IN THE NATIONAL GREEN TRIBUNAL, EASTERN ZONE
KOLKATA BENCH
ORIGINAL APPLICATION NO. 154/2023/EX
(EARLIER O.A. NO. 110/2012/PB)

IN THE MATTER OF:

Threat to life arising out of Coal
Mining in South Garo Hills District … Applicant

Versus

State of Meghalaya & Ors. … Respondents

Supplementary/Additional Affidavit
on behalf of Respondent No.15/Amrit Cements Limited

Index

BEFORE THE NATIONAL GREEN TRIBUNAL, KOLKATA

ORIGINAL APPLICATION NO. 154/2023/EZ

(EARLIER O.A. NO. 110/2012/PB)

IN THE MATTER OF:

THREAT TO LIFE ARISING OUT OF COAL MINING

IN SOUTH GARO HILLS DISTRICT ...APPLICANT

VERSUS

STATE OF MEGHALAYA AND ORS. ...RESPONDENTS

SUPPLEMENTARY AFFIDAVIT ON BEHALF OF AMRIT CEMENT LIMITED, RESPONDENT NO. 15 IN THE CAPTIONED APPLICATION TO PLACE ON RECORD ADDITIONAL DOCUMENTS

I, Krishanu Banerjee, son of Sh. Sukumar Banerjee, aged about 42 years, working for gain at Opposite Horseshoe Building, Lower Lachumiere, Shillong, Meghalaya 793001 and presently residing at Usoshi Apartment, Ramratan Ghosh Road, Rajpur, Kolkata – 700149, solemnly affirm and state as follows:

1. I say that I am the Manager (Legal) of Amrit Cement Limited, the Respondent No. 15 in the proceedings and I am competent and duly authorized to make and affirm the present Affidavit on behalf of Respondent No. 15.

2. I say that I have made myself aware of the facts of the present case on perusal of the records of the proceedings and the records and documents maintained by Respondent No. 15 in its usual course of business, which I verily believe to be true and correct.

3. I say that the present Affidavit is being on behalf of Respondent No. 15 to place on record additional documents, which are necessary for the final hearing of the captioned Application on January 31, 2025. I pray that the contents of the present Supplementary Affidavit be read as part and parcel with the contents of the Reply Affidavit already filed on behalf of Respondent No. 15 (dated April 05, 2024) in the captioned case, which contents are not being repeated for the sake of brevity.

NOTARY KOLKATA REKHA TEWARI Regn. No. 10288/13 GOVT. OF INDIA

RELEVANT FACTS PERTAINING TO THE PRESENT AFFIDAVIT

4. I say that the main challenge before this Hon'ble Tribunal is the 5th Interim Report of the Katakey Committee dated December 03, 2019 ("**Impugned Report**") appointed by the Hon'ble National Green Tribunal, Principal Bench, New Delhi ("**Predecessor Bench**") in Original Application No. 110 (THC) of 2012.

5. I say that as per the Impugned Report, the Committee has passed a blanket order, thereby making several unsubstantiated allegations against Respondent No. 15 and other cement and thermal power plant companies and directed punitive measures to be initiated against the companies so listed by the Committee.

6. I say that the Impugned Report has purportedly assumed that during the years 2014-15 to 2018-19, the coal required by Respondent No. 15 for producing power and clinker was allegedly 543,690 MT whereas the coal procured during this period was 237,622 MT. Therefore, the Committee has arbitrarily concluded that there was a gap of 306,068 MT between the required coal and the alleged procured coal while disregarding the purchase of alternate fuel by Respondent No. 15. To add to the misery of Respondent No. 15, (*Refer - paragraph 3.1.4 of the Impugned Report*) the Committee recommended that the Hon'ble Predecessor Bench realize royalty along with GST/VAT etc. and to MEPRF from Respondent No. 15.

7. I say that the aforesaid findings were accepted *in toto* by the Hon'ble Predecessor Bench vide its Order dated January 17, 2020, and the Chief Secretary of the State of Meghalaya was directed to take punitive measures. Pertinently, the said Order did not even envisage any opportunity of hearing to Respondent No. 15 which was aggrieved by the incorrect and wrongful recommendations of the Committee.

8. I say that being aggrieved by the order dated January 17, 2020, of the Hon'ble Predecessor Bench, Respondent No. 15 filed an appeal before the Hon'ble Supreme Court of India, vide Civil Appeal No. 16446 of 2022 titled *Respondent No. 15 Limited v. State of Meghalaya & Others*. The said Appeal was tagged along with the Appeal of Star Cement bearing Civil Appeal No. 3820 of 2020. Upon hearing Respondent No. 15 herein and the other concerned

NOTARY KOLKATA REKHA TIWARI Regn. No. 10288/13 GOVT. OF INDIA

Banerjee

companies, the Hon'ble Supreme Court of India disposed all Appeals vide its judgment dated May 02, 2023 ("**SC Judgment**"), and restored the proceedings in relation to Respondent No. 15 back to the file of the NGT, at the stage, at which they stood prior to the passing of the Order dated January 17, 2020, and directed all aggrieved companies (including Respondent No. 15) to submit responses to the Impugned Reports

9. I say that in compliance with the SC Judgement, Respondent No. 15 filed its Reply Affidavit dated April 06, 2024, to the Impugned Report of the Committee, before this Hon'ble Tribunal. In addition to what has already contended in the Reply Affidavit, Respondent No. 15 states and submits as under:

a. It is pertinent to note that there is not even a shred of physical evidence to substantiate that there is any illegal procurement/ transportation of coal by Respondent No. 15. Not even a single instance of illegal transportation of coal to the plant of Respondent No.15 herein was found when more than 2800 such cases were detected by the State Government. Moreover, during the physical verification process by the concerned government authorities, procurement and usage of large quantities of Alternate Fuel can be corroborated from the financial statements of Respondent No. 15. However, the Committee in complete ignorance of the same, chose to proceed with its findings in the Impugned Report.

b. The procurement and payments made to the vendors who supplied Alternate Fuel were also verified by the Chartered Accountant for the period in question and has provided a certificate certifying the procurement and usage of Alternate Fuel by Respondent no.15 in the CA Certificate dated January 24, 2025 ("**CA Certificate**"), which is annexed to the present Affidavit.

c. That the use of Alternate Fuel by the cement industries is being encouraged by the concerned authorities and there are ample write-ups to substantiate the same.

d. The coal requirement of a cement/power plant is dependent on many variable circumstances, which have not been taken into account for the purposes of rendering

NOTARY KOLKATA REKHA TEWARI Regn. No. 10288/13 GOVT. OF INDIA

findings in the Impugned Report, which are including but not limited to the size of the plant, grade of the coal, fuel mix, type(s)/ category(ies) of alternate fuel utilized, design of the plant, capacity utilization etc. Therefore, the Impugned Order is nothing short of selective analysis of the limited information available by one competitor company and equating the same arbitrarily across all other companies for blanket observations.

e. The Report of the Committee is based on conjectures and surmises and completely disregards true and correct factual position with its accompanying documentary evidence. The same is evidenced from the "***System Compatibility Study for Maximizing use of Alternative Fuels(AF) at Amrit Cement Limited, Meghalaya***" ("**Study Document**") prepared by Holtec Consulting Private Limited ("**Holtec**"), which has also been annexed with the present Affidavit. This said Study Document assesses the feasibility of maximizing usage of identified alternate fuels which have been used by Respondent No. 15. This study Report confirms in detail that the company's cement manufacturing facilities are equipped to use Alternate Fuel and also provides evidence of usage of Alternate Fuel at the facility.

f. In the Study Document, a team of three Process Specialists undertook field mission from January 08, 2025, to January 10, 2025, for data collection, assessment of operation and process measurement. Holtec was commissioned by Respondent No. 15 for the Study Document since Holtec is an industry expert with 50+ years of experience which primarily caters to Cement, Captive Power Plants and mineral-based industries, delivering integrated services to about 1000+ client based in 90+ countries including India. Credentials of the Holtec is annexed to the present affidavit. The contents of the Report are self-explanatory.

10. I say that in order to substantiate the aforesaid, and in addition to the documents already produced by Respondent No. 15 in their Reply Affidavit, I seek to bring on record the following additional documents, the details of which are as below:

a. Copy of a CA Certificate to demonstrate certified purchases of coal and alternate fuel after April 2014, which is annexed hereto and marked as **Annexure R-7**; and

NOTARY KOLKATA REKHA TEWARI Regn. No. 10268/13 GOVT. OF INDIA

b. Study Document by Holtec, demonstrating that the use of "alternate fuel" is an acceptable industry practise, which is annexed hereto and marked as **Annexure R-8**; and

c. Copy of Credentials of the Holtec, which is annexed hereto and marked **as Annexure R-9.**

11. I say that the additional documents sought to be placed on record are of utmost importance for the upcoming hearing on January 31, 2025, as they substantiate Respondent No. 15's compliance with industry norms and regulations whilst directly addressing critical findings of the Committee, provide incontrovertible evidence to clarify the discrepancies noted by the Committee and will play a pivotal role in ensuring a just and fair adjudication of the captioned Application.

12. I say that the annexures annexed along with the present Affidavit are true copies of their respective originals.

13. I say that the contents of the present Affidavit are true and correct to the best of my knowledge, no part of it is false and nothing material has been concealed therefrom.

AMRIT CEMENT LIMITED
Krishanu Banerjee
Authorised Signatory

DEPONENT

NOTARY KOLKATA REKHA TEWARI NOTARIAL NOTARIAL GOVT. OF INDIA

SOLEMNLY AFFIRMED AND DECLARED BEFORE ME ON IDENTIFICATION

REKHA TEWARI
NOTARY

30 JAN 2025

Identified by me

TINA DAS ADVOCATE C.M.M. Court, Kol-1

TINA DAS
Advocate
Regn No. - F-1322/21

VERIFICATION:

Verified at Kolkata on this day of January 30, 2025, that the contents of para 1 to 13 of this affidavit are true and correct to my knowledge and belief. No part of it is false and nothing material has been concealed therefrom.

AMRIT CEMENT LIMITED
Krishanu Banerjee
Authorised Signatory
DEPONENT

NOTARY
KOLKATA
RBKHA TEWARI
Regn. No.
10288/13
GOVT. OF INDIA

Kumar Sanjeev & Associates
Chartered Accountants
H.O. : 1C, 249A, Motilal Gupta Road, Kolkata - 700 082
Mob. : 9903880738, 033 - 40646453
e-mail : kumarsanjeev1312@gmail.com

TO WHOM IT MAY CONCERN

We have examined the Purchase Register & Books of Accounts of **M/s Amrit Cement Limited (CIN-U26940ML2008PLC008302)** having its Registered office at Opposite – Horse Shoe Building, Lower Lachumiere, Shillong -793 001, Meghalaya and having integrated Cement plant located at Umlaper Village, Elaka Rymbai, Jaintia Hills District, Meghalaya – 793200 and according to the information and explanation given to us by the management, we hereby certify the Quantity of Coal and Alternate Fuel purchased and payment done to Vendors are as under -

1. Quantity of Coal procured during FY 2014-15 to FY 2018-19.

FY	Qty in MT
2014-15	3,861
2015-16	88,165
2016-17	38,785
2017-18	74,978
2018-19	31,833
Total	**2,37,622**

2. Quantity of Alternate Fuel procured during FY 2014-15 to FY 2018-19.

FY	Qty in MT
2014-15	23,033
2015-16	28,977
2016-17	1,29,698
2017-18	-
2018-19	-
Total	**1,81,708**

3. **Payment to Vendors from whom Coal and Alternate Fuel has been procured -**

We understand that the company procures Coal and Alternate Fuel from various vendors. We have reviewed and found that all the payments are made through Bank Account.

KUMAR SANJEEV & ASSOCIATES * KOLKATA * Chartered Accountants

During the period FY 2014-15 to FY 2018-19, total payment for procurement of Coal and Alternate Fuel which the company has made is given below -

Coal:

Total payment to the vendors for the Coal procured during FY 2014-15 to FY 2018-19 through banks is Rs. 2,13,79,74,468.

Alternate Fuel:

Total payment to the vendors for the Alternate Fuel procured during FY 2014-15 to FY 2018-19 through bank is Rs. 58,55,96,106.

For Kumar Sanjeev & Associates
Chartered Accountants
(FRN-328267E)

Sanjeev kumar.

Sanjeev Kumar
Partner
M.No.- 069730

KUMAR SANJEEV & ASSOCIATES * Chartered Accountants * KOLKATA

Place: Kolkata`
Date: 24th Jan 2025
UDIN- 25069730BMJBVR6198

Annexure R-8

AMRITCEM
Cementing Performance

AMRIT CEMENT LIMITED, MEGHALAYA

SYSTEM COMPATIBILITY STUDY

MAXIMIZING USE OF ALTERNATIVE FUELS (AF)

JANUARY 2025

Holtec Consulting Private Limited

CONFIDENTIAL

THIS DOCUMENT SHOULD BE TREATED AS CONFIDENTIAL AND MUST NOT BE REPRODUCED, COPIED, LOANED OR DISPOSED, DIRECTLY OR INDIRECTLY NOR USED FOR ANY PURPOSE OTHER THAN FOR WHICH IT IS SPECIFICALLY FURNISHED WITHOUT THE PRIOR WRITTEN CONSENT OF HOLTEC.

ACKNOWLEDGEMENT

WE EXPRESS OUR SINCERE GRATITUDE TO THE OFFICIALS OF AMRIT CEMENT LIMITED, MEGHALAYA FOR THE ASSISTANCE AND CO-OPERATION EXTENDED DURING OUR VISIT, BUT FOR WHICH THIS REPORT COULD NOT HAVE BEEN SUCCESSFULLY PREPARED.

TABLE OF CONTENTS

LIST OF ANNEXURES

LIST OF DRAWINGS

CHAPTER NO.	DRAWING NO.	DESCRIPTION
3	24185-03-IU-1-01	Plant Layout of Proposed AFR System
	24185-03-IU-1-02	Flowsheet for AFR Shredding, Storage & Feeding to Calciner
	24185-03-IU-1-03	General Arrangement of Proposed AFR System Belt Profile

LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
%	Percent
A	Annum
AF	Alternative Fuel
ACL	**Amrit Cement Limited**
AlK	Alkali
AM	Alumina Modulus
AR	Alumina Ratio
As	Arsenic
Avg.	Average
^{o}C	Degree Centigrade
Cd	Cadmium
CFD	Computational Fluid Dynamics
CH_4	Methane
Clk	Clinker
Co	Cobalt
CU	Clinkerisation Unit
Cu	Copper
BE	Bucket Elevator
BH	Bag House
CCR	Central Control Room
CCTV	Closed Circuit Television
cm	Centimeters
CO	Carbon Monoxide
CO_2	Carbon Dioxide

ABBREVIATION	DESCRIPTION
CF	Conversion Factor
Cr	Chromium
Cl	Chloride
Dia.	Diameter
Diff	Differential
dpa	Days Per Annum
DRE	Destruction & removal efficiency
Drg.	Drawing
ECD	Electron Capture Detector
EDXRF	Energy Dispersive X-Ray Fluorescence
E&I	Electrical & Instrumentation
EPC	Engineering, Procurement and Construction
FID	Flame Ionization Detector
FY	Financial Year
GA	General Arrangement
Gcal	Giga calorie
GJ	Giga Joule
HCB	Hexa chloro benzene
HCl	Hydrogen Chloride
HF	Hydrogen Flouride
Hg	Mercury
H_2O	Water
HOLTEC	**Holtec Consulting Private Limited, India**
hpd	Hours per day

ABBREVIATION	DESCRIPTION
hr	Hour
ICP-OES/AAS	Inductivity Coupled Plasma Optical Emission Spectroscopy/Atomic Absorption Spectroscopy
ID	Induced Draft
IEC	International Electro-technical Commission
IGBT	Insulated-Gate Bipolar Transistor
I/O	Input Output
ISO	International Organization for Standardization
kcal	Kilo Calories
kg	Kilograms
kl	Kilo Liters
km	Kilometers
KPIs	Key Performance Indicators
kV	Kilo Volts
kVa	Kilovolt Amperes
kW	Kilo Watts
kWh	Kilo Watt Hours
LSF	Lime Saturation Factor
LT	Low Tension
LV	Low Voltage
m	Meters
Max.	Maximum
MCCs	Motor Control Centers
mg	Milligrams

ABBREVIATION	DESCRIPTION
MGH	Mass Gas & Heat
min	Minutes
Min.	Minimum
mio	Millions
mm	Millimeters
Mn	Manganese
MSD	Mass Selective Detector
MTBF	Mean Time Between Failure
N_2	Nitrogen
NCV	Net Calorific Value
Ni	Nickel
Nm^3	Normal Meter Cube
No./ nos.	Numbers
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
O_2	Oxygen
PA	Primary Air
pa	Per annum
Pb	Lead
PbO	Lead Oxide
PC	Pre Calciner
PCB	Polychlorinated Biphenyl
PCDD/F	Polychlorinated di-benzo-p-dioxins/di-benzo furans
PH	Preheater

ABBREVIATION	DESCRIPTION
PLC	Programmable Logic Control
p.m.	Per Month
ppm	Parts per million
PVC	Poly Vinyl Chloride
QC	Quality Control
RDF	Refuse Derive Fuel
rpm	Revolution per minute
s	Second
S	Sulphur
SA	Secondary Air
Sb	Antimony
SM	Silica Modulus
Sn	Serial Number
SR	Silica Ratio
SO_x	Sulphur Oxides
SWL	Safe Working Load
t	Tonnes
TA	Tertiary Air
TAD	Tertiary Air Duct
TCDD	Tetra Chloro Dibenzo- p- Dioxin
TEQ	Toxic Equivalency Quantity
Ti	Titanium
TOC	Total Organic Carbon

ABBREVIATION	DESCRIPTION
tpa	Tonnes Per Annum
tpd	Tonnes Per Day
tph	Tonnes Per Hour
TSR	Thermal substitution rate
UPS	Uninterrupted Power Supply
USD	United States Dollars
V	Vanadium
V	Volts
VOC	Volatile Organic Compound
VVVF	Variable-Voltage Variable-Frequency
WBCSD	World Business Council for Sustainable Development
XLPE	Cross Linked Poly-Ethylene
XRF	X-ray Fluorescence
Zn	Zinc

CHAPTER 0: EXECUTIVE SUMMARY

0.1 INTRODUCTION

Amrit Cement Limited (Hereinafter called **ACL**) operates an integrated cement plant and captive power plant of 12 MW at Umlaper village in East Jaintia Hills District of Meghalaya state.

The current operating capacity of the integrated cement plant is 2,200 tpd clinker (0.726 MTPA) and 3,570 tpd cement (1.18 MTPA). The plant is under process of further clinker capacity enhancement to 3,200 tpd by suitable upgradation/ installation of new equipment.

ACL currently utilizes various alternative fuels (AF), including sawdust, rice husk, municipal solid waste, plastic waste, and spent oil. **ACL** relies on a manual handling & feeding process. This process involves manual handling of the materials, filling them into bags, lifting them using an electric winch, and unloading and feeding them onto a belt conveyor with the help of laborers. The conveyor then feeds the materials to Precalciner through a chute equipped with a double flap gate.

ACL targets to maximize Thermal Substitution Rate (TSR) while maintaining a sustained clinker production of 2,200 tons per day (TPD) with a proper Pre-Processing, storage & handling system. To achieve this target, **ACL** has appointed **Holtec Consulting Private Limited (HOLTEC)** to conduct a feasibility study.

0.2 PROJECT BACKGROUND

This study assesses the feasibility of maximizing usage of identified AFs in the system, its impact on production & Key Performance Indicators (KPI's) and identifies mitigation measures to the extent feasible at a clinker production rate of 2,200 tpd.

0.3 KEY OBJECTIVE

Key objectives of the proposed study are:

- To maximize the TSR up to 50% with the available raw materials.
- Impact assessment on the Pyro processing system at the target TSR, w.r.t equipment suitability, plant output, specific heat consumption.
- Estimate Broad Capex

0.4 REPORT

The report has been formulated based upon the data collected, process measurements carried out during the site visit, information gathered through interactive discussions with **ACL** operation/ project team and assessment of data. This study draws extensively from **HOLTEC**'s experience and database on plant operation, design and investment costs etc.

0.5 METHODOLOGY

A team comprising of Three Process specialists undertook a field mission from 8th - 10th Jan 2025 to **ACL** for data collection, assessment of operation & process measurement.

0.6 PLANT OPERATIONS - PRESENT STATUS

A detailed Mass, Gas & Heat balance study of the Pyro-processing section (i.e. PH, PC, kiln, cooler System) was carried out to ascertain the current specific heat consumption and thereby identify the margin available in the critical equipment. At 0% TSR the specific heat consumption has been calculated as 860 kcal/kg clk. which may vary depending upon level of optimization in the plant.

Specific Heat Consumption varies from plant to plant & depends upon many factors incl. levels of optimization, presence of false air, heat losses etc. In case of similar Vintage and technology Cement plant specific heat consumptions typical value comes to around 770-780 kcal/kg of clinker @ 0% TSR.

Specific heat consumption will increase further with addition of AF depending upon level of TSR.

0.7 IMPACT ASSESSMENT

0.7.1 AF Quality

The important Cost & quality parameters and Availability of proposed AFs, considered for assessment of impacts are summarized below:

Physical state	Alternative Fuels	NCV	Landed Cost	Moisture (H_2O)	Ash	Cl	S
		Kcal/kg	Rs/ton	%	%	%	%
	Plastic Waste	3,372	6000	10	8.01	0	0.04

Physical state	Alternative Fuels	NCV	Landed Cost	Moisture (H_2O)	Ash	Cl	S
		Kcal/kg	Rs/ton	%	%	%	%
Solid AF	Rice husk	3,000	5,800	12	16	0.07	0.65
	Saw Dust	2,900	5,200	48	30	0.034	2.2
	Municipal waste	2,000	2,000	12	8.41	0.6	0.15
	Spent Oil	9,567	0	0	0.01	-	-

Source: ACL

Table 0.1: Alternate Fuel Cost & Quality

0.7.2 Proposed TSR based on Availability

The proposed composition of TSR, taking into consideration the availability of various Alternate fuels, is as follow:

AF Material	30% TSR	40% TSR	50% TSR
Plastic Waste	12.00	16.00	20.00
Rice husk	8.40	11.20	14.00
Saw Dust	8.00	10.67	13.34
Municipal waste	1.00	1.33	1.67
Spent Oil	0.60	0.80	1.00
Grand total from Mix AFR's	**30%**	**40%**	**50%**

Table 0.2: Thermal Substitution Rates based on available quantity

0.7.3 Impact on Production

Impacts on production (base 2,200 tpd clk) & specific heat (base 860 kcal/kg clk) are summarized at various TSR% in the table below.

Impact on KPIs	Unit	Values	Remarks
Clinker Production Loss	TPD	~110 @ 20% TSR	Debottlenecking is required to avoid Clinker production loss
		~160 @ 30% TSR	
		~205 @ 40% TSR	

Impact on KPIs	Unit	Values	Remarks
		~247 @ 50% TSR	
Sp. Heat consumption (from base Value of 860 kcal/kg clinker)	Kcal/Kg clk.	~25 @ 20% TSR	Expected specific heat consumption will be ~885 kcal/kg clinker with 20% TSR.
		~32 @ 30% TSR	Expected specific heat consumption will be ~892 kcal/kg clinker with 30% TSR.
		~40 @ 40% TSR	Expected specific heat consumption will be ~900 kcal/kg clinker with 40% TSR.
		~48 @ 50% TSR	Expected specific heat consumption will be ~908 kcal/kg clinker with 50% TSR.

Table 0.3: Impact assessment at various TSR%

From the above table, Clinker production loss of ~ 247 TPD, is assessed @ 50% TSR with the existing PH fan (ref above Table no 0.3)

0.7.4 Impact on Plant Operations

Impact on plant operation shall be due to reduction in effective margin in kiln exhaust gas handling capacity because of increase in exhaust gas volume at increased heat consumption.

To estimate the margin/ shortfall in PH fan capacity at 50 % TSR & 2,200 TPD clinker production, current operating fan speed, static pressure & fan power consumption has been considered as the basis.

0.7.4.1 Preheater Fan

The existing PH fan which has a design volume of 4,25,000 m3/hr and pressure 730 mmWC is suitable for upto 30% TSR.

Expected PH fan parameters with 2,200 TPD clinker production & 50% TSR are as gas Flow 5,75,000 m3/hr and pressure 1000 mmWC which exceeds the present design value of installed PH fan. Hence, it is recommended to replace the existing PH fan with new PH fan suitable for 50% TSR

ACL is already replacing the existing PH fan with a new one. The new fan is adequately sized and will support up to 50% TSR of alternative fuel at 2200 TPD Clinker.

0.7.4.2 Calciner Residence time

Based on the effective PC volume (Existing ~ 915 m^3) the gas residence time works out as **5.5 sec**, which is manageable up to 30% TSR, with 2,200 tpd clinker production provided uniform size & consistent quality of AF is maintained.

At 50.0% TSR, with 2,200 tpd clinker production PC residence time ≥ 8 seconds is recommended for complete combustion of AF in PC. Since space is available in the PH tower for extending the calciner to enhance the residence time this option needs to be explored to achieve higher AFR targets. However, a structural audit of the PH tower must be conducted to ensure it can withstand the additional load of the Pre calciner extension.

Alternatively, Option of installing AF Incinerators like Hot disc/ Pyrorotor / External Combustor in Calciner circuit can also be explored with minimum pre-processing efforts. However, layout feasibility for selection of Incinerator technology needs to be established before placement of order.

0.7.4.3 Preheater

At 2,200 tpd clinker production:

- **Preheater**

Up to 30% TSR

- Average pressure drop at PH outlet/ Down comer is estimated as ~ 750 mmWG for 30 % TSR which are just meeting the recommended limits of 800 mmWG for peak PH pressure. Hence,

  The existing Preheater is considered suitable for 2,040 tpd clinker up to 30% TSR.

30 - 50% TSR

- The riser velocities of Top stage and 2nd Stage are on higher side than optimum limits (<18.0 m/s) which increases PH return dust %

- Average pressure drop at PH outlet/ Down comer is estimated as ~ 910 mmWG for 50 % TSR which are exceeding the recommended limits of 800 mmWG for peak PH pressure. Hence,

  Existing Preheater shall be Suitably Modified for 2,200 tpd clinker @ 50% TSR.

TAD

The expected gas velocity in TAD works out to 32 m/s @50% TSR (considering TAD volume of 0.60 nm3/kg clk), which is acceptable @ 2,200 tpd clinker

Impact on Production & Heat Consumption

Descriptions	Units	Base Line 0%TSR (AF)	20% TSR (AF)	30% TSR (AF)	40% TSR (AF)	50% TSR (AF)
Original Capacity	tpd	**2,200**	**2,200**	**2,200**	**2,200**	**2,200**
% Production Loss	**%**	**-**	**5.3**	**7.8**	**10.28**	**12.65**
Capacity after Production loss	tpd	**2,200**	**2090**	**2,040**	**1,995**	**1,953**
Fuel Consumption						
Estimated Specific Heat Consumption	kcal/ kg Clk.	**860**	**885**	**892**	**900**	**908**

Table 0.4: Impact of AF on Production and Specific Heat

0.7.5 Impact on Existing Raw Mix

AFs usages introduce significant Ash quantities in the system. An adaptation of the raw mix must be made to meet the LSF (also SR and AR) target in the clinker. Since the ash content in the proposed AFs (Saw Dust) is high (30%) at high TSR of 50%, the effect of ash content can only be neutralized by fine tuning the raw mix design.

The software developed by **HOLTEC** for computerized raw mix optimization has been used to evaluate the impact of the shortlisted AFs. While evaluating the impacts on raw mix composition, currently maintained clinker quality parameters (tabulated below) have been considered as target:

Clinker Quality

C_3S	SM	AM	% LSF
49-52%	2.3-2.5	1.04 - 1.08	0.92-0.94

Source: ACL

Table 0.5: Considered guide values for Clinker

Target Achievable TSR with available Limestone

A raw mix design exercise has been carried, to find out maximum achievable TSR, with the available average quality limestone & other correctives, being presently used along with proposed Alternate Fuels in varying proportions.

Various Raw mix designs considering different %TSRs using average quality limestone & other correctives being presently used are tabulated below:

Parameters	Raw Mix Using Present Average Quality Limestone		
TSR %	0	30	50
RAW MATERIAL PROPORTION			
Limestone	87.87	87.87	88.1
Clay	7.75	7.75	7.5
Shale	4	4	3.9
Laterite	0.38	0.38	0.5
FUEL			
Coal	100	52.1	31.79
Saw Dust	-	13.7	19.44
Rice Husk	-	13.9	19.73
Plastic Waste	-	17.6	25.08
Municipal Waste	-	2.5	3.52
Spent Oil	-	0.3	0.44
CLINKER			
CaO	63.86	63.17	63.06
BOGUE COMPONENTS			

Parameters	Raw Mix Using Present Average Quality Limestone		
C3S	49.36	49.15	50.49
C2S	23.33	23.75	22.37
C3A	4.99	4.92	4.81
C4AF	12.81	12.68	12.45
MODULI			
AM	1.08	1.08	1.08
SM	2.40	2.44	2.48
LSF	0.94	0.92	0.93
OTHER INDICES			
Liquid	26	26	26

Table 0.6: Raw Mix Designs with available Limestone at various % TSRs

0.8 TECHNICAL CONCEPT FOR PRE & CO-PROCESSING OF AFs.

The technical concept for addition of pre-processing & co-processing system for AFs includes receiving, storage & handling, shredding material, transport & dosing system. Currently, ACL relies on a manual handling & feeding process which involves manual handling of the materials, filling them into bags, lifting them using an electrical winch, and unloading and feeding them onto a belt conveyor with the help of labourers. The conveyor then feeds the materials to Pre calciner through a chute equipped with a double flap gate. it is recommended to install a new suitable pre-processing & co-processing system for sustained AF usage for target TSR.

Selection of Feeding Location

The three general options for feeding alternative fuels in kiln system are:

- Through kiln main burner
- At kiln inlet
- In the calciner.

Depending upon the physical condition/ size (lumpy fuel with average size of < 40 mm) and other parameters of shortlisted AFs, **the most appropriate and flexible location for**

feeding the available materials is the calciner as tertiary air with adequate oxygen is available for achieving efficient combustion.

There might be some wall-effects, which will force the materials towards the calciner walls, where there is little or no velocity (risk of direct fall to kiln back-end and damage to refractories). For this reason, **the feed chute angle and length must be such that the materials are forced into the middle of the main stream** (=> enough injection velocity to overcome the wall-effect).

0.8.1 System Design (Shredder Capacity)

Details of proposed new shredder capacities are summarized in shown below **Table 0.7**

Description	50% TSR	R.hrs	AF Qty.	Moist	50% TSR	AF Qty	Shredder Eff. & Capacity	
	tph	hrs.	tpd	%	tph	tpd	Eff. %	tph
Total Requirement @ 50%	15.18 on dry basis	20	364.3	12	17.0 on wet basis	408	60	28

Table 0.7: New Shredder Capacity

0.9 IMPLEMENTATION SCHEDULE

An implementation period of **12 months** is envisaged for the completion of the project activities, after Placement of Main Machinery Order.

For **Pre Project-Activities** (Till Placement of Main Machinery/ Equipment Order) **3 months** has been considered.

0.10 CAPEX FOR CO-PROCESSING OF ALTERNATIVE FUEL

Block Cost Estimates

The total capital cost estimate for the proposed 50% TSR project works out to be **Rs. 46.0 Cores, which includes:**

1. Preprocessing including AF storage, Shredding
2. Co- Processing including AF transportation & feeding
3. Calciner Extension

New Preheater Fan & Top stage Cyclone Modifications are already under execution hence CAPEX not included.

0.11 CONCLUSION

- Existing Cement manufacturing facilities of **ACL** incl. PH fan are equipped to operate up to 30% TSR of Alternate Fuel with maximum Clinker production of 2040 tpd without modification.

  Currently, **ACL** relies on a manual handling & feeding process. To achieve 30% TSR on a sustained basis, suitably sized New AF Pre-processing and co- processing system is envisaged.

- For 50% AFR on TSR basis in the **ACL** plant, a new PH Fan, modification in Calciner, Top stage & 2nd stage Cyclones is required. **ACL** is planning to install a new PH Fan and adding new top stage cyclone.

  To achieve 50% TSR on a sustained basis, suitably sized New AF Pre-processing and co- processing system is envisaged.

- Estimated CAPEX for the proposed project for enhancing AF usage in the plant (upto 50% TSR) is estimated as **Rs ~4,600 Lakhs**

CHAPTER 1: PREAMBLE

1.1 INTRODUCTION

Amrit Cement Limited (Hereinafter called **ACL**) operates an integrated cement plant and captive power plant of 12 MW at Umlaper village in East Jaintia Hills District of Meghalaya state.

The current operating capacity of the integrated cement plant is 2,200 tpd clinker (0.726 MTPA) and 3,570 tpd cement (1.18 MTPA). The plant is under process of further clinker capacity enhancement to 3,200 tpd by suitable upgradation/ installation of new equipment.

ACL currently utilizes various alternative fuels (AF), including sawdust, rice husk, municipal solid waste, plastic waste, and spent oil. **ACL** relies on a manual handling & feeding process. This process involves manual handling of the materials, filling them into bags, lifting them using an electric winch, and unloading and feeding them onto a belt conveyor with the help of laborers. The conveyor then feeds the materials to Precalciner through a chute equipped with a double flap gate.

ACL targets AF's up to 50% Thermal Substitution Rate (TSR) based on plant requirement while maintaining a sustained clinker production of 2,200 tons per day (TPD) with a proper Pre-Processing, storage & handling system. To achieve this target, **ACL** has appointed **Holtec Consulting Private Limited (HOLTEC)** to conduct a feasibility study.

PROJECT BACKGROUND

This study assesses the feasibility of maximizing usage of identified AFs in the system, its impact on production & Key Performance Indicators (KPI's) and identifies mitigation measures to the extent feasible at a clinker production rate of 2,200 tpd.

1.2 KEY OBJECTIVES

Key objectives of the proposed study are:

- To maximize TSR up to 50% for the proposed AF's with the available raw materials.
- Impact assessment on the Pyro processing system at various TSR levels, w.r.t equipment suitability, plant output, specific heat and specific power consumption.

- Estimate Broad Capex

1.3 PROMOTER's BACKGROUND

The corporate office of **ACL** is:

226/1 A.J.C Bose Road, Trinity Towers
6th Floor, Kolkata 700020
+91 33 40033441
info@amrit.co.in

ACL, an ISO 9001:2015 certified company, is one of the leading manufacturers of cement with a pan-India presence and has a strong foothold particularly in the North East Indian market.

A leading cement company in Meghalaya, **ACL** manufactures various types of quality cement including PPC, OPC 43 & 53 as per BIS specifications to cater to the diverse market requirements

1.4 HOLTEC BACKGROUND

This report has been prepared by:

HOLTEC Consulting Private Limited
HOLTEC Centre,
A Block, Sushant Lok - I
Gurgaon – 122 001, Haryana, INDIA

Incorporated in 1967, **Holtec Consulting Private Limited (HOLTEC)** is an ISO 9001 certified advisory, primarily positioned to service the entire gamut of multi-functional, consulting needs of the global cement industry.

HOLTEC's ensemble of 1,000^{+} strong client base, in over 90^{+} countries, includes cement producers, equipment & service providers, EPC & construction firms, investing & funding bodies and all other relevant stakeholders. Since its inception, **HOLTEC** has delivered significant value to its clientele through 4,500+ consulting assignments.

1.5 METHODOLOGY

A team comprising of Three Process specialists undertook a field mission from 8th - 10th Jan 2025 to **ACL** for plant data collection, assessment of operation & process measurement.

The methodology adopted for the study is outlined below:

- Discussion with plant operating & project teams at **ACL** during site visit
- Collection of relevant data through data collection questionnaire
- Carried out process measurements (flow, temperature, pressure and Oxygen)
- Calculations based on field measurements.
- Impact Assessment of usage of AF
- Report preparation & submission

Instruments used during the Study

The following instruments were used for carrying out the process measurements:

Process Parameter	Instruments	Image
Gas/ Material Temperature	Temperature measuring instrument/ Thermocouples	
Gas and Air Velocity/ Pressure	Pitot tube/ Micro manometer	
Air Velocity	Vane anemometer	

Process Parameter	Instruments	Image
Gas composition Analysis (O_2, CO, NO_x, So_x)	Gas analyzer	
Surface temperature of Kiln Shell, Cyclone preheater Assembly, Precalciner and Tertiary air duct etc.	Radiation pyrometer	

The calibration status of instruments was verified for the accuracy of the measurements and reliability of the results.

1.6 REPORT

The report has been formulated based upon the data collected, process measurements carried out during the site visit, information gathered through interactive discussions with **ACL** operation/ project team and assessment of data. This study draws extensively from **HOLTEC**'s experience and database on plant operation, design and investment costs etc.

This report is prepared considering Maximization of AF up to 50% TSR based on plant requirement and covers the Executive Summary, Preamble, Impact Assessment, Technical Concept, Investment cost estimate & Implementation Schedule.

CHAPTER 2: IMPACT ASSESSMENT

2.1 INTRODUCTION

Impacts of AF utilization at **Amrit Cement limited** plant w.r.t plant operation and allied major KPI's like clinker production, specific heat consumption and clinker quality are identified by using "Impact simulation program" of **HOLTEC.**

Along with the AF related impacts on plant's operation, the impact on potential environmental issues related to emissions of the likes of CO, CO_2, NO_X, SO_X, dust, volatile organic compounds and metals etc., were evaluated based on the nature of raw materials, raw mix, fuel mix, vintage and design of the plant and on the requirements laid down by the permitting authority.

This chapter covers assessment of all the probable impacts of co-processing of AFs identified for usage by plant team at **Amrit Cement limited.**

2.2 IMPACT ON PLANT OPERATION

The use of alternate fuels always has certain impacts on the process. A few of these impacts are immediately visible and some appear after continued operation. If alternate fuel is used at very low quantities, it may happen that the effects are not measurable within the given accuracy, or the effect disappears within the normal fluctuations.

Consistent long-term supply of appropriate quality of AF is required to maintain stable conditions during operation. Content of sulphur, nitrogen, chlorine, fluorine, metals and volatile organic compounds needs to be specified and carefully monitored and controlled. Limitations with respect to the production capacity and/ or the process should be established.

Feeding of AF to the kiln/ pyro must ensure exposure to sufficient:

a) Temperature

b) Retention time

c) Mixing conditions

d) Oxygen

The possible impacts are described and quantified based on the following technical criteria and methodology:

Technical Criteria	Methodology
Clinker Production	Process Simulation
Heat Consumption	
Compatibility with Raw Materials	Raw Mix Design
Product Quality	

Table 2.1: Technical Criteria and Methodology

AF Quality

The quality of proposed alternative fuels and their annual availability have been the guiding factor for estimating the various impacts.

Based on the discussion, it was concluded that following types of waste materials shall be available for utilization as AF:

a. Plastic Waste
b. Saw Dust
c. Rice husk
d. Spent oil
e. Municipal waste

The Cost & quality parameters and availability of proposed AFs, considered for assessment of impacts are summarized below:

Physical state	Alternative Fuels	NCV	Landed Cost	Moisture (H_2O)	Ash	Cl	S
		Kcal/kg	Rs/ton	%	%	%	%
Solid AF	Plastic Waste	3,372	6,000	10	8.01	0	0.04
	Rice husk	3,000	5,800	12	16	0.07	0.65
	Saw Dust	2,900	5,200	48	30	0.034	2.2
	Municipal waste	2,000	2,000	12	8.41	0.6	0.15
	Spent Oil	9,567	0	0	0.01	-	-

Source: ACL

Table 2.2: Alternate Fuel Cost & Quality

2.3 PROPOSED TSR BASED ON AVAILABILITY

The proposed composition of TSR, taking into consideration the availability of various Alternate fuels, is as follows:

AF Material	30% TSR	40% TSR	50% TSR
Plastic Waste	12.00	16.00	20.00
Rice husk	8.40	11.20	14.00
Saw Dust	8.00	10.67	13.34
Municipal waste	1.00	1.33	1.67
Spent Oil	0.60	0.80	1.00
Grand total from Mix AFR's	**30%**	**40%**	**50%**

Table 2.3: Thermal Substitution Rates

2.4 IMPACT ON PRODUCTION

Usage of selected AFs shall introduce additional ash and moisture along with false air ingress through the feeding points. In addition to this, complete combustion of the selected coarse fuels shall require increased O_2% at kiln inlet and at calciner outlet. All this shall contribute to a potential reduction in clinker production due to increased heat consumption and with the reduced capacity of the exhaust gas handling system.

Impact assessment was carried out considering a base production of 2,200 TPD clinker and a specific heat consumption of 860 kcal/kg clinker as established through MGH Balance.

Impacts on production & specific heat have been estimated and summarized at various TSR% in below table:

Impact on KPIs	Unit	Values	Remarks
Clinker Production Loss	TPD	~110 @ 20% TSR	Debottlenecking is required to avoid Clinker production loss
		~160 @ 30% TSR	
		~205 @ 40% TSR	
		~247 @ 50% TSR	
Increase in Sp. Heat consumption (from base Value of 860 kcal/kg clinker)	Kcal/Kg clk.	~25 @ 20% TSR	Expected specific heat consumption will be ~885 kcal/kg clinker with 20% TSR.
		~32 @ 30% TSR	Expected specific heat consumption will be ~892 kcal/kg clinker with 30% TSR.
		~40 @ 40% TSR	Expected specific heat consumption will be ~900 kcal/kg clinker with 40% TSR.
		~48 @ 50% TSR	Expected specific heat consumption will be ~908 kcal/kg clinker with 50% TSR.

Table 2.4: Impact assessment at various TSR%

From the above table, Clinker production loss of ~ 247 TPD, is assessed @ 50% TSR (Target value) with the existing PH fan (ref above Table no 2.4)

2.5 IMPACT ON HEAT CONSUMPTION

The factors that influence the specific heat consumption on account of use of alternate fuel are:

- Moisture content in alternate fuel
- Ash content in alternate fuel
- Increase on O_2 for complete combustion
- Additional false Air ingress from feeding points

While estimating the impacts on heat consumption, the existing heat consumption has been considered as 860 kcal/ kg Clk @ 0% TSR, as measured **by HOLTEC** team along with **ACL** Process team.

Overall, an increase in Heat consumption of ~48 kcal/ kg clk. is expected with ~ 50.0 % TSR. Expected heat consumption will be ~908 kcal/kg clinker with 50% TSR.

2.6 ASSESSMENT OF PH FAN

Expected PH fan design parameters & operating parameters (@ 50% TSR & 2,200 tpd production) are tabulated below:

Description	Production capacity, tpd clinker	Temperature, °C	Pressure, mmWG	Flow, m^3/ h	Power, kW
Design Parameters					
PH fan	2,200	400	730	4,25,000	1,200
Expected Operation at 2,200 tpd clinker (@ 50% TSR)					
PH fan	2,200	400	1,000	5,75,000	2,100

Table 2.5: Preheater Fan parameters

PH fan: Expected operating volume (**5,75,000** m^3/hr) & operating pressure (**1000** mmWC) @ 50% TSR exceeds design volume (4,25,000 m^3/hr) & design pressure (730 mmWC) of PH fan. Hence, it is recommended to replace the existing PH fan with new PH fan.

Specifications of the proposed new PH fans are as follows:

- Volume : 5,75,000 m^3/hr
- Pressure : 1000 mmWG
  (After addition of proposed new twin top cyclone
  & PH down comer duct enlargement this may reduce)
- Temperature : 400 ^{0}C
- Power : 2100 kW
- Speed Control : MVD/VFD required.

ACL is already replacing the existing PH fan with a new one. The new fan is adequately sized and will support up to 50% TSR of alternative fuel.

Existing PH fan can Support up to 30 % TSR of Alternative fuel,

2.7 ASSESSMENT OF PH SECTION

Based on pressure and temperature profile measurements carried out across each stage of preheater, estimated velocities with 2200 Clinker production at 30% TSR & 50% TSR without considering any modification are given in **Table 2.6**

Pre-Heater string

Sn	Capacities	Measured @ 0% TSR 2200 TPD	Estimated @ 30% TSR 2200 TPD	Estimated @ 50% TSR 2200 TPD
		Velocity, m/s	Velocity, m/s	Cyclone Loading, tpd/m^2
1	Cyclone 1 outlet (Top stage)	19.7	23.3	24
2	Cyclone 2 outlet	17.9	20.6	21.1
3	Cyclone 3 outlet	15.9	18.2	18.6
4	Cyclone 4 outlet	15.6	17.8	18.1
5	Cyclone 5 outlet	11.3	12.9	13.2
6	TAD	30	31.5	32.0

Table 2.6: Details of assessment of PH, PC and TAD

At 2,200 tpd clinker production:

Up to 30% TSR

- Average pressure drop at PH outlet/ Down comer is estimated as ~ 750 mmWG which are just meeting the recommended limits of 800 mmWG for peak PH pressure. Hence,

➢ **The existing Preheater is considered suitable for 2,040 tpd clinker up to 30% TSR.**

30 - 50% TSR

- The riser velocities of Top stage and 2nd Stage are on higher side than optimum limits (<18.0 m/s) which increases PH return dust %
- Average pressure drop at PH outlet/ Down comer is estimated as ~ 910 mmWG for 50 % TSR which are exceeding the recommended limits of 800 mmWG for peak PH pressure. Hence,

➢ **Existing Preheater shall be Suitably Modified for 2,200 tpd clinker @ 50% TSR.**

PC (Pyroclone) Residence Time

As per the data received from **Amrit cement**, the average size of the shortlisted AFs shall be <50 mm. Considering the indicated size range, the AFs are found to be suitable for firing at the Pre Calciner (PC). Hence, the suitability of existing Pre Calciner (PC) with respect to gas residence time has been evaluated below.

Based on the effective PC volume (Existing ~ 915 m^3) the gas residence time works out as **5.5 sec**, which is manageable upto 30% TSR, with 2,200 tpd clinker production provided uniform size & consistent quality is maintained.

At 50.0% TSR, with 2,200 tpd clinker production PC residence time ≥ 8 seconds is recommended for complete combustion of AF in PC. Since space is available in the PH tower for extending the calciner to enhance the residence time this option needs to be explored to achieve AFR targets. However, a structural audit of the PH tower must be conducted to ensure it can withstand the additional load of the Pre calciner extension.

Alternatively, Option of installing AF Incinerators like Hot disc/ Pyrorotor / External Combustor in Calciner circuit can also be explored with minimum pre-processing efforts. However, layout

feasibility for selection of Incinerator technology needs to be established before placement of order.

AF INCINARATOR is a Step forward in Alternative Fuel firing through Incineration process, An upcoming technology option, to achieve higher AF substitution of up to 60-85% in Calciner, with minimum pre-processing efforts. However, layout feasibility for selection of Incinerator technology needs to be established before placement of order.

TAD

The expected gas velocity in TAD works out to 32 m/s @50% TSR (considering TAD volume of 0.60 Nm^3/kg clk), which is acceptable @ 2,200 tpd clinker

2.8 SIMULATED IMPACT ASSESSMENT

Impacts are simulated for all available AFs at different %TSR @ 2,200 TPD clinkerisation capacity, considering maximum TSR as 50 % and the results are summarized in the table below

Descriptions	Units	Base Line 0%TSR (AF)	30% TSR (AF)	40% TSR (AF)	50 %TSR (AF)
Original Capacity (Clinker)	tpd	**2,200**	**2,200**	**2,200**	**2,200**
% Production Loss	**%**	**-**	**7.8**	**10.28**	**12.65**
Capacity after Production loss	tpd	**2,200**	**2,040**	**1,995**	**1,953**
Net Annual Clk. Production @ 330 days	tpa	**7,26,000**	**6,73,200**	**6,58,350**	**6,44,490**
Specific Heat Consumption					
Estimated Specific Heat Consumption	kcal/ kg Clk.	**860**	**892**	**900**	**908**

Table 2.7: Impact of AF on Production and Specific Heat

HOLTEC Observations

At 30.0 % TSR level, maximum reduction in annual production (without any modification) is estimated to be ~7.8 % (160 tpd) from the baseline value (2200 tpd) with an estimated increase in specific heat consumption of ~32 kcal/kg clinker.

To achieve 30% TSR on a sustained basis, suitably sized New AF Preprocessing and co-processing system is envisaged.

At 50.0 % TSR level, maximum reduction in annual production (without any modification) is estimated to be ~12.6 % (247 tpd) from the baseline value (2200 tpd). The expected operating production would be 1,953 tpd clinker. Alternatively, to achieve the production capacity of 2,200 tpd on sustained basis with 50.0 % TSR the following modifications are proposed: -

- New preheater fan, Top stage & 2nd stage Cyclones Modification/ replacement
- Expected Increase in specific heat consumption is ~ 48 kcal/kg clinker with AFR- 50 % (TSR).
- Suitably sized New AF Preprocessing and co- processing system

***Note: ACL** is planning to replace the existing PH fan with a new one. The new fan is adequately sized and will support up to 50% TSR of alternative fuel. Further **ACL** is planning to add a new top stage cyclone. Hence, block cost estimate does not include these equipment.*

2.9 IMPACT ON EXISTING RAW MIX

AFs usages introduce significant Ash quantities in the system. An adaptation of the raw mix must be made to meet the LSF (also SR and AR) target in the clinker. Since the ash content in the proposed AFs (Saw Dust) is high (30%) at high TSR of 50%, the effect of ash content can only be neutralized by fine tuning the raw mix design.

The software developed by **HOLTEC** for computerized raw mix optimization has been used to evaluate the impact of the shortlisted AFs. While evaluating the impacts on raw mix composition, currently maintained clinker quality parameters (tabulated below) at **ACL** have been considered as target.

Clinker Quality

C_3S	SM	AM	% LSF
49-52%	2.3-2.5	1.04 - 1.08	0.92-0.94

Source: ACL

Table 2.8: Considered guide values for Clinker

The chemical compositions of average available limestone quality being currently used at **ACL,** is tabulated below:

Raw Materials	Composition												
	LOI	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	SO_3	TiO_2	Mn_2O_3	P_2O_5	Cl
Limestone	38.27	6.04	0.82	0.96	47.26	1.62	0.67	0.09	0.67	0	0	0	0

Source: ACL

Table 2.9: Present Limestone Quality

Target Achievable TSR with available Limestone

A raw mix design exercise has been carried out, to find maximum achievable TSR, with the available average quality limestone & other correctives, being presently used along with proposed Alternate Fuels in varying proportions.

The chemical analysis of existing raw materials (other than limestone) in use is as follow:

Component Name	LOI	SiO2	Al2O3	Fe2O3	CaO	MgO	K2O	Na2O	SO3	TiO2	Mn2O3	P2O5	Cr2O3	Cl
Clay	4.92	68	7	13	0.3	0.9	0.19	0.12	0.24	0.001	0.001	0	0	0
Shale	6.06	57	17.8	8	2	2.1	0.23	0.32	0.75	0.001	0	0	0	0
Laterite	8.2	26	21.4	25	0.13	0.23	0.39	0.13	0	0	0	0	0	0

Source: ACL

Table 2.10: Present Raw Material Quality

Various Raw mix designs considering different %TSRs using average quality limestone & other correctives being presently used are tabulated below:

Parameters	Raw Mix Using Present Average Quality Limestone		
TSR %	**0**	**30**	**50**
RAW MATERIAL PROPORTION			
Limestone	87.87	87.87	88.1
Clay	7.75	7.75	7.5
Shale	4	4	3.9
Laterite	0.38	0.38	0.5
FUEL			
Coal	100	52.1	31.79
Saw Dust	-	13.7	19.44
Rice Husk	-	13.9	19.73
Plastic Waste	-	17.6	25.08
Municipal Waste	-	2.5	3.52
Spent Oil	-	0.3	0.44
CLINKER			
CaO	63.86	63.17	63.06
BOGUE COMPONENTS			
C3S	49.36	49.15	50.49
C2S	23.33	23.75	22.37
C3A	4.99	4.92	4.81
C4AF	12.81	12.68	12.45
MODULI			
AM	1.08	1.08	1.08
SM	2.40	2.44	2.48
LSF	0.94	0.92	0.93
OTHER INDICES			
Liquid	26	26	26

Table 2.11: Raw Mix Designs with available Limestone at various % TSRs

2.10 IMPACT ON CLINKER QUALITY

Presence of ash, heavy metals or iron content in the shortlisted AFs may impact the clinker and thereby cement quality which is elaborated in the below section:

Impact of Ash content: If ash is introduced into the kiln by AFs in significant quantities relative to clinker, an adaptation of the raw mix must be made to meet the LSF (also SR and AR) target in the clinker. Since the ash content in the proposed AFs (Plastic Waste) is high the effect of ash content can be neutralized by varying raw mix designs as indicated above.

Impact of Heavy metals: The metal which has a relatively high density and toxic at low quantity is referred as heavy metal. Since metals are not destroyed at any temperature, they may be absorbed in the clinker matrix or emitted from stacks.

Heavy metals like As, Cr, Ni, V and Zn are considered to be non-volatile, Pb and Cd are low volatile, Tl is volatile while Hg is high volatile responsible for emissions. Low volatile heavy metals generally combine with clinker and their effect on clinker based on their concentration in AFs ash sample is highlighted below.

Zinc: Presence of zinc (Zn) appears to be the main constraint, limiting AF in fuel mix in most cement kilns. However, traces of non-volatile metals such as zinc, present in AFs, chemically combine with clinker and therefore there is no risk of these metals leaching from the clinker, once produced.

Generally, Zinc concentration of upto 500 ppm (0.05%) in clinker does not have impact on cement properties. Investigations show that zinc concentration above 500 ppm in clinker impact the workability of cement. Small amounts of Zinc, between 0.01 and 0.2% have been reported to increase the reactivity of the C_3A and in consequence lead to possible setting time problems. Zinc levels above 0.4% increase setting time and experiments on laboratory clinker and cement show a clear retarding effect at 2.5% of zinc in clinker.

- **Cr, Ni, V**: These non-volatile components are generally in traces in AFs ash sample and shall be primarily incorporated into the clinker. Addition of these elements in the cement shall results in no leaching from the final product, due to their being incorporated into the crystal phase during cement hydration.

- **Lead:** Lead in the clinker is typically in the range of 0.001-0.02 wt.% (as PbO) but may increase to 0.02-0.04 wt.% PbO when using alternative fuels.

As long as the concentration is below 0.1 by weight%, no setting and/ or hardening problems are to be expected. It is to be noted that presence of chlorine in kiln or stack can cause some metals like lead to volatilize at far lower temperatures than normally is the case. If these temperatures are below the range for dust collection equipment, the metals leave the stack.

- **Cadmium:** Low volatile component Cd tends to volatilize in the hottest section of kiln i.e. burning zone and only partly integrate into clinker. They condense at lower temperatures on dust particles which are removed from gas stream in dust collector. In the shortlisted AFs ash sample, the Cd concentration is found out to be very low at around 0.001% which is negligible on clinker basis. Hence, it would not affect the quality of clinker.

2.11 ENVIRONMENTAL REGULATORY FRAMEWORK

There are emission standards (currently) developed by CPCB for co-processing of waste in cement plants in India as mentioned in table below:

Substance	Value *	Unit
Total dust (Particulate Matter)	30	mg/m^3
NOx	600	mg/m^3
SO_2 **	100 (pyritic sulphur is < 0.25%) 700 (pyritic sulphur is between 0.25% to 0.5%) 1000 (pyritic sulphur is between > 0.5%)	mg/m^3
HCl	10	mg/m^3
HF	1	mg/m^3
Cd,Ti	0.05	mg/m^3
Hg	0.05	mg/m^3
As, Sb, Pb, Cr, Co, Cu, Mn, Ni, V	0.5	mg/m^3

Substance	Value *	Unit
PCDD/F (dioxins & Furans)	0.1	Ng TEQ/m^3
TOC **	10	mg/m^3
CO	Competent authority has to set a limit value	

* *Daily average for continuously monitored substances, average over sampling periods for heavy metals and for PCDD/F*

** *The competent authority may grant derogations in cases where Hg, TOC and SO_2 do not result from incineration of waste*

Table 2.12: Emission Standards

2.12 IMPACT ON ENVIRONMENT EMISSION

Alternative fuels vary in their composition and the contaminants present in them. Depending on the composition of chosen fuel, there may be an increased / decreased input of Nitrogen, Sulphur, Chlorine or heavy metals. The likely emissions need to be ascertained on case to case basis and care has to be taken to contain them within prescribed limits.

Typically heavy metals, chloride, sulphur, ash from AFs, might affect the emissions from the Kiln main bag house. All these parameters are discussed below to estimate the impact of AFs utilization along with natural gas as main fuel.

NO_X emissions

There are mainly two types of NO_X formation i.e. Thermal NO_X and Fuel NO_X during clinker production. Thermal NO_X is formed at high temperatures above 1300 ^{0}C in burning zone of kiln by reaction of nitrogen and oxygen in combustion air.

In case AFs are fed into calciner, the temperature is not sufficiently high for formation of thermal NO_X. Hence thermal NO_X is not expected to increase by introducing AFs into calciner.

Fuel NO_X is formed by direct oxidation of nitrogen bearing organic compounds in fuels. Ultimate Analysis of shortlisted AFs sample indicates Plastic Waste & other AF's contains <1% N_2, which is lower

Hence, the substitution of Petcoke/Coal with the identified AFs will lead to reduced nitrogen content in fuel mix in calciner. Considering this, the expected impact on the emission will be a reduction of the NOX generation.

SO_X emissions

Sulphur in Coal is of around aprox, 2.5% while AFs sample has around 0.6 % Sulphur which will lead to marginal decrease in overall % Sulphur in fuel mix.

In general, the increase in sulphur content shall help to reduce the ratio of Alkali/ SO_3 and shall reduce the chances of coating formation in kiln system.

As established globally, fuel sulphur does not contribute to SO_2 emissions from pre-calciner kilns. Hence, there will be no impact on SO_X emissions due to the use of AFs. Moreover, the SO_2 is absorbed into clinker matrix as calcium or alkali sulphate and eventually becomes part of finished cement product.

In case, any operational issues are observed due to the coating formation, air cannons (blasters) already installed be used frequently which can be done by making necessary changes in the programming in CCR. If required addition of extra air blasters to be considered

The expected $\%SO_3$ & Alk/ SO_3 in Clinker for Baseline and with different AF consumption of 50.0 % TSR are compared in the table below.

Parameters	Limits	Baseline 0% TSR (Operating)	Mix AFs (30% TSR)	Mix AFs (50% TSR)
$\%SO_3$ in Clinker	2.0 max	2.65	2.05	2.02
Alk/SO_3 in Clinker	0.8 min	0.43	0.44	0.46

Table 2.13: Alkalis and Sulfur in Clinker

Particulate Matter emissions

Coal has 12% ash content while the shortlisted AFs have around 8 to 30% ash (lowest in MSW and highest in Saw Dust) which may contribute to particulate emissions. Considering that major part of ash released via combustion is absorbed into clinker, ash from AFs seems to have less

potential to contribute to particulate matter emission via kiln stack. Moreover, **ACL** is well equipped with state of art Bag filters/ Bag houses to arrest a marginal increase, if any.

The data available from different cement plants also indicates that emissions from AFs firing kilns had no influence related to particulate matter.

Carbon Monoxide (CO) emissions

There is a possibility of an increase in CO formation whenever large pieces of AFs are fed into the calciner in oxygen deficient regions of the kiln. Hence, **it is of prime importance that the AFs of size bigger than 50 mm should not be accepted.**

Carbon Dioxide (CO2) emissions

CO_2 emissions in a cement plant comprise of direct and indirect CO_2 emissions. Direct CO_2 emissions include CO_2 emitted during calcination of limestone and CO_2 from fuel combustion. Indirect CO_2 emissions are related to emissions during the generation of grid/ CPP electricity consumed by the cement plant. Since **ACL** is planning to replace about 50.0 % of Traditional fuel with AFs, only direct CO_2 emissions based upon fuel combustion shall be impacted.

Total Organic Carbon:

Organic compounds emitted with the flue gas stream mainly from carbonaceous matter in the raw material volatilized in the upper preheater stages or secondarily from incomplete combustion of the fuel in the calciner.

Organic carbon emissions from the calciner are mainly due to incomplete combustion of the fuels applied in the calciner, forming mainly CO that is transported with the gas up through the preheater stages. Experiments based on using the shortlisted AFs (of ~50 mm average size) in the calciner with calciner fuel **substitution rates of up to 50%, showed no significant changes in CO or total organic carbon emission**, provided sufficient gas residence time of at least > 8 sec is available in PC.

2.13 EMISSION MONITORING

Emission monitoring is obligatory to demonstrate compliance with existing laws, regulations, and agreements. Emission monitoring is also needed for controlling the input of conventional materials and their potential impacts. Sulfides in raw materials may result in the release of SO_2 and organic

carbon in raw materials will result in CO, CO_2 and volatile organic compound (VOC) emissions. Heavy metals in fuel and raw material, especially volatile heavy metals, which are not completely captured in the clinker, must be assessed, monitored and controlled.

Depending on the new regulations issued by the Ministry of Environment, the monitoring requirement shall be required to be fulfilled. However, in general, the following two broad categories of monitoring are being done by cement plants.

Regular monitoring

Periodical monitoring should be conducted for the following substances on a regular basis:

a. Metals and their compounds

b. Oxides of nitrogen (NO, NO_2)

c. Oxides of sulphur (SO_2, SO_3)

d. Carbon monoxide

e. Particulate matter

f. Total organic carbon

g. HF

h. PCDD/ PCDF;

i. Chlorobenzenes, HCB and PCBs including coplanar congeners and chloro-naphthalene's.

Occasional monitoring

Measurements of the following substances may be required occasionally under special operating conditions:

a. Destruction and removal efficiency (DRE)

b. Benzene, Toluene and xylene.

c. Polycyclic aromatic hydrocarbons and other organic pollutants if any.

CHAPTER 3: CO-PROCESSING OF ALTERNATIVE FUELS

TECHNICAL CONCEPT

3.1 INTRODUCTION

The technical concept for addition of pre-processing & co-processing system for AFs includes receiving, storage & handling, shredding material, transport & dosing system. Currently, **ACL** relies on a manual handling & feeding process which involves manual handling of the materials, filling them into bags, lifting them using an electrical winch, and unloading and feeding them onto a belt conveyor with the help of labourers. The conveyor then feeds the materials to Pre calciner through a chute equipped with a double flap gate. it is recommended to install a new suitable pre-processing & co-processing system for sustained AF usage for target TSR.

This chapter covers the technical concept for installation of preprocessing & co-processing system, including receiving, storage, preprocessing (shredding) & handling, material transport, dosing and firing into pyro process section, for AF usage @ **50% TSR** at sustained clinker production capacity of 2,200 tpd.

3.2 ALTERNATIVE FUEL AVAILABILITY

ACL proposes to use the AF's listed below, and the expected NCV along with important properties of the fuels are highlighted in the table below:

Fuel	Ash Content (%)	Moisture (%)	Sulphur (%)	Chlorine (%)	NCV, Kcal/kg fuel
Alternative Fuel					
Saw Dust	30	48	2.2	0.034	2900
Rice husk	16	12	0.65	0.07	3000
Plastic waste (HDPE)	8	10	0.04	0	3372
Municipal waste	8.4	12	0.15	0.6	2000
Spent Oil	0.01	0	0	0	9567
Main Fuel					
Coal	12	9.79%	2.28	0	6900

Table 3.1: NCV and Key Parameters of Alternative and Traditional fuels

Below are photos showing the alternative fuels currently on-site.

	
Plastic and Municipal Waste	**Saw Dust**
	
Rice Husk	**Plastic waste**

Photo Plate 3.1: Alternative fuels

3.3 SELECTION OF FEEDING LOCATION

The three general options for feeding alternative fuels in kiln system are:

- Through kiln main burner
- At kiln inlet
- In the calciner

Depending upon the physical condition/ size and other parameters, alternative fuel may be introduced at one of the above locations.

1. **Injection through kiln main burner:** The feeding of coarse AF of >25 mm size (heavy weight), through the main burner pipe is not feasible due to the expected possibility of material dropping on the hot clinker bed. This shall result in localized reducing burning condition. The thermal energy would not be available from the materials at high heat zone in kiln, resulting in extra fuel requirement to maintain high burning zone temperature, which may change the thermal profile of the kiln, upset the kiln parameters and affect the product quality.
2. **Injection at kiln inlet:** This location is commonly used for feeding whole tyres, so that the heat liberated from burning of tyres shall be available in calciner for calcination. However, the chances of CO peaks remain high.

Therefore, **the most appropriate and flexible location for feeding the available materials is the calciner** as tertiary air with adequate oxygen is available for achieving efficient combustion.

3. **Injection point in calciner:** The injection point should be such that, the materials remain suspended in the calciner vessel and maximize their residence time in Oxygen rich atmosphere. The materials aerodynamic behavior depends on its size: the smaller, the lighter, therefore lower the risk of falling in the kiln back-end (bypass the calciner) and the better the chances to combust rapidly.

The coarse AFs aerodynamic behavior depends on the way it falls (sideway or facing the flow) and there is not much to do to control it. Materials falling face down (higher drag force) might be lifted by the gas stream, whereas those falling sideway (lower drag force) will fall down.

The overall material behavior is therefore a combination of both the effects. It might acquire a high momentum when falling from a height (momentum = velocity x mass), thus making the required upward velocity for “suspension” higher than if the material is injected at low level.

The drag force increases when the material combusts, due to the swelling effect (doubles or triples its size), so the increasing momentum effect (downwards) during the fall is partly counterbalanced by this increasing drag force (upwards).

There might be some wall-effects, which will force the materials towards the calciner walls, where there is little or no velocity (risk of direct fall to kiln back-end and damage to refractories). For this reason, the feed chute angle and length must be such that the

materials are forced into the middle of the mainstream (=> enough injection velocity to overcome the wall-effect). **Accordingly, a chute of 60° from horizontal & approximately 1.5 - 2.5 m long is considered in the system design**.

3.4 SYSTEM DESIGN

The technical concept for the system design of the proposed project has been developed in accordance with technical guidelines for the state-of-art technology coupled with **HOLTEC**'s experience in engineering, design of AF Co-processing facilities and common operational performance objectives. The main objectives for developing the plant/ system concept, layout and arrangement design are:

- Choice of process and main machinery best fitting the prevailing circumstances
- Optimized investment cost and low production cost based on:
  - Selecting efficient, reliable and well proven equipment with:
    - ✓ High AFR usage & thermal energy efficiency,
    - ✓ Low electrical energy consumption
    - ✓ High availability
  - High degree of mechanization and process control automation
    - ✓ Adequate equipment capacities
    - ✓ Sufficient storage volumes
  - Environmental protection measures in accordance with applicable National/ International norms and standards i.e.
    - ✓ Maximum dust emissions in cleaned exhaust gas <30 mg/ Nm^3
    - ✓ Noise level below limits set forth by international standards
    - ✓ Health and safe workplace by selecting equipment with zero risk to the employees thus meeting targets set for lost time due to accidents and injuries

The above objectives are partly interrelated and conflicting, thus priority will be given to the most cost-efficient solution incorporating the trends and developments in the internationally operating AF systems in cement industry, which are considered to be representative in this field.

3.4.1 Design Basis

The followings are the consideration for Co processing system design:

- Targeted **TSR – 50%**
- Average Clinker Production is considered as **2,200 tpd**.
- Heat consumption of ~**860 kcal kg Clk at 0% TSR** (As per heat balance) & ~ **910 kcal/kg clinker @ 50% TSR** is considered as baseline value.

3.4.2 Fuel Mix Scenarios

Based on material availability and considering maximum increase in heat consumption to ~910 kcal/kg Clk with 50%TSR (Increasing 50 kcal/kg from AF co-processing)., from ~860 kcal/ kg Clk. following fuel mix options are considered:

Fuel Mix No.		Fuel Type & % TSR contribution to heat consumption				
	Coal	Saw Dust	Rice Husk	Plastic waste	Muncipal waste	Spent Oil
Baseline	100	0	0	0	0	0
Fuel Mix 1	50.0	13.34	14.0	20.0	1.67	1.0

Table 3.2: % TSR of Alternate Fuels

3.4.3 New Shredder Capacity

Details of proposed new shredder capacities are summarized below Table.

Description	50% TSR	R.hrs	AF Qty.	Moist	50% TSR	AF Qty	Shredder Eff. & Capacity	
	tph	hrs.	tpd	%	tph	tpd	Eff. %	tph
Total Requirement @ 50%	15.18 on dry basis	20	364.3	12	17.0 on wet basis	408	60	28

Table 3.3: New Shredder Capacity

3.4.3.1 Solid AFR at 50% TSR:

To meet the 50% TSR, a new suitably designed shredder system of 28 tph is proposed.

3.4.4 AF Storage, Shredding, Handling & Firing System

The concept covers the selection of location where AF storage, shredding and handling set up to be installed, selection of equipment with their basic technical specifications etc.

3.4.4.1 Proposed System for Solid AFs Co-processing

The proposed system consists of the following sections:

A. AF Receiving, Storage and Extraction System

- AFs shall be transported to **ACL** plant by self-tipping trucks or normal trucks. After weighing at the designated weigh bridge, with sampling for initial testing, the accepted AFs shall be delivered to storage shed. 2 nos truck tippler (2 x 20 t) are proposed for smooth & quick unloading of AFR material to avoid traffic congestion of trucks inside the plant.

Photo Plate 3.2: Truck tippler & Pit arrangement

- One storage shed (covered) having storage capacity of 500 t for R, and 250 t for Rice Husk, 250 t for Saw Dust &, 5 t for spent Oil is proposed for storage **at ground level** and Small pits are also provided for smooth unloading of AFR through truck tippler. This is equivalent to 3 days storage of individual AF.

  100% Pit type storage is not considered for this project due to following reasons:

  - ✓ Pit type storage is preferred where space is constraint
  - ✓ Initial construction cost is high

- ✓ Safety concern is more during operation
- ✓ Possible dead-volume of materials at the corners of pit

- The storage shed shall be completely **covered with rolling shutter** to avoid odor and spillage of material. Trucks will be unloaded at specified PIT location inside the shed.
- The storage shed shall be equipped with **foam/ water sprinkler and fire gas detector system** as a precaution for any fire hazard.
- A **single automated grab crane** is required which will be used to stack the material inside the shed as well as extracting the material from storage area for further shredding & feeding to Pyro process. Smart crane control to be provided to prevent uncontrolled swinging of the bucket.

Photo Plate 3.3: grab Crane

- Grab crane shall discharge the materials to hopper, designated for Plastic waste having capacity of 5 m^3. Provision shall be kept to feed these hoppers by pay-loaders, as and when required.
- Plastic waste shredding system of 28 tph is considered. From Hopper, material is fed to shredder, where size reduction is taking place. Output of shredder is passes through **Trommel Screen**, where < 50 mm size is fed to extractor/ designated storage through reversible belt conveyor. Oversize material is fed back to hopper & shredder for further size reduction.
- From Extractor (hoppers shall be mounted on "**inclined apron feeder)**, Plastic waste is extraction and feeding to the belt conveyor. The inclined apron feeders provide small

discharge opening without compaction and eliminate extraction problem and dosing fluctuations.

- At the discharge end a counter-rotating **stripping roll** ensures a constant material bed height and throws back surplus material. For better activation of material, this drum has to be a moving device and not a static leveling blade. **The tip speed of stripping roll shall be approximately double of apron conveyor speed.**
- A weigh feeder is proposed below extractor for accurate weighment of Plastic waste (as an alternative option),
- For rice husk and biomass, separate hopper is proposed along with screw conveyor system (below hopper).
- **The maximum hopper filling level should not exceed the 9 o'clock position of the stripping roll.** This level defines the useable hopper volume. The hopper can be put on load cells for filling level detection. Different calibration of load cells shall be required for different bulk densities of materials.

  A great advantage of inclined apron feeder is its precise volumetric dosing. Hence, no separate volumetric dosing arrangement is required. The finer the particle size, the higher the dosing accuracy. **The maximum accuracy of the apron feeder is reached below 50 mm size**.
- The filling level of receiving hoppers will be continuously monitored by CCR operator through **CCTV**. To avoid condition of empty hopper due to ignorance of CCR Operator, One number low level switch shall be installed to get low level (at 1.0 t) alarm of apron feeder hopper level. Once the low level alarm is generated in alarm window of CCR, the operator will have ~12 to 15 minute to start the refill the receiving hoppers with the help of Grab crane/ Payloader.
- For continuous monitoring of apron feeders operation, a **zero speed detection switch** to be provided.
- To avoid material spillage a **spillage conveyor** shall be installed below the apron feeder.
- In proposed AF handling system, there is belt conveyor under apron feeder to transfer AFs to the conveying system for Calciner firing. Belt Conveyor shall be equipped with

necessary safety instruments like pull chord switch, belt sway switch and zero speed switches.

- AF storage hall shall be provided with bag filters to control fugitive dust emission. As the AFs shall be transferred from one belt to another, for proper environmental control installation of **nuisance bag filters** are proposed at all the material transfer points.

A) Basic technical specifications for proposed AF handling and extraction equipment

The basic technical specifications for proposed AF handling and extraction equipment are given below:

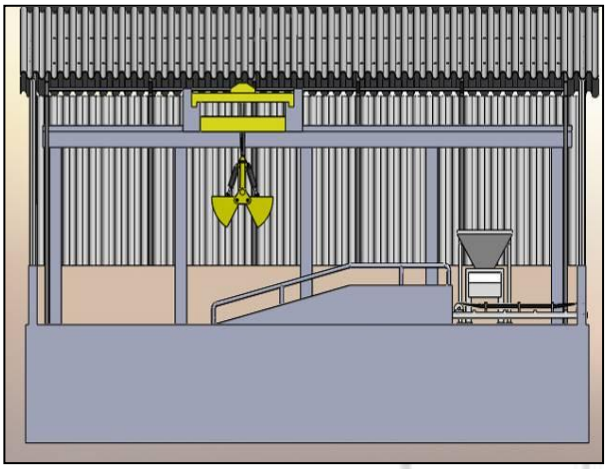
Grab Crane	
Crane Grab Capacity	5 m^3 Grab
Type	Double Girder Box Type Grabbing EOT
Duty Indoor	Heavy Duty
Safe Working Load (S.W.L.)	15 T

Table 3.4: Technical specifications of Grab crane

For Plastic waste, considering more chances of oversized material, a trommel screen shall be provided before feeding to Extractor through reversible belt conveyor. This screen shall be used for separation of oversized materials from feeding stream. It shall comprise of transverse shafts with rubber star shaped discs with defined gap so the material with correct lump size falls through to the conveying belt and oversized material is carried over the length of the screen to the reject conveyor/ container. The basic technical specifications for proposed trommel screen are given below:

Trommel Screen	
Output Lump Size	<40-50 mm
Stars	Antistatic Rubber
Motor power	3-5 kW (Preliminary)

Table 3.5: Technical specifications of AF handling and extraction equipment



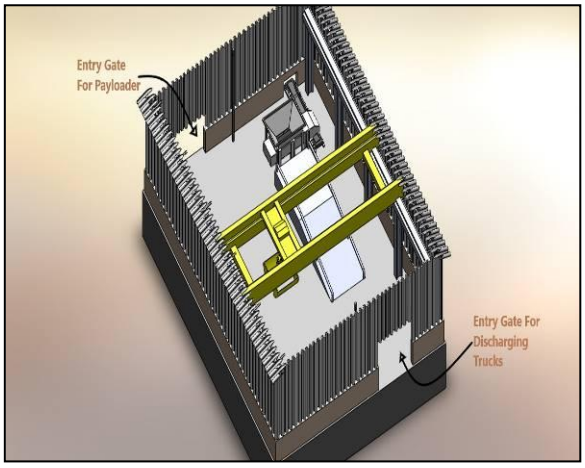


Photo Plate 3.4: Proposed Storage Shed

B. Solid AF Conveying and Firing to Calciner

- For conveying of AF from storage shed to calciner feeding two types of conveying technology is available i.e. Belt conveyor and Pipe Conveyor
- Following table compares both conveying options with respect to AF conveying:

Parameter	Belt Conveyor	Pipe Conveyor
Equipment Cost	Half of Pipe conveyor	Twice of Belt conveyor
Civil & Structural requirement	~500kg/m open gallery with local covering and 750 kg/m closed gallery	~ 350 to 400 Kg/m gallery (No enclosed conveying is required)
Power Consumption	At par. (as conveyor profile is straight)	At par. (as conveyor profile is straight)
Spillage & Smell	High	Chances only at opening and closing part during pipe formation.
Inventory	Common inventory can be kept with plant belt conveyor	Separate inventory is required for pipe conveyor components

Parameter	Belt Conveyor	Pipe Conveyor
Operating references	Plenty for AFR in India as well as abroad	• Ultratech Cement, India (For AFR) • Lafarge Holcim, India (for Limestone) • Lafarge, Poland (For AFR) • Heidelberg, Belgium (for AFR) • JP Cement, India (Limestone) • Sterlite Industry, India (Rock Phosphate/Copper Concentrate) etc. • Cementir Italia, Italy for Cement
Any Specific Issue	…..	Sharpe edge AF may damage the pipe if Metal detector & Magnetic separator are not working well.

Table 3.6: AF Conveying System options

Although pipe conveyor is having number of advantage over belt conveyor, however, with the concern of belt damage (in pipe shape) due to possibility of presence of other foreign materials in other shortlisted AFs and in view of low initial investment, for this project belt conveyor (50 tph) is recommended.

- **A totally covered troughed type belt conveyor** shall be provided to avoid spillage of any material due to wind. Spillage sheets are provided along the complete length of the belt conveyor.
- In proposed material transfer system, **a Metal detector and a Magnetic Separator** shall be installed for belt safety and as well as to avoid jamming.

  Magnetic Separator is used to separate metals from coarse AFs. After magnetic separator for safety considerations, a metal detector shall also be provided. If magnetic separator is unable to separate metal, then metal detector will generate alarm. The alarm shall stop the belt conveyor suddenly so as to manually remove the metal part, for safe operation.

Basic details of the key equipment for material transport are given below:

Belt Conveyor	
Conveyor Capacity	50 tph (Design)
Belt Speed	1.0 m/ sec

Bulk Density	0.2 - 0.6 t/ m³
Belt type	Oil resistant, fire retardant and antistatic
Magnetic Separator	
Type	Over band Self Cleaning Cross Belt Permanent Magnetic Separator
Location	On belt Conveyor from Storage shed to Preheater tower
Operating Height	250mm. (Gap Between Magnet Bottom Surface To Conveyor Belt)
Tramp	Iron Material Of Pipes/ Rods/ Bolts/ Cut Pieces/ Other Irregular Shapes
Duty Cycle	Continuous

Table 3.7: Key Equipment for AF transport

- The conveying belts shall feed the materials to apron conveyor for controlled firing to PC.
- Electrically operated double flap valve airlock is proposed for introduction of Alternative fuel into the calciner. The features of the Electro-pneumatic cabinet is elaborated as following:
  - ✓ Upper valve
  - ✓ Lower valve
  - ✓ Shut-off gate
    - Double flap valve airlock can be operated both in REMOTE or LOCAL mode. The flap opening & closing time can be adjusted as per the calciner process/ AF flow rate (t/hr.) requirement.
    - Each flap should have provision to be pneumatically activated with a counterweight or a spring to ensure fail-safe closing
    - **Heat resistant steel (resistant up to 950°C)** must be used for casing and flaps, if no refractory lining is used.

- Brick lining for the lower and middle flap casing and the intermediate box casing is envisaged. Water cooling system to be avoided considering danger of brick damages during shutdowns when water leakages occur.
- Since flap valves are not 100% airtight, hot kiln gases can pass the flaps in case of upset kiln condition. Therefore, at least one **automatically operated shut-off gate (safety gate)** must be installed below the flap valve.
- In case the installation below the flap gate is not possible with due layout constraint and the shut-off gate has to be mounted above the flap gate, an additional manual gate below the flap gate is needed for maintenance purposes.
- The safety shut off-gate must be power fail-safe (springs, weights or a small pneumatic buffer tank shall ensure closing in case of power failure).
- The shut-off gate must be triggered by an **overpressure sensor**, located below the gate. The pressure sensor must be in an area where its signal is not influenced by air-blasters and positions indicators must control gate's opening status.

➢ To avoid material, fall through due to possible wall effect from calciner while introducing AF to PC from flap valves, **a chute of 60° from horizontal & approximately 1.5-2.5 m long** is recommended to install. This chute shall be attached to the lower cylindrical portion of the Precalciner.

➢ Proposed AF System shall be operated from CCR.

➢ Considering installation of a fully automated Control System, installation of **a separate PLC cum I/O Panel, Feeder Panel and UPS (Uninterrupted Power Supply)** is considered.

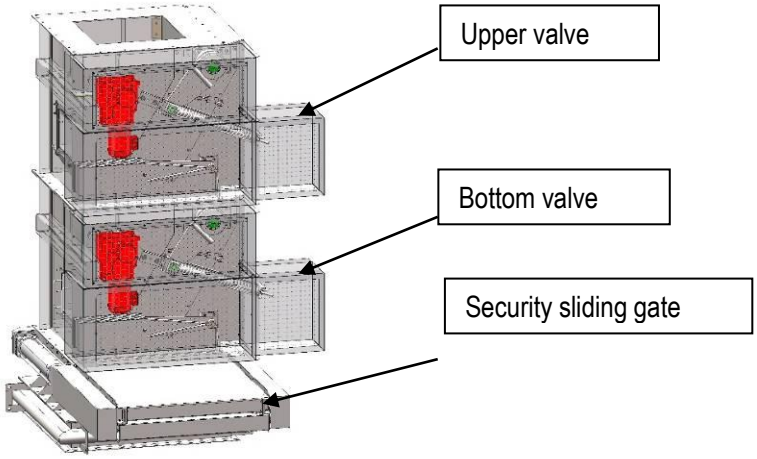


Photo Plate 3.5: Electrical Double Flap Valve

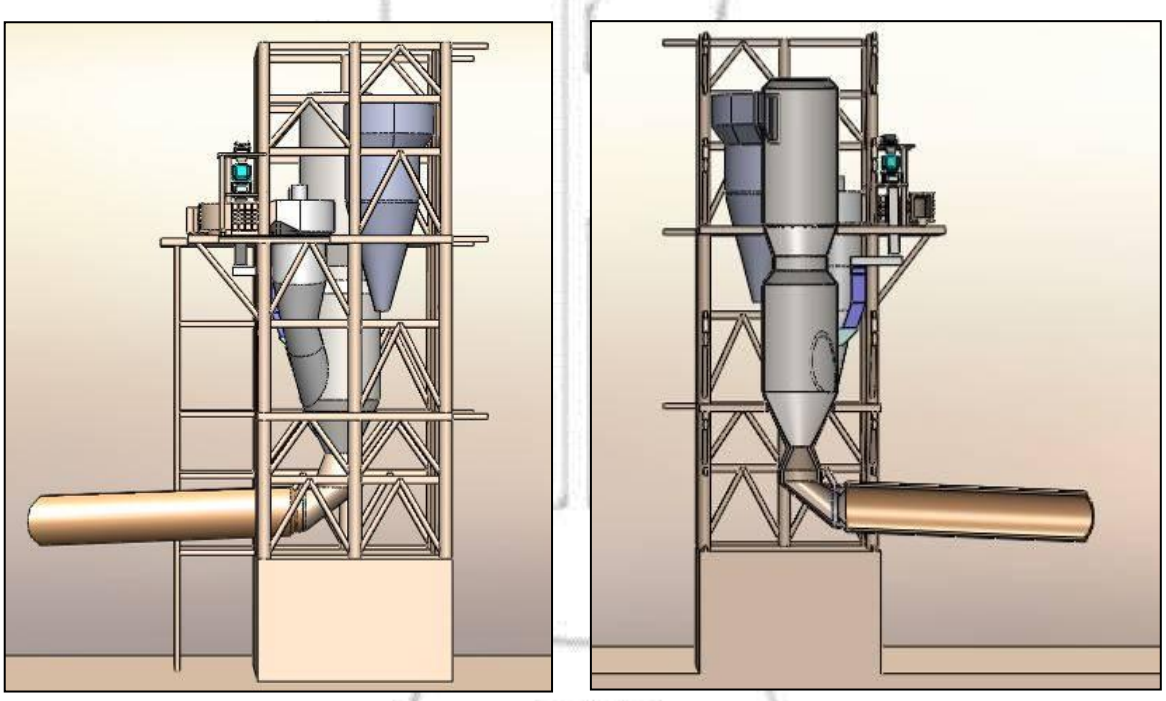


Photo Plate 3.6: Proposed feeding System

3.5 PLANT LAYOUT

Detailed flow sheets and Plant Layout are attached as per the table below:

S No.	Description	Drawing No.
1	Plant Layout of Proposed AFR System	24185-03-IU-1-01
2	Flowsheet for AFR Shredding, Storage Feeding to Calciner	24185-03-IU-1-02
3	General Arrangement of Proposed AFR System Belt Profile	24185-03-IU-1-03

Table 3.8: Plant Layout and Flow sheets

While developing the plant layout, it has been taken care that there is

- Optimum use of free space without any hindrance to the existing facility i.e. existing equipment, roads etc.

3.6 CONCLUSION

- Existing Cement manufacturing facilities of **ACL** incl. PH fan are equipped to operate up to 30% TSR of Alternate Fuel with maximum Clinker production of 2040 tpd without modification.

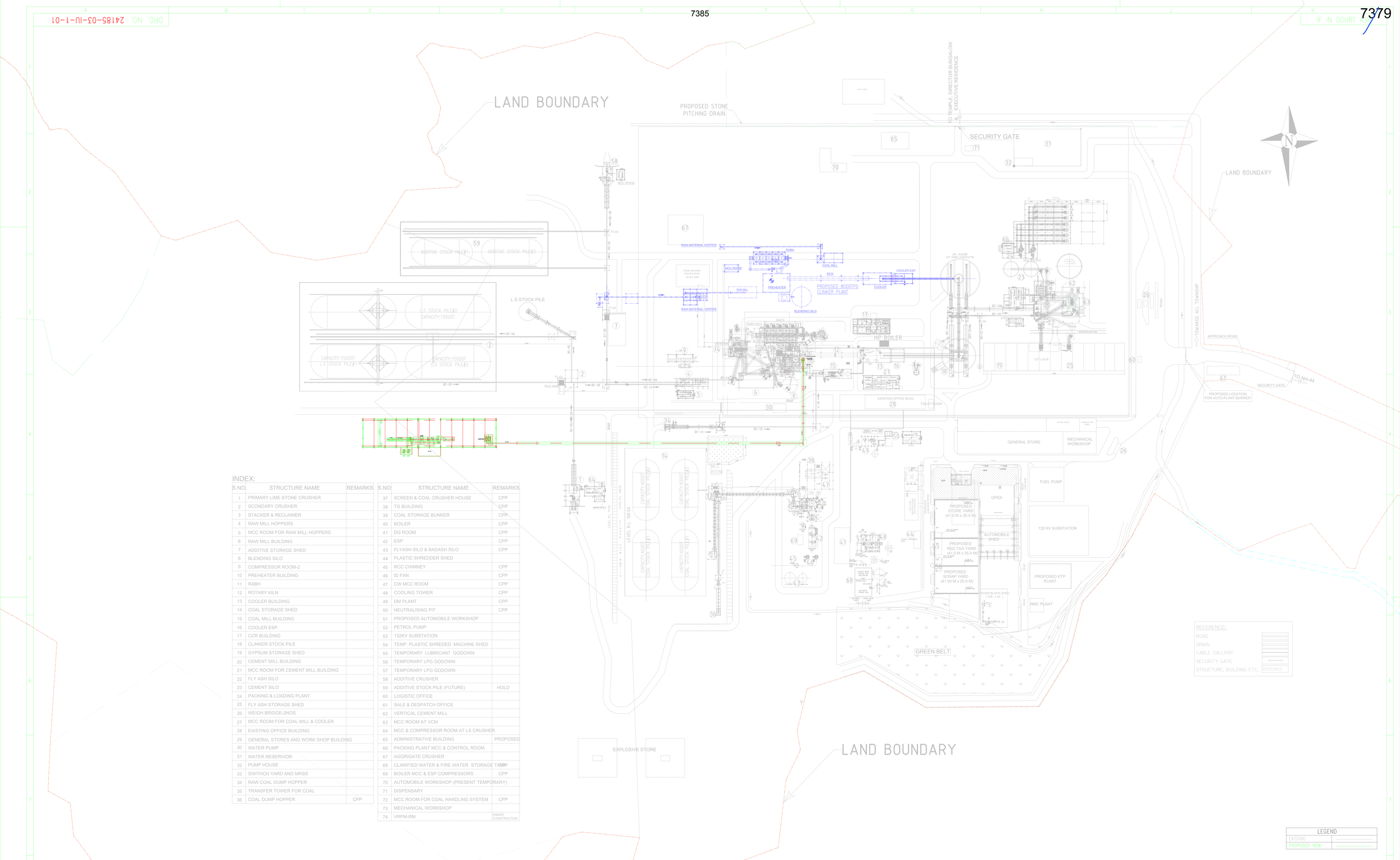
  Currently, **ACL** relies on a manual handling & feeding process. To achieve 30% TSR on a sustained basis, suitably sized New AF Pre-processing and co- processing system is envisaged.

- For 50% AFR on TSR basis in the **ACL** plant, a new PH Fan, modification in Calciner, Top stage & 2nd stage Cyclones is required. **ACL** is planning to install a new PH Fan and adding new top stage cyclone.

  To achieve 50% TSR on a sustained basis, suitably sized New AF Pre-processing and co- processing system is envisaged.

DRG. NO. 24185-03-IU-1-01

IF IN DOUBT ASK



INDEX:

S.NO.	STRUCTURE NAME	REMARKS
1	PRIMARY LIME STONE CRUSHER	
2	SCONDARY CRUSHER	
3	STACKER & RECLAIMER	
4	RAW MILL HOPPERS	
5	MCC ROOM FOR RAW MILL HOPPERS	
6	RAW MILL BUILDING	
7	ADDITIVE STORAGE SHED	
8	BLENDING SILO	
9	COMPRESSOR ROOM-2	
10	PREHEATER BUILDING	
11	RABH	
12	ROTARY KILN	
13	COOLER BUILDING	
14	COAL STORAGE SHED	
15	COAL MILL BUILDING	
16	COOLER ESP.	
17	CCR BUILDING	
18	CLINKER STOCK PILE	
19	GYPSUM STORAGE SHED	
20	CEMENT MILL BUILDING	
21	MCC ROOM FOR CEMENT MILL BUILDING	
22	FLY ASH SILO	
23	CEMENT SILO	
24	PACKING & LOADING PLANT	
25	FLY ASH STORAGE SHED	
26	WEIGH BRIDGE-2NOS	
27	MCC ROOM FOR COAL MILL & COOLER	
28	EXISTING OFFICE BUILDING	
29	GENERAL STORES AND WORK SHOP BUILDING	
30	WATER PUMP	
31	WATER RESERVIOR	
32	PUMP HOUSE	
33	SWITHCH YARD AND MRSS	
34	RAW COAL DUMP HOPPER	
35	TRANSFER TOWER FOR COAL	
36	COAL DUMP HOPPER	CPP

S.NO.	STRUCTURE NAME	REMARKS
37	SCREEN & COAL CRUSHER HOUSE	CPP
38	TG BUILDING	CPP
39	COAL STORAGE BUNKER	CPP
40	BOILER	CPP
41	DG ROOM	CPP
42	ESP	CPP
43	FLYASH SILO & BADASH SILO	CPP
44	PLASTIC SHREDDER SHED	
45	RCC CHIMNEY	CPP
46	ID FAN	CPP
47	CW MCC ROOM	CPP
48	COOLING TOWER	CPP
49	DM PLANT	CPP
50	NEUTRALISING PIT	CPP
51	PROPOSED AUTOMOBILE WORKSHOP	
52	PETROL PUMP	
53	132KV SUBSTATION	
54	TEMP. PLASTIC SHREDED MACHINE SHED	
55	TEMPORARY LUBRICANT GODOWN	
56	TEMPORARY LPG GODOWN	
57	TEMPORARY LPG GODOWN	
58	ADDITIVE CRUSHER	
59	ADDITIVE STOCK PILE (FUTURE)	HOLD
60	LOGISTIC OFFICE	
61	SALE & DESPATCH OFFICE	
62	VERTICAL CEMENT MILL	
63	MCC ROOM AT VCM	
64	MCC & COMPRESSOR ROOM AT LS CRUSHER	
65	ADMINISTRATIVE BUILDING	PROPOSED
66	PACKING PLANT MCC & CONTROL ROOM	
67	AGGRIGATE CRUSHER	
68	CLARIFIED WATER & FIRE WATER STORAGE TANK	CPP
69	BOILER MCC & ESP COMPRESSORS	CPP
70	AUTOMOBILE WORKSHOP (PRESENT TEMPORARY)	
71	DISPENSARY	
72	MCC ROOM FOR COAL HANDLING SYSTEM	CPP
73	MECHANICAL WORKSHOP	
74	VRPM-RM	UNDER CONSTRUCTION

REFERENCE:
ROAD
DRAIN
CABLE GALLERY
SECURITY GATE
STRUCTURE, BUILDING ETC.

LEGEND
EXISTING
PROPOSED NEW

FOR FEASIBILITY REPORT

REFERENCE NO. | DETAILS — R E F E R E N C E S

N O T E S
1. DO NOT SCALE, WORK TO DIMENSIONS ONLY.
2. FOR TOLERENCES REF. HOLTEC STD. DRG. NO. A1-HOL-STD-1-129

N O T E S

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED

REV No	DATE	BY	CHKD	APPD	DETAILS

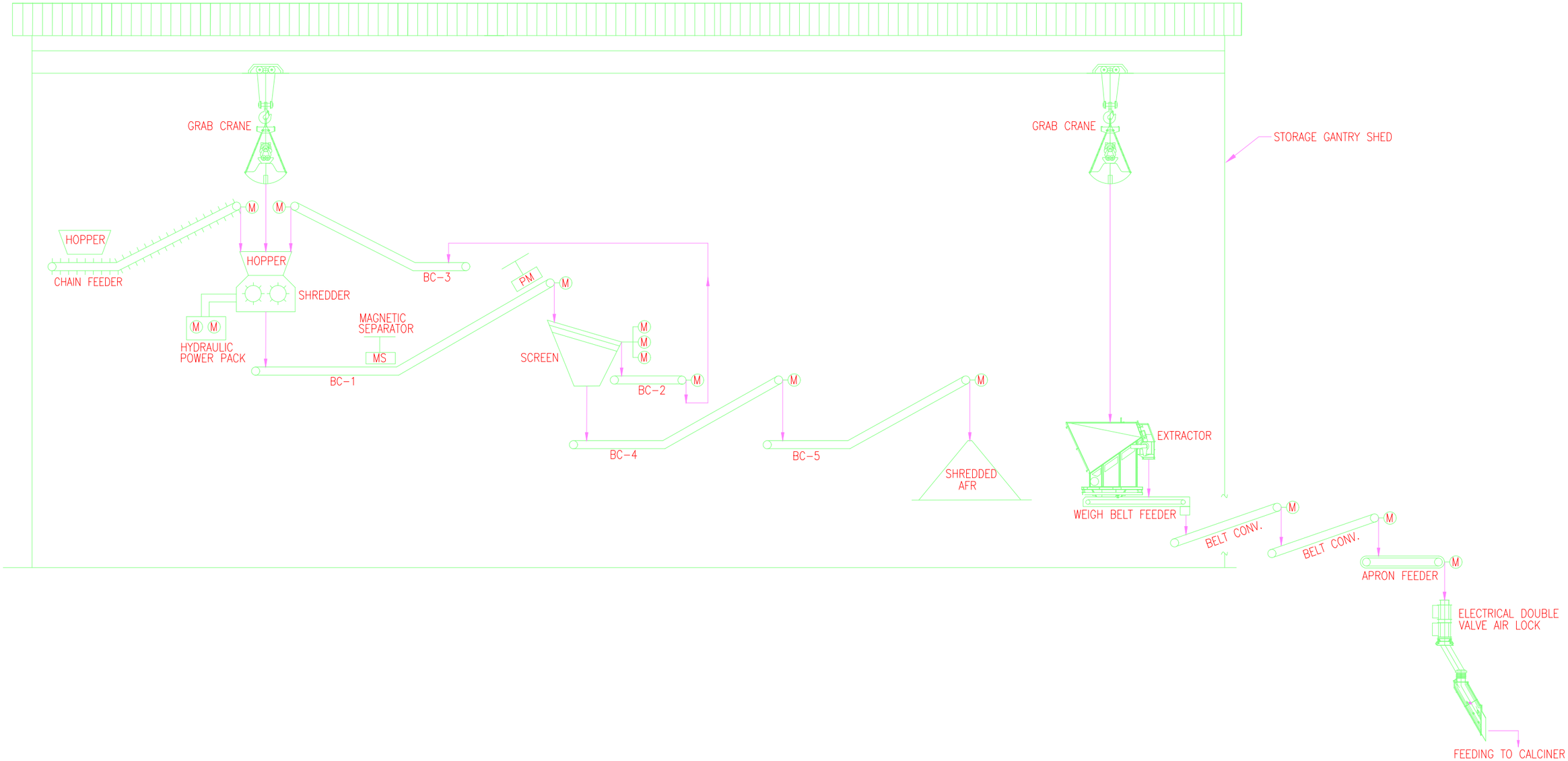
R E V I S I O N S

HOLTEC CONSULTING PRIVATE LIMITED
HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

CUSTOMER : AMRIT CEMENT LIMITED, MEGHALAYA

DES.	STK	17.01.25	PROJECT : 24185	CAD FILE : 2418503U101R0
DRN.	STK	17.01.25	PLANT LAYOUT OF PROPOSED AFR SYSTEM	
CHKD.	SKJ	17.01.25		
APPD.	DSA	17.01.25		
SCALE : 1:600			DRG. NO. 24185-03-IU-1-01	REV. 0

CAD FILE :- 24185031U102R0



FOR FEASIBILITY REPORT

CUSTOMER : AMRIT CEMENT LIMITED, MEGHALAYA

PROJECT : 24185

FLOW SHEET FOR
AFR SHREDDING, STORAGE
AND FEEDING TO CALCINER

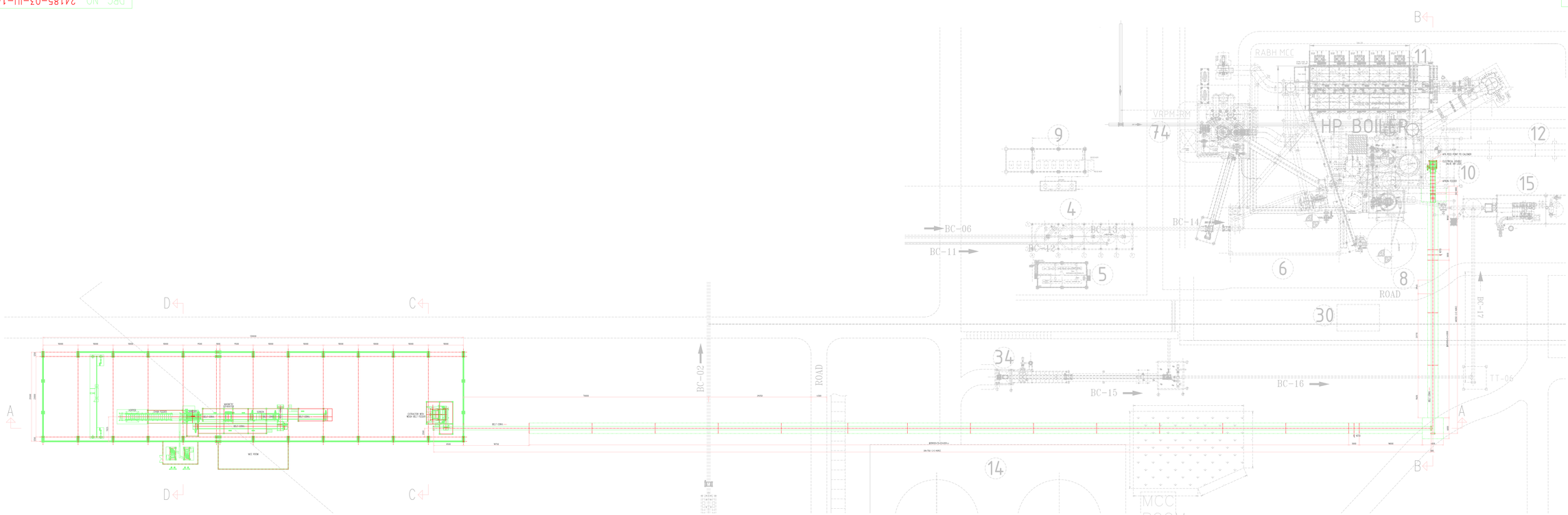
HOLTEC CONSULTING PRIVATE LIMITED

HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

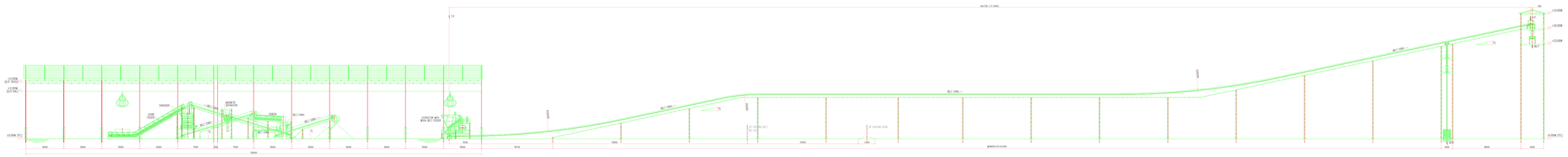
DRN.	CHKD.	APPD.	SCALE	DRG. NO.	REV.
STK	SKJ	DSA	NTS	24185-03-IU-1-02	0

DRG. NO. 24185-03-IU-1-03

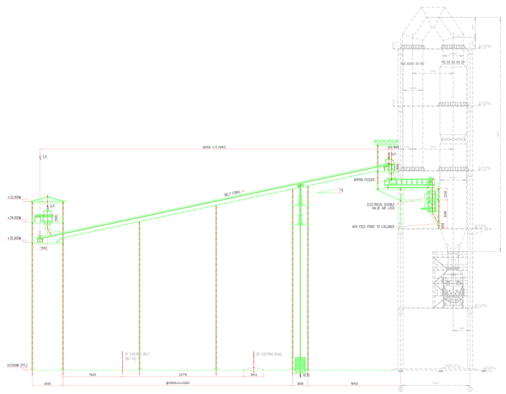
IF IN DOUBT ASK



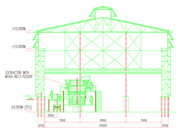
GENERAL PLAN



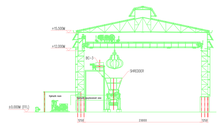
SECTION – AA



SECTION – BB



SECTION – CC



SECTION – DD

LEGEND	
EXISTING	
PROPOSED NEW	

FOR FEASIBILITY REPORT

REFERENCE NO. | DETAILS

R E F E R E N C E S

N O T E S

1. DO NOT SCALE, WORK TO DIMENSIONS ONLY.
2. FOR TOLERENCES REF. HOLTEC STD. DRG. NO. A1-HOL-STD-1-129

N O T E S

ALL DIMENSIONS IN MILLIMETRES

UNLESS OTHERWISE SPECIFIED

REV No	DATE	BY	CHKD	APPD	DETAILS

R E V I S I O N S

HOLTEC CONSULTING PRIVATE LIMITED
HOLTEC CENTRE, A BLOCK, SUSHANT LOK, GURGAON-122001 HARYANA, INDIA

CUSTOMER : AMRIT CEMENT LIMITED, MEGHALAYA

DES.	STK	17.01.25	PROJECT : 24185	CAD FILE : 24185031U103R0
DRN.	STK	17.01.25	GENERAL ARRANGMENT OF PROPOSED AFR SYSTEM BELT PROFILE	
CHKD.	SKJ	17.01.25		
APPD.	DSA	17.01.25		
SCALE : 1:600			DRG. NO. 24185-03-IU-1-03	REV. 0

CHAPTER 4: INVESTMENT COST

4.1 INTRODUCTION

Amrit Cement Limited (ACL) aims to maximize its Thermal Substitution Rate (TSR) up to 50% by leveraging its inherent potential and through carrying out modifications and addition in PH and AF pre-processing and co-processing system.

Summary of proposed Modifications are given below to achieve 50% TSR @ 2200 tpd sustained clinker production.

AFR Pre-processing & Co-processing system

- 2 Nos truck tippler (2 x 20 tph)
- One storage shed (covered) having storage capacity of 1,500 t for Plastic waste, 200 t for Rice Husk, 100 t for organic barrels & 200 t for preprocessed material
- Preprocessing System of 28 tph
- Co-processing system of 50 tph (Feeding belt conveyors to Calciner)
- Electrical Power distribution system for Preprocess & Co-process.

Modifications in Preheater

- Replacement of existing PH fans with new fan (already considered by ACL)
- Extension of Calciner
- Addition of one more cyclone in top stage (already considered by ACL)
- Enlargement of downcomer duct (already considered by ACL)

This chapter addresses the broad investment cost of the proposed modification in the cement plant.

4.2 INVESTMENT COSTS

The total capital cost estimate for the proposed 50% TSR project works out to be **Rs. 46.0 Crores (including GST),** Which includes:

1. Preprocessing including AF storage, Shredding
2. Co- Processing including AF transportation & feeding
3. Calciner Extension

New Preheater Fan & Top stage Cyclone Modifications are already under execution hence CAPEX not included

The details of total capital cost is shown in **Table 4.1**

SUMMARY OF INVESTMENT COST ESTIMATES

(In Lakhs INR Unless Specified Otherwise)

Sn	Description	Total Cost (Including GST)
1	Land and Site Development	10
2	Civil Works and Structures	1,150
3	Plant and Machinery	2,950
4	Engineering & Know How	90
5	Miscellaneous Fixed Assets including equipment for power distribution etc	260
6	Pre-Operative Expenses excluding IDC	140
	Total Investment Cost (1+2+3+4+5+6)	**4,600**

*Source: Holtec Analysis *Include Mechanical, Electrical & Civil costs*

Table 4.1: Project Cost Estimate

Estimated CAPEX for the proposed project for enhancing AF usage in the plant is estimated as **Rs ~4,600 Lakhs**

CHAPTER 5: PROJECT IMPLEMENTATION SCHEDULE

5.1 INTRODUCTION

This chapter covers the implementation planning/ scheduling for the proposed system for Pre-processing & Co-processing of alternative fuel as detailed in **Chapter-2&3.**

5.2 KEY FACTORS/ STRATEGY

The key factors that would facilitate successful and timely project implementation are:

- ❑ Proper choice of technology and machinery suppliers
- ❑ Adequate diligence in formulating the technical concept and system design/ selection of the plant
- ❑ Proper choice of contractors for civil construction and erection of equipment
- ❑ Formulation of a effective project team led by an experienced Project Manager
- ❑ Establishment of an efficient system for project planning & monitoring including reporting procedures for progress review and co-ordination
- ❑ Customization of project execution plan to suit the promoter's profile

The benefits of recognizing and addressing the key factors have been successfully demonstrated in most cement/ AF preprocessing & Co-processing projects executed in the recent past / currently under implementation.

Learning from the implementation strategies adopted in successful projects has been dovetailed with the profile of the promoters to evolve the most appropriate implementation strategy for the proposed project. The salient features of the proposed strategy are summarized below:

5.3 IMPLEMENTATION STRATEGY

Typically, any project has four core dimensions, viz.:

- ❑ **Engineering:** this directly impacts the smooth operations of the plant over its entire life.
- ❑ **Procurement:** is critical on account of the impact that it has on investment and performance benchmarks and also in ensuring the choice of appropriate technology.

- **Construction:** is critical in terms of its impact on completion quality and the duration of the project phase
- **Project Management:** other than its obvious impact on project timeliness it also contributes to risk minimization for the promoter.

"Zero date" for a project is generally reckoned as the date on which the contract for "main machinery" becomes effective.

The plant & machinery for a project can be procured in four modes:

- ➔ Turnkey
- ➔ Semi-turnkey
- ➔ Package
- ➔ Shopping

The four procurement modes are described below:

Turnkey — In the Turnkey mode, one single contractor is responsible for all project activities concluding with the handing over of the plant to the owner. The role of the owner is limited to appointing the turnkey contractor and making payments (for details refer **Annexure 5.1**).

Semi Turnkey — A variant of turnkey is the Semi-turnkey mode. In this case there are usually two agencies, one the supplier and the other the contractor. The supplier is responsible for all activities that occur offshore, i.e. outside the country/ project site. The contractor is responsible for all activities that occur on shore i.e. within the country/ project site (for details refer **Annexure 5.2**).

Package — In this case the plant is split up into functional process departments and procured accordingly. Several main suppliers are responsible for detailed engineering, manufacturing and supply. Similarly, multiple contractors are appointed to carry out on shore activities (for details refer **Annexure 5.3**).

Shopping In this case the client/ consultant formulates the basic design for the project and specify & procure equipment by discipline/ type (for details refer **Annexure 5.4**).

The pros and cons of these modes are described in **Annexure 5.5** and summarized in **Table 5.1** below:

Sn	Characteristics	Procurement Modes		
		Turnkey/ Semi-turnkey	Package	Shopping
1	Efforts on Co-ordination	Low	Medium	High
2	Execution Period	Low	Medium	High
3	Project Cost	High	Medium	Low
4	Project Cost Control	High	Medium	Low
5	Supplier Responsibility	High	Medium	Low

Table 5.1: Characteristics of Mode(s) of Procurement

For the proposed project for **ACL, Package mode** is recommended for project implementation, with the assumption that either a strong in-house project team shall be constituted and/ or the services of a professional Project Management agency, with a cement background, shall be utilized. The proposed solution shall help **ACL** in optimizing project investment and minimizing entrepreneur risk due to cost escalation.

5.4 IMPLEMENTATION SCHEDULE

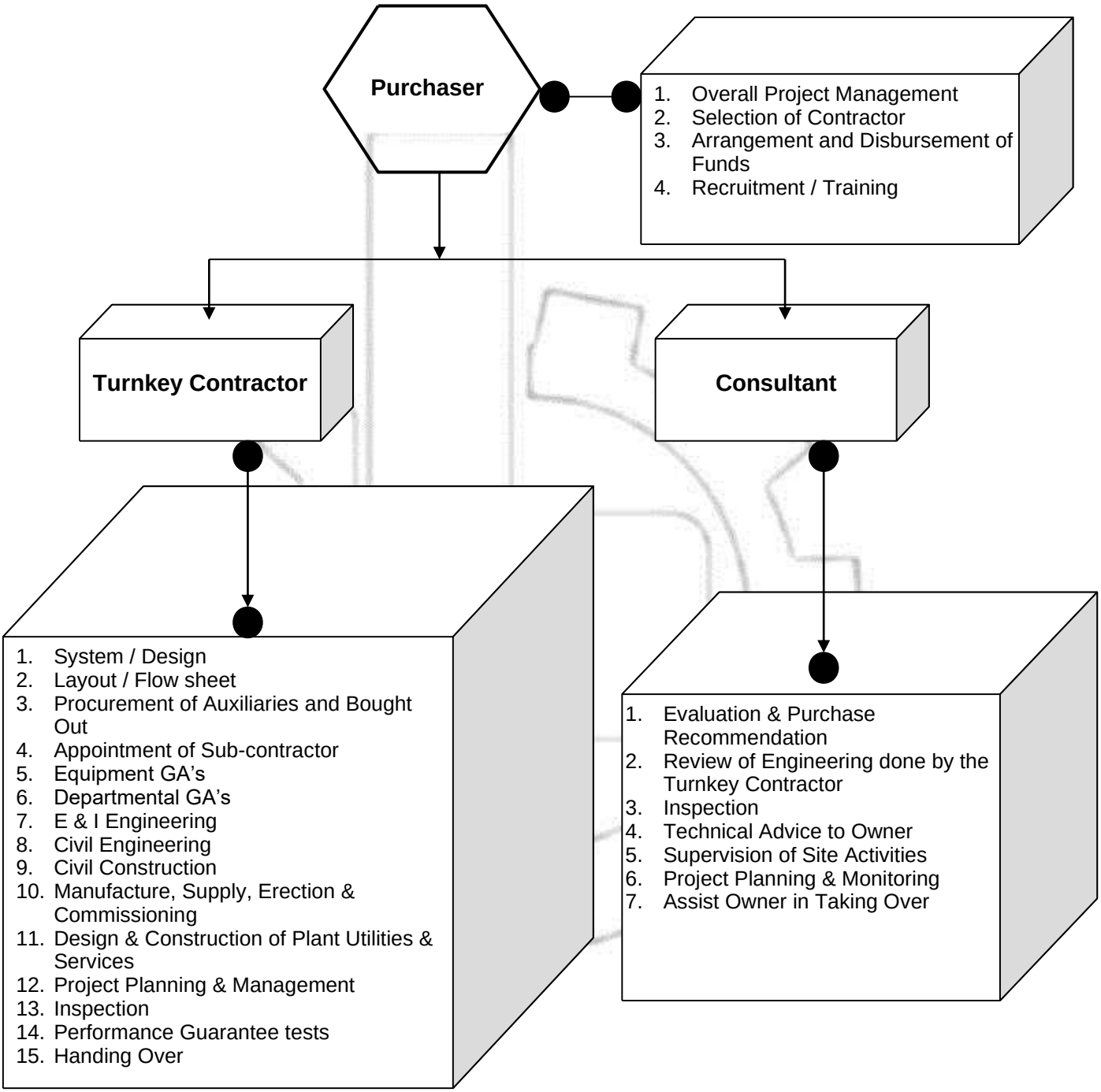
An implementation period of **12 months** is envisaged for the completion of the project activities, after Placement of Main Machinery Order.

For **Pre Project-Activities** (Till Placement of Main Machinery/ Equipment Order) **3 months** has been considered.

The implementation schedule is furnished in **Annexure 5.6** which illustrates the proposed implementation activities for the project.

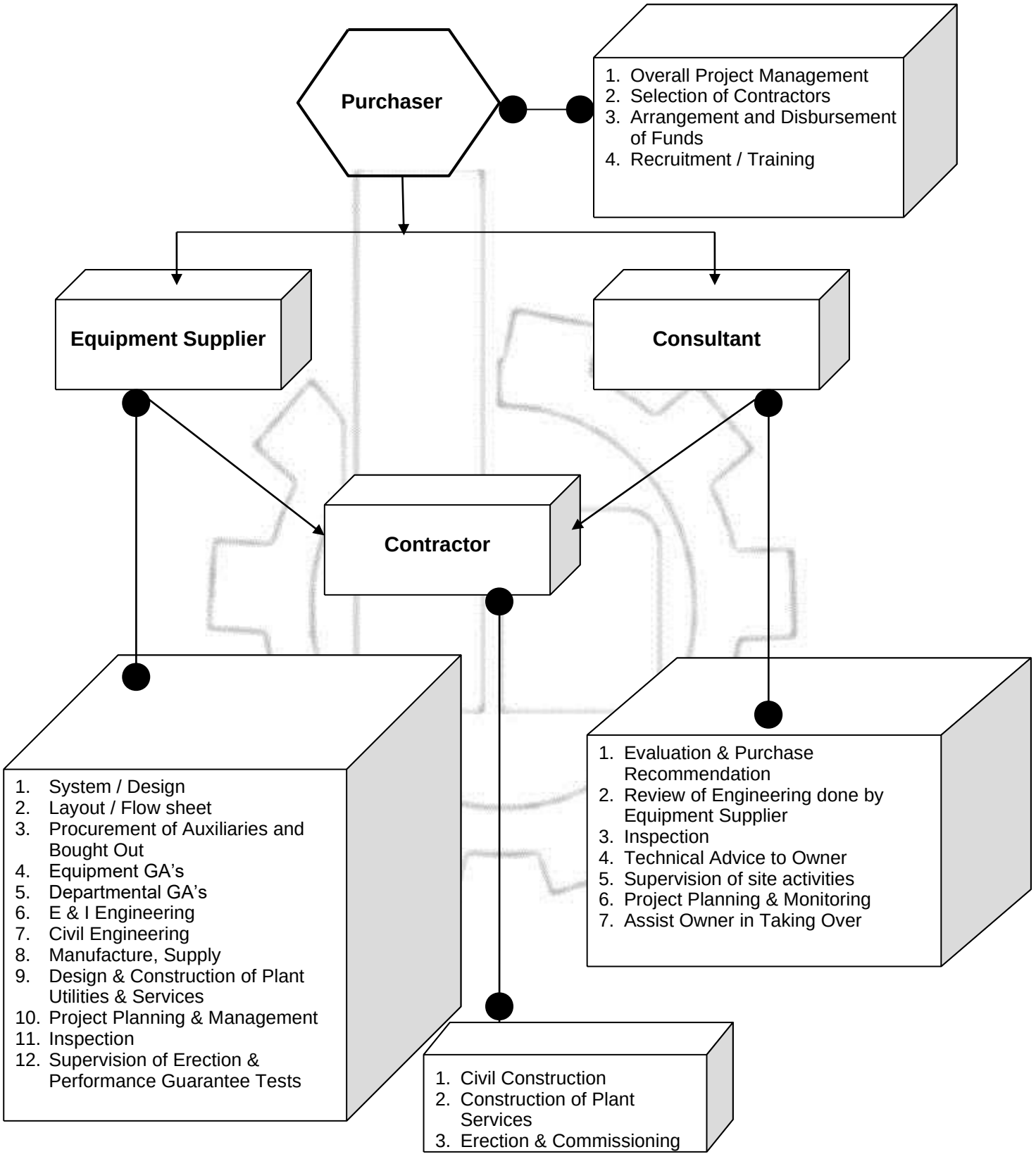
Annexure 5.1

PROJECT EXECUTION: TURNKEY



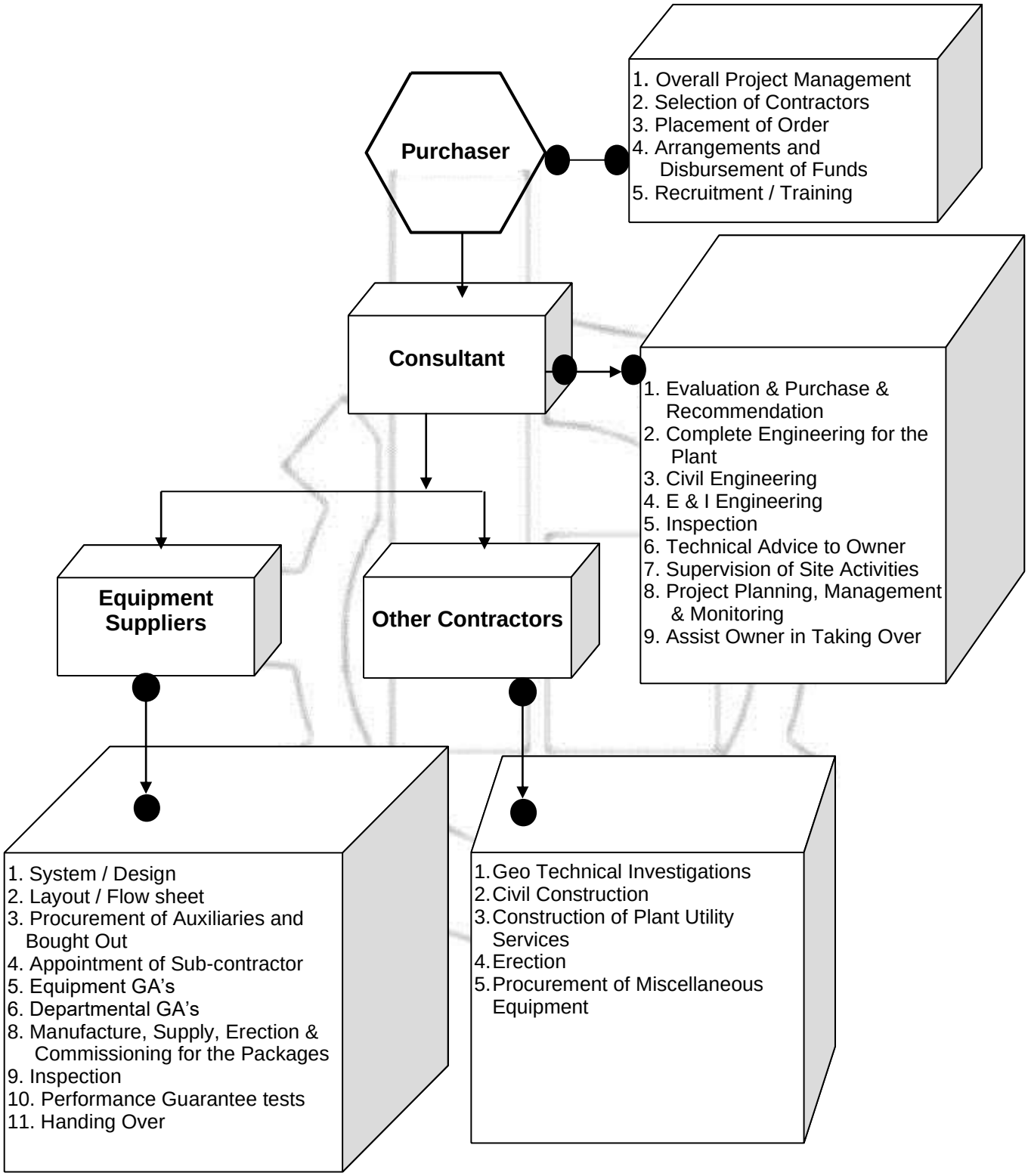
Annexure 5.2

PROJECT EXECUTION: SEMI-TURNKEY



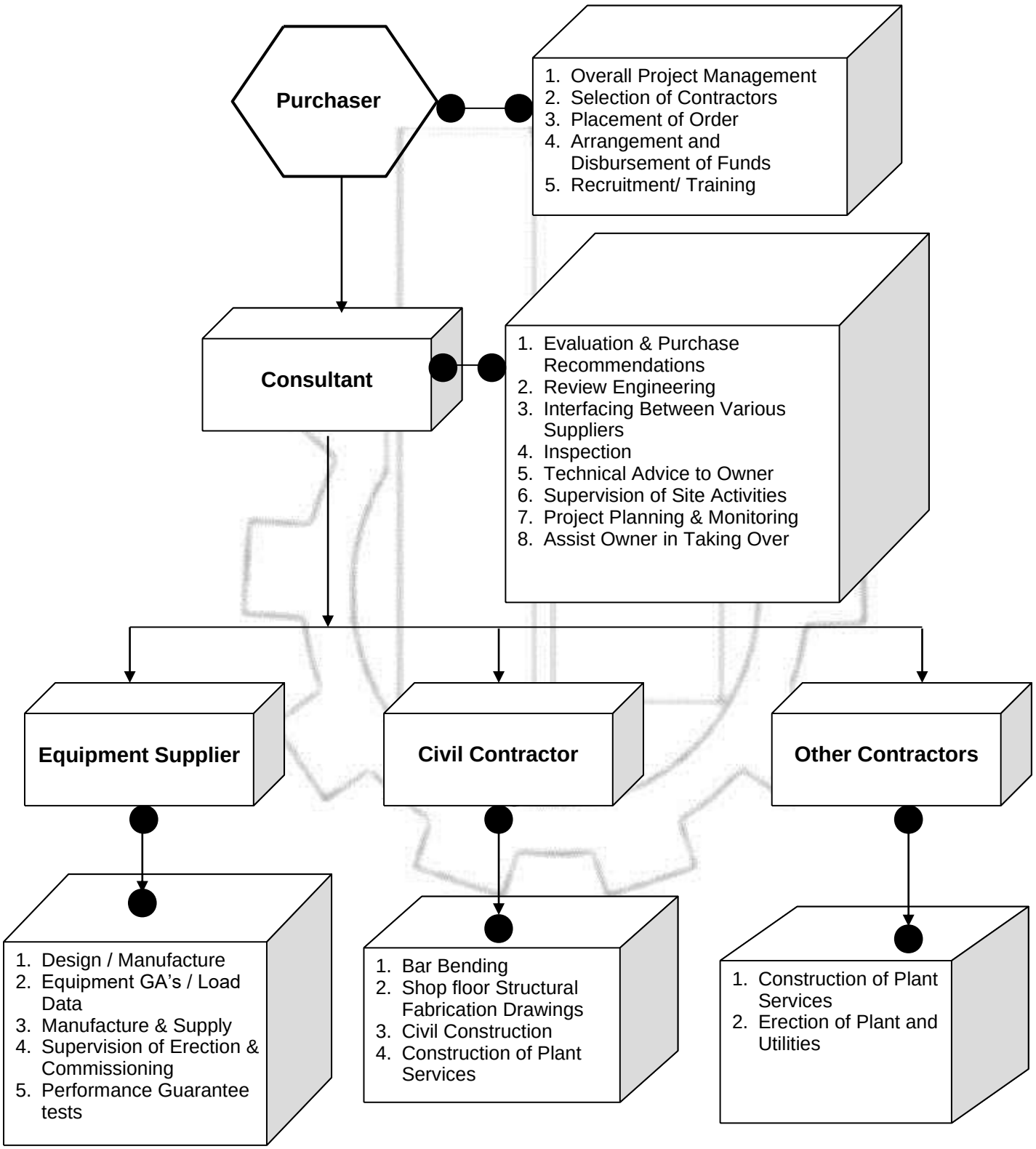
Annexure 5.3

PROJECT EXECUTION: PACKAGE



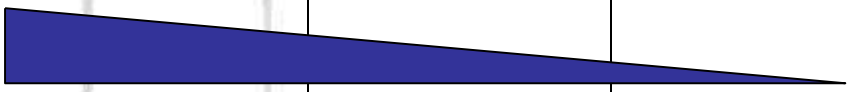
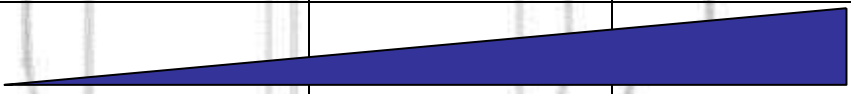
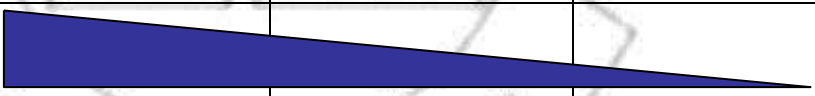
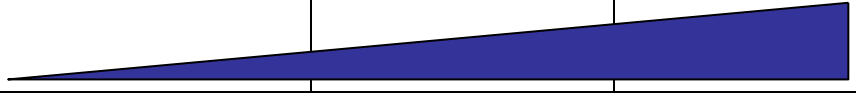
Annexure 5.4

PROJECT EXECUTION: SHOPPING



Annexure 5.5

COMPARATIVE: PROCUREMENT OPTIONS

Element	Turnkey	Semi-turnkey	Package
Choice of Optimum Process Equipment	Limited depending upon Contractor	All main equipment, limited for auxiliaries	Free Choice
Total Investment Costs			
Total Duration			
Performance Guarantee	Entire Plant	Entire Plant	By Department
Warranty	Undivided	Undivided	By Individual department
Execution Responsibility	Undivided	Partly	Consultant, Contractor(s), Client
Final Costs Known	At signing	At signing of both contracts	During execution or final at commitment
Risk of Cost Overrun			
Risk of Time Overrun	Moderate	Medium	Medium
Ability to obtain Insurance			
Client's remedy against Performance Failure	Claims based on total contract value	Claims based on total contract value	Limitation by counter claims of each package supplier
Requirements for Project Management			
Overall Risk			

Annexure 5.6

PROJECT IMPLEMENTATION SCHEDULE

Sn	Project Activity	Months														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Total Implementation Period															
A	**Pre-Project Activities**															
1	Approval /clearance(s) of project.															
2	Appointment of consultants for Procurement, engineering & other services.															
3	Preparation of tender document, Receipt of offer from bidders, Offer evaluation and ordering for AF utilization															
B	**Project Activites**															
4	Order Placement for Main machinery															
5	Design & Engineering.															
6	Civil Construction & Steel Fabrication (including new balancing Preheater)															
7	Inspection of equipment.															
8	Arrival of mechanical, electrical, instrumentation and control equipment at Site															
9	Erection of Electro-Mechanical equipment.															
10	Commisioning															

HOLTEC CONSULTING PRIVATE LIMITED

'**Holtec Centre**'
A Block, Sushant Lok,
Gurgaon - 122 001, Haryana, India
Phones : +91-0124-4047900, 2392940, 2385095*
Fax : +91-0124-2385114, 2385116
(from Delhi prefix '95124')
Email : info@holtecnet.com

Registered Office
01-0103 Imperial Tower, C-Block Community Centre, Naraina, New Delhi-110028
Phone : 25771002 Fax : ++91-11 25771001

HOLTEC

Capability Statement

APR 22

50+ YEARS EXPERIANCE

4,500 ASSIGNMENTS

90+ COUNTRIES

HOLTEC

TABLE OF CONTENTS

I. ABOUT HOLTEC

BACKGROUND

HOLTEC Consulting is an Indian consulting firm catering primarily to Cement, Captive Power Plants and Mineral based industries. Founded in India during **1967** as an engineering consultancy organization, the company has, over the ensuing period, grown to become a full-service, engineering & management consulting firm, delivering integrated services to its about **1000+** strong client base in **90+** countries including India. HOLTEC's exemplary track record, global exposure, ISO 9001 certified quality standards, infrastructure and independence from any manufacturing companies/ equipment suppliers/ EPC contractors, differentiates it sharply from its competitors and allows it to cost-effectively deliver high value and impartial services to its discerning clientele.

COLLABORATIONS & REGISTRATIONS

HOLTEC maintains active collaborations with a variety of international companies in order to source global business and share best consulting practices. Over a period of over three decades, it has enjoyed a close association with the Holcim Group of Switzerland, the undisputed world leaders in cement. HOLTEC also has project-to-project tie-ups with international consulting firms such as GHD Australia, CPG Consultants etc. Additionally, HOLTEC maintains close relationships with several research laboratories, specialised technology companies, market research firms and industry opinion leaders.

HOLTEC is registered with a variety of international bodies such as The World Bank, the Asian Development Bank, the African Development Bank, the Kuwait Fund for Arab Economic Development and several UN organizations. Domestically, it is registered with several Banks; bodies like the Ministry of Industry of the Government of India, all the principal development finance institutions, the National Highways Authority, etc. HOLTEC is also a member of the Confederation of Indian Industry and a founder member of the Consulting Engineers Association of India (CEAI) and the Consultancy Development Centre (CDC).

OUR TRACK RECORD

Over the last five decades, HOLTEC has executed **4,500+** assignments in **90+** countries. Many of these have merited specific customer accolades in terms of having exceeded customer expectations.

In recognition of its commitment towards service quality, HOLTEC has been awarded the ISO 9001 quality certificate by BVQI since 1995, for both engineering and management consulting.

HOLTEC has rich experience in the areas encompassing pre-investment studies, geological exploration & mine planning, equipment & service procurement, multi-functional basic & detailed engineering, project management including field services, performance enhancement in operations, environment audit & management, strategic planning, marketing, human resources, logistics, information systems, M&A investigations, Use of alternative fuel, waste heat etc.

OUR PRIMARY RESOURCES

HOLTEC today, comprises of **200+** professionals from various engineering and other disciplines. Diverse expertise is made available to our clientele in the fields of geology & mining, multi-functional engineering, project management, environment, marketing, human resources, information, investment analysis, strategic planning and other competencies required for executing assignments, holistically.

Each and every HOLTEC professional is carefully chosen and nurtured so that he/ she can provide the highest levels of professional service. Regular training, both in India and abroad and frequent work on demanding international projects, provides our consultants with global exposure and thus attunes them towards delivering international levels of service quality.

- Highly experienced, multi-disciplinary staff
- 53,000 sq ft of Owned Office Space in Gurgaon, India & Sharjah, UAE
- Contemporary Engineering Software: AutoCAD, Autodesk Civil 3D, Autodesk Revit, Autodesk Inventor, Autodesk Advanced Steel, Autodesk Robot Structural Analysis, Tekla Structures, SDS/ 2, STAAD, ETAP, Primavera, MS Project, Surpac, MX Road, etc.
- Proprietary Databases such as LDSS, Incem, etc
- Analysis Software for Process Engineering
- Proprietary Online Plant Analytics Platform
- Office Automation Software
- Video-conferencing Facility, Client Accessible FTP Site for File Exchange
- Systems such as ISO, Project MIS, etc
- Outsourcing Associates

INFORMATION TECHNOLOGY & DATABASE

Our state-of-the art IT resources in the form of hardware devices, software tools and communication infrastructure allow us to rapidly design, test and deploy new designs and concepts and maintain global databases. These also allow us to efficiently share information across our offices and with our clients.

By virtue of having executed **4,500+ consulting** assignments in India and abroad and having worked with all major equipment suppliers both Indian and international, HOLTEC has developed an excellent database on:

- Equipment suppliers/ contractors
- Equipment types and performance
- Plant Data (installations, consumption rates, operating costs, investments, manpower, operational experiences etc.)
- Raw Material Data (mineral concessions, characteristics of limestone deposits, correctives, blending materials, fuels, etc.)
- Operating Conditions (climatic, seismic, soil, hydrology, environment, etc.) Statute, legislation, incentives and taxation frameworks.
- Market Data (logistics, prices, demands, market characteristics, competition, etc.)

2. BUSINESS AREA

Incorporated in **1967**, HOLTEC Consulting Private Limited is an ISO-certified consulting company, primarily positioned to service the entire gamut of needs of the global cement industry. It also offers comprehensive services in the areas of Power, Highways & Bridges, and Engineering Support Services for Bulk Material Handling & Structural Steel Detailing. Its portfolio of services spans all disciplines of Engineering, Business Consulting, Geology & Mining, Project & Construction Management, Environment Management, Performance Enhancement, Logistics, etc. In addition, HOLTEC operates and maintains cement plants globally for its clients and also provides solutions encompassing the integrated delivery of services & products through its domestic & international group entities.

Since its inception, HOLTEC has delivered significant value to its **1000+** clientele comprising of cement producers, equipment & service providers, EPC & construction firms, infrastructure developers, investing & funding bodies and all other relevant stakeholders through **4,500+** consulting assignments in **90+** countries executed by its **200+** multi-disciplinary staff with an experience inventory of **6,300+** person-years.

CEMENT PLANT	POWER PLANT-CAPTIVE
❑ Integrated Unit ❑ Grinding Unit ❑ Blending Unit, Bulk Terminals ❑ Balancing, Modernization, Rehabilitation, Expansion Projects	❑ Solid Fuel Based ❑ Liquid Fuel Based ❑ Gas Based ❑ Waste Heat Recovery Based

BULK MATERIAL HANDLING SYSTEM	HIGHWAYS & BRIDGES	ENGINEERING SUPPORT & STRUCTURAL DETAILING
❑ Mining ❑ Process Plant & Power Plants ❑ Ports etc	❑ National Highways, State Highways ❑ Flyovers, Railway Over Bridges, Grade Separators ❑ Junctions & Intersections, Tunneling, Subways, Underpass	❑ Convocation Centers ❑ Commercial Buildings, Schools etc

3. RANGE OF SERVICES - CEMENT INDUSTRY

HOLTEC provides comprehensive & integrated solutions for all phases of a cement project. For the planning stage we provide services such as establishing feasibility of mines, plants & markets, including doing due diligence on existing assets. For the plant building stage, we provide services to specify, procure, engineer and manage the entire project from design through commissioning. Once projects are operational, we provide services for optimizing performance, operating & maintaining plants, integrating WHR & AFR, improving marketing efficacy, etc. Our substantial experience includes:

- **230+ New Cement Lines and Major Plant Upgradations, including 50+ split Grinding Units**
- **1,200+ Plant Modification Assignments**
- **300+ Plant Audits & Performance Enhancement Assignments**
- **600+ Raw Material Investigation & Environment Assessment Assignments**
- **1,200+ Business Consulting Assignments, Including 750+ Feasibility Studies**
- **120+ Captive Power Plant Assignments, 50+ Waste Heat Recovery & 20+ Alternate Fuel Assignments**
- **Operations & Maintenance Experience Across Multiple Integrated Plants and Grinding Units**

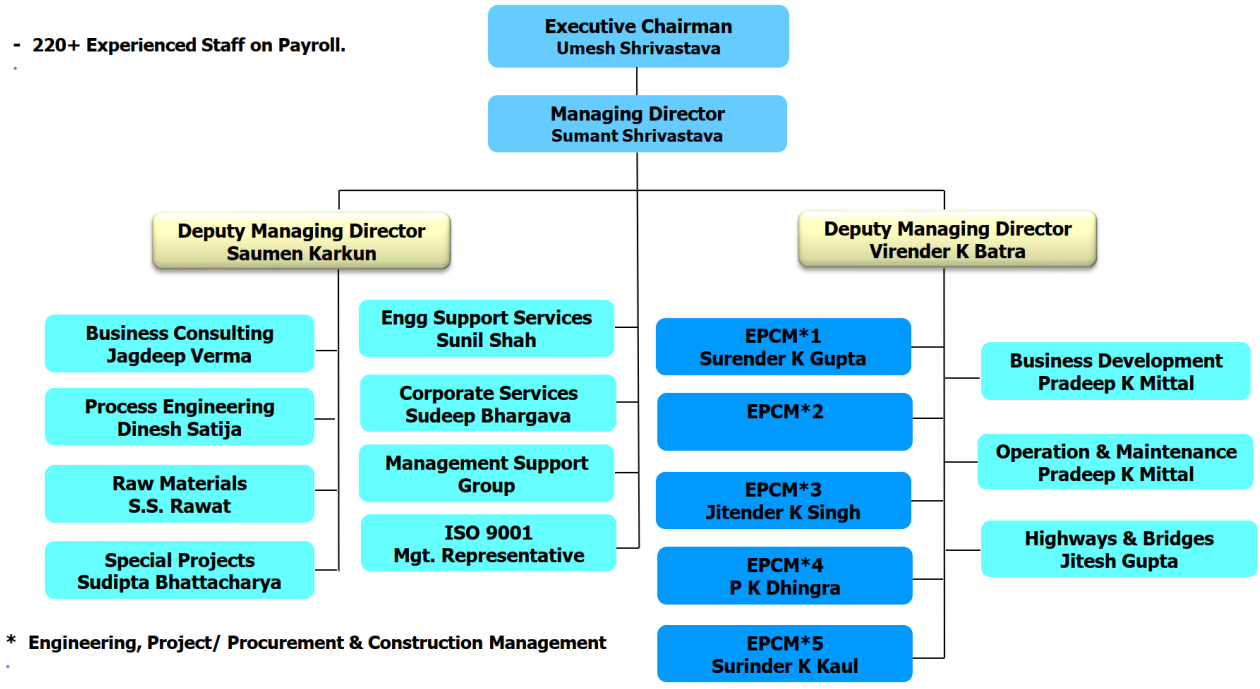
HOLTEC offers a wide range of services from concept to commissioning for green-field, modernization/ conversion/ expansion of cement as well as Captive power plant/ Waste heat recovery-based power plant projects. In addition, HOLTEC also offers consulting services in the operation and management of cement units. The entire service range could be categorized into the following 3 phases:

Pre Project Phase	Project Phase	Operation Phase
• Investment Opportunity and Due Diligence Studies • Strategic Plant Location • Techno-Economic Feasibility Studies • Raw Materials • Environmental (EIA/EMP) Studies • Statutory Mining Plans and Computer Aided Deposit Evaluation • Data/ Information Services	• Basic Engineering • Procurement • Detailed Engineering • Inspection • Project Planning and Monitoring • Field Supervision • Commissioning and Plant Stabilization Services • Mine Scheduling & Optimization • Market Entry & Distribution Planning • Project Due-Diligence	• Balancing, Modernization, Rehabilitation, Expansion Projects • Plant Audits • Alternative Fuel Utilization • Plant Operation & Maintenance • Asset Management • Civil & Structural Assessment • Mining Operations Enhancement • Business Process Enhancement

4. ORGANISATIONAL STRUCTURE

At **HOLTEC**, we recruit highly capable professionals and through our meritocratic work culture, organizational experience & structured systems enable them in becoming industry-leading performers. Our large team of professionals, located in four offices in India and the UAE, comprise of highly qualified engineers (civil, mechanical, electrical, chemical & mining), geologists, strategy & market specialists, HR specialists, finance specialists, highway & bridges specialists, draftsmen, etc. It is because of the commitment of our team that we are able to deliver innovative & comprehensive solutions that typically exceed client expectations in our areas of operation, viz: Cement, Power, Highways & Bridges and Engineering Support & Detailing.

HOLTEC is a cross-functional organisation consisting of dedicated specialists and multi-disciplinary professionals, structured as shown below, and put HOLTEC is in a unique position to service competency requirements of consultancy



Each and every HOLTEC professional is carefully chosen and nurtured so that he/ she can provide the highest levels of professional service. Regular training, both in India and abroad and frequent work on demanding international projects, provides our consultants with global exposure and thus attunes them towards delivering international levels of service quality.

5. LIST OF KEY PERSONNEL

NAME	DESIGNATION	EDUCATIONAL QUALIFICATIONS	EXP (YRS)	YEARS WITH FIRM
Umesh Shrivastava	Executive Chairman	BSc Engineering (Civil) AMP USA	68	54
Sumant Shrivastava	Managing Director	MS (Comp Sc), MBA	31	25
V K Batra	Dy. Managing Director	MSc (Hons), Mechanical	54	47
S Karkun	Dy. Managing Director	BE (Electrical), MBA	49	43
S K Gupta	Chief General Manager	BSc Engineering (Mechanical), ME	51	47
P K Mittal	Chief General Manager	B. Tech (Mechanical) MBA	47	39
J K Singh	Chief General Manager	BE, Mechanical	46	45
S K Kaul	Chief General Manager	BE, Electrical	41	31
S S Rawat	Chief General Manager	MSc. Geology	41	32
Jagdeep Verma	Chief General Manager	MBA, Finance & Marketing	30	19
Jitesh Gupta	Chief General Manager	BE(Civil), M Tech Geo	28	9
Dinesh Satija	Sr. General Manager	BE, Chemical	34	19
Sudeep Bhargava	Sr. General Manager	Chartered Accountant	29	8
Pawan K Dhingra	Sr. General Manager	BE, Mechanical	34	25
M. Khalid Umar	Sr. General Manager	MSc. Civil Engg	33	26
T C Jindal	Sr. General Manager	BE, Elec. & TC	31	26
Sudipta Bhattacharya	Sr. General Manager	BE, Ceramic	26	4
Rajesh Gupta	General Manager	BE, Electrical	34	15
Naiyar Azam	Addl General Manager	B.Sc. Engg (Mech), MBA	36	15
Sunil Sah	Addl General Manager	Diploma, Civil	30	20
Sandeep Taneja	Addl General Manager	M.Sc Tech (Geology)	31	16
Shripal Jain	Addl General Manager	AMIE, Mechanical	26	15
Puneet Nigam	Dy General Manager	PhD, Geology	31	22
N K Doshi	Dy General Manager	AMIE, Electrical	33	10

6. OUR DISTINGUISHING FEATURES

- **We believe in Innovation**

  Given our global experience and information access, we have many 'firsts' in terms of adopting new technologies, methods of project execution and effecting plant improvements. In addition, we have innovatively developed a vast repertoire of tools & techniques that find practical application in multi-functional consulting situations.

- **We believe in Integrated Solutions**

  We believe that most issues facing companies have multi-functional interfaces and can be solved by adopting a holistic approach. As a consulting practice therefore, we involve multi-functional teams in each individual consulting assignment, irrespective of its specific functional focus. This precludes us from delivering solutions, in which the gain in one function is offset by losses in others.

- **We believe in Implementation**

  Consulting history, especially in India, is replete with instances of solutions, which though theoretically sound, are extremely difficult to implement. These end up as beautiful reports, languishing in resplendent cabinets. We believe that our customers have invariably benefited from our innate skills in participating in the hands-on process of actual implementation.

- **We believe in Benchmarking**

  A major strength of our consulting interventions is our ability to use national and international databases for performance benchmarking. This enables our customers to be aware of the best operating practices, worldwide, and prevents the adoption of a head-in-the-sand approach to being satisfied with internal, local, and time-based comparisons.

- **We believe in Quantification**

  It is our firm belief that everything that merits improvement can be quantified, either parametrically or non-parametrically. This enables us to generate performance measures that can be tracked for each and every consulting intervention.

- **We believe that Ownership of Solutions is Important**

  Since it is people who finally implement solutions, obtaining ownership is extremely critical. Our consulting process thus adopts the head plus heart approach. Head level acceptance of our solutions is ensured through hard core analysis and sound experiential logic. Heart level acceptance is invoked through process involvement, aimed at transmitting the imperative of change-from-within.

- **We believe in Doing-it-Together**

  Our consulting interventions steer clear of the we-they syndrome that often prevents clients and consultants from working synergistically. Our assignments, therefore, invariably commence with setting up a joint team, in which the respective strength domains of each member, are tapped to its full potential.

7. CLIENTS LIST - PARTIAL

India

ABG Cement, Abhijeet Group, ACC, Adhunik Group, Ambuja Cements, Andhra Cement, Biltech Building Elements, Birla Corp., Calcom Cement, Cement Corporation of India, Cement Manufacturing Company, Chettinad Cement, Dalmia Group, DCM Shriram Group, Deccan Cement, Hindustan National Glass Industries, India Cements, Indiabulls Group, J K Cements, Jaiprakash Group, Jammu & Kashmir Cement, JSW Cement, KJS Cement, Malabar Cements, Mangalam Cement, Mawmluh Cherra Cements, Meghalaya Cements, Metso Minerals, MSP Group, National Thermal Power Corporation, Nirma, Orient Cement, Reliance Cementation, Sanghi Industries, Saurashtra Cement, Shree Cement, Sterlite Industries, Tamil Nadu Cements, Tata Power; UltraTech Cement, Usha Martin, Vinay Cements, Wonder Cement, Zuari Cement

Asia (except India)

Afghan Investment Company, Attock Cement, Bestway Cement, Chakwal Cement, Dandot Cement, Donglam Cement, Dungsam Cement, Fecto Cement, Fico Tay Ninh Cement JSC, Ha Tien 1 Cement, IHI Japan, Kobe Steel, Lucky Cement, Morning Star Cement, Norm LLC, Penden Cement, Puttalam Cement, Vietnam Construction & Import-Export Company

Middle-East

Al Jouf Cement, Al-Rajhi Investments, City Cement, Emirates Cement, Hail Cement, Kuwait Cement, Najran Cement, National Cement, Northern Region Construction Company, Qatrana Cement, Riyadh Cement, Saudi Cement, Southern Province Cement, Tabuk Cement, Yemeni Saudi Cement

Africa

Al Takamol Cement, Algerian Cement, Alnsr Cement, ASEC Cement, Atbara Cement, BSA Group, Cimerwa Cement, Dangote Industries, Derba Midroc Cement, Egyptian Cement, Messebo Cement, Orascom Construction Industries, United Cement of Nigeria

Europe, America, Oceania

Aalborg Portland Cement, Cementir, Cementizillo, Ciments Francais, FCB Ciment, Irish Cement, Titan Cement, Vigier Group, Vicat Cement, Ausenco, Battelle Memorial Institute, CLI Corporation, Prospect Steel

Financial Institutions

Axis Bank, Canara Bank, Citibank, Deutsche Bank, Ecobank Development Corporation, HSBC Bank, Industrial Development Bank of India, International Bank for Reconstruction and Development, International Finance Corporation, J P Morgan, Punjab National Bank, State Bank of India, Swiss Agency Cooperation, The World Bank, U S Aid, UNDP

8. EXPERIENCE DETAILS

GENERAL	With **50+** years of experience in the international Cement Industry, HOLTEC has developed a unique position in the cement-consulting sector. With a multi-disciplinary team of **250+** qualified personnel, HOLTEC represents a one-stop consulting point for executing cement projects from concept to commissioning. Over the period, HOLTEC has additionally developed specialist experience in the area of performance enhancement of existing units through technical as well as management-related interventions. HOLTEC has also specialized in rendering complete range of services for captive power plants based on all type of fuel as well as waste heat recovery-based power plant.
BUSINESS CONSULTING	**PRE-INVESTMENT STUDIES** These services are aimed at evaluating options available for investment. Constituting facets are choice of country, industry sectors, make or buy decisions, etc. The final output recommends whether to invest, and if so in what, where and how much. Country scanning, Market Transparency, Option Analysis for Capacity/ Location and Due Diligence are typical covered under this set of services. These have been undertaken for both clients in India and abroad and include studies financed by International funding agencies. **Techno-Economical Feasibility Report, Techno-Viability Report, Site Locational Analysis Report etc.** Techno-Economic Feasibility Studies/ Detailed Project Reports is to determine the technical feasibility and financial viability of the project, assess the risks associated with the project and enumerate imminent actions that are required. It helps a client get a detailed evaluation of a project. HOLTEC has been involved in over **750+** pre-investment studies (Techno-Economical Feasibility Report, Techno-Viability Report, Site Locational Analysis Report and Detailed Project Reports) for both Greenfield and expansion/ modernisation cement projects. A partial list of some of these assignments are presented in **Annexure I (A)**. **Market Studies Report, Market Opportunity, Marketing Business Plan etc.** Market Transparency gives a clear understanding of the cement market for both a new player venturing into the industry, as well as an existing player. It is important to understand:

- Market dynamics today and tomorrow, covering demand, supply, prices, competition, product mix, etc.
- Cost structure in the industry.
- Opportunities and threats.
- Risks and mitigation measures.

HOLTEC has developed considerable expertise in this area by virtue of completing over **230+ assignments**, in addition to TEFR. HOLTEC has undertaken numerous market-related studies including those that required the formulation and implementation of marketing action plans for various clients in India and abroad.

The experience details for undertaking such assignments are enclosed as **Annexure I (B)**.

Acquisition Assistance, Project Valuation, Due-Diligence, Investment Opportunity etc.

In today's age of integrated consulting, HOLTEC is, perhaps, one of the very few consulting companies in the world that has effectively amalgamated its expertise in both technical and management consulting to deliver total solutions to its discerning clientele.

The experience details for undertaking M&A, due-diligence assignments are enclosed as **Annexure I (C)**.

RAW MATERIAL SERVICES

Our geologists, armed with a diverse knowledge of deposit characteristics, availability status and site conditions assist customers in narrowing down a wide span search, to a single deposit. Our strength is our extensive database and our rich analytical experience with over three hundred deposits globally.

Geological Reconnaissance Survey.

Geological Reconnaissance Survey is to conduct a geological reconnaissance of an area for assessment and establishment of the likely available reserves and quality of limestone. This study is generally carried out for filing of Prospecting License (PL) / Mining Lease (ML) application.

Site Identification Study.

Site Identification Study is to identify suitable site(s) to sustain an envisaged capacity cement plant. This is a macro-level study that broadly demarcates the potential area bearing major raw materials for cement manufacture. The study

also broadly considers aspects like market potential, infrastructural facilities, fuel availability etc. for selecting the most suitable site.

Computer Aided Deposit Evaluation.

Computer Aided Deposit Evaluation is to:

- Achieve enhanced knowledge of the deposit and ensure its optimum utilization.
- Ensure cost effective mining operations and raw mix design for effective production planning and extend deposit life.

Mine Planning.

Mine Planning is to ensure optimized and economic extraction of a mineral on a sustainable basis. The Mining Plan is prepared in conformity with Mineral Concessions Rules of National/ International authorities for its approval.

Mine Scheduling & Optimization.

To ensure proper exploitation of minerals from the mines, minimizing costs and maximising deposit life; mines scheduling is carried out by our geologists & mining engineers using contemporary software platforms, successfully implemented in over 60 large cement plants across the world.

Mine Scheduling and Optimization involves use of Computer Aided Deposit Evaluation (CADE) and Quarry Scheduling Optimization (QSO) to plan most optimal mining schedules.

HOLTEC has provided for a large number of cement plants in India and abroad services related to prospecting, Geological investigations, EIA/EMP studies, preparing mining plan and Mine Scheduling & Optimization during plant operation. The experience details for undertaking such assignments are enclosed as **Annexure II.**

DESIGN, ENGINEERING & PROJECT MANAGEMENT SERVICES

GREENFIELD + EXPANSION

HOLTEC had provided Design, Engineering & Project Management services from concept to commissioning for the first 1,200 tpd dry process cement plant in India of Madras Cement in Tamil Nadu, which was commissioned in 1976. Since then, HOLTEC has provided comprehensive services for setting up 125+ Greenfield cement projects from concept to commissioning including 98 integrated projects of capacities ranging from 3,000 tpd to 10,000 tpd, including 50+ split grinding units. Details of these green field cement projects are shown in **Annexure III**. However, consulting scope of these projects are enumerated in **Annexure VIII.**

Basic Engineering.

Basic Engineering service is to formulate and firm up project implementation technical dimension. It has two key elements viz (a) technological consideration and (b) initiating plant engineering. In addition, various studies required for project implementation are formulated at this point. Equipped with a large continuously updated database and wide international experience, our specialists design the most optimum technological concept for the project.

Procurement Services.

HOLTEC has been involved in the procurement of over US $3.5 Billion worth of cement industry plant, machinery and spares to date, for all its clients globally. Procurement Assistance service caters to selection and appointment of partners for the project during construction encompassing technological partners, plant & machinery suppliers, and service providers for On-site works.

Detailed Project Engineering.

Detailed Project Engineering is the core service provided by our engineers' as an integrated engineering service. Integrated engineering, by a multi-disciplinary engineering team, is to ensure seamless integration of plant O&M needs (productivity, design duties) and engineering requirements for building up of plant.

With mechanical, electrical, instrumentation and civil/ structural engineering services along with process & raw material capabilities available under one roof and interlinked through a Local Area Network, the customer is assured of completion of engineering activities in the shortest possible time and without rework. Past experience with similar equipment and painstakingly created databases ensure a continuous supply of data, documents and drawings to the site for uninterrupted work.

Equipment Inspection.

Equipment Inspection services are specialized services delivered at manufacturing workshops of suppliers/sub suppliers by the experts with functional domain knowledge.

Correction at the workshop itself is the basic philosophy pursued by our inspection specialists, employing stringent quality standards, to save precious time during erection and commissioning.

Site Supervision Services.

On Site Field services are specialized supervisory services rendered by functional experts in the multi discipline domain for installation of cement plant in a cohesive manner.

Engineers specializing in civil construction, structural fabrication and equipment erection provide designer supervision during the implementation phase of the project. They, additionally, assist in start-up and plant commissioning by ensuring that individual items of plant and machinery and the department/ plant as a whole, meet performance criteria as laid down in the specifications, both qualitatively and quantitatively.

Modernization/ Up-Gradation Projects

The Modernization/ Up-gradation projects (Major) undertaken by HOLTEC covered the following areas in the plant i.e.

- Pre-heater modifications through addition of high efficiency cyclone, addition of Pre-calciner, Modernization of process fans, Addition of new Pre-heater and pre-calciner stream.
- Conversion of wet process to dry process
- Conversion of Pneumatic kiln feed system to Mechanical kiln feed system
- Cooler Modifications (Conversion from planetary cooler, conventional cooler to high efficiency grate cooler)
- Modernization/ Automation of Material handling systems
- Up-gradation of grinding systems to increase output /efficiency and improve product quality
- Increasing grinding capacity by installation of pre-grinders / high efficiency separators / vertical roller mills etc.
- Up-gradation of Packing, bagging / bulk loading facilities
- Kiln / Burner modifications etc.
- Usage of Alternative fuels

PROJECT PLANNING & MONITORING

Project Planning, Monitoring and Progress Reporting is a super specialty service rendered by an integrated team of high caliber managers and engineers with domain knowledge of cement plant construction & project implementation. Uniqueness of service being blending of experience for On-Site plant construction activities and expertise of engineers with sound IT skills. Reports.

This brings transparency to client's top management or bankers about actual ground reality and recommendations & measures for balance work.

The experience details for undertaking such assignments are enclosed as **Annexure IV**.

ALTERNATIVE FUEL & RAW MATERIALS	Alternative Fuels and Raw materials (AFR) usage in the production of cement clinker becomes a key to reduce fossil fuel & raw material consumption/ cost optimization and Greenhouse gas emissions as environmental obligation for the society. At the same time, its usage has an impact on plant operations including production as well as product quality. Therefore, it is very important to evaluate each type of AFR and study its impact on plant operating and quality parameters through Impact Assessment Study. The services offered by HOLTEC in this field are: • Evaluation of various types of AFR available, process requirements, compatibility with existing system & modification required for each AFR with broad Capex estimate and simple payback • Study the impact of use of available AFR on clinker production, product quality, emission, equipment performance, plant stability, refractory etc. at different level of %Thermal Substitution Rate (TSR) HOLTEC has been providing consulting services for use of Alternative Fuel in the cement & captive power plants in India and abroad, for last nearly 2 decades. A partial list of such assignments is given in **Annexure V**.
PLANT AUDIT / OPTIMIZATION STUDIES	Enhancing productivity, improving plant availability & product quality and reducing the energy consumption in an operating cement plant is the need of the hour. HOLTEC is engaged in carrying out plant operations audit/ optimization studies involving high caliber analytical team with domain knowledge of cement plant processes through process measurements The study identifies the measures to optimize the plant operations with Action Plans for implementation, covering operational de-bottlenecking, establishing potential plant capacity, improving key performance indicators, product quality, environment etc. The Action Plans provides description of the suggested intervention, expected benefits, time for implementation, estimated capex and payback period under following scenarios: • Without Investment • With marginal investment (Investment requiring less than 2 years payback) • With major investment

CAPACITY ENHANCEMENT STUDIES	The objective of such study is to unleash the hidden potential of all major equipment and auxiliaries and identify the shortfall through capacity assessment and balancing so as to propose up gradation of existing equipment or propose additional equipment to meet the target capacity ensuring: • **TECHNICAL FEASIBILITY** of setting up additional equipment/ modifications of existing equipment confirming: - Ease of doing modification with minimum plant shutdown - Adequacy of infrastructural facilities - Layout feasibility - Access to other equipment for maintenance jobs - Environmental control and safety measures • **Minimum Investment Cost** • **Minimum Project execution time** HOLTEC has successfully carried out many capacity enhancements studies with target of exploiting the full potential of the plant with substantially low specific investment per annual tone of cement and shorter project execution time vis-à-vis a Greenfield project/ Brownfield expansion project.
PROCESS & PRODUCT QUALITY SUPPORT	Such services are offered by HOLTEC based on customer's specific trouble shooting requirements related to plant operational problems and issues related to Product quality enhancement, through deputation of specialists. Following are the broad coverage: • Provide support in identifying the operational issues by carrying out process observations, discussions with the plant team and conducting process measurements wherever required. • Provide support to plant operators in the control room for optimizing the plant operation. • Provide assistance to the plant team in rectifying the operational issues to the extent possible. • Product quality Bench marking and enhancement support through Optimization of raw mix design, fineness of raw materials, intermediate & final products and usage of performance enhancers. • **CFD simulation services** to provide detailed information of fluid velocity, pressure and flow distributions, turbulence kinetic energy and other variables in the process. HOLTEC has carried out **300+** comprehensive studies for a large number of existing cement plants in India and abroad to identify capacity optimization/ performance enhancement potential. A partial list of such studies is presented in **Annexure VI**.

CAPTIVE POWER PLANTS **WASTE HEAT RECOVERY BASED POWER PLANT**	Our clients have full confidence in our long experience from concept development to construction management and plant commissioning. Our in-depth familiarity with cement process and all the influencing factors also provides a sound basis for optimum sizing, operation of **Captive Power Plants as well as Waste Heat Recovery based Power Plant** for cement plants in conjunction with available grid supply. HOLTEC has been involved in pre-investment studies (Feasibility, and Detailed Project Reports), Procurement, Design, Engineering & Project Management services for both greenfield and expansion of power plants. These have been undertaken for both clients in India and abroad and include studies financed by International funding agencies. HOLTEC successfully completed first Captive thermal power plant for Jaypee Rewa Cement in India in Satna, which was commissioned in 2000. Since then, HOLTEC has provided **over 180+ power** plant engineering assignments **comprising 120 + fuel** based **Captive Power Plants** using **Solid fuel**, **Liquid fuel**, **Gas** based and **60+ Waste heat** based, in India and abroad. A partial list of such assignments is given in **Annexure VII**.
TRAINING	HOLTEC offers training services for strengthening the capabilities of plant officials (process engineers, section in-charges and plant operators) in Pyro-process, Raw Material, Fuel & Cement Grinding through an interactive workshop/ training program covering the following broad aspects under various modules: • Plant Operation & Control • Assessment of key design and operating parameters • Plant optimization • System Configuration • Technological Advances Various training modules include Pyro-processing, combustion Technology, Material Grinding, Mass Gas & Heat Balance, Process Fans, AFR utilization, Waste heat recovery system, Monitoring, Measurement, Calculation & Analysis etc.

Partial Reference List

Table of Content

I. Business Consulting Service

A. Techno-Economical Feasibility Report, Techno-Viability Report Site Locational Analysis Report etc.

Country	Number of Clients	Number of Assignments
India	285+	600+
50+ (excluding India)	100+	170+

	Client Name	Project Location	Project Description
1.	Lafarge Building Materials Holding	Algeria	CIBA - White & Grey Cement Feasibility Report
2.	Arabian Gulf Cement Co	Angola	TEFR for Cement Grinding Unit & a Cement Terminal
3.	Ultratech Cement Ltd	Bangladesh	TEFR for a Grinding Unit
4.	Jk Cement Ltd	Bhutan	Pre-Feasibility for a Integrated Cement Plant
5.	Tl Cement Lda	DR of Timor-Leste	TEFR and an EIA Study Report for a 1.5 mio tpa Greenfield Integrated Cement Project
6.	Longulf Trading (Uk) Ltd	Ethiopia	Evaluation of Investment Alternatives
7.	Eta Ascon Group Of Companies	Germany	TEFR for cement facility at Rostock, Germany
8.	Pt United Tractors Tbk	Indonesia	Market Transparency and Option Analysis Study
9.	Al Rehab For Building & Construction	Iraq	TEFR for 5,000 tpd Integrated Plant in Erbil
10.	Al Rajhi Investments	Jordan	TEFR for Grey Cement Project
11.	Arabian Gulf Cement Co	Kuwait	Cement Study for new cement Grinding Unit
12.	Cement Industries (Sabah) Sdn Bhd	Malaysia	TEFR for expansion of Grinding Unit
13.	Groupe Bsa	Mauritania	TEFR for clinker grinding plant
14.	Longulf Trading (Uk) Ltd	Mozambique	Location Option Analysis Study
15.	Amrit Cement Nepal Pvt Ltd	Nepal	Location Option Analysis Study
16.	Mangal Cement Company	Nigeria	Location Option Analysis Study & Techno Economic Feasibility Study Report
17.	Cimenterie Du Rwanda	Rwanda	Cement Market Scenario and Financial Analysis
18.	Red Sea Cement Factory	Somaliland	Option Evaluation and TEFR in Somaliland

Client Name		Project Location	Project Description
19.	Lafarge Building Materials Holding	South Africa	TEFR for 2.0 MTPA Cement plant
20.	Puttalam Cement Co Ltd	Sri Lanka	Prefeasibility for grinding unit in Colombo
21.	Holderbank Management & Consulting Ltd	Sri Lanka	Assistance in Environmental Clearance for grinding unit in Colombo
22.	Berber Cement Co Ltd	Sudan	Technical Evaluation and Valuation of cement plant
23.	Eta Ascon Group of Companies	UAE	Consultancy services for updation of TEFR (Desk based) Cement Grinding plant at Dubai, UAE
24.	Arabian Gulf Cement Co	Yemen	Feasibility study for new grinding unit
25.	Shree Cement Ltd	India	Desk based Option Evaluation Study
26.	Adani Cementation Ltd	India	Preparation of DPR for cement projects at Lakhpat & Mundra, Gujarat and Udupi, Karnataka
27.	Orient Cement Ltd	India	Preparation of TEFR for Line II at Chitapur Karnataka
28.	Asian Concretes & Cements Pvt Ltd	India	Site Identification and TEFR of cement plant in Himachal Pradesh
29.	Krishna Specialty Chemicals Pvt Ltd	India	TEFR for a 0.5 mio tpa Grinding Unit at Butiburi, Nagpur, Maharashtra
30.	Sanghi Industries Ltd	India	Option Evaluation and TEFR
31.	Adani Power Ltd	India	Multi-location study for establishing cement units
32.	Calcom Cement India Ltd	India	Techno Economic Viability Report for Umrangshu Plant, Assam
33.	Orient Cement Ltd	India	Option Evaluation for a Grinding Unit
34.	Lafarge India Ltd	India	TEFR for a cement plant in Jaisalmer, Rajasthan
35.	Jaypee Cement Corp Ltd	India	Preparation of TEFR for Jaypee Balaji Plant
36.	Adani Power Maharashtra Ltd	India	Option Evaluation for setting up Cement Grinding Unit / Blending Unit using flyash generated from Tiroda TPP
37.	My Home Industries Ltd	India	Location Option Analysis Study Report
38.	Jaykaycem (Central) Ltd	India	Location Option Analysis Study for cement Facilities Based on Clinker Manufacture in M.P.
39.	Wadi Cement Pvt Ltd	India	Option Evaluation Study for a Greenfield cement project in Karnataka/ Maharashtra
40.	Dalmia Cement Bharat Ltd	India	Consultancy services for Desk Based TEFR for cement project in district Cuddapah, A.P.

B. Market Studies Report, Market Opportunity, Marketing Business Plan etc

Country	Number of Clients	Number of Assignments
India	38+	55+
37+ (excluding India)	50+	90+

	Client Name	Project Location	Project Description
1.	United International Bank (Bahrain)	Bahrain	Operational Due Diligence and Performance Assessment Study - RMC and Block Mfg Plants
2.	Ministry of Trade And Industry (Royal Government Of Bhutan)	Bhutan	Detailed Market Study of Ferro Silicon
3.	Penden Cement Authority Ltd	Bhutan	Techno economic Feasibility study for RMC Plant
4.	Ministry Of Trade And Industry (Royal Government Of Bhutan)	Bhutan	Detailed investment Feasibility report for the electronic Industry
5.	Arabian Cement Company Ltd	Jordan	Consultancy Services for Ready Mix Concrete Study
6.	Khaleeji Commercial Bank	Qatar	Due diligence of RMC Company
7.	Arabian Cement Company Ltd	Saudi Arabia	Feasibility Study for RMC and Concrete products
8.	Khaleeji Commercial Bank	Saudi Arabia	Investment Opportunity Study for RMC & Precast in UAE and KSA
9.	Samba Capital & Investment Management Company	Saudi Arabia	RMC Market Study
10.	El Seif Engineering Contracting Company Ltd	Saudi Arabia	Feasibility Study for Precast Concrete
11.	Arabian Cement Company Ltd	Saudi Arabia	Consultancy services for Market study for RMC
12.	Titan Cement	Saudi Arabia	Market Research for Cement and Downstream products
13.	Penden Cement Authority Ltd	Bhutan	Feasibility Study for RMC in Bhutan
14.	Jhajjar Power Ltd	India	Consultancy Services for Fly Ash Study
15.	Robo Silicon Pvt Ltd	India	Market Study for Aggregates in Pune and Ahmedabad
16.	Heidelberg Cement India Ltd	India	Market Study for PSC, GGBS and Wet Slag in Mumbai region

Client Name		Project Location	Project Description
17.	Tata Power Company Ltd	India	Fly Ash Utilisation Study
18.	Ministry of Trade And Industry (Royal Government Of Bhutan)	India	Detailed Feasibility Study of Calcium Carbonate Project and Hydrated Lime Unit
19.	ACC Ltd	India	RMC study in Kolkata region
20.	Ultratech Cement Ltd	India	Market Study for Ready Mix Mortar
21.	International Bank for Reconstruction and Development	India	Independent Technical and Financial Due Diligence for the FAL-G Bricks/ Blocks Program
22.	Building Materials & Technology Promotion Council	India	Market survey of Fly ash bricks / blocks at Delhi and Mumbai
23.	Dalmia Cement Bharat Ltd	India	Study on Potential for value added cement-based products
24.	Ultratech Cement Ltd	India	RMC Study in Delhi, Ahmedabad, Vadodara, Mumbai, Cochin and Chandigarh
25.	Holcim Group Support Ltd	India	Mapping of RMC Sources in India
26.	Gujarat Fluorochemicals Ltd	India	Market Study - Gypsum Board
27.	Ultratech Cement Ltd	India	Study for RMC plants at Jaipur, Indore, Ludhiana and Kolkata
28.	Ultratech Cement Ltd	India	Market & Commercial feasibility study - Concrete and Paving Blocks
29.	Lafarge India Pvt Ltd	India	Study for Use of Cementitious Materials in India
30.	Ultratech Cement Ltd	India	Market and Project Feasibility Study for RMC plant at Pune
31.	North Eastern Development Finance Corporation Ltd (Nedfi)	India	Pre-investment feasibility report for manufacturing value added products based on limestone and coal in Meghalaya and Assam
32.	Dalmia Cement Bharat Ltd	India	Market Study for Cement Based Products

C. Acquisition Assistance, Project Valuation, Due-Diligence, Investment Opportunity etc.

Country	Number of Clients	Number of Assignments
India	60+	98+
31+ (excluding India)	38+	68+

	Client Name	Project Location	Project Description
1.	Holcim Group Support Ltd	Sri Lanka	Investment Opportunity Study in Jaffna
2.	Libyan African Investment Company	Tanzania	Investment Opportunity Assessment
3.	Gulf Finance House	Bahrain	Assessment of Grinding Unit
4.	Lafarge Cement	Middle East	Review of Business Plan
5.	Cdc Group Plc	Kenya	Due Diligence of cement plants in Kenya and Tanzania
6.	Islamic Corporation for The Development of The Private Sector	Africa	Valuation of Cement Plant
7.	Baring Private Equity Asia	Philippines	Due Diligence of cement plants in Philippines
8.	Mohamed Aballala	Tanzania	Due Diligence of a cement project in Tanzania
9.	Baring Private Equity Asia	South Korea	Due Diligence of Cement Plants
10.	Kkr India Advisors Private Limited	India	Due Diligence of a cement plant in Western India
11.	Reliance Infrastructure Ltd	India	Valuation of cement plants
12.	Kkr Credit Advisors (Us) Llc	India	Due Diligence of cement plants in India
13.	Vadraj Cement Ltd	India	Valuation of cement plant
14.	Emami Cement Ltd	India	Due Diligence of cement plant in Odisha
15.	Vadraj Cement Ltd	India	Due Diligence of Cement Plant
16.	Il&Fs Financial Services Ltd	India	Updation of Due Diligence Study for Cement Plant
17.	Binani Industries Ltd	India	Commercial Due Diligence of Binani Cement

	Client Name	Project Location	Project Description
18.	Binani Cement Ltd	India	Technical Due Diligence of cement plants in Rajasthan
19.	Piramal Enterprises Ltd	India	Commercial Due Diligence
20.	Orient Cement Ltd	India	Due Diligence of Cement Plants
21.	Piramal Enterprises Ltd	India	Due Diligence of Cement Plants
22.	Bain Capital Mauritius	India	Support in Due Diligence exercise
23.	Il&Fs Financial Services Ltd	India	Due Diligence of cement plant
24.	Binani Cement Ltd	India	Valuation of Binani Cement Ltd
25.	Emami Cement Ltd	India	Due Diligence of Cement Grinding Plant in Bihar
26.	Binani Cement Ltd	India	Valuation of cement plant
27.	Yes Bank Ltd	India	Due Diligence of cement plant
28.	Emami Cement Ltd	India	TEV and Valuation of Grinding Plant
29.	Jaiprakash Associates Ltd	India	Due Diligence of cement plants
30.	Murli Agro Products Ltd	India	Sustainability Study for Cement Plant at Chandrapur
31.	Kkr India Advisors Pvt Ltd	India	Due Diligence of a cement plant in Western India

II. Raw Material & Environment Service

Country	Number of Clients	Number of Assignments
India	140+	460+
38+ (excluding India)	85+	145+

	Client Name	Project Location	Project Description
1.	AL Jouf Cement Company	Saudi Arabia	CADE and Quarry Planning in Saudi Arabia
2.	Al Omran Cement Company	Saudi Arabia	Prospecting Report of Limestone area, Saudi Arabia
3.	Al Rajhi Investments	Jordan	Raw Material services for cement project
4.	Arab Gulf Cement Company	UAE	Quarry exploration and deposit modeling for cement plant at Ras Al Khaimah, UAE
5.	Arabian Cement Company Ltd	Saudi Arabia	Preliminary Investigation & Evaluation of Raw Material Limestone for a Greenfield Cement Project at Labounah
6.	Arabian Gulf Cement Company	UAE	Quarry exploration and deposit modeling for setting up 1.8 mio tpa cement plant at Ras Al Khaimah
7.	Arabian Yemen Cement Company Ltd	Yemen	Mining Consultancy Services for 4000 tpd Cement Project
8.	Cementizillo S.P.A. Italy	Senegal	Geological investigation & Hydrological Investigation for Cement Project in Senegal, Africa
9.	Chemaf Sarl	DR Congo	Geological Investigation & Deposit Evaluation for Limestone Deposit, Lumbudi
10.	CIMERWA Ltd.	Rwanda	EIA/ EMP Studies & Resettlement Action Plan (RAP) for a cement plant in Mugher, Rwanda
11.	City Cement Company	Saudi Arabia	Geological investigations, CADE and Mine Planning for LS deposit, Saudi Arabia
12.	CNC Trading DMCC	Mozambique	Site Identification Study for a Cement Plant
13.	Dangote Industries Ltd	Nigerai	Preparation of Master Plan of Mining for Obajana Limestone Mines, Ibese Limestone Mines, Shagamu Limestone Mines in Nigeria and Pout Limestone Mines at Senegal
14.	Dao Africa Limited	Uganda	Geological Appraisal of Limestone Deposit
15.	Derba Midroc Cement Plc	Ethiopia	Development and Initial Operations of Raw Materials Mines
16.	Donglam Cement Limited	Vietnam	Deposit Evaluation, Mine Design and Drawings for Limestone and Clay Mines at Phong Xuan, Hue

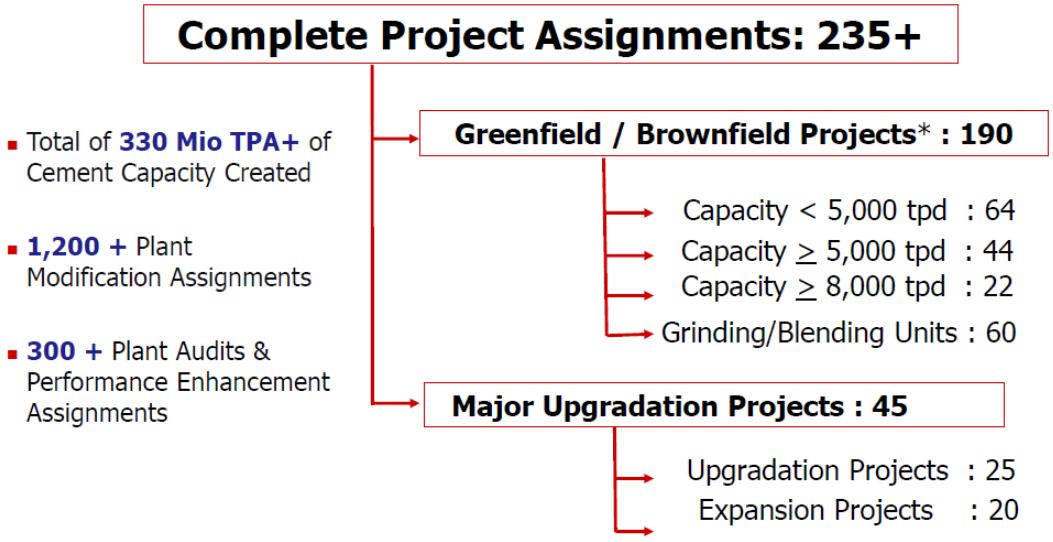
	Client Name	Project Location	Project Description
17.	Egypro Group	Sudan	Geological Investigation for a greenfield project
18.	EMCO Power Ltd	Zambia	Preliminary Geological Reconnaissance Survey of a Limestone Deposit
19.	F&K Cement Engineering Services	Middle East Asia	Raw Material Assessment Services
20.	Hatien 1 Cement Company	Vietnam	Mine Design Services for Binh Phuoc Cement Project in Vietnam
21.	International Finance Corporation	Tanzania	Environmental & Social Audit of Cement Units in Tanzania & Gabon
22.	Lake Cement (TZ) Ltd	Tanzania	Deposit Evaluation, Mine Planning for Kimbiji and Deposit Evaluation for Tarwanada Project
23.	Lhaki Cement	Bhutan	Mine Feasibility Study including CADE, QSO, Mining Plan, EIA & EMP over Limestone Mines, Bhutan
24.	Lhoist Group	Oman	Pre-Feasibility study for Limestone
25.	Ministry of Trade and Industry Royal Government of Bhutan	Bhutan	Investment Feasibility report for manufacturing value added products based on Gypsum in Bhutan
26.	Mongolyn Alt (MAK) Corporation	Mongolia	Geological Investigation & Deposit Evaluation of Limestone and Clay Deposits
27.	Najran Cement Company	Saudi Arabia	Mining Plan & Raw Material Services for Tawique Limestone Deposit at Najran, Saudi Arabia
28.	Nyumba YA Akiba	DR Congo	Detailed mine Design and mine Closure Plan for Songololo Limestone Deposit, Bas Congo Province
29.	Oman Cement Company (SAOG)	Oman	Geological Investigation of Limestone Deposit at Rusayl Factory Site
30.	PPC Cement Sa (Pty) Ltd	South Africa	Reassessment and quarry scheduling for life of mine at Slurry
31.	PPC Ltd	Algeria	Raw Material Services for a 2.0 mtpa integrated cement project
32.	PPC Zimbabwe Ltd	Zimbabwe	Remote Quarry Monitoring Services for Collen Bawn Limestone Mine
33.	Pt Ultratech Mining Indonesia	Indonesia	Geological Investigation, Deposit Evaluation and Mine Planning of Limestone Deposit in Central Java
34.	Saudi Cement Company	Saudi Arabia	Geological Investigation and Mine Planning for additional area at Al Jadidih Mines
35.	Shivam Cements Ltd	Nepal	Turnkey Geological Investigation & Raw Material Evaluation for Limestone Concession
36.	Tama Design Consultancy	Iraq	Geological Investigations and Computer aided deposit

	Client Name	Project Location	Project Description
	& Construction		evaluation for cement project in Kurdistan
37.	Tl Cement LDA	Democratic Republic of Timor-Leste	Preparation of Bulk Samples, Mine Planning and Mine Closure Plan for Bucoli Limestone Deposit
38.	Tororo Cement Industries Ltd	Uganda	Prospecting and Preparation of Mining Plan
39.	Yemeni Saudi Cement Company	Yemen	EIA/EMP study for Batis Cement plant
40.	ABG Cement Ltd	India	Turnkey Services for Geological Investigation of Limestone Deposit in Katni District, Madhya Pradesh
41.	ACC Ltd.	India	Technical Feasibility for modification in ACC, Wadi
42.	Adhunik Cement Ltd.	India	Geological investigation of various leaseholds at Jaintia Hills Dist., Meghalaya
43.	Binani Cement Ltd	India	EIA/EMP studies for setting up a new cement plant Unit II and mines at Binanigram, Rajasthan
44.	Blackstone Advisors Pvt. Ltd.	India	Status of Mineral Concession - Western Region of India
45.	Bollard Strategic Advisers PTE Ltd.	India	Assessment of limestone deposits of a cement project in Andhra Pradesh
46.	CARMEUSE	India	Identification of Limestone and Dolomite Deposits in Andhra Pradesh, Karnataka and Rajasthan, India
47.	Carmeuse Group	India	Identification of Limestone and Dolomite Deposits in Andhra Pradesh, Karnataka and Rajasthan
48.	Chettinad Cement Corporation Ltd	India	Turnkey geological investigation and Preparation of Geological Exploration Report at Kallur Limestone Mine, Karnataka
49.	Dalmia Bharat Enterprises Ltd	India	Mining Plan for Limestone mines in Belgaoan Karnataka
50.	Dalmia Cement Bharat Ltd	India	Computer aided deposit evaluation and quarry scheduling Optimisation (QSO) for new LS deposit at Trichy, Tamilnadu
51.	Grasim Industries Ltd	India	Review of mining operation of Limestone mines, Rawan, District Raipur, Madhya Pradesh.
52.	Heidelberg Cement India Ltd	India	Turnkey geological Investigation of Patharia limestone deposit
53.	Holcim Group Support Ltd	India	Development of Raw Material Data Base for Cement
54.	Jaiprakash Associates Ltd	India	Statutory Mining Plan & Progressive Mine Closure Plan of Budhawada Limestone Mine in Andhra Pradesh.

Client Name		Project Location	Project Description
55.	Jaykaycem Ltd	India	CADE & Quarry Planning at Mudhol, Bagalkot, Karnataka
56.	Lafarge Building Materials Holding	India	Preliminary raw material and geotechnical investigation and topographical survey for Gulbarga project
57.	Larsen & Toubro Ltd	India	Geological prospecting work for Kurnul / Ananthpur Limestone deposits
58.	OCL India Ltd	India	Raw material services of mining lease hold area of our Lanjiberna Limestone & Dolomite Mines, Sundargarh
59.	Orient Cement Ltd	India	Turnkey Services for Geological Investigation, Deposit evaluation and Modified Mining Plan for LS Deposit, Gulbarga, Karnataka
60.	Penden Cement Authority Ltd	India	Consultancy Services for Feasibility Study of outsourcing of Earth Moving Equipment
61.	Revati Cements Pvt Ltd	India	Turnkey Services for Geological Investigation of Bharjuna - Shivpura Limestone Deposit, Satna District, Madhya Pradesh
62.	Robo Silicon Pvt Ltd	India	Identification of suitable aggregate deposits in Rajasthan
63.	Sanghi Infrastructure Mp Ltd	India	Turnkey Services for Geological Investigation of Limestone Deposit, Katni District Madhya Pradesh
64.	Springway Mining Pvt Ltd	India	Turnkey Services for Geological Investigation, Computer Aided Deposit Evaluation & Preparation of Mining plan for Limestone deposit in Panna District, Madya Pradesh
65.	Ultratech Cement Ltd	India	To carry out geological investigations for limestone deposit in district Chitradurga, Karnataka
66.	Ultratech Cement Ltd	India	Cost Optimisation in Mining Operations at Hirmi Cement Works
67.	Ultratech Cement Ltd	India	Deposit Evaluation, Mine Designing and Resource Assessment for Naokari Limestone Mine at Awarpur
68.	Vedanta Industries Ltd	India	Turnkey Services for Geological Investigation of Limestone Concession Areas in Rajasthan
69.	Zuari Cement Ltd	India	Carrying out exploration work (core drilling), preparation & getting approval of mining from IBM for Gulbarga Cement Limited, Gulbarga.

III. Cement Plant Engineering

HOLTEC



* 81 Complete Lines in India, 49 Outside India

A. INTEGRATED CEMENT PROJECTS (OUTSIDE INDIA)

	Client Name	Project Location	Capacity tpd
1.	Saudi Cement Company Line 2	Hofuf, Saudi Arabia	10000
2.	Saudi Cement Company Line 1	Hofuf, Saudi Arabia	10000
3.	Eastern Province Cement Company #	Dammam, Saudi Arabia	10000
4.	Vietnam Construction & Import Export Cooperation	Cam Pha, Vietnam	7000
5.	Najran Cement Company Line 3	Najran, Saudi Arabia	6500
6.	United Cement Group @	Middle East	6000
7.	Dangote Industries Limited Line 2	Ibese, Nigeria	6000
8.	Dangote Industries Limited Line 1	Ibese, Nigeria	6000
9.	Hatien 1 Cement Company	Binh Phuoc, Vietnam	6000
10.	Northern Region Cement Company Line 1	Turaif, Saudi Arabia	6000
11.	Al-Rajhi Investments	Amman, Jordan	6000
12.	Najran Cement Company Line 1	Najran, Saudi Arabia	6000
13.	Yanbu Cement Company #	Yanbu, Saudi Arabia	6000
14.	City Cement Company Line 2	Riyadh, Saudi Arabia	5500
15.	Oman Cement Company (SAOG)	Daqm, Oman	5000

	Client Name	Project Location	Capacity tpd
16.	Abay Industrial Development SC	Dejen, Amahara, Ethiopia	5000
17.	Al-Jouf Cement Company	Jouf City, Saudi Arabia	5000
18.	Al Nsr Cement Company #	Tripoli, Libya	5000
19.	Atbara Cement Plant	Atbara	5000
20.	Building Materials Industries Company	Egypt	5000
21.	City Cement Company Line 1	Riyadh, Saudi Arabia	5000
22.	Derba Midroc Cement	Addis Ababa, Ethiopia	5000
23.	Donglam Cement Limited	Hue, Vietnam	5000
24.	Hail Cement Company	Hail Region, Saudia Arabia	5000
25.	Norm LLC	Baku, Azerbaijan	5000
26.	Riyadh Cement Company Line 2	Riyadh, Saudi Arabia	5000
27.	Riyadh Cement Company Line 1	Riyadh, Saudi Arabia	5000
28.	Southern Province Cement Line 2 #	Al Majardah, Saudi Arabia	5000
29.	Southern Province Cement Line 1	Al Majardah, Saudi Arabia	5000
30.	Yemeni Saudi Cement Company	Batis, Yemen	5000
31.	Al Khalij Cement Company	Umm-Bab, Qatar	5000
32.	Arabian Cement Company Limited - Al Katrana	Amman, Jordan	5000
33.	Al-Takamol Cement Company	Atbara	4500
34.	Afyon Cemen t#	Afyonkarahisar, Turkey	4500
35.	National Cement Company Line 1 (Longulf)	Aden, Yemen	4250
36.	Fico Tay Ninh Joint Stock Company#	Tay Ninh, Vietnam	4200
37.	Arabian Yemen Cement Company	Mukalla, Yemen	4000
38.	Shwe Taung Cement Co. Limited	Thazi, Myanmar	4000
39.	Ehdas Management Company Cerro Azoul Cement	Venezuela	3000
40.	Ehdasse Sanat (Hama Cement)	Hama	3000
41.	Najran Cement Company Line 2	Najran, Saudi Arabia	3000
42.	Messebo Cement Project Line 2	Mekele, Ethiopia	3000
43.	Dungsam Cement Corporation Limited	Dungsum, Bhutan	3000
44.	Messebo Cement Project Line 1	Mekele, Ethiopia	2000
45.	Longulf Trading (UK) Ltd Line 2	Yemen	2000
46.	Arabian Bulk Terminal Company	Port Digna	1500
47.	Cimerwa	Bugarama, Rwanda	1500
48.	Senj Sant Llc	Gobi, Mongolia	1500
49.	Ashoka Technologies	Djibouti	600

B. INTEGRATED CEMENT PROJECTS (INSIDE INDIA)

	Client Name	Project Location	Capacity tpd
1.	Jaypee Associates Limited	Jaggayapet, Andhra Pradesh	10000
2.	Jaypee Associates Limited	Baga, Himachal Pradesh	10000
3.	Reliance cementation Limited	Maihar, Madhya Pradesh	10000
4.	ABG Cement Limited	Kachh, Gujarat	10000
5.	Ultratech Cement Limited (Rajashree Cement)	Malkhed, Karnataka	10000
6.	Ultratech Cement Limited (Rawan Cement)	Hirmi, Chattisgarh	10000
7.	Ultratech Cement Limited	Kotputli, Rajasthan	10000
8.	Ultratech Cement Limited (Aditya Cement)	Shambhupura, Rajasthan	10000
9.	Ultratech Cement Limited	Tadipatri, Andhra Pradesh	10000
10.	Sanghi Cement Limited	Kachh, Gujarat	10000
11.	Adani Cementation Limited	Lakhpat, Gujarat	10000
12.	ACC Limited	Ametha, Madhya Pradesh	9500
13.	Emami Cement Limited	Rishda, Chhattisgarh	9000
14.	Ambuja Cement Limited	Marwa Mundwa, Rajasthan	9000
15.	Wonder Cement Limited Line 3	Chittorgarh, Rajasthan	8500
16.	Wonder Cement Limited Line 2	Chittorgarh, Rajasthan	8500
17.	RCCPL Private Limited	Mukutban, Maharashtra	8200
18.	Chettinad Cement Limited	Dachepalli, Andhra Pradesh	8000
19.	OCL Limited Line 3	Rajgangpur, Odisha	8000
20.	JK Cement Limited	Panna, Madya Pradesh	7500
21.	JK Cement Limited Line 3	Mangrol, Rajasthan	7500
22.	Jaypee Associates Limited Super	Dalla, Uttar Pradesh	7000
23.	Wonder Cement Limited Line 1	Chittorgarh, Rajasthan	6500
24.	Shree Cement Limited	Raipur, Chhattisgarh	6000
25.	Shree Cement Limited	Belgaum, Karnataka	6000
26.	JSW Cement Limited	Nandyal, Andhra Pradesh	6000
27.	KJS Cement Pvt. Limited	Maihar, Madhya Pradesh	6000
28.	Chettinad Cement Corp. Limited Line 1	Kallur, Karnataka	6000
29.	Jaypee Associates Limited Line 2	Bhuj, Gujarat	6000
30.	Jaypee Associates Limited Line 1	Bhuj, Gujarat	6000
31.	Jaypee Associates Limited	Bela, Madhya Pradesh	6000
32.	Binani Cement Limited Line 2	Pindwara, Rajasthan	6000

	Client Name	Project Location	Capacity tpd
33.	Jaypee Associates Limited Line 2	Rewa, Madhya Pradesh	5500
34.	Nirma Limited (Siddhi Vinayak)	Pali, Rajasthan	5000
35.	Zuari Cement Limited (Ital Cementi)	Yerraguntla, Andhra Pradesh	5000
36.	Jaypee Associates Limited Line 2	Sidhi, Madhya Pradesh	4500
37.	Jaypee Associates Limited Line 1	Sidhi, Madhya Pradesh	4500
38.	Jaypee Associates Limited Line 2	Dalla, Uttar Pradesh	4500
39.	Binani Cement Limited Line 1	Pindwara, Rajasthan	4500
40.	Dalmia Cement (Bharat) Limited	Belgaum, Karnataka	4500
41.	Dalmia Cement (Bharat) Limited	Kaddapah, Andhra Pradesh	4500
42.	Jaypee Associates Limited Line 1	Rewa, Madhya Pradesh	4500
43.	DLF Cement Limited (now Ambuja Cement)	Ras, Rajasthan	4200
44.	Chettinad Cement Corp Limited	Karikkali, Tamil Nadu	4000
45.	Chettinad Cement Corp Limited Line 1	Ariyalur, Tamil Nadu	4000
46.	Chettinad Cement Corp Limited Line 2	Ariyalur, Tamil Nadu	4000
47.	Dalmia Cement (Bharat) Limited	Ariyalur, Tamil Nadu	4000
48.	Raj Cement Limited	Beawar, Rajasthan	4000
49.	Orient Cement Limited Line 3	Devapur, Telangana	4000
50.	Deccan Cement Ltd Line 2	Nalgonda	3500
51.	Chettinad Cement Corporation Limited	Dindigul, Tamil Nadu	3300
52.	Dalmia Cement Company	Dalmiapuram, Tamil Nadu	3300
53.	JSW Cement Limited (Shiva Cement)	Kandeimunda, Odisha	3000
54.	Jaiprakash Associates Limited (BJCL)	Satna, Madhya Pradesh	3000
55.	Coromandel Fertilizers Ltd (now India Cements Ltd)	Kalamalla, Andhra Pradesh	3000
56.	Grasim Industries Limited	Reddipalayam, Tamil Nadu	3000
57.	Tata Iron and Steel Co. (now Lafarge India Ltd)	Sonadih, Chattisgarh	3000
58.	Tamil Nadu Cements Corporation Limited	Ariyalur, Tamil Nadu	1500
59.	Texmaco (now Zuari Cement-Italcementi)	Yerraguntla, Andhra Pradesh	1500
60.	Ultratech Cement Limited (Birla White) #	Jodhpur, Rajasthan	1500
61.	The Uttar Pradesh State Cement Corporation	Dalla, Uttar Pradesh	1200
62.	The Uttar Pradesh State Cement Corporation	Dalla, Uttar Pradesh	1200
63.	Cement Corporation of India	Akaltara, Chattisgarh	1200
64.	Cement Corporation of India	Neemuch, Madhya Pradesh	1200
65.	Cement Corporation of India	Yerraguntla, Andhra Pradesh	1200
66.	Cement Manufacturing Company Limited	Jaintia Hills, Meghalaya	1200

	Client Name	Project Location	Capacity tpd
67.	Madras Cements Limited	RR Nagar, Tamil Nadu	1200
68.	Malabar Cements Limited	Walayar, Kerala	1200
69.	Meghalaya Cements Limited	Jaintia Hills, Meghalaya	1200
70.	Trumboo Industries Private Limited	Srinagar, Jammu & Kashmir	1000
71.	Nagarjuna Construction Company Limited	Anantapur, Andhra Pradesh	800
72.	Cement Corporation of India	Rajban, Himachal Pradesh	600
73.	Deccan Cements Limited	Miryalaguda, Andhra Pradesh	600
74.	RNB Cements Private Limited	Barapani, Meghalaya	600
75.	Nihon Nirmaan White Cement Limited	Gotan, Rajasthan	250
76.	Balaram Cements Limited	Palanpur, Gujarat	200
77.	Dhar Cement Limited	Dhar, Madhya Pradesh	200
78.	Karnataka Cement Limited	Chitapur, Karnataka	200
79.	Gujarat Himalaya Cements (White Cement)	Porbandar, Gujarat	150
80.	NECEM Limited	Umarangshu, Assam	100
81.	Tamil Nadu Magnesite (Dead Burnt Magnesite)	Salem, Tamil Nadu	100
82.	Virgo Cement Limited	Dudhnai, Meghalaya	100

Procurement Services @ PMC Services On-Going

C. SPLIT GRINDING UNITS

	Client Name	Project Location	Capacity mio TPA
1.	ABG Cement Limited	Surat, Gujarat	5.0
2.	Shah Cement $	Munshiganj, Bangladesh	4.0
3.	Jaiprakash Associates Limited	Chunar, Uttar Pradesh	3.0
4.	UltraTech Cement Limited	Dadri, Uttar Pradesh	2.6
5.	Wonder Cement Limited	Jhajjar, Haryana	2.5
6.	OCL India Limited Line 2	Kapilas, Odisha	2.3
7.	OCL India Limited Line 2	Midnapur, West Bengal	2.3
8.	OCL India Limited	Bihar	2.3
9.	Jaiprakash Associates Limited	Bhilai, Chattisgarh	2.2
10.	Jaiprakash Associates Limited	Bokaro, Chattisgarh	2.2
11.	Adani Cementation Ltd (Cement Terminal)	Raigarh, Maharashtra	2.0
12.	Jaiprakash Associates Limited Line 1	Nigri, Madhya Pradesh	2.0
13.	Jaiprakash Associates Limited Line 2	Nigri, Madhya Pradesh	2.0

	Client Name	Project Location	Capacity mio TPA
14.	Jaiprakash Associates Limited Line 1	Bara, Uttar Pradesh	2.0
15.	Jaiprakash Associates Limited Line 2	Bara, Uttar Pradesh	2.0
16.	Jaiprakash Associates Limited Line 3 (Expansion)	Bhuj, Gujarat	2.0
17.	Lafarge India (GU expansion)	Jojobera, Jharkhand	2.0
18.	Emami Cement Limited	Panagarh, West Bengal	2.0
19.	Wonder Cement Limited	Dhule, Maharshtra	2.0
20.	Wonder Cement Limited	Madhya Pradesh	2.0
21.	Emami Cement Limited	Jajpur, Odisha	2.0
22.	Shree Cement Limited	Pune, Maharashtra	2.0
23.	Shree Cement Limited	Bhubaneshwar, Odisha	2.0
24.	Shree Cement Limited Line 2	Suratgarh, Rajasthan	2.0
25.	Shree Cement Limited Line 2	Aurangabad, Bihar	2.0
26.	Shree Cement Limited Line 1	Aurangabad, Bihar	2.0
27.	Shree Cement Limited	Bulandsehar Uttar Pradesh	2.0
28.	Chettinad Cement Pvt Ltd.	Visakhapatnam, AP	2.0
29.	Sanghi Industries Limited	Surat, Gujarat	2.0
30.	Star Cement Limited	Siliguri, West Bengal	2.0
31.	JSW Cement Ltd	Vijaynagar, Karnatka	2.0
32.	JSW Cement Ltd	Dolvi, Maharashtra	1.8
33.	Reliance Cementation Limited Line 1	Kundangaunj, Uttar Pradesh	1.7
34.	ACC Limited #	Tikaria, Uttar Pradesh	1.6
35.	Boral Cement Limited $#	Queensland, Australia	1.5
36.	Orient Cement Limited	Devapur, Telangana	1.5
37.	J K Cement Limited	Ujjain, Madhya Pradesh	1.5
38.	J K Cement Limited	Hamipur, Uttar Pradesh	1.5
39.	J K Cement Limited	Aligarh, Uttar Pradesh	1.5
40.	Jaiprakash Associates Limited	Panipat, Haryana	1.5
41.	Jaypee Ventures Limited	Bagheri, Himachal Pradesh	1.5
42.	Ultratech Cement Limited	Panipat, Haryana	1.5
43.	Ultratech Cement Limited	Aligarh, Uttar Pradesh	1.5
44.	Ultratech Cement Limited	Ginigera, Karnataka	1.5
45.	Lafarge India Limited	Jojobera, Jarkhand	1.4
46.	Jaypee Associates Limited Line 2	Wanakbori, Gujarat	1.2

	Client Name	Project Location	Capacity mio TPA
47.	Jaypee Associates Limited Line 1	Wanakbori, Gujarat	1.2
48.	RCCPL Private Limited Line 2	Kundangaunj, Uttar Pradesh	1.2
49.	Hormuz Al Anwar Cement SAOC $	Duqm, Oman	1.0
50.	Jaiprakash Associates Limited	Sikandrabad, Uttar Pradesh	1.0
51.	Ambuja Cement Limited (Expansion)	Sankrail West Bengal	1.0
52.	Star Cement Limited (Expansion)	Jaintia Hills, Meghalaya	1.0
53.	Jaypee Associates Limited	Roorkee, Uttrakhand	1.0
54.	Lafarge India Limited	Mejia, West Bengal	1.0
55.	OCL India Limited Line 1	Midnapur, West Bengal	1.0
56.	OCL India Limited Line 1	Kapilas, Odisha	1.0
57.	Jaiprakash Associates Limited	Tanda, Uttar Pradesh	1.0
58.	Chettinad Cement Corporation Limited	Solapur, Maharashtra	1.0
59.	KJS Cement (I) Limited	Maiher, Madya Pradesh	1.0
60.	KJS Cement (I) Limited	Allahabad, Uttar Pradesh	1.0
61.	Deccan Cements Ltd	Vishakhapatnam	0.8
62.	Adani Cementation Ltd (Cement Terminal)	Vizhinjam, Kerala	0.8
63.	J K Cement Limited	Balasinor, Gujarat	0.7
64.	Jaypee Rewa Cement (Blending Unit)	Allahbad, Uttar Pradesh	0.6
65.	JSW Cement Ltd	Salboni, West Bengal	0.6
66.	Adani Cementation Ltd (Cement Terminal)	Mangalore, Karnatka	0.6
67.	JSW Cement Limited (GGBS)	Salem, Tamil Nadu	0.6
68.	Adani Cementation Ltd (Cement Terminal)	Hazira, Gujarat	0.6
69.	Jaiprakash Associates Ltd.	Vizag	0.5

D. MAJOR PLANT MODERNISATION/ EXPANSION PROJECTS

	Client Name	Project Location
1.	Heavy Engineering Corporation $	Chhatak, Bangladesh
2.	Sri Lanka Cement Corporation	Sri Lanka
3.	Cement Corporation of India Limited	Mandhar, Chhatisgarh
4.	Chettinad Cement Corporation Limited	Karur, Tamil Nadu
5.	Udaipur Cement Works	Udaipur, Rajasthan

	Client Name	Project Location
6.	OCL India Limited	Rajgangpur, Odisha
7.	Dalmia Cement (Bharat) Limited	Dalmiapuram, Tamil Nadu
8.	Industrial Development Corporation of Orissa Limited	Bargarh, Odisha
9.	ACC Limited	Kymore, Madhya Pradesh
10.	Tororo Cement Industries Limited $	Tororo, Uganda
11.	Tamil Nadu Cement Corporation Limited	Alangulam, Tamil Nadu
12.	Birla Jute and Industries Limited	Satna, Madhya Pradesh
13.	Mysore Cement Limited	Ammasandra, Karnataka
14.	Saurashtra Cements Limited	Ranavav, Gujarat
15.	India Cements Limited	Sankari/Sankarnagar, Tamil Nadu
16.	The Uttar Pradesh State Cement Corporation Limited	Churk, Uttar Pradesh
17.	Deccan Cement Limited	Miryalguda, Andhra Pradesh
18.	Kalyanpur Cements Limited (Modernisation/Conversion)	Banjari, Bihar
19.	Industrial Development Corporation of Orissa Limited	Bargarh, Orissa
20.	Tamil Nadu Cement Corporation Limited	Alangulam, Tamil Nadu
21.	Mawmluh Cherra Cement Limited	Cherrapunji, Meghalaya
22.	Vikram Cement Limited	Khor, Madhya Pradesh
23.	Rajashree Cement Limited	Malkhed, Karnataka
24.	Dalmia Cement (Bharat) Limited	Dalmiapuram, Tamil Nadu
25.	Sufian Cement Company $	Middle East-Asia
26.	Bestway Cement Plant $	Pakistan
27.	Pakland Cement Plant $	Pakistan
28.	Fecto Cement Limited $	Pakistan
29.	Garibwal Cement Limited $	Pakistan
30.	Dandot Cement Limited $	Pakistan
31.	Saadi Cement Limited $	Pakistan
32.	Zeal Pak Cement Factory Limited $	Pakistan
33.	Al-Samawah Cement Plant $	Iraq
34.	Lafarge Ashakacem $	Ashaka, Nigeria
35.	Atbara Cement Plant $	Atbara
36.	Oman Cement Company (SAOG) $	Ruwi, Oman
37.	Unye Cimento $	Unye, Turkey
38.	http://intranet/Prod/bd/acquisitionSingleEntryForm.php3?pcode=13186&mode=view&disabled_elements=all_elementsRiyadh Cement Company $	Riyadh, Saudi Arabia

	Client Name	Project Location
39.	Longulf Trading (uk) Limited $	Aden, Yemen
40.	Falcon Cement Company $	Bahrain
41.	Green Valley Industries Limited	Jaintia Hills, Meghalaya
42.	Shwe Taung Cement Co. Limited $	Thazi, Myanmar
43.	Nuvoco Cement Limited	Jojobera, Jharkhand
44.	Nuvoco Cement Limited #	Chittorgarh, Rajasthan
45.	Nirma Limited #	Pali, Rajasthan

Procurement Services $ Outside India On-Going

IV. Project Planning & Monitoring Services

	Client Name	Project Location	Project Description
1.	Chhatak Cement Project	Bangladesh	Project Planning and Monitoring Services for Greenfield Cement Project
2.	Derba Midroc Cement Plc	Ethiopia	Management Assistance & Monitoring of Asset Utilisation & Longevity For 5000 TPD Clinkerisation & 7000 TPD Cement Plant
3.	Messebo Cement Project	Ethiopia	Project Planning and Monitoring Services For Cement Plant
4.	Pt Semen Padang	Indonesia	Project Planning and Monitoring Services for Cement Plant
5.	National Cement Company Ltd	Kenya	Independent Monitoring Consultant for Projects and Operating Units
6.	Hama Cement	Middle East	Project Planning and Monitoring Services for Cement Plant
7.	United Cement Group	Middle East	Project Management Consultancy Services for 6000 TPD Cement Plant
8.	Senj Sant LLC	Mongolia	Project Planning and Monitoring Services for Cement Plant
9.	Shwe Taung Cement Co Ltd	Myanmar	Independent Monitoring Consultant for Cement Project
10.	Najran Cement	Saudi Arabia	Project Planning and Monitoring Services for Cement Plant
11.	Hatien 1 Cement JSC	Vietnam	Project Planning and Monitoring Services for Cement Plant
12.	National Cement Company	Yemen	Project Planning and Monitoring Services for Cement Plant
13.	Allahabad Bank	India	Review and Monitoring of Project Implementation of a Cement Plant in Chattisgarh
14.	Emami Cement Ltd	India	Project Management Consultant (PMC) to Monitor the Balance Work at Risda Cement Plant
15.	Emami Cement Ltd	India	Project Management Services for Panagarh Grinding Unit
16.	Jaypee Cement	India	Project Implementation Monitoring Report for Balaji

	Client Name	Project Location	Project Description
	Corporation Ltd		Cement Plant at Jaggayyapeta, Andhra Pradesh
17.	OCL India Ltd	India	Project Planning and Monitoring Services for Brownfield Clinkersation Unit at Rajgangpur - Line 3
18.	OCL India Ltd	India	Project Planning and Monitoring Services for Brownfield Grinding Unit at Kapilas - Line 2
19.	OCL India Ltd	India	Project Planning And Monitoring Services for Brownfield Grinding Unit at Midnapore - Line 2
20.	Ultratech Cement	India	Project Planning and Monitoring Services for Cement Plant, Aligarh, Uttar Pradesh
21.	Ultratech Cement	India	Project Planning and Monitoring Services for Cement Plant Dadri, Uttar Pradesh
22.	Ultratech Cement	India	Project Planning and Monitoring Services for Cement Plant, Ginigera, Karnataka
23.	Ultratech Cement	India	Project Planning and Monitoring Services for Cement Plant, Kotputli, Rajasthan
24.	Ultratech Cement	India	Project Planning and Monitoring Services for Cement Plant, Panipat, Haryana
25.	Ultratech Cement	India	Project Planning and Monitoring Services for Cement Plant, Shampura, Rajasthan
26.	Ultratech Cement	India	Project Planning and Monitoring Services for Cement Plant, Tadpatri, Andhra Pradesh

On-Going

V. Alternative Fuel Projects

	Client Name	Project Location	Project Description
1.	Union Cement Company	Ras Al Khaimah UAE	Project Engineering Consultancy services for Alternative fuel feeding System
2.	City Cement Company	Saudi Arabia	Pre-Feasibility Study for use of Alternate Fuels
3.	Al Jouf Cement Company	Saudi Arabia	Pre-Feasibility Study for use of Alternate Fuels
4.	Yanbu Cement Company	Saudi Arabia	Pre-Feasibility Study for use of Alternate Fuels
5.	Southern Province Cement Company	Jazan, Saudi Arabia	Pre-Feasibility Study for use of Alternate Fuels
6.	Eskisehir Cement Plant	Eskisehir, Turkey	Pre-Feasibility Study for usage of Alternative Fuels (RDF, Whole and Shredded Tires)
7.	Al Jouf Cement Company	Al Jouf, Saudi Arabia	Basic Engineering and Procurement Assistance for Installation of Alternate Fuel Usage System
8.	City Cement Company	Riyadh, Saudi Arabia	Engineering Services for Alternative Fuel Feeding System
9.	Al Jouf Cement Company	Riyadh, Saudi Arabia	Engineering Services for Alternative Fuel Feeding System
10.	Riyadh Cement Company	Riyadh, Saudi Arabia	Pre-Feasibility Study for use of Alternate Fuels in Cement Plant
11.	ACC Madukkarai	Madukkarai, Tamil Nadu	Engineering Services for Alternative Fuel Processing System
12.	Al Khalij Cement Company	Qatar	Feasibility Report for AFR Firing (Kiln 1)
13.	PPC	South Africa	Process Assistance for AFR Firing
14.	ACC Limited	Wadi, Karnataka	Engineering Services for Alternative Fuel Processing System
15.	Gasin Cement Company	Sulaimaniah, Iraq	Engineering Services for Alternative Fuel Processing System
16.	LafargeHolcim Bangladesh Ltd	Bangladesh	Concept Finalisation for Alternative Fuel Processing System
17.	Dalmia Cement (Bharat) Limited	Belgaum, Karnataka	Feasibility Study for Co Processing of Alternate Fuels and Raw Materials
18.	J K Cement Limited	Nimbahera,	Technical Feasibility Study for Agro based bio-

	Client Name	Project Location	Project Description
		Rajasthan	mass receipt, storage and feeding system in Calciner of Kiln 3 as an Alternative Fuel
19.	UltraTech Cement Limited	Shambhupura, Rajasthan	Engineering Services for Installation of Alternative Fuel Feeding System
20.	Saurashtra Cement Limited	Ranavav, Gujarat	Waste derived Fuel Preparation Plant
21.	Madras Cement Limited	Jayanthipuram, Andhra Pradesh	Pre-feasibility for Availability and Usage of Waste Derived Fuel
22.	Dalmia Cement (Bharat) Limited	Dalmiapuram, Tamil Nadu	Pre-feasibility for Availability and Usage of Waste Derived Fuel
23.	Saurashtra Cement Limited	Ranavav, Gujarat	Pre-feasibility for Availability and Usage of Waste Derived Fuel
24.	Kalyanpur Cements Limited	Banjari, Bihar	Pre-feasibility for Availability and Usage of Waste Derived Fuel
25.	UltraTech Cement Limited	Reddipalayam	Installation of AFR Feeding belt conveyor to Kiln Hood at Reddipalayam Cement Works
26.	Star Cement Limited	Meghalya	Study of Existing System Compatibility for Using Muslate as an Alternative Fuel at Star Cement Ltd., SCML & Meghalaya Power Ltd.
27.	Hills Cement Company Ltd	Hills Cement Company Ltd	Study of Existing System Compatibility and Optimizing use of Muslate as an Alternate Fuel
28.	Meghalaya Cements Ltd	Meghalya	Study of Existing System Compatibility and Optimizing use of Alternative Fuel
29.	Dalmia Cement Bharat Ltd	Meghalya	Study of Existing System Compatibility & Optimizing Use of Alternative Fuel and Fuel Mix
30.	Jsw Cement Ltd	Andhra Pradesh	Preparation of Feasibility Report use of Alternative Fuels at JSW Nandyal Works
31.	IFC	Myanmar	Alternative Fuel study in Myanmar
32.	Institute for Industrial Productivity (USA)	PAN, India	Study on Increasing Thermal Substitution Rate (TSR) in Indian Cement Industry
33.	Calcom Cement India Ltd	Assam	Technical Feasibility Study for use of Alternative Fuels at CCIL Umrongso, Assam.
34.	Ccb Compagnie Des Ciments Belges	Belgium	Consultancy services towards Pyro upgradation and new AFR system
35.	Nu Vista Ltd	Chhattisgarh	Consultancy Services for AFR System Installation

	Client Name	Project Location	Project Description
36.	Prism Johnson Limited	Madhya Pradesh	Consultancy services for Liquid AFR firing system in Line-2 Calciner
37.	Nuvoco Vistas Corp Ltd	Rajasthan	Consultancy services for AFR feeding system in Nibol Plant
38.	Shree Cement Ltd	Rajasthan	Consultancy services for AFR feeding system in various plants (Line 2 to 10)

On-Going

VI. Process Engineering Services

Plant Audits for De-Bottlenecking / Optimisation / Energy Savings / Performance Enhancement etc

Country	Number of Clients	Number of Assignments
India	100+	230+
30+ (excluding India)	45+	65+

	Client Name	Project Location	Project Description
1.	Eastern Province Cement Company	Saudi Arabia	Technical assistance services: Oil Well Cement (OWC) Cement production assessment and report
2.	Southern Province Cement Company	Saudi Arabia	Plant Operations Audit for Two Production Lines
3.	Cimsa Eskisehir Cement Plant	Turkey	Heat, Gas, Mass Balance and Alternative Fuel (RDF & Tyres - whole and shredded) Study
4.	Shah Cement Industries Ltd	Bangladesh	Operations Audit of Cement Mills 1 & 4 of Grinding Unit
5.	Askale Cimento Fabrikasi	Turkey	Performance Enhancement Services for a Cement Mill in an existing Cement Plant
6.	Caricom Cement Company Inc	Guyana	Plant Operations Audit of an Integrated Cement Plant at Everton Berbice
7.	National Cement Co	Kenya	CFD study
8.	Messebo Cement Factory Plc	Ethiopia	Characterization of Pozzolana Samples
9.	Ppc Cement Sa (Pty) Ltd	South Africa	Process support and Optimization of Cement Production Line of De Hoek plant
10.	Zarya Construction Co	Iraq	Plant Operations Audit of Tasluja Cement Plant (2 Lines)
11.	Shivam Cements Ltd	Nepal	Feasibility Study for Utilization of Pet Coke
12.	Shwe Taung Cement Co. Ltd	Myanmar	Plant Operations Audi
13.	National Cement Co	Kenya	Performance Improvement Plan for 3 operating cement plants
14.	Star Cement Meghalaya Ltd	India	Process Guidance for Improving Clinker Quality
15.	Allahabad Bank	India	Review and Monitoring of Project Implementation of a cement plant in Chattisgarh

Client Name		Project Location	Project Description
16.	Ocl India Ltd	India	Plant Capacity Assessment of Grinding Unit at Midnapur, West Bengal
17.	Nirma Ltd	India	Plant Operations Audit and Capacity upgradation, Rajasthan
18.	Jk Lakshmi Cement Ltd	India	Plant Operations Audit
19.	Lafarge India Ltd	India	Operational Audit of cement plant in Chittorgarh
20.	Deccan Cements Ltd	India	Consultancy Services for Capacity Expansion. AP
21.	Green Valliey Industries Ltd	India	Capacity Upgradation Study of Cement Plant at Meghalaya
22.	Acc Ltd	India	Optimisation of Manufacturing Cost at 2 cement plants
23.	Shriram Cement Works	India	Thermal Energy Audit & Cement Grinding capacity enhancement study of cement plant in Kota
24.	Cement Corporation of India Ltd	India	Plant Operation Audit of Tandur Cement Factory at tandur,Telengana
25.	Nuvoco Vistas Corp Ltd	India	Technical Study for Pyro Process Optimisation & Capacity Enhancement
26.	Calcom Cement Ltd	India	Clinker capacity enhancement study
27.	Hills Cement Ltd	India	Plant optimization study
28.	Nuvoco Vistas Corp Ltd	India	Technical Study for Capacity Enhancement of Line 1 & 2
29.	Mckinsey & Company	India	Cooperation in Cost Transformation Project in Rajasthan

A. WASTE HEAT RECOVERY BASED CAPTIVE POWER PLANT

	Client Name	Project Location	Capacity MW
1.	Yanbu Cement Company $	Yanabu, Saudi Arabia	36
2.	J K Cement Limited	Mangrol, Rajasthan	27
3.	Najan Cement Company $	Najran, Saudi Arabia	27
4.	Prism Cement Limited	Satna, Madhya Pradesh	22
5.	Eastern Province Cement Company $- Hold	Saudi Arabia	21
6.	ACC Limited	Wadi, Maharashtra	19.8
7.	Chettinard Cement Private Limited	Dachapalli, Andhra Pradesh	19
8.	Al Ain Cement Factory $	Abu Dhabi, UAE	18
9.	Wonder Cement Limited	Nimbahera, Rajasthan	18
10.	Ambuja Cements Ltd	Chhattisgarh, India	17.0
11.	J K Cement Limited	Panna, MP	17
12.	JK Cement Ltd	Muddapur, Karnataka	16.5
13.	ACC Limited	Ametha, Madhya Pradesh	16.2
14.	Nageri Sembilan Cement Ind SDN BHD $	Bahau, Malaysia	16
15.	City Cement Company $	Riyadh, Saudi Arabia	14.7
16.	Union Cement Company $	Ras al Khaimah, UAE	14.7
17.	Dalmia Cement Bharat Limited (Murli)	Chandrapur, Maharashtra	14
18.	JSW Cement FZE	United Arab Emirates	14
19.	Nageri Sembilan Cement Industries SDN BHD $	Perlis, Malaysia	14
20.	Sanghi Industries Limited	Sanghipuram, Gujarat	13.7
21.	Ambuja Cement Limited	Maratha, Maharashtra	13.5
22.	J K Cement Limited (Line 3)	Nimbahera, Rajasthan	13.5
23.	UltraTech Cement Limited	Awarpur, Maharashtra	13.22
24.	Jaiprakash Associates Ltd., (Unit I, II)	Rewa, M.P.	13
25.	JSW Cement Ltd	Nandyal, Andhra Pradesh	13
26.	Wonder Cement Limited (Line 4)	Nimbahera, Rajasthan	13
27.	Ambuja Cement Limited	Marwa Mundwa, Rajasthan	13

	Client Name	Project Location	Capacity MW
28.	ACC Limited	Chanda, Maharashtra	12.8
29.	Heidelberg Cement India Limited	Damoh, Madhya Pradesh	12.7
30.	Ambuja Cement Limited	Ambuja Nagar, Gujarat	12.5
31.	Emami Cement Limited	Rishda, Chattisgarh	12.5
32.	Fujairah Cement Industries $	Fujairah, UAE	12.5
33.	OCL India Limited (Line -3)	Rajgangpur, Odisha	12.5
34.	CG Cément Industries Palpa Pvt Ltd $	Nepal	12
35.	Dalmia Cement Bharat Limited	Belgaum, Karnatka	12
36.	Nuvoco Vistas Corporation Limited	Sonadih, Chhattisgarh	12
37.	UltraTech Cement Limited	Rawan, Rajasthan	12
38.	Kjs Cement (I) Ltd	Madhya Pradesh, India	11.5
39.	Star Cement Limited	Jaintia Hills, Meghalya	11.5
40.	Wonder Cement Limited (Line 2)	Nimbahera, Rajasthan	11.5
41.	RCCPL Private Limited	Mukutban, Maharashtra	11
42.	UltraTech Cement Limited (Rajashree)	Malkhed, Karnataka	10.7
43.	UltraTech Cement Limited	Hirmi, Rajasthan	10
44.	Meghalaya Cements Limited	Meghalaya	9.5
45.	Raysut Cement Company $	Salalah, Oman	9.5
46.	Longulf Trading (UK) Ltd., Line-1 & 2 $	Yemen	9.0
47.	Adani Cementation Limited - Hold	Lakhpat, Gujarat	9.0
48.	Atbara Cement Company $	Atbara	9.0
49.	Dalmia Cement Bharat Limited	Kadapa Andhra Pradesh	9.0
50.	Shiva Cement Limited (JSW Cement Ltd)	Rajgangpur, Odisha	8.9
51.	Shwe Taung Cement Co. Limited $	Thazi,Myanmar	8.9
52.	Smart 4 Power LLC $	United Arab Emirates	8.5
53.	National Cement Company	Yemen	8.3
54.	Calcom Cement India Limited	Umrangshu, Assam	8.0
55.	Chettinad Cement Corporation Limited	Kallur, India	7.5
56.	Dalmia Cement Bharat Limited	Meghalaya	7.0
57.	Nuvoco Vistas Corporation Limited	Chittorgarh, Rajasthan	7.0
58.	Nuvoco Vistas Corporation Limited	Arasmeta, Chhattisgarh	7.0
59.	E.ON Masdar Integrated Carbon Limited $	Turkey	6.3
60.	UltraTech Cement Limited Aditya (Line 2)	Shambhupura, Rajasthan	6.3
61.	Dalmia Cement Bharat Ltd (Line-2)	Dalmiapuram, TN	6.0

	Client Name	Project Location	Capacity MW
62.	Oman Cement Company (SAOG) $ - Hold	Daqm, Oman	6.0
63.	Ambuja Cement Limited	Rabriyawas, Rajasthan	6.0
64.	Ras Al Khaimah Cement Company $	Ras Al Khaimah, UAE	6.0
65.	Dalmia DSP Limited (Kalyanpur)	Banjari, Bihar	5.5
66.	Gujarat Sidhee Cement Limited	Sidheegram, Gujarat	5.5
67.	Dalmia Cement Bharat Limited	Dalmiapuram, TN	4.9
68.	Siddhi Vinayak Cement Limited (Nirma)	Pali, Rajasthan	4.75

B. SOLID FUEL CAPTIVE POWER PLANTS

	Client Name	Project Location	Capacity MW
1.	Jaiprakash Associates Limited	Churk, Uttar Pradesh	180
2.	Sanghi Industries Limited	Sanghipuram, Gujarat	124
3.	Jaiprakash Associates Limited	Sidhi, Madhya Pradesh	120
4.	ABG Cement Limited	Kutch & Surat, Gujarat	100
5.	DCM Shriram Fertilisers Limited (Co-Gen)	Bharuch, Gujarat	63
6.	Brijraj Power & Metallics Limited	Meghalaya	60
7.	DCM Shriram Fertilisers Limited (Co-Gen)	Kota, Rajasthan	60
8.	Jaiprakash Associates Limited	Bhuj, Gujarat	60
9.	Jaiprakash Associates Limited	Jaggayapeta, Andhra Pradesh	60
10.	Jaiprakash Associates Limited	Shahabad, Karnataka	60
11.	Transasia Refinery Limited $ - Hold	Karachi, Pakistan	55.5
12.	OCL India Limited	Rajgangpur, Odisha	54
13.	UltraTech Cement Limited	Tadipatri, Andhra Pradesh	50
14.	UltraTech Cement Limited (Rajashree)	Malkhed, Karnataka	50
15.	S B R Investment Llc	United Arab Emirate	46
16.	Adani Cementation Limited - Hold	Lakhpat, Gujarat	46
17.	Binani Cement Limited	Sirohi, Rajasthan	46
18.	Grasim Industries Limited	Kotputli, Rajasthan	46
19.	Orient Cement Company	Chittapur, Karnataka	45
20.	RCCPL Private Limited	Mukutban, Maharashtra	40
21.	Jaiprakash Associates Limited	Chunar, Uttar Pradesh	38
22.	Kanpur Fertilizers Limited (Co-Gen)- Hold	Kanpur, Uttar Pradesh	37

	Client Name	Project Location	Capacity MW
23.	Jmc Projects (india) Ltd $	Dronogovi, Mongolia	35
24.	Arabian Yemen Cement Co. (Co-Gen) $	Mukalla, Yeman	35
25.	Mangalam Cement Limited	Morak, Rajasthan	35
26.	Oman Cement Company (SAOG) $- Hold	Daqm, Oman	30
27.	Ambuja Cement Limited - Hold	Marwa, Mundwa, Rajasthan	30
28.	Emami Cement Limited	Rishda, Chattisgarh	30
29.	Siddhi Vinayak Cement Limited	Pali, Rajasthan	30
30.	UltraTech Cement Limited	Rawan, Chattisgarh	30
31.	Wonder Cement Limitedm Line 1	Chittorgarh, Rajasthan	30
32.	Wonder Cement Limited Line 2	Nimbahera, Rajasthan	30
33.	Dalmia Cement (Bharat) Limited	Ariyalur, Tamil Nadu	27
34.	Jaiprakash Associates Limited	Dalla, Uttar Pradesh	27
35.	Jaypee Cement Corporation Limited	Dhepalli, Andhra Pradesh	27
36.	KJS Cement Limited	Madhya Pradesh	27
37.	Nuvoco Vistas Corp Limited	Chittorgarh, Rajasthan	27
38.	Nuvoco Vistas Corp Limited	Jojobera, Jharkhand	27
39.	Shwe Taung Cement Co. Ltd $	Thazi, Myanmar	25
40.	Jaiprakash Associates Limited	Wanakbori, Gujarat	25
41.	Nuvoco Vistas Corp Limited	Sonadih, Chattisgarh	25
42.	DCM Shriram Fertilisers Limited (Co-Gen)	Ajbapur, Uttar Pradesh	22
43.	KJS Sponge & Iron (Co-Gen) - Hold	Maihar, Madhya Pradesh	22
44.	KJS Steel Limited	Rugudhi, Orissa	20
45.	UltraTech Cement Limited (Birla White) - Hold	Jodhpur, Rajasthan	20
46.	JSW Cement Limited	Nandyal, Andhra Pradesh	18
47.	JSW Cement Limited	Salboni, West Bengal	18
48.	Nuvoco Vistas Corp Limited	Arasmeta, Chattisgarh	18
49.	Vasavadutta Cement Limited	Sedam, Andhra Pradesh	17.5
50.	OCL India Limited (Sponge Iron) (Co-Gen)	Rajgangpur, Odisha	17
51.	Digvijay Cement Limited - Hold	Jamnagar, Gujarat	16
52.	Chettinad Cement Corporation Limited	Karikkali, Tamil Nadu	15
53.	Grasim Industries Limited	Ariyalur, Tamil Nadu	12.5

C. LIQUID / GAS BASED CAPTIVE POWER PLANTS

	Client Name	Project Location	Capacity MW
1.	Jaiprakash Associates Limited	PAN India	120
2.	Saudi Cement Company (Gas Turbine) $	Hofuf, Saudi Arabia	115.5
3.	Najran Cement Limited $	Najran, Saudi Arabia	85
4.	City Cement Limited $	Marat, Riyadh, Saudi Arabia	65
5.	Riyadh Cement Company $	Riyadh, Saudi Arabia	54
6.	Tabuk Cement $	Tabuk, Saudi Arabia	52
7.	Al-Ain Cement $	Abu Dhabi, UAE	50
8.	Al Safwa $	Jeddah, Saudi Arabia	45
9.	Unicem Cement $	Mfamosing, Calabar, Nigeria	45
10.	Hail Cement $	Hail Region, Saudi Arabia	40
11.	Northern Region Cement Company $	Northern Region, Saudi Arabia	40
12.	Arabian Cement Company Limited $	Amman, Jordon	39
13.	Arabian Yemen Cement Company $	Mokalla, Yemen	35
14.	Jaiprakash Associates Limited	Baga & Bagheri, H.P.	30
15.	Jaiprakash Associates Limited	Rewa, Madhya Pradesh	30
16.	Gujarat Sidhee Cement Limited	Sidheegram, Gujarat	20
17.	Grasim Industries Limited	Kotputli, Rajasthan	18
18.	Jaiprakash Associates Limited	Chunar, Uttar Pradesh	12.5
19.	Jaiprakash Associates Limited	Sikenderabad, Uttar Pradesh	12.5
20.	Jaiprakash Associates Limited	Dalla, Uttar Pradesh	10.5

$ Outside India On-Going

****

VIII. Detailed Consulting Scope of Projects

A. Integrated Cement Projects (Outside India)

Sn	Client Name	Capacity tpd	Location	Status	A	1	2	3.1	3.2	3.3	4	5	6
1.	Saudi Cement Co. Line 2	10000	Hofuf, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.	Saudi Cement Co. Line 1	10000	Hofuf, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.	Eastern Province Cement Co. #	10000	Dammam, Saudi Arabia	C	✓	✓	✓	--	--	--	--	--	--
4.	Vietnam Construction & Import Export Cooperation	7000	Cam Pha, Vietnam	C	--	--	✓	✓	✓	✓	--	--	--
5.	Najran Cement Co. Line 3	6500	Najran, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
6.	United Cement Group @	6000	Middle East	E	--	--	--	--	--	--	✓	✓	✓
7.	Dangote Industries Ltd. Line 2	6000	Ibese, Nigeria	C	--	--	✓	✓	✓	✓	✓	✓	✓
8.	Dangote Industries Ltd Line 1	6000	Ibese, Nigeria	C	--	--	✓	✓	✓	✓	✓	✓	✓
9.	Hatien 1 Cement Co.	6000	Binh Phuoc, Vietnam	C	--	✓	✓	✓	✓	✓	✓	✓	✓
10.	Northern Region Cement Co. Line 1	6000	Turaif, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
11.	Al-Rajhi Investments	6000	Amman, Jordan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
12.	Najran Cement Co. Line 1	6000	Najran, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
13.	Yanbu Cement Co. #	6000	Yanbu, Saudi Arabia	C	✓	✓	✓	--	--	--	--	--	--
14.	City Cement Co. Line 2	5500	Riyadh, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
15.	Oman Cement Co. (SAOG)	5000	Duqm, Oman	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
16.	Abay Industrial Development SC	5000	Dejen, Amahara, Ethiopia	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
17.	Al-Jouf Cement Co.	5000	Jouf City, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
18.	Al Nsr Cement Co. #	5000	Tripoli, Libya	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
19.	ACP Cement	5000	Africa	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
20.	Building Materials Industries Co.	5000	Egypt	C	--	--	--	✓	✓	✓	✓	✓	✓
21.	City Cement Co. Line 1	5000	Riyadh, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
22.	Derba Midroc Cement	5000	Addis Ababa, Ethiopia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
23.	Donglam Cement Ltd.	5000	Hue, Vietnam	C	✓	✓	✓		✓	✓	✓	✓	✓
24.	Hail Cement Co.	5000	Hail Region, Saudia Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
25.	Norm LLC	5000	Baku, Azerbaijan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
26.	Riyadh Cement Co. Line 2	5000	Riyadh, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
27.	Riyadh Cement Co. Line 1	5000	Riyadh, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
28.	Southern Province Cement Line 2 #	5000	Al Majardah, Saudi Arabia	C	✓	✓	✓	--	--	--	--	--	--
29.	Southern Province Cement Line 1	5000	Al Majardah, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
30.	Yemeni Saudi Cement Co.	5000	Batis, Yemen	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
31.	Al Khalij Cement Co.	5000	Umm-Bab, Qatar	C	--	✓	✓	✓	✓	✓	✓	✓	✓
32.	Arabian Cement Co. Ltd. - Al Katrana	5000	Amman, Jordan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
33.	Al-Takamol Cement Co.	4500	Atbara	C	--	--	--	✓	✓	✓	✓	✓	✓
34.	Afyon Cement #	4500	Afyonkarahisar, Turkey	C	✓	✓	✓	--	--	--	--	--	--
35.	National Cement Co. Line 1 (Longulf)	4250	Aden, Yemen	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
36.	Fico Tay Ninh Joint Stock Co.#	4200	Tay Ninh, Vietnam	C	✓	✓	✓	--	--	--	--	--	--
37.	Arabian Yemen Cement Co.	4000	Mukalla, Yemen	C	✓	✓	✓	✓	✓	✓	✓	✓	✓

Sn	Client Name	Capacity tpd	Location	Status	A	1	2	3.1	3.2	3.3	4	5	6
38.	Shwe Taung Cement Co. Ltd.	4000	Thazi, Myanmar	E	--	--	--	✓	✓	✓	✓	✓	✓
39.	Ehdas Management Co. Cerro Azoul Cement	3000	Venezuela	C	--	✓	✓	✓	✓	✓	✓	✓	✓
40.	Ehdasse Sanat (Hama Cement)	3000	Hama	C	--	✓	✓	✓	✓	✓	✓	✓	✓
41.	Najran Cement Co. Line 2	3000	Najran, Saudi Arabia	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
42.	Messebo Cement Project Line 2	3000	Mekele, Ethiopia	C	--	✓	✓	✓	✓	✓	✓	✓	✓
43.	Dungsam Cement Corp. Ltd.	3000	Dungsum, Bhutan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
44.	Messebo Cement Project Line 1	2000	Mekele, Ethiopia	C	--	✓	✓	✓	✓	✓	✓	✓	✓
45.	Arabian Bulk Terminal Co.	1500	Port Digna	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
46.	Longulf Trading (UK) Ltd Line 2	2000	Yemen	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
47.	Cimerwa	1500	Bugarama, Rwanda	C	--	--	✓	✓	✓	✓	✓	✓	✓
48.	Senj Sant Llc	1500	Gobi, Mongolia	C	--	--	--	✓	✓	✓	✓	✓	✓
49.	Ashoka Technologies	600	Djibouti	C	--	✓	✓	✓	✓	✓	✓	✓	✓

B. Integrated Cement Projects (Inside India)

Sn	Client Name	Capacity tpd	Location	Status	A	1	2	3.1	3.2	3.3	4	5	6
1.	Jaypee Associates Ltd.	10000	Balaji, Andhra Pradesh	C	✓	✓	✓	--	✓	✓	✓	✓	✓
2.	Jaypee Associates Ltd.	10000	Baga, Himachal Pradesh	C	✓	✓	✓	--	✓	✓	✓	✓	✓
3.	Reliance cementation Ltd., Line 1	10000	Maihar, M.P	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
4.	ABG Cement Ltd.	10000	Kachh, Gujarat	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
5.	Ultratech Cement Ltd.	10000	Rajashree Cement, Malkhed	C	--	✓	✓	--	✓	✓	✓	✓	✓
6.	Ultratech Cement Ltd.	10000	Rawan Cement, CG	C	--	✓	✓	--	✓	✓	✓	✓	✓
7.	Ultratech Cement Ltd.	10000	Kotputli, Rajasthan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
8.	Ultratech Cement Ltd.	10000	Aditya Cement, Rajasthan	C	--	✓	✓	✓	✓	✓	✓	✓	✓
9.	Ultratech Cement Ltd.	10000	APCW Tadipatri, A.P.	C	--	✓	✓	✓	✓	✓	✓	✓	✓
10.	Sanghi Cement Ltd Line 2	10000	Kutch, Gujarat	C	--	✓	✓	✓	✓	✓	✓	✓	✓
11.	Adani Cementation Ltd	10000	Lakhpat, Gujarat	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
12.	ACC td	9500	Ametha, M.P	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
13.	Emami Cement Ltd.	9000	Chhattisgarh	C	--	--	--	--	✓	✓	✓	✓	✓
14.	Ambuja Cement Ltd.	9000	Marwa Mundwa, Rajasthan	E	--	✓	✓	✓	✓	✓	✓	✓	✓
15.	Wonder Cement Ltd., Line 3	8500	Chittorgarh, Rajasthan	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
16.	Wonder Cement Ltd., Line 2	8500	Chittorgarh, Rajasthan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
17.	RCCPL Private Ltd.	8200	Mukutban, Maharashtra	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
18.	Chettinad Cement Ltd	8000	Dachepalli, A.P.	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
19.	Dalmia Cement Ltd (OCL-Line 3)	8000	Rajgangpur, Odisha	E	--	✓	✓	✓	✓	✓	✓	✓	✓
20.	JK Cement Ltd.	7500	Panna, Madhya Pradesh	E	--	✓	✓	--	✓	✓	✓	✓	✓
21.	JK Cement Ltd., Line-3	7500	Mangrol, Rajasthan	E	--	✓	✓	--	✓	✓	✓	✓	✓
22.	Jaypee Associates Ltd. Super	7000	Dalla, U.P	C	✓	✓	✓	--	✓	✓	✓	✓	✓
23.	Wonder Cement Ltd., Line 1	6500	Chittorgarh, Rajasthan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
24.	Shree Cement Ltd.	6000	Raipur, CG	C	--	✓	--	--	✓	--	--	--	--
25.	Shree Cement Ltd.	6000	Karnatka	C	--	✓	--	--	✓	✓	--	--	--

Sn	Client Name	Capacity tpd	Location	Status	A	1	2	3.1	3.2	3.3	4	5	6
26.	JSW Cement Ltd.	6000	Nandyal, AP	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
27.	KJS Cement Pvt. Ltd.	6000	Madhya Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
28.	Chettinad Cement Corp. Ltd. Line 1	6000	Gulbarga	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
29.	Jaypee Associates Ltd. Line 1	6000	Bhuj, Gujarat	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
30.	Jaypee Associates Ltd. Line 2	6000	Bhuj, Gujarat	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
31.	Jaypee Bela Cement Ltd.	6000	Bela, Madhya Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
32.	Binani Cement Ltd, Line 2	6000	Pindwara, Rajasthan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
33.	Jaypee Rewa Cement (Unit II)	5500	Rewa, Madhya Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
34.	Nirma Ltd. (Siddhi Vinayak)	5000	Pali, Rajasthan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
35.	Zuari Cement - Ital Cementi	5000	Yerraguntla, Andhra Pradesh	C				✓	✓	✓	✓	✓	✓
36.	Jaypee Associates Ltd. Line I	4500	Sidhi, Madhya Pradesh	C	✓	✓	✓	--	✓	✓	✓	✓	✓
37.	Jaypee Associates Ltd. Line II	4500	Sidhi, Madhya Pradesh	C	✓	✓	✓	--	✓	✓	✓	✓	✓
38.	Jaypee Associates Ltd. Line II	4500	Dalla, U.P	C	✓	✓	✓	-	✓	✓	✓	✓	✓
39.	Binani Cement Ltd, Line 1	4500	Pindwara, Rajasthan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
40.	Dalmia Cement (Bharat) Ltd	4500	Belgaum, Karnataka	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
41.	Dalmia Cement (Bharat) Ltd	4500	Andhra Pradesh	C	✓	✓	✓	--	✓	✓	✓	✓	✓
42.	Jaypee Rewa Cement Ltd Line 1	4500	Rewa, Madhya Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
43.	DLF Cement Ambuja Cement Rajasthan Ltd)	4200	Ras, Rajasthan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
44.	Chettinad Cement Corp. Ltd.	4000	Karikkali	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
45.	Chettinad Cement Corp Ltd Line 1	4000	Ariyalur	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
46.	Chettinad Cement Corp Ltd Line 2	4000	Ariyalur	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
47.	Dalmia Cement (Bharat) Ltd	4000	Ariyalur	C	✓	✓	✓		✓	✓	✓	✓	✓
48.	Raj Cement	4000	Beawar, Rajasthan	C	--	✓	✓	✓	✓	✓	✓	✓	✓
49.	Orient Cement Line 3	4000	Devapur	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
50.	Deccan Cement Ltd Line 2	3500	Nalgonda	E	✓	✓	✓	✓	✓	--	✓	✓	✓
51.	Chettinad Cement Corporation Ltd	3300	Dindigul, Tamil Nadu	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
52.	Dalmia Cement Bharat Ltd	3300	Dalmiapuram, TN	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
53.	JSW Cement Limited (Shiva Cement)	3000	Kandeimunda, Odisha	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
54.	Jaiprakash Associates Ltd. (BJCL)	3000	Satna, Madhya Pradesh	C	✓	✓	✓	--	✓	✓	✓	✓	✓
55.	Coromandel Fertilizers Ltd (India Cement Ltd)	3000	Kalamalla, Andhra Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
56.	Grasim Industries Ltd	3000	Reddipalayam, Tamil Nadu	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
57.	Tata Iron and Steel Co. (Lafarge I Ltd) Line 1	3000	Sonadih, Madhya Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
58.	Tamil Nadu Cements Corporation Ltd	1500	Ariyalur, Tamil Nadu	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
59.	Texmaco (now Zuari Cement-Italcementi)	1500	Yerraguntla, Andhra Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
60.	Ultratech Cement Ltd (Birla White) #	1500	Kharla Khangar,Jodhpur,	C	✓	✓	✓	--	--	--	--	--	--
61.	Uttar Pradesh State Cement Corporation Ltd 1	1200	Dalla, Uttar Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
62.	Uttar Pradesh State Cement Corporation Ltd 2	1200	Dalla, Uttar Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
63.	Cement Corporation of India	1200	Akaltara, Madhya Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
64.	Cement Corporation of India	1200	Neemuch, Madhya Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
65.	Cement Corporation of India	1200	Yerraguntla, Andhra Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
66.	CMCL	1200	Meghalaya	C	✓	✓	✓		✓	✓	✓	✓	✓

Sn	Client Name	Capacity tpd	Location	Status	A	1	2	3.1	3.2	3.3	4	5	6
67.	Madras Cements Ltd.	1200	Thulukkapatti, Tamil Nadu	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
68.	Malabar Cements Ltd.	1200	Walayar, Kerala	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
69.	Meghalaya Cements Ltd.	1200	Jaintia Hills, Meghalaya	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
70.	Trumboo Industries Private Ltd	1000	Srinagar, Kashmir	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
71.	Nagarjuna Construction Co. Ltd	800	Anantapur, Andhra Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
72.	Cement Corporation of India	600	Rajban, Himachal Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
73.	Deccan Cements	600	Miryalaguda, Andhra Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
74.	RNB Cements Pvt Ltd.	600	Meghalaya	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
75.	Nihon Nirmaan White Cement	250	Gotan, Rajasthan	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
76.	Balaram Cements	200	Palanpur, Gujarat	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
77.	Dhar Cement	200	Dhar, Madhya Pradesh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
78.	Karnataka Cement	200	Chitapur, Karnataka	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
79.	Gujarat Himalaya Cements (White Cement)	150	Porbandar, Gujarat	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
80.	NECEM Ltd.	100	Umarangshu, Assam	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
81.	Tamilnadu Magnesite (Dead Burnt Magnesite)	100	Salem, Tamil Nadu	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
82.	Virgo Cement	100	Dudhnai, Meghalaya	C	✓	✓	✓	✓	✓	✓	✓	✓	✓

C. Split Grinding Units

Sn	Client Name	Capacity mio TPA	Location	Status	A	1	2	3.1	3.2	3.3	4	5	6
1.	ABG Cement Ltd.	5.0	Surat, Gujarat	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.	Shah Cement	4.0	Bangladesh	C	--	✓	✓	✓	✓	✓	✓	✓	✓
3.	Jaiprakash Associates Ltd.	3.0	Chunar	C	✓	✓	✓	--	✓	✓	✓	✓	✓
4.	UltraTech Cement Ltd.	2.66	Dadri, U.P.	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
5.	Wonder Cement Ltd	2.5	Jhajjar, Haryana	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
6.	OCL India Ltd.- Line 2	2.25	Kapilas	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
7.	OCL India Ltd.- Line 2	2.25	Midnapur	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
8.	OCL India Ltd.	2.25	Bihar	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
9.	Jaiprakash Associates Ltd.	2.2	Bhilai,	C	✓	✓	✓	--	✓	✓	✓	✓	✓
10.	Jaiprakash Associates Ltd.	2.2	Bokaro, Chattisgarh	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
11.	Adani Cementation Ltd (Cement Terminal)	2.0	Raigarh, Maharashtra	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
12.	Jaiprakash Associates Ltd. Line 1	2.0	Nigre, MP	C	✓	✓	✓	--	✓	✓	✓	✓	✓
13.	Jaiprakash Associates Ltd. Line 2	2.0	Nigre, MP	H	✓	✓	✓	--	✓	✓	✓	✓	✓
14.	Jaiprakash Associates Ltd. Line 1	2.0	Bara, UP	C	✓	✓	✓	--	✓	✓	✓	✓	✓
15.	Jaiprakash Associates Ltd. Line 2	2.0	Bara, UP	E	✓	✓	✓	--	✓	✓	✓	✓	✓
16.	Jaypee Associates Ltd. Line 3 (Expansion)	2.0	Bhuj, Gujarat	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
17.	Lafarge India (Expansion)	2.0	Jojobera	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
18.	Emami Cement Ltd	2.0	Panagarh, West Bengal	C	--	✓		--	✓	✓	✓	✓	✓
19.	Wonder Cement Ltd	2.0	Maharshtra	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
20.	Wonder Cement Ltd	2.0	Madhya Pradesh	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
21.	Emami Cement Ltd	2.0	Jajpur, Odisha	C	--	✓	✓	✓	✓	✓	✓	✓	✓
22.	Shree Cement Ltd	2.0	Pune	E	--	✓	--	--	✓	✓	--	--	--
23.	Shree Cement Ltd	2.0	Odisha	E	--	✓	--	--	✓	✓	--	--	--
24.	Shree Cement Ltd (Line 2)	2.0	Suratgarh	C	--	✓	--	--	✓	--	--	--	--
25.	Shree Cement Ltd (Line 1)	2.0	Bihar	C	--	✓	✓	--	✓	✓	--	--	--
26.	Shree Cement Ltd (Line 2)	2.0	Bihar	C	--	✓	--	--	✓	--	--	--	--

Sn	Client Name	Capacity mio TPA	Location	Status	A	1	2	3.1	3.2	3.3	4	5	6
27.	Shree Cement Ltd	2.0	Bulandsehar UP	C	--	✓	--	--	✓	--	--	--	--
28.	Chettinad Cement Pvt Ltd.	2.0	Visakhapatnam	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
29.	Sanghi Industries Ltd	2.0	Surat, Gujarat	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
30.	Star Cement Limited	2.0	Siliguri, West Bengal	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
31.	JSW Cement Ltd	2.0	Vijaynagar, Karnatka	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
32.	JSW Cement Ltd	1.8	Dolvi, Maharashtra	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
33.	Reliance cementation Ltd. Line 1	1.65	Raiebareily U.P	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
34.	ACC Ltd	1.6	Tikaria, U.P.	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
35.	Boral Cement Ltd	1.5	Australia	E	--	✓	✓	--	--	--	--	--	--
36.	Orient Cement Company	1.5	Devapur, Telangana	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
37.	J K Cement Limited	1.5	Ujjain, Madhya Pradesh	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
38.	J K Cement Limited	1.5	Hamipur, Uttar Pradesh	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
39.	J K Cement Ltd	1.5	Aligarh, U P	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
40.	Jaiprakash Associates Ltd.	1.5	Panipat, Haryana	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
41.	Jaypee Ventures Ltd.	1.5	Bagheri, H.P.	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
42.	Ultratech Cement Ltd.	1.5	Panipat, Haryana	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
43.	Ultratech Cement Ltd.	1.5	Aligarh, UP	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
44.	Ultratech Cement Ltd.	1.5	Ginigera, Kar.	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
45.	Lafarge India	1.43	Jojobera, Jharkhand	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
46.	Jaypee Associates Line 1	1.2	Wanakbori, Gujarat	C	✓	✓	✓	--	✓	✓	✓	✓	✓
47.	Jaypee Associates Line 2	1.2	Wanakbori, Gujarat	C	✓	✓	✓	--	✓	✓	✓	✓	✓
48.	RCCPL Pvt Ltd Line 2	1.2	Kundangaunj, UP	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
49.	Hormuz Al Anwar Cement SAOC	1.0	Oman	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
50.	Jaiprakash Associates Ltd.	1.0	Sikandrabad, U. P	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
51.	Ambuja Cement Ltd. (Expansion)	1.0	Sankrail, West Bengal	C	--	✓	--	✓	✓	✓	✓	✓	✓
52.	Jaypee Associates Ltd.	1.0	Roorkee, Uttarakhand	C	✓	✓	✓		✓	✓	✓	✓	✓
53.	JSW Cement Ltd.	1.0	Tornagallu, Kar.	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
54.	Lafarge India Ltd	1.0	Mejia, West Bengal	C	--	✓	✓	✓	--	--	--	✓	--
55.	OCL India Ltd. Line 1	1.0	Midnapur, West Bengal	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
56.	OCL India Ltd. Line 1	1.0	Kapilas, Odisha	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
57.	Jaiprakash Associates Ltd.	1.0	Tanda, UP	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
58.	Chettinad Cement Pvt Ltd.	1.0	Solapur, Maharashtra	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
59.	KJS Cement (I) Limited	1.0	Maiher, Madya Pradesh	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
60.	KJS Cement (I) Ltd	1.0	Allahabad, U.P	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
61.	Deccan Cements Ltd	0.8	Vishakhapatnam	E	✓	✓	✓	✓	✓	--	✓	✓	✓
62.	Adani Cementation Ltd (Cement Terminal)	0.8	Vizhinjam, Kerala	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
63.	J K Cement Ltd	0.7	Balasinor, Gujarat	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
64.	Jaypee Rewa Cement (Blending Unit)	0.6	Allahabad, U.P.	C	✓	✓	✓	✓	✓	✓	✓	✓	✓
65.	JSW Cement Ltd	0.6	Salboni, West Bengal	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
66.	Adani Cementation Ltd (Cement Terminal)	0.6	Mangalore, Karnatka	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
67.	JSW Cement Limited (GGBS)	0.6	Salem, Tamil Nadu	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
68.	Adani Cementation Ltd (Cement Terminal)	0.5	Hazira, Gujarat	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
69.	Jaiprakash Associates Ltd.	0.5	Vizag	C	✓	✓	✓	✓	✓	✓	✓	✓	✓

A. Project Report
1. Basic Engineering
2. Procurement Assistance
3. Detailed/ Review Engineering
   3.1 Civil Engineering
   3.2 Mechanical
   3.3 Electrical & Automation
4. Equipment Inspection
5. Site supervision
6. Project Planning & Monitoring

C: Completed
E: Under Execution

Holtec Consulting Pvt Ltd
Holtec Centre
A Block, Sushant Lok
Gurgaon 122001, Haryana, India
Ph: +91-124-4047900 Fax: +91-124-2385114, 116

Holtec Consulting Pvt Ltd
Holtec Centre UV
65 HSIIDC Sector-18, Udyog Vihar
Gurgaon 122015, Haryana, India
Ph: +91-124-4693200 Fax: +91-124-4693103, 104

Holtec Global Solutions FZE
Sharjah Airport International Free Zone (SAIF Zone)
P O Box 121016, Sharjah, United Arab Emirates
Ph: +971-6-5575984 Fax: +971-6-5575985

www.holtecnet.com
Email: info@holtecnet.com/ pkm@holtecnet.com

VAKALATNAMA

Before the Hon'ble National Green Tribunal, Eastern Bench, Kolkata

Original Application No.154 of 2023

Threat to life arising out of coal mining in South Garo Hills District

...Petitioner/Applicant

-Versus-

State of Meghalaya & Ors ... Respondent / Op. Party

Vakalatnama on behalf of **Amrit Cement Limited** Know all men by these presents that by Vakalatnama, I/We appoint the Advocates noted below or any one of them my/our lawful advocate or advocates for filing memorandum or entering appearance in the above matter for appearing conducting and arguing the same for depositing or withdrawing any money in connection therewith for moving the Court in any matter connected therewith, for preparing the paper book in the case and for putting in papers, petitions etc. on my/our behalf. For filing, taking back any documents, for withdrawing suits or appeals or petitions with permissions to institute fresh suit etc. for signing and filling petitions of compromise in connections with the said matter and for taking copies of paper from the Record.

I/We further say that any act done by my/our said Advocate or Advocates or by any one of them after accepting this Vakalatnama, shall be considered as my/our own true and lawful act.

And I/We further hereby agree and undertake to pay the said Advocate his/their fees as settled and all other sums that may by necessary to carry out the requisition of the Court and otherwise to enable the said Advocates to conduct the case properly. Failing which the said Advocates after notice to me/us will be at liberty to withdraw from further conducting the case.

IN WITNESS WHEREOF I/WE sign and execute this Vakalatnama on this the 3th day of ~~October~~ 2023

Pranav Sharma

Name of Advocate

Mr. Pranav Sharma
Hastings Chambers, 6th Floor
7C Kiran Shankar Roy Road
Kolkata -700001
Phone: +91.98310.96193

email: cs@asyst.in

Amrit Cement Ltd.
Krishanu Banerjee