quantity of coal deposits in a specified coal block placed for competitive bidding for captive use is determined with reasonable accuracy to avoid speculative bidding – whether the reserves are proven reserves, probabilistic reserves or inferred reserves as per acceptable international norms. The basis of bidding should provide complete information on mineral reserves after full exploration. It is, therefore, proposed that coal blocks should be placed for competitive bidding for captive use only after detailed exploration. This will help in avoiding speculative bidding because of incorrect initial valuations.
- 4.5.7 It is also recommended that all requisite clearances as may be practicable should be obtained by Coal India Ltd. before putting the Coal blocks for competitive bidding in order to streamline the process and reduce delays. This will also improve the realization from the bidding process as it will reduce the uncertainty about when the block can come into production.
- 4.6 **Coal Mining:** It is recommended that mining should be done in accordance with a pre-approved mining plan and a close monitoring of the mining activity throughout the mining period should be carried out through the deployment of latest technology.

4.7 Alternate Fuels in Cement Industry

4.7.1 Co-processing is defined as the use of alternative fuels and raw materials (AFR) or disposal of waste materials in industrial processes to recover energy and material from them. Due to the high temperature and long residence time in cement kiln all types of wastes can be effectively disposed without any harmful emissions.

4.7.1a The cement industry in India has the potential to utilize the entire hazardous waste generation of the country, if found suitable, for co-processing. Apart from hazardous waste, other wastes that can be targeted for co-processing are RDF, segregated non-recyclable plastics from MSW, forest felling and agricultural residues, waste from ports, airports and railways, confiscated goods, pesticides, other non hazardous waste, etc., that are difficult to manage at present.

4.7.1b Considering the cost towards developing landfills and incinerators and the contingent cost of the land (which is no more usable for any other activities), associated very long term liability thereof, the cost towards environmental remediation and the expenses related to health and well-being of the society, co-processing offers the most economical solution for the management of wastes. In addition, landfill has tremendous liability and ecological footprint as any leaks in terms of leachate and landfill gas will adversely affect the environment.

4.7.1c Co-processing of waste in cement production has been recognized as an environmentally sound disposal method in the context of the Basel Convention (the 'Basel Convention Technical Guidelines on Incineration on Land', SBC, 1995 paragraphs 26-27).

4.7.2 Achievements So Far:

4.7.2.1 The utilization of AFRs in cement industry was practiced sporadically; however a focused approach has been witnessed from 2005 onwards. Some cement producers have taken several steps in this direction and now more and more units are showing interest in this direction. However, initial cost involved for installing feeding and handling system is a main constrained.

4.7.2.2 World over cement plants are easily operating with an average Thermal Substitution Rate (TSR) of 10 -15%, some go up to 60-70%. In India, TSR values across the country range from 0.5% to 1%. At current TSR levels, we are saving about 0.2 Million Tonnes of coal. The estimated conservation of coal when we

reach meagre TSR levels of 10-15% would be 5.5 Million Tonnes. Therefore, cement industry in India have a huge potential to contribute towards sustainable development.

4.7.3 Difficulty experienced and suggestions/steps necessary for encouraging use of AFR: A number of regulatory/legislative issues were resolved with the release of the CPCB Guidelines for Co-processing in Cement/Steel/Power Industry (February 2010). However, few still remain and are as follows:

- a) **Lengthy Permission Process and High cost of Trials-** The greatest problem faced is with regard to permission process and cost involved before start of use of waste. The existing permission process involving the SPCBs and CPCB is lengthy and time consuming. There are variations in terms of application procedures and methodologies to be followed from state to state. As per the CPCB Guidelines a comprehensive 5 day trial run is required to be done for co-processing any new waste stream. The cost associated with conducting such trial runs, are high. Average cost works out to about Rs. 50 Lakh to Rs. 75 Lakh. The waste generators, therefore, hesitate to dispose off their waste by co-processing. The CPCB Guidelines also mentioned that, emissions during co-processing should be less than (the level achieved) without co-processing. It is very difficult to comply with this clause.
- b) **Pre-qualified Cement plants to get permit to process all types of wastes-** A cement plant which fulfills the co-processing prequalification criteria should be issued a permit to co-process all types of waste, while remaining within maximum permissible emission norms. Trial run should be required only for wastes containing critical hazardous constituent. A consistent methodology should be developed for the permitting process which should be followed across all states.

Alternatively Central Pollution Control Board (CPCB) / Ministry of Environment and Forests (MoEF) should create a fund to subsidize expenses for conducting the trial run to the extent of 75% of the total cost involved for such trial runs. Balance amount could be incurred by cement factories and waste generator. Processing of the report of the trial run should also be completed in a time bound manner so that processing of waste can start with minimum time lap.

- c) **Issues in Inter-state movement of waste-** The current regulation with regard to, as it stands, does not encourage the inter-state movement of hazardous waste. In fact, some states do not at all permit movement of waste from other states.

Inter-state movement of hazardous waste for co-processing should be encouraged, as it is a recovery option, where the use of waste (from within/outside the state) reduces the natural resource consumption of the state. In fact, the state receiving waste from surrounding states should be recognized for its attempt to reduce use of natural resources. For this purpose, standard guidelines should be notified. The cement plants may be permitted to move waste from other states with minimum restrictions if they are following standing guidelines.

- d) **Need to modify current CPCB Guidelines-** The current CPCB Guidelines on co-processing needs modifications with a view to truly encourage utilization of AFRs by cement plants co-processing should be recognized as a preferred technology for waste disposal as against other options like incineration and landfill. For this purpose, Govt. should frame policy which recognizes co-processing in cement kiln as a preferred technology for dealing with all types of waste except the 10 banned wastes, namely, Anatomical Hospital Wastes, Asbestos-containing Wastes, Bio-hazardous Wastes, Electronic Scrap, Entire Batteries, Explosives, High-concentration Cyanide Wastes, Mineral Acids, Radioactive Wastes and Unsorted Municipal Garbage. Waste generator should explore feasibility of co-processing first in a cement factory, if it fails, only then disposal option should be exercised.
- e) **Set pre-qualification criteria for cement plants utilizing AFR-** A minimum prequalification criteria should be set for cement plants utilizing AFR considering environment, safety and cement quality parameters. It should include AFR Technical Assessment (wherein the potential/capacity of the cement plant to handle and co-process waste is evaluated), laboratory, continuous emission monitoring system, appropriate AFR feeding systems and pre-processing platforms (where quantity utilized are large).

- f) Currently there are no emission norms set for cement plants undertaking co-processing activity. For this purpose maximum permissible emission norms should be put in place for cement kilns undertaking co-processing.
- g) **Building Awareness towards co-processing-** Capacity building and awareness generation towards acceptance of co-processing should be undertaken by the Ministry of Environment and Forests (MoEF) which will help in promotion and encouragement of co-processing technology in the country.

For this purpose, CPCB / MoEF should conduct workshops/seminars through CII, FICCI, NSC, etc. for encouraging and creating awareness regarding co-processing.

- h) **Cement plants should be allowed to build their own pre-processing facilities.** They should receive the waste directly from waste generator, pre-process and then co-process the waste. Requirements of each cement plants are specific and they vary from plant to plant. Cement plant should therefore be allowed to pre-process the waste as per own requirements. Externally processed waste might not necessarily meet cement plant requirements. It is necessary as the process fluctuations occur in cement kiln due to inconsistency in the quality and availability of waste streams causing production loss and low thermal substitution rate. To improve the energy and material recovery from the different types of waste streams, there is a need to pre-process waste to produce homogenous AFR that can be easily utilized by cement plant. Each cement plant is aware of the constituents of its inputs and process requirements and can accordingly pre-process the waste material to meet the demands of the plant. Moreover, in case of any issue with health, safety, environment, process or product quality, cement plant can easily trace the waste responsible for the problem. Traceability is very important to rectify the problem as soon as possible.

4.8 FLY-ASH

4.8.1 Current Scenario

4.8.1.1 One of the major contributions of cement industry to society is in the form of absorption of industrial waste generated by other sectors, particularly the power sector and plastics. The power generation in India is coal intensive which generates huge amounts of ash and enormous areas of land is used to store it. According to the 2007 report of a committee constituted by the Central Electricity Authority to assess land requirements for power plants, 196 million tonnes of ash would be generated every year by the end of 11th Five Year Plan. Assuming land requirement of 0.4 acre per megawatt capacity, about 50,000 acre of land would be required every year to store ash if it is not consumed. These numbers would increase further with increasing power plants. The ash ponds have adverse effect on water bodies and agriculture land. In order to conserve top soil and prevent the dumping and disposal of fly ash from coal or lignite based thermal power plants, Ministry of Environment and Forests has issued directions through Gazette notification number S.O.763 (E), [14.9.1999] – Dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land with two amendments, one in 2003 and the other in 2009. The statute requires all coal and or lignite based thermal power stations and or expansion units in operation before the date of this notification to achieve a target of 100 per cent utilization of fly ash within five years of issue of the notification. However, unconfirmed reports indicate that utilization of fly ash is still less than 60 per cent of generated quantity. Cement industry with about 38 per cent share in utilization of fly ash plays an important role in evacuation and fruitful utilization of this harmful waste.

4.8.1.2 Utilization of fly ash is not a costless process. It requires establishment of a proper processing infrastructure at the power plant site in the form of dry fly ash collection system and dedicated system of transport to the grinding unit. However, after government allowed free sale of ash, several power plants have started putting price on fly ash even if evacuation is not 100 per cent. In fact, it appears that there is lack of transparency in the disposal process of fly ash which is revealed by the fact that no information is available in public domain about the amount of stock of fly ash, the amount of generation at each location and the amount of fly ash disposed off to various sectors. The Central Pollution Control Board (CPCB) is supposed to collect all this information but nothing is made public either through its website or otherwise. It is very much essential that the information about fly ash generation, utilization and its stock is made public by the

Ministry of Environment and Forests and Central Electricity Authority. At the same time it should also be made mandatory for each power plant to display complete information about the plant level ash generation, its stock and disposal at their respective websites including pricing, if any, on a regular basis.

4.8.1.3 With priced fly ash, the cement manufacturers have to compare costing between use of lime stone and fly ash and it is likely to put pressure on extraction of more lime stone as well the final price of cement. Socially, utilization of fly ash for manufacturing cement means (1) saving of natural resource of lime stone and coal for future generations; (2) saving the quality of land around power plants and thus reducing the misery of farmers, local residents and the flora and fauna; (3) availability of cement at relatively lower prices on account of lower capital requirement as also lower lime stone requirement; and (4) availability of power at relatively lower price to the extent power plants save cost of disposing fly ash to the ash ponds and maintain large inventory of land for this purpose and (5) saving precious water that would otherwise be wasted in converting fly ash into slurry for dumping purpose. No power plant is paying anything to the farmers and the local residents for the damage done to the environment due to storage of ash. However, through its use in cement, several benefits are passed on to the society. Therefore, any agency which is interested in permanently evacuating this waste is in fact helping the environment, the farmers and the local people and must be welcome to do so free of cost.

4.8.2 Current and Future Fly-ash Generation Estimation

4.8.2.1 During FY 2010-11, as per details provided by CEA, thermal power plants (based on 79202 MW of coal based capacity) generated a total of 130.7 million tonnes of fly ash.

4.8.2.2 The total utilization of fly ash was only 72.8 million tonnes (i.e. 56%) of which 35.2 million tonnes (i.e. 27% of total fly ash) was consumed by the cement industry. The other users included Brick Manufacturers 4.59 million tonnes (3.5%), Roads, Embankment and Ash Dykes 8.52 million tonnes (6.5%), Reclamation and Mine-filling 15.19 million tonnes (11.5%), and other misc applications 9.34 million tonnes (7%). Balance 57.90 million tonnes which is about 44% of the total fly ash remained unutilized.

4.8.2.3 However, above fly ash generation estimate is based on power plant capacity of 79202 MW while the all India actual coal based thermal power capacity as of 31st July, 2011 was 94953 MW and which is expected to rise by another 10000 MW capacity by 31st March, 2012. Considering an assumed fly ash generation of 4.5 tonnes per MW per day, the actual fly ash generation is likely to be about 172 million tonnes. If we add expected thermal power generation capacity of 60000 MW planned to be achieved in 12th Plan, the fly ash generation is likely to reach 271 million tonnes per annum.

Particular	All India (in MW)
Current Thermal Capacity (as on 31 st July 2011)	94953
Estimated Thermal addition in rest of 2011-12	10000*
Capacity at end of 11 th Plan	104953
Fly ash generation at end of 11th plan	172 Million Tonnes p.a.
Planned addition in 12 th plan	60000
Thermal capacity at the end of 12 th plan	164953
Fly ash generation at end of 12 th plan	271 Million tonnes p.a.

* As per CEA annual capacity addition target for FY 2011-12 is 11600 MW.
Projected capacity addition during 12th plan -1,00,000 MW

Expected share of coal based thermal capacity in installed capacity- 60%
Estimated coal based thermal capacity addition in 12th plan: 60,000 MW

4.8.3 Current and Projected Fly ash requirement of Cement Industry

4.8.3.1 As stated above, cement is the largest user of fly ash in the country. The projected requirement of fly ash under four different scenarios of cement demand projections would be as under: -

Fly-ash Requirement				
(Million Tonnes)				
Year	Scenario I	Scenario II	Scenario III	Scenario IV
2012-13	40.8	41.2	41.4	41.5
2013-14	44.3	45.1	45.5	45.7
2014-15	48.3	49.6	50.3	50.6
2015-16	52.6	54.6	55.6	56.1
2016-17	57.4	60.0	61.4	62.1

4.8.3.2 While current and projected fly ash generation is much larger than requirement of cement industry, due to locational demand - supply issues, fly ash is being sold for a price by various thermal power plants.

4.8.3.3 If the fly ash generated in power plants is not consumed by the cement industry, the actual cost on the economy by way of disposal risks and threat to health of society shall be very high. In order to protect the environment, conserve top soil and prevent the dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land; in fact Ministry of Environment and Forests had in 1999 issued a notification making it mandatory for thermal power plants to supply fly ash at free of cost for at least 10 years. However, in Nov 2009, MoEF has amended the said notification making the fly ash as a priced commodity.

4.8.4 Recommendations

4.8.4.1 Ministry of Power needs to corroborate the fly ash generation projections. This will certainly bring the looming problem of fly ash disposal on table. The alarming level of fly ash surplus quantity should be a cause of worry and should be given due consideration for its effective disposal.

4.8.4.2a Cement CPP's should not be under obligation to supply free-of-cost fly ash to neighboring industries - MOEF Notification of 3rd November, 2009 which makes it mandatory for cement industry, having Captive Power Plants, to provide 20% of the fly ash generated by them as Free to the small brick/tile manufacturers within 100 kms vicinity of their plants, which otherwise would have been utilized by the cement plants for their own consumption.

4.8.4.2b As a result of the above Notification, cement plants are compelled to purchase 'cement graded fly ash' from the Power Houses located far away from their plants, which unnecessarily increases avoidable production cost of cement due to involvement of the cost of fly ash they purchase and its transportation. This also leads to a National Wastage of Diesel in transportation, a product for which Govt. is struggling to find ways for its conservation. In view of this, the need for exemption of these provisions in the Notification for Captive Power Plants of cement plants becomes all the more necessary.

4.8.4.3 Railways to provide attractive Freight rebate for the entire life of the wagons if Industry is supposed to procure Special Purpose Wagons for movement of fly ash and also to create necessary infrastructure facilities for unloading at their respective plants.

4.9 LAND ACQUISITION

4.9.a The cement projects and limestone mines require large amount of land to be acquired. The industry has been facing lot of difficulties in acquiring land which cause delay in the project execution as well as increases the project cost. The growth of cement industry as also national economy would depend on smooth and fast acquisition of land. For this purpose, Government is working on bringing out a new legislation on land acquisition. The following suggestions need consideration for facilitating land acquisition by the industry: -

4.9.1 The On-Line availability of revenue / land records should be ensured.

4.9.2 The allotment of Govt. Land should also be prompt and the NOC from Gram Panchayat should be required, only in cases where it is essentially required like Charagah Land / Water Body etc.

4.9.3 Land conversion / diversion process should be made simple in some time bound manner for avoiding delay in execution of the projects.

4.9.4 In most of the cases there are encroachments on the Govt. land, hence, Government must ensure that peaceful possession of the land is allotted to a corporate / company.

4.9.5 Many times it is found that road or electrical line of similar facility passes through the mining lease area which makes the use of mineral lying beneath such facility unusable. Therefore, such facilities should be allowed to be shifted to some other suitable area, may be on cost to the company.

GOVERNMENT ORDERS

No. I&M-3 (7)/2011
Planning Commission
(Industries Division)

Yojana Bhavan, Sansad Marg,
New Delhi, the 29th April, 2011

OFFICE MEMORANDUM

Subject: Constitution of Working Group on “Cement Industry” for the Twelfth Five Year Plan (2012 – 2017)

In the context of preparation of Twelfth Five Year Plan (2012-2017), it has been decided to set up a Working Group on “Cement Industry”. The Composition and Terms of Reference of the Working Group would be as follows:

I. Composition

Sl. No.	Name	
1	Secretary, Department of Industrial Policy & Promotion	Chairman
2	Secretary, Ministry of Housing and Poverty Alleviation or nominee	Member
3	Secretary Ministry of Urban Development or Nominee	Member
4	Secretary Ministry of Rural Development or nominee	Member
5	Secretary Ministry of Coal or nominee	Member
6	Secretary Ministry of Road Transport & Highways or nominee	Member
7	Controller General of Indian Bureau of Mines	Member
8	Secretary, Railway Board or nominee	Member
9	Advisor (I & VSE), Planning Commission	Member
10	Chairman, Industrial Development Bank of India	Member
11	Director General, National Council for Cement and Building Materials, (NCCBM)	Member
12	Director, Central Road Research Institute	Member
13	President, Cement Manufacturers’ Association (CMA)	Member
14	President, All India Mini Cement Manufacturers’ Association	Member
15	President, Federation of India Chambers of Commerce & Industry or nominee	Member
16	President, Confederation of Indian Industry (CII) or nominee	Member
17	Representative from NCAER	Member
18	Director IIT, Delhi or nominee	Member
19	Shri M. C. Singhi, Sr. Economic Adviser, Deptt. of Industrial Policy & Promotion	Member
20	Shri Talleen Kumar, Joint Secretary, Deptt. of Industrial Policy & Promotion	Member Secretary

Terms of Reference

- i. To articulate the long term goals to be achieved in terms of growth, competitiveness and share in global trade for the domestic Cement Industries.
- ii. To review the current status of Cement Industry highlighting the achievements during the Eleventh Plan and reasons for shortfall, if any in the fulfilment of targets.
- iii. To project demand, state-wise, region-wise for Cement Industry during the Twelfth Plan and to recommend measures for increase in production through modernization, expansion, setting up of new cement units etc.
- iv. To examine and recommend measures for encouraging use of cement in infrastructure projects and propagation of cement concrete road for the growth of this sector.
- v. To analyse trend of exports vis-à-vis global market, identify potential export markets, its demand and competitive sources of supply and to suggest measures to promote cement exports to these markets.
- vi. To examine cement imports and implications of WTO on cement industry.
- vii. To benchmark the indigenous cement industry against international industry and review the status of existing technology and suggest measures for bridging the gaps, where necessary, including the needs for further R & D activities and /or technology collaboration to upgrade technology, economize on consumption of energy and increase productivity so as to make the cement industry globally competitive.
- viii. To explore use of alternate sources of energy like pet coke, LNG, CNG, organic waste materials etc.
- ix. To identify the environment related issues and mitigation measures in cement plants and examine various options of promotion of such measures like incentivizing non-polluting cement units.
- x. To examine and recommend measures for encouraging recycling technology using industrial waste and effluents in the cement industry and fiscal and other measures for accelerated use of waste products (like fly-ash, slag, effluent from paper industry etc.)
- xi. To review the performance of mini cement plants and recommend measures for the growth of this sector.
- xii. Laying emphasis on development and adoption of nano-technology practices involving appropriate policy initiatives.
- xiii. To update national inventory of limestone and other raw material such as coal, take stock of their availability for cement plants and review status of upstream linkage for cement units.
- xiv. To examine the status of bulk transportation of cement and recommend measures for increased bulk transportation.
- xv. To assess availability of skilled manpower, facilities for training and human resource development.
- xvi. To indicate the milestones to be achieved in 12th Plan in the context of long term goals as per item I above and recommend programmes/schemes/measures that are to be initiated, continued or discontinued in the 12th Plan period and estimated fund requirement.

- xvii. To make any other recommendations as may be appropriate for sustained growth and competitiveness of the sector.
2. The Chairman may constitute Sub-Groups/Task Forces as considered necessary and co-opt other members to the Working Group for specific inputs.
3. The working Group would submit its report to the Chairman of the Steering Committee on Industry by 30th August 2011. The Working Group will be serviced by Department of Industrial Policy and Promotion.
4. The expenditure towards Travelling Allowance (TA)/DA in connection with the meetings of the Working Group/Steering Committee in respect of the official members will be borne by their respective Ministry/Department. In case of non-official Members of the Working Group, expenditure towards their TA/DA would be met by the Planning Commission as admissible to the class I officers of the Government of India. As per extant Guidelines, air travel required for attending the meeting may be undertaken on Air India.
5. Shri Debasis Banerjee, Joint Adviser (Industry), Planning Commission, New Delhi (Room No 464, Yojana Bhawan – Tel: 011-2335-3437, E-mail: banerjee-pc@nic.in) will act as Nodal Officer for this Working Group and any further query/communication in this regard may be made with the Nodal Officer.



(Dr. Renu S. Parmar)
Adviser (Industry & VSE)
Telefax: 2309 6605
E-mail: rsparmar@nic.in

To,

The Chairman and All Members of the Working Group

Copy to:

1. PSs to Deputy Chairman/MOS(Planning)/Members/Member-Secretary, Planning Commission
2. Prime Minister's Office, South Block, New Delhi
3. Cabinet Secretariat, Rashtrapati Bhawan, New Delhi
4. All Ministries/ Departments of the Government of India
5. All Principal Advisers/Adviser (including JS(SP & Admn.), Planning Commission
6. Director (PC), Planning Commission



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F. No. 5(7) / 2011 – Cement
Government of India
Ministry of Commerce & Industry
Department of Industrial Policy & Promotion

Udyog Bhawan, New Delhi-110 011
Dated the 17th June, 2011

Subject: - Working Group on Cement Industry for the 12th Five Year Plan (2012-17) – Constitution of Sub-Groups – Regarding

1. As decided in the first meeting of the Working Group on Cement Industry held on 19th May, 2011, the following Sub-Groups are constituted to look into the various aspects of the industry:

Sub Group I : Macro overview of Cement Industry and Measures for Demand Stimulation in Housing, Infrastructure and Concrete Roads.

Sub Group II : Productivity, Technology, Environment, Sustainability, Standards, Skill Development and Research and Development (R&D)

Sub Group III : Taxes and Capital Funding

Sub Group IV : Logistics including Railways and Issues related to Raw Materials, Fuel, Fly ash, Minerals Rights and Land Acquisition.

2. The composition and terms of reference of each Sub-Group are given in the Annexure. The chairman of the sub-group will be at liberty to associate/co-opt any other expert personnel/institution on the subject as member, if deemed necessary. The Sub-Group will expedite the finalization of their report by 31st July, 2011 and submit it to the Working Group.
3. It is requested that the name(s) of the representatives(s) of the organizations mentioned in the Annexure may kindly be communicated to the Member Secretary of the Working Group as well as to the Chairman of the Sub-Group immediately.
4. Further, it is requested that each Sub-Group will hold periodical meetings and minutes of the same would be made available to Member Secretary, Working Group on Cement Industry from time to time.
5. The Report of the Sub-Group may be submitted to the Member Secretary, latest by 31.7.2011.


(Premanshu Bishwas)
Director

Enc. As above

Sub-Group-I

MACRO OVERVIEW OF CEMENT INDUSTRY AND MEASURES FOR DEMAND STIMULATION IN HOUSING, INFRASTRUCTURE AND CONCRETE ROADS

Terms of Reference

1. To review the current status of cement industry highlighting the achievements during the Eleventh Plan and reasons for shortfall, if any in the fulfilment of targets.
2. To analyse trend of exports vis-à-vis global market, identify potential export markets, its demand and competitive sources of supply and to suggest measures to promote cement exports to these markets.
3. To examine cement imports and implications of WTO on cement industry.
4. To articulate the 12th Plan, long term goals to be achieved in terms of growth, competitiveness and share in global trade for the domestic cement industries.
5. To project demand, state-wise, region-wise for cement industry during the Twelfth five year plan and to recommend measures for increase in production through modernization, expansion, setting up of new cement units etc.
6. To examine and recommend measures for encouraging use of cement in infrastructure projects and propagation of cement concrete roads including specific recommendations for its mandatory use in various government schemes for the growth of this sector.
7. To review the performance of mini cement plants and recommend measures for the growth of this sector.
8. To examine and recommend specific fiscal and other incentives / measures required for stimulating demand for housing.
9. To examine and recommend priority for grant of coal and lignite blocks to cement sector and also examine the current method of coal distribution and to recommend measures for its equitable distribution.

Composition of the Sub-Group-I

1.	Shri M.C. Singhi, Sr. Economic Advisor, DIPP	Chairman
2.	Shri Talleen Kumar, Joint Secretary, DIPP	Member
3.	Shri R. Muralidhar, Vice President, India Cements	Member
4.	Shri S. Chouksey, Wholetime Director, JK Lakshmi Cement	Member
5.	Mr M.K. Singhi, ED, Shree Cement Ltd.	Member
6.	Shri Kamlesh Sharma Sr. Vice President, Ambuja Cements Ltd.	Member
7.	Shri K.M. Gupta, Advisor, ACC Ltd	Member
8.	President, All India Mini Cement Manufacturer's Association	Member
9.	Representative from M/o Urban Development	Member
10.	Representative from M/o Road Transport and Highways	Member
11.	Representative from M/o Rural Development	Member
12.	Representative from Ministry of Housing and Poverty Alleviation	Member
13.	Smt. Renu Mathur, Head-Rigid Pavement Divn, Central Road Research Institute (CRRI)	Member
14.	Dr. Kanhaiya Singh, Senior Fellow, NCAER	Member
15.	Shri Premanshu Bishwas, Director DIPP	Member
16.	Shri S.K. Dalmia, Acting Secretary	Member
17.	Representative from M/o Power	Member
18.	Representative from Planning Commission	Member
19.	Shri Rajiv Sharma, Dy. General Manager, IDBI	Member
20.	Shri K. Swaminathan, President (COMM), Jaiprakash Associates Ltd.	Member
21.	Shri NA Viswanathan, Secretary General, CMA	Convener

Sub-Group-II

PRODUCTIVITY, TECHNOLOGY, ENVIRONMENT, SUSTAINABILITY, STANDARDS, SKILL DEVELOPMENT AND RESEARCH AND DEVELOPMENT (R&D)

Terms of Reference

1. Laying emphasis on development and adoption of nano-technology practices involving appropriate policy initiatives.
2. To identify the environment related issues and mitigation measures in cement plants and examine various options of promotion of such measures like incentivizing non-polluting cement units.
3. To examine and recommend measures for encouraging recycling technology using industrial waste and effluents in the cement industry and fiscal and other measures for accelerated use of waste products (like fly-ash, slag, effluent from paper industry etc.)
4. To benchmark the indigenous cement industry against international industry and review the status of existing technology and suggest measures for bridging the gaps, where necessary, including the needs for further R&D activities and /or technology collaboration to upgrade technology, economize on consumption of energy and increase productivity so as to make the cement industry globally competitive.
5. To examine and recommend allocation of part of the funds from the National Clean Energy Fund which is being generated through levy of cess on coal, for promoting various clean energy projects in the cement sector.
6. To examine and recommend granting Renewable Energy status to power generated from waste heat recovery in cement plants.
7. To assess availability of skilled manpower, facilities for training and human resource development.
8. To explore use of alternate sources of energy like pet coke, LNG, CNG, organic waste materials etc.
9. To make any other recommendations as may be appropriate for sustained growth and competitiveness of the sector.

Composition of the Sub-Group-II

1.	Director, IIT, Delhi (Represented by Dr B. Bhattacharjee – Professor, Civil Engineering Deptt.)	Chairman
2.	Shri Ashwani Pahuja, DG, NCCBM	Member
3.	Shri Chetan Bijesure, Addl Director, FICCI	Member
4.	Joint Adviser (Industry), Planning Commission	Member
5.	Director, Ministry of Environment and Forest	Member
6.	Shri Nand Lal, Sr. D.O. DIPP	Member
7.	Representative from CPCB	Member
8.	Representative from Ministry of Power	Member
9.	Representative from CII	Member
10.	Representative from Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology	Member
11.	Dr. S.K. Handoo, Adviser (Technical), CMA	Member
12.	Shri K.N. Rao, Director, ACC Ltd.	Member
13.	Shri J.C. Toshniwal, Business Head (North), Ambuja Cements Ltd.	Member
14.	Representative from Grasim Industries Ltd.	Member
15.	Representative from All India Mini Cement Association	Member
16.	Industrial Adviser, M/o Commerce and Industry	Member
17.	Shri Sanjay Jain, Vice President, Lafarge India Pvt. Ltd.	Member
18.	Smt. Renu Mathur, Head-Rigid Pavement Divn, Central Road Research Institute (CRRI)	Member
19.	Shri V. S. Bajaj, President (Corporate Affairs) Jaiprakash Associates Ltd.	Member
20.	Shri Pradeep Kumar, Joint Director, NCCBM	Convener

Sub-Group-III

TAXES AND CAPITAL FUNDING

Terms of Reference

1. Capital funding required for increasing the production through Modernization, Expansion, Greenfield projects during 12th plan.
2. Review taxes and duties on clinker and cement.
3. To promote exports through incentives.
4. Fiscal incentives for recycling (co-processing) technologies
5. Rationalization of duty and taxes on raw materials and coal, grid power, captive power and cogeneration
6. Duties structure for import of raw materials, fuels etc.
7. Incentives for promoting energy & environmental friendly technologies.

Composition of the Sub-Group-III

- | | | |
|-----|--|-----------------|
| 1. | Shri R. M. Malla, CMD,
Industrial Development Bank of India (IDBI Ltd) | Chairman |
| 2. | Shri Premanshu Biswas, Director, DIPP | Member |
| 3. | Dr. Kanhaiya Singh, Senior Fellow, NCAER | Member |
| 4. | Shri R. Muralidhar, Vice President, India Cements | Member |
| 5. | Shri Rahul Kumar, Director and CFO, Jaiprakash Associates Ltd. | Member |
| 6. | Mr S.S. Khandelwal, Member, FICCI Sub-group on Cement and
Company Secretary, Shree Cement Ltd | Member |
| 7. | Mr Vipin Agarwal, ED, Dalmia Cement | Member |
| 8. | Representative from CII | Member |
| 9. | Shri K.M. Gupta, Advisor, ACC Ltd | Member |
| 10. | Shri L. Rajasekar, Executive President, Grasim Industries Ltd | Member |
| 11. | Advisor (I & VSI), Planning Commission | Member |
| 12. | Shri Kamlesh Sharma Sr. Vice President, Ambuja Cements Ltd. | Member |
| 13. | Director / Deputy Secretary, Department of Commerce | Member |
| 14. | Shri S. Chouksey, Wholetime Director, JK Lakshmi Cement | Member |
| 15. | Representative from Ministry of Shipping | Member |
| 16. | Representative from Ministry of Road Transport and Highways | Member |
| 17. | Shri S.K. Dalmia, Acting Secretary, CMA | Convener |

Sub-Group-IV

LOGISTICS INCLUDING RAILWAYS AND ISSUES RELATED TO RAW MATERIALS, FUEL, FLY-ASH, MINERALS RIGHTS AND LAND ACQUISITION

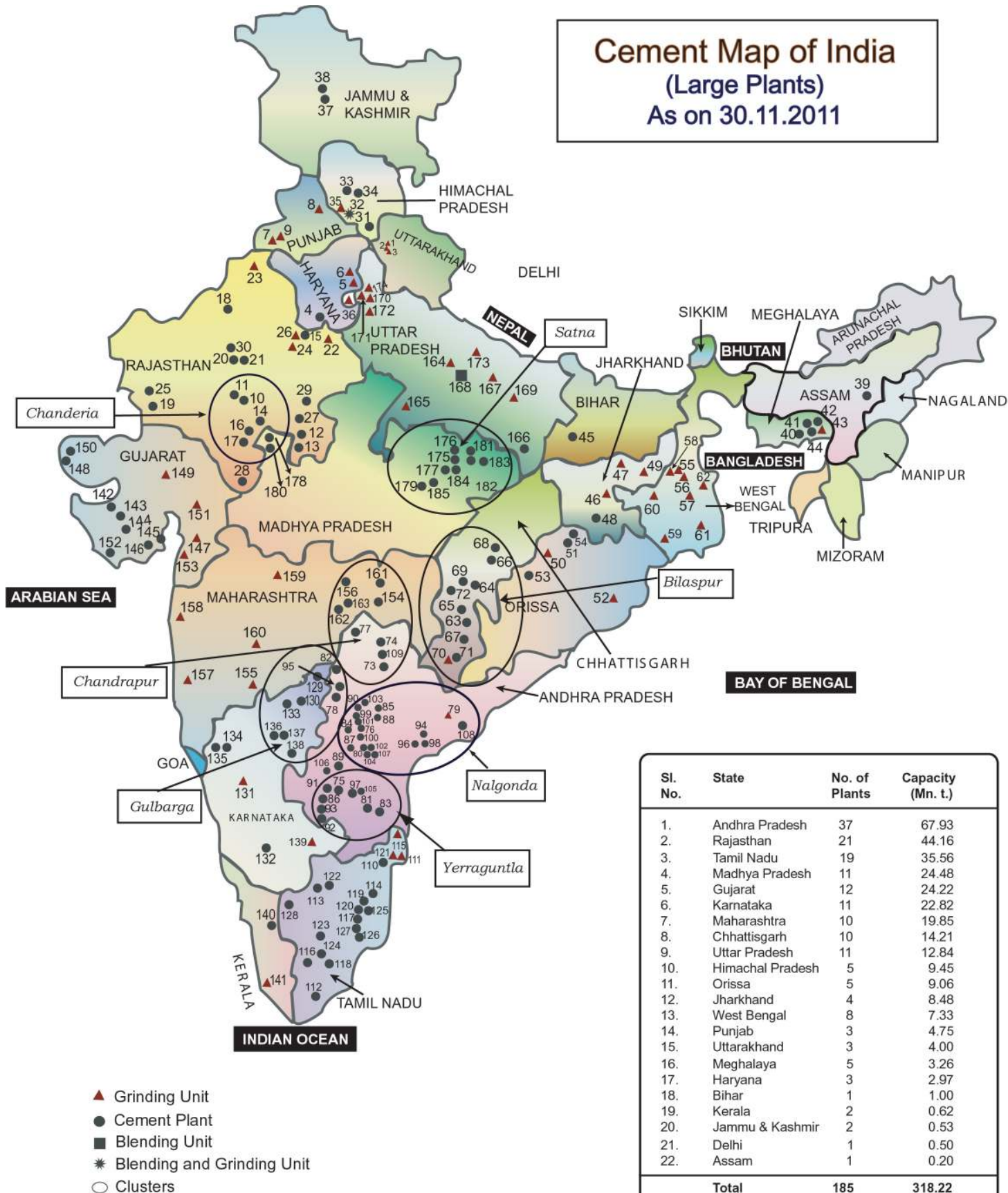
Terms of Reference

1. To update national inventory of limestone and other raw materials such as coal, take stock of their availability for cement plants and review status of upstream linkage for cement units
2. Examination of issues pertaining to Mining Rights of limestone and Land Acquisition
3. To examine the status of bulk transportation of cement and recommend measures for increased bulk transportation
4. To recommend measures for Development of mechanized Freight Terminals.
5. To consider and recommend Wagon Investment Schemes for bagged and bulk cement.

Composition of the Sub-Group-IV

1.	Shri Talleen Kumar, Joint Secretary, DIPP	Chairman
2.	Representative from Ministry of Coal	Member
3.	Representative from Ministry of Railways	Member
4.	Representative from Ministry of Road Transport and Highways	Member
5.	Controller General, Indian Bureau of Mines	Member
6.	Representative from Ministry of Power	Member
7.	Representative from NTPC	Member
8.	Representative from FICCI	Member
9.	Representative from CII	Member
10.	President, All India Mini Cement Manufacturer's Association	Member
11.	Dr. P.L. Ahuja Rai, Director (IA-II), Ministry of Environment and Forests	Member
12.	Shri R. Muralidhar, Vice President, India Cements	Member
13.	Representative from Inland Waterways Authority of India	Member
14.	Representative from Planning Commission	Member
15.	Representative from Ministry of Rural Development	Member
16.	Representative from Ministry of Shipping	Member
17.	Representative from CPCB	Member
18.	Dr. M. Imran, Joint Director, NCCBM	Member
19.	Shri N.A. Viswanathan, Secretary General, CMA	Member
20.	Shri Kamlesh Sharma, Sr. Vice President, Ambuja Cements Ltd.	Member
21.	Shri Rajeev Mehta, Ultra-tech Cement	Member
22.	Shri P.K. Goel, Sr. Vice President, Jaiprakash Associates Ltd.	Member
23.	Mr M.K. Singhi, ED, Shree Cement Ltd.	Convener

Cement Map of India (Large Plants) As on 30.11.2011



Sl. No.	State	No. of Plants	Capacity (Mn. t.)
1.	Andhra Pradesh	37	67.93
2.	Rajasthan	21	44.16
3.	Tamil Nadu	19	35.56
4.	Madhya Pradesh	11	24.48
5.	Gujarat	12	24.22
6.	Karnataka	11	22.82
7.	Maharashtra	10	19.85
8.	Chhattisgarh	10	14.21
9.	Uttar Pradesh	11	12.84
10.	Himachal Pradesh	5	9.45
11.	Orissa	5	9.06
12.	Jharkhand	4	8.48
13.	West Bengal	8	7.33
14.	Punjab	3	4.75
15.	Uttarakhand	3	4.00
16.	Meghalaya	5	3.26
17.	Haryana	3	2.97
18.	Bihar	1	1.00
19.	Kerala	2	0.62
20.	Jammu & Kashmir	2	0.53
21.	Delhi	1	0.50
22.	Assam	1	0.20
Total		185	318.22

C E M E N T C A P A C I T Y (Large Plants)
(As on 30-11-2011)

Sl. No.	Region/State	Location	Installed Capacity (Mn. T.)	Sl. No.	Region/State	Location	Installed Capacity (Mn. T.)
NORTHERN REGION				66.36			
UTTARAKHAND				4.00			
1	Jaypee Cement (G)	Roorkee	1.20	50	UltraTech Cement Ltd. (G)-JCW	Jharsuguda	1.00
2	Shree Cement (G)	Roorkee	1.80	51	OCL India Ltd.	Rajgangpur	4.00
3	Ambuja Cements Ltd. (G)	Roorkee	1.00	52	OCL India Ltd. (G)	Kapilas	1.35
				53	Bargarg Cement Works	Bargarh	2.11
				54	Shiva Cement	Kutra(SunderGarh)	0.60
HARYANA				7.33			
4	CCI Ltd.	Charkhi-Dadri	0.17	55	Birla Corpn. Ltd. (G)	Durgapur	0.60
5	Jaypee Cement (G)	Panipat	1.50	56	Birla Corpn. - Durga Hitech (G)	Durgapur	1.00
6	UltraTech Cement Ltd. (G)	Panipat	1.30	57	UltraTech Cmt. Ltd.-WBCW (G)	Durgapur	1.20
PUNJAB				58	Lafarge India (P) Ltd. (G)	Mejia	1.00
7	UltraTech Cement Ltd. (G)	Bhatinda	1.75	59	Madras Cements (G)	Kolaghat	1.00
8	Ambuja Cements Ltd. (G)	Ropar	2.50	60	Damodhar Cmt. Works (G)	Purulia	0.53
9	Ambuja Cements Ltd. (G)	Bhatinda	0.50	61	Ambuja Cmts. Ltd. (G)	Sankrail	1.00
				62	Ambuja Cmts. Ltd. (G)	Farakka	1.00
RAJASTHAN				14.21			
10	Birla Cement	Chittorgarh	2.00	63	Century Cement	Tilda	2.10
11	Chanderia Cement			64	UltraTech Cement Ltd.-Rawan	Raipur	2.50
12	Mangalam Cement			65	UltraTech Cement Ltd.-HCW	Hirmi	1.90
13	Neer Shree Cement	Morak	2.00	66	CCI Ltd.	Akaltara	0.40
14	UltraTech Cement Ltd.-Aditya	Shambhupura	5.00	67	CCI Ltd.	Mandhar	0.38
15	UltraTech Cement Ltd.	Kotputli	3.10	68	Lafarge India (P) Ltd.-Arasmeta	Bilaspur	1.60
16	J.K. Cement Ltd.	Nimbahera	3.30	69	Lafarge India (P) Ltd.	Sonadih	0.55
17	J.K. Cement Ltd.	Mangrol	0.75	70	Bhilai Jaypee (G)	Bhilai	2.20
18	J.K. Cement Ltd.	Gotan	0.47	71	ACC Ltd.	Jamul	1.58
19	JK Lakshmi Cement Ltd.	Sirohi Road	4.20	72	Ambuja Cmt-Bhatapara	Bhatapara	1.00
20	Shree Cement	Beawar	3.00	SOUTHERN REGION			
21	Shree Cement	Ras	3.00	126.93			
22	Shree Cement (G)	Khushkhera	3.00	ANDHRA PRADESH			
23	Shree Cement (G)	Suratgarh	1.20	67.93			
24	Shree Cement (G)	Jaipur	1.39	73	Kesoram Cement	Ramagundam	1.50
25	Binani Cement	Sirohi	4.85	74	Orient Cement	Devapur	3.00
26	Binani Cement-Sikar (G)	Neem Ka Thana	1.40	75	Zuari Cement	Krishna Nagar	2.20
27	Shriram Cement	Kota	0.40	76	Sri Vishnu Cement	Sitapuram	1.20
28	India Cements-Trinetra	Banswara	1.80	77	CCI Ltd.	Adilabad	0.40
29	ACC Ltd.	Lakheri	1.50	78	CCI Ltd.	Tandur	1.00
30	Ambuja Cmt.-Rabriyawas	Pali	1.80	79	Andhra Cements (G)	Vishakhapatnam	0.62
HIMACHAL PRADESH				80	Andhra Cements	Nadikude	0.80
31	CCI Ltd.	Rajban	0.20	81	India Cements	Chilamkur	1.46
32	Jaypee Cement (B & G)	Bagheri	1.75	82	India Cements-Visaka	Tandur	2.40
33	ACC Ltd.	Gagal	4.40	83	India Cements	Yerraguntla	0.73
34	Ambuja Cmts. Ltd.	Suli	1.60	84	India Cements-Rassi	Wadapally	2.50
35	Ambuja Cmts. Ltd. (G)	Nalagarh	1.50	85	Madras Cements	Jaggayyapet	3.60
DELHI				86	UltraTech Cement Ltd. - APCW	Tadipatri	5.60
36	CCI Ltd. (G)	Tughalakabad	0.50	87	K.C.P Ltd.-Macherla	Macherla	0.83
JAMMU & KASHMIR				88	K.C.P Ltd.-Kuktyala	Jaggayyapet	1.52
37	J & K Cements	Khrew	0.20	89	Panyam Cements	Bugganipalle	0.53
38	Khyber Indus. (P) Ltd.	Khyber	0.33	90	Rain Cements Unit - I	Ramapuram	1.40
EASTERN REGION				91	Rain Cements Unit - II	Racherla	2.60
43.54				92	Penna Cement	Tadipatri	1.50
ASSAM				93	Penna Cement	Boyareddypalli	2.00
39	CCI Ltd.	Bokajan	0.20	94	Penna Cement	Ganeshpahad	1.00
MEGHALAYA				95	Penna Cement	Tandur	2.00
40	Mawmluh Cherra	Cherrapunji	0.20	96	My Home Indus. Ltd.	Mellacheruvu Mandal	3.20
41	Meghalaya Cement Ltd.	Lumshnong	0.30	97	Dalmia Cement - Kadapa	Jammalamadugu	2.50
42	Cement Manu. Co. Ltd.	Lumshnong	0.59	98	Anjani Portland Cement Ltd.	Mellacheruvu Mandal	1.16
43	Megha T & E (P)Ltd (G)	Lumshnong	0.67	99	Deccan Cements	Huzurnagar	2.20
44	Adhunik	Jaintia Hills	1.50	100	NCL Indus.	Matampally	2.00
BIHAR				101	Sagar Cements	Huzurnagar	2.50
45	Kalyanpur Cement	Banjari	1.00	102	Sri Chakra Cements	Gurajala	0.75
JHARKHAND				103	Keerthi Indus.	Kodad	0.62
46	Lafarge India (G)-Jojobera	Singbhum	4.60	104	Parasakti Cmt.	Rentachintala	1.68
47	Bokaro Jaypee (G)	Bokaro	2.10	105	Bharathi Cement	Kamalapuram	5.00
48	ACC Ltd.	Chaibasa	0.87	106	Jayajothi Cement	Banaganapalle	3.20
49	ACC Ltd. (G)	Sindri	0.91	107	Bhavya Cement	Dachepally	1.20
				108	My Home - Vizag	Visakapatnam	1.20
				109	MCC (Mancheria)	Mancheria	0.33

C E M E N T C A P A C I T Y (Large Plants)
(As on 30-11-2011)

Sl. No.	Region/State	Location	Installed Capacity (Mn. T.)	Sl. No.	Region/State	Location	Installed Capacity (Mn. T.)
TAMIL NADU				MAHARASHTRA			
110	UltraTech Cement Ltd.	Reddipalayam	1.40	154	Manikgarh Cement	Manikgarh	1.90
111	UltraTech Cmt. (G)-ARCW	Arakonam	1.10	155	UltraTech Cement Ltd. (G)	Hotgi	1.80
112	India Cements-Sankarnagar	Tulaiyuth	2.05	156	UltraTech Cement Ltd. - ACW	Chandrapur	3.60
113	India Cements	Sankaridurg	0.86	157	UltraTech Cement Ltd.- (G)	Ratnagiri	0.40
114	India Cements-Dalavoi	Trichy	1.85	158	Heidelberg Cmt(I) Ltd.-Dolvi (G)	Raigad	1.00
115	India Cements (G)	Vallur	1.10	159	Orient Cement (G)	Jalgaon	2.00
116	Tamil Nadu Cements	Alangulam	0.40	160	India Cements (G)	Parli	1.10
117	Tamil Nadu Cements	Ariyalur	0.50	161	ACC Ltd.	Chanda	2.65
118	Madras Cements	R.S. Raja Nagar	1.80	162	Maratha Cement	Chandrapur	2.40
119	Madras Cements	Alathiyur	3.12	163	Murali Agro	Chandrapur	3.00
120	Madras Cements	Ariyalur	2.00	CENTRAL REGION			
121	Madras Cements (G)	Uthiramerur	0.60	UTTAR PRADESH			
122	Madras Cements (G)-Salem	Valapadi	0.60	164	Birla Cement (G)	Raebareli	0.63
123	Chettinad Cement	Karur	1.60	165	Heidelberg Cement(I) Ltd. (G)	Jhansi	0.50
124	Chettinad Cement I & II	Karikalli	4.30	166	Jaypee Cement	Dalla	0.50
125	Chettinad Cement	Ariyalur	4.60	167	Jaypee Cement (G)	Chunar	2.50
126	Dalmia Cement	Dalmiapuram	4.00	168	Jaypee Cement (B)	Sadva Khurd	0.60
127	Dalmia Cement - Ariyalur	Thamaraikulam	2.50	169	Jaypee Cement-Ayodhya (G)	Tanda	1.00
128	ACC Ltd.	Madukkarai	1.18	170	Jaypee Cement-Sikandrabad (G)	Sikandrabad	1.00
KARNATAKA				171	UltraTech Cement Ltd. (G)	Dadri	1.30
129	Vasavadatta Cement	Sedam	5.75	172	UltraTech Cmt. Ltd.-Aligarh (G)	Koil	1.30
130	UltraTech Cmt. -Rajashree	Malkhed	3.20	173	ACC Ltd. (G)	Tikaria	2.31
131	UltraTech Cement Ltd (G)	Ginigera	1.30	174	Ambuja Cmts.Ltd. (G)	Dadri	1.20
132	Heidelberg Cement(I) Ltd.	Ammasandra	0.57	MADHYA PRADESH			
133	CCI Ltd.	Kurkunta	0.20	175	Birla Vikas	Satna	1.55
134	Bagalkot Udyog Ltd.	Bagalkot	0.30	176	Satna Cement		
135	J.K. Cement Ltd.-Muddapur	Mudhol	3.00	177	Maihar Cement	Maihar	3.80
136	ACC Ltd.	Wadi	2.60	178	UltraTech Cement Ltd.-Vikram	Jawad Road	3.00
137	ACC Ltd.-New	Wadi	3.20	179	Heidelberg Cement(I) Ltd.	Damoh	1.03
138	ACC Ltd.	Bellary	1.10	180	CCI Ltd.	Neemuch	0.40
139	ACC Ltd. (G)	Kolar	1.60	181	Jaypee Cement	Rewa	3.00
KERALA				182	Jaypee Cement	Bela	2.40
140	Malabar Cements	Palghat	0.42	183	Jaypee Cement	Sidhi	1.50
141	Malabar Cements (G)	Alappuzha	0.20	184	Prism Cement-I&II	Satna	5.60
WESTERN REGION				185	ACC Ltd.	Kymore	2.20
GUJARAT				GRAND TOTAL			
142	Shree Digvijay-Sikka	Sikka	1.07	185 Plants			
143	Saurashtra Cement	Ranavav	1.50	318.22			
144	Gujarat Sidhee Cement	Veraval	1.20				
145	UltraTech Cement - GCW	Pipavav	5.80				
146	UltraTech Cement Ltd.	Jafrabad	0.50				
147	UltraTech Cement Ltd.- (G)	Magdalla	0.70				
148	Sanghi Indus. Ltd.	Abdasa	2.60				
149	JK Lakshmi Cement Ltd. (G)	Kalol	0.55				
150	Jaypee Cement-Kutch I & II	Sewagram	2.40				
151	Jaypee Cmt-Wanakbori (G)	Sonipur	2.40				
152	Ambuja Cement	Kodinar	4.50				
153	Ambuja Cmt.-Magdalla (G)	Magdalla	1.00				

(G) : Grinding Unit
(B) : Blending Unit
(B & G) : Blending & Grinding Unit