EXECUTIVE SUMMARY

1. INTRODUCTION

— The study on Precalcinator Technology in Indian Cement Industry was commissioned by the Department of Scientific and Industrial Research (DSIR) with Holtec Engineers Private Limited (HOLTEC) in January 1986 under the scheme known as National Register of Foreign Collaboration (NRFC).

— To prepare the report, HOLTEC visited and interacted with all the six Indian licensees of Precalcinator Technology, National Council for Cement and Building Materials (NCB) which has developed an indigenous system and also with five of the cement plants that have Precalcinators under operation at their Works.

— The study has been essentially directed towards the current status of this technology, its acquisition and absorption/adaptation by the licencees.

2. CEMENT INDUSTRY AND ITS DEVELOPMENT

— The cement manufacturing process may be divided into three classes i.e. wet process, semi-dry/semi-wet process and dry process. Although old cement works are based on wet process, the new plants as far as possible invariably adopt the dry process. The dry process is very much superior in terms of fuel economy.

— The cement industry in India has grown from an installed capacity of 5 million tonnes per annum at the end of First 5-year plan (1951-56) to an installed capacity of 42 million tonnes per annum at the end of Sixth 5-year plan (1980-85) and 51 million tonnes by the end of 1987. The Sixth 5-year plan especially is notable for the accelerated growth of the capacity by more than 86% and a comfortable supply position in the market has been achieved.

— The growth of cement industry in the country has been closely linked in the past with the pricing policy of the Government with respect to the levy cement.

Cement industry's capacity utilisation, which has been on decline and with the currently unsatisfactory level of about 76%, is a matter of deep concern.

Some of the factors contributing towards low capacity utilisation include :

- Poor quality of coal with upto 45% ash content.
- Power cuts, power trippings and unstable voltage of the grid.
- Transportation bottlenecks in transporting cement and coal over exceptionally long lead distances.
- Lack of operational experience with newly emerging large size plants and skills and training needed to absorb and adopt the technological developments.
- Lack of adequate pollution control measures.
- Lack of proper plant maintenance systems.

— Due to insufficient neutralisation of increasing costs of production, the profitability of the cement industry has come under pressure. The financial institutions are reluctant to finance "green field" cement plants and the long term targets of 80 million tonne capacity by the end of Eighth 5-year plan and 100 million tonne capacity by the turn of the century would seem to be very much in doubt. A fiscal restructuring of the industry may be needed to ensure continued growth of this core sector.

3. PRECALCINATOR TECHNOLOGY

— The Precalcinator Technology, initially innovated by the Japanese in 1971, makes the heat transfer in cement clinker-making process more efficient by dividing the fuel application into separate streams for calcination and for burning.

— The advantages of precalcinator may be summarised as :

- Increase in output of the kiln tube by almost 100% by dividing the heat application and gas flow.

- Improved operational stability of the kiln.
- Better refractory life.
- Efficient burning of low grade high ash coals available in India.
- Better fuel economy.
- Lesser air pollution through lower nox emission.

— Although the Precalcinators developed by various cement machinery manufacturers in Japan, Europe and USA number 19 at the last count, the basic principle of having a separate heat source for calcining is common to all of them.

— Six Indian Companies have entered into foreign collaboration agreements with licensors abroad for manufacture of Pre-calcinators in the country. In addition, the National Council for Cement and Building Materials (NCB) has developed an indigenous system.

— The Indian licensees/foreign licensors are as follows :

i) The Associated Cement Cos Limited (ACC) with Mitsubishi of Japan

Plants completed	:	10
Plants under implementation	:	1

ii) Buckau Wolf India (BWI) with Krupp Polysius of West Germany

Plants completed	:	5
Plants under implementation	:	Nil

iii) The CIMMCO Limited (CIMMCO) with KHD Humboldt Wedag of West Germany

Plants completed	:	4
Plants under implementation	:	3

iv) The KCP Limited (KCP) with Fuller Company of USA

Plants completed	:	3
Plants under implementation	:	2

v) Larsen & Toubro Limited (L&T) with F.L. Smidth of Denmark

Plants completed	: 6
Plants under implementation	: 8

vi) The Walchandnagar Industries Limited (WIL) with Onoda of Japan.

Plants completed	: 5
Plants under implementation	: 1

4. INDIGENOUS TECHNOLOGY

— NCB has developed an indigenous Precalcinator system known as CRI-Precal keeping in view the requirements of using coal which is the primary fuel for cement industry in India.

— CRI-Precal has been developed for modifying existing kiln systems as well as for incorporation in new kilns.

— The commercial application of CRI-Precal has been confined to modification of small existing kilns at Mysore Cements Limited, Ammasandra Works. Initially a 300 tpd kiln was modified followed by another two 300 tpd kilns and a 600 tpd kiln making four in all.

— Although for the modification on the first kiln, the client reported certain benefits, the reaction to subsequent installations has not been positive and for subsequent work Mysore Cements has chosen KHD Humboldt Wedag system through CIMMCO.

5. PRECALCINATOR COLLABORATIONS IN INDIA

— ACC was the first company in India to enter into a collaboration agreement for Precalcinator Technology with Mitsubishi of Japan in 1978. As a first step ACC modified five of its kilns at Wadi, Chanda and Jamul between 1979 and 1980 which in addition to other benefits was found to result in a 25% lower capital outlay for additional capacity generated as compared to a "green field" site. Subsequently the agreement was renewed in 1984 as also an improved version of Mitsubishi Precalcinator technology known as N-MFC was applied to the ACC's new 1700 tpd cement plant at Gagal in Himachal Pradesh. A total of about Rs. 70 lacs has so far been remitted to the foreign collaborators as know-how and other

fees. ACC is well equipped for engineering and manufacture of cement plants based on Precalcinator technology.

— BWI entered cement plant manufacture field in 1980 in technical collaboration with Krupp Polysius of West Germany which included Precalcinator Technology. The first plant supplied by BWI was for Coromandel Fertilisers Limited's Cement division in 1984. Thereafter BWI supplied five plants in quick succession, including 2 one million tonne units fitted with Precalcinators. A sum total of Rs. 24 lacs has so far been remitted to the collaborators. Due to relatively late entry of the company in the field of cement, its dependence on the collaborators for design, engineering, and installation work is substantial. Whilst BWI has developed strong manufacturing facilities, its design and engineering functions need further strengthening.

— CIMMCO is a newcommer to the field having signed an agreement in 1984 with KHD Humboldt Wedag of West Germany to provide know-how for manufacture of cement plant and machinery including the Precalcinators. So far a sum of Rs 7 lacs only has been remitted to the collaborators as fees. The company is still in the process of setting up adequate technical support structure to encompass design, engineering and R&D functions.

— L&T entered into collaboration with F.L. Smidth of Denmark for the manufacture of cement plant/machinery in 1964. Since then two renewals have taken place. the current agreement between L&T and FLS was executed in 1985. The company is well equipped for engineering and manufacture of cement plants based on Precalcinator technology. Quantum of fee paid by L&T for Precalcinator technology only could not be provided by L&T as they had a composite collaboration for all items of cement plant.

— Fuller-KCP is the only company where there is an equity participation from the collaborator. The agreement between Fuller-KCP and Fuller Company was executed in February 1985. Although substantial development work is being carried out by Fuller-KCP, the company has to progress a good deal towards developing a strong technical support system. Fuller-KCP was developed good manufacturing facilities.

— WIL entered into collaboration with Onoda Engineering and Consulting Company of Japan in 1983. Besides an initial fees of approximately Rs 9.0 lacs, WIL has paid about Rs 48 lacs towards three (3) projects implemented/under implementation by WIL. Although WIL has developed strong manufacturing facilities, its technicals support services need strengthening.

6. CEMENT PLANTS' EXPERIENCE WITH PRECALCINATOR IN INDIA

— The advent of the large one million tonnes cement plants in the country has been simultaneous with the introduction of Precalcinator technology in the country. In fact it may be said that the latter made the former possible.

— Thirty five Precalcinator systems are currently operational and the new installations are being undertaken at such a fast rate that by end of this decade about half of total cement capacity in the country would be using the Precalcinator systems.

— Although none of the one million tonne cement plants in the country have reached their installed capacities, the reasons for sub-optimal operations cannot be attributed to the Precalcinators except in one case where a proper dust settling chamber had not been provided for the tertiary air duct system.

— The degree of calcination achieved through Precalcinator has been satisfactory.

— The system has been able to burn the low quality high ash coals without any problems.

— The refractory brick lining life has shown considerable improvement.

— On fuel economy no comments are possible due to lack of adequate data.

7. RESEARCH AND DEVELOPMENT

— The R&D effort in the country has to aim at realising a heat economy in the region of 700 Kcal/Kg of clinker for the Precalcinator system.

— Under Indian conditions some specific issues which would need additional R&D attention include :

- high ash coals upto 45% ash
- instability of power grid
- variable quality of coal and raw materials
- lack of sophisticated control systems

— NCB, at the national level, has developed an indigenous precalcinator system. Some of its R&D projects have an indirect bearing on the Precalcinator technology.

— ACC at its Central Research Station has done notable work on fluidized bed combustion which is directly related to Precalcinator technology development. Similary L&T is doing research on retention time of materials in the Precalcinator and Kiln gas flows in collaboration with the Bhaba Atomic Research Centre (BARC).

— The other companies involved in Precalcinator technology transfer (BWI, KCP, CIMMCO and WIL) are in the process of establishing R&D Units for Precalcinator technology.

8. TRAINING OF PERSONNEL

— The job of training a cadre of personnel well versed in all aspects of Precalcinator technology by most of the machinery manufacturers as well as the cement plants has been sketchily undertaken so far. The approach is by and large ad hoc and there is no clear appreciation of long term and short term objectives.

— The training imported at the collaborators' Works has so far covered the following :

ACC	: 11 engineers and 2 supervisors 1-4 months duration
BWI	: 5 persons per year 4-6 months duration
CIMMCO	: 3 engineers

Fuller-KCP : 6 reciprocal visits per year

L&T : A number of engineers and technicians (unspecified)

WIL : 6 engineers 60 days durations

— NCB has been conducting training programmes on cement technology since 1972. It is in the process of setting up a simulator system for kiln optimisation.

— Dalmia Institute of Scientific and Industrial Research (DISIR) has set up a kiln simulator for training purposes.

— The training requirements need proper evaluation; suitable design of programmes and subsequent implementation in a well coordinated fashion are called for.

STATUS OF TECHNOLOGY ABSORPTION AND ADAPTATION

— So far the number of systems commissioned by each of the six companies forms a very narrow base for meaningful evaluation to be carried out. Furthermore the data collection on the system operation is very sketchy and not over a sufficiently long period of time to make clear-cut judgement on absorption and adaptation of the Precalcinator technology.

— Most of the design and engineering work on Precalcinators is being carried out at the foreign collaborators' Works except in some cases notably ACC and L&T who are doing restricted basic engineering and most of the detailed engineering work.

— The operators and engineers at the cement plants where Precalcinators are installed, are not adequately trained to fully absorb/adapt the new technology.

— There is a complete lack of suitable machinery to periodically monitor and assess the status of technology absorption and adaptation.

— The Indian Licensee companies with respect to the current status of technology absorption may be grouped under three categories.

Whereas ACC and L&T may be considered to have a good grasp of the technology application, BWI, Fuller-KCP and WIL are at an intermediate stage where necessary infrastructure and technical support services to adapt the technology is being set up, and lastly CIMMCO has yet to make a worthwhile effort towards the ultimate objective of self-sufficiency in design and engineering for adapting the Precalcinator technology.

10. CONSTRAINTS AND GAPS

— The Precalcinator technology transfer is confronted with the following gaps/problems :

- Since the rated outputs of Precalcinator fitted cement plants have yet to be achieved, proper techno-economic evaluation is not possible at the present stage.
- Operational feedback from cement plants is lacking.
- Adequate number of experienced erection and commissioning engineers and other personnel are not available.
- The operating personnel will need more training and guidance for optimisation of the Precalcinator systems.
- Failure of some indigenous items, notably high tension motors, thus disrupting the functioning of plant.
- Variable quality of coal and raw materials.
- Frequent disturbances in the power supply grid.

The application of Precalcinator technology for expansion of existing cement plants assumes all the more greater importance since the economic viability of new green field cement plants are under the shadow of inadequate financial returns.

11. RECOMMENDATIONS

The recommendations arising out of the study are included in Chapter 12 of the report. It is not proposed to summarise the recommendations chapter and therefore Chapter on recommendations should be read in toto alongwith this Chapter.