FIELD IMMERSION- II

MAHAGAMS

Report

On

Fly-Ash Utilization

Submitted By:

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Acknowledgement

The outcome of the project required an extensive support from the many people, we are very thankful for the support and guidance which we required for the successful completion of the project at MAHAGAMS (MAHAGENCO Ash Managements Service Ltd.). The project would not have been full to completion without the constant support and guidance from the college authority.

We thank at MAHAGAMS, Sudhir Paliwal (Director) and Pankaj Dharaskar, Dy. Exe Engr at MAHAGAMS for providing us with an opportunity to do the field immersion work in their organization. We are thankful to them for providing us with constant support and access to data and infrastructure which enabled us to complete the report duly.

We would like to specially thanks Mr. Pankaj Dharaskar, who has been a constant guide and mentor and without his guidance the field visit to the power plant and organization's data sharing would not have been organized and the report would not have been completed

We owe the deepest gratitude to our field office In-charge, Mr Shivaji Dhawad, who took a keen interest on our work and guided us all along, till the completion of our work by providing all the necessary information for developing a sound system.

We would also like to thank our entire faculty at IIM Nagpur with special mention to Prof. Prem Chander, Prof. Chetan Soman and Prof. Pradyumana Khokle.

Executive Summary

The report focuses on Fly-Ash management system of MAHAGAMS. The report starts with understanding the chemical composition of Fly-Ash. It elaborates on the detailed applications of Fly Ash in sectors ranging from construction to agriculture. The report provides a detail on the installed capacity of MAHAGENCO (Maharashtra state power generation company), As MAHAGENCO is a thermal based electricity generation unit, it utilizes coal to produce electricity which in turn leads to generation of Fly-Ash. Due to this MAHAGENCO faces the problem of disposing the Fly-Ash as well as formulating alternative methods to utilize the Fly-Ash. Both these problems have been addressed, we found out that the alternative use of Fly-Ash in the cement producing unit has been used to the maximum and also that setting up a captive cement plant in the vicinity of the power plants under study is ruled out because of inadequate demand for cement. Thus, alternative methods for utilization of the Fly-Ash are suggested which are detailed in the report, and it confirms to the norms of Ministry of Forests and Environment Circular dt. 25th January 2016.

Contents

1. About MAHAGAMS

MAHAGAMS (MAHAGENCO Ash Management Services Ltd., a fully owned subsidiary of MAHAGENCO was started with the intent of ensuring better utilization of all the Fly-Ash generated from power plants. The company looks after compliance of the Central Government's policy, which is to achieve a 100% utilization of Fly-Ash.

The idea behind the formation of this company was to identify and encourage industries based around Fly-Ash. The regional office at Nagpur was started in the year 2016. Ever since its inception, the company has signed numerous MOUs with organizations for use and research purposes. Previously as per government directive, power plants had to transport fly-ash to users around the 100-km radius free of cost. This would cost MAHAGENCO a substantial amount of money annually. In order to save this expense, the company intends to identify and help set-up industries around these power plants in addition to helping MAHAGENCO earn money from the sale of Fly-Ash.

2. About MAHAGENCO

Maharashtra State Power Generation Company Limited (MSPGCL) or commonly known as MAHAGENCO is a Government of Maharashtra owned power generation company in Maharashtra. The company gives all the power generated to the state of Maharashtra. Until 2005, it was a part of Maharashtra State Electric Board (MSEB). In terms of power generation, MAHGENCO is the second largest in the country.

Among all state-owned power generation utilities in India, MAHAGENCO has the highest thermal installed capacity as well as the highest overall capacity. The company has a balanced portfolio of Hydro Power Stations, Gas Turbine Power Stations and Thermal Power Stations

2.1 Installed Capacity of MAHAGENCO

S. No.	POWER STATION	UNITS & SIZE(MW)	INSTALLED CAP.(MW)
A	THERMAL POWER STATIONS		
1	KORADI 6 TO 10	2x210 + 3x660	2400
2	NASIK 3 TO 5	3x210	630
3	BHUSAWAL 3 TO 5	1x210 + 2x500	1210
4	PARAS 3 & 4	2x250	500
5	PARLI 4 TO 8	2x210+ 3x250	1170
6	K'KHEDA 1 to 5	4x210 + 1x500 MW	1340
7	CHANDRAPUR 3 TO 9	2x210 + 5x500	2920

	Total		10170
B	GAS TURBINE POWER STATION		
	URAN G.T.	4x108	432
	W.H.R. 1&2	2x120	240
	Total		672
C	HYDRO POWER STATIONS		
	KOYNA HYDRO	St I&II- 4x70 + 4x80, St III-4x80, St. IV-4x250 & Koyna Dam foot- 2x18	1956
	SMALL HYDRO		374
	GHATGHAR PUMP STORAGE	2x125	250
	Total		2580
D	SOLAR		180
	Grand Total		**13602**

2.2 Ongoing and Future Projects (Thermal)

Name of Project	Capacity in MW	Commissioning Year
Bhusawal Unit 6	1 x 660	2018-2019
Paras Unit 5	1 x 250	2018-2019
Nasik Unit 6 (Replacement)	1 x 660	2019-2020
Dondaicha Project	5 x 660	2020-2021 to 2022-2023
Uran GTPS	Block-I: 406 Block-II: 814	2019-2020*

2.3 Subsidiaries

MAHAGENCO has 3 subsidiaries:

1. *Mahaguj Collieries Ltd.* – A joint venture between Gujarat State Electricity Co Ltd. and MAHAGEMCO. It was set up for captive mining of coal blocks in Angul District of Orissa State at Machchakata. Their preliminary activities include acquisition of land and getting government clearances.

2. *Dhopave Coastal Power Co. Ltd.* – This company was started with the aim to start numerous Thermal Power projects based on the guidelines set by the Ministry of Power (Government of India).

3. *MAHAGAMS* – MAHAGENCO Ash Management Services Ltd. or commonly known as MAHAGAMS is a fully owned subsidiary of MAHAGENCO which was started for ash utilization.

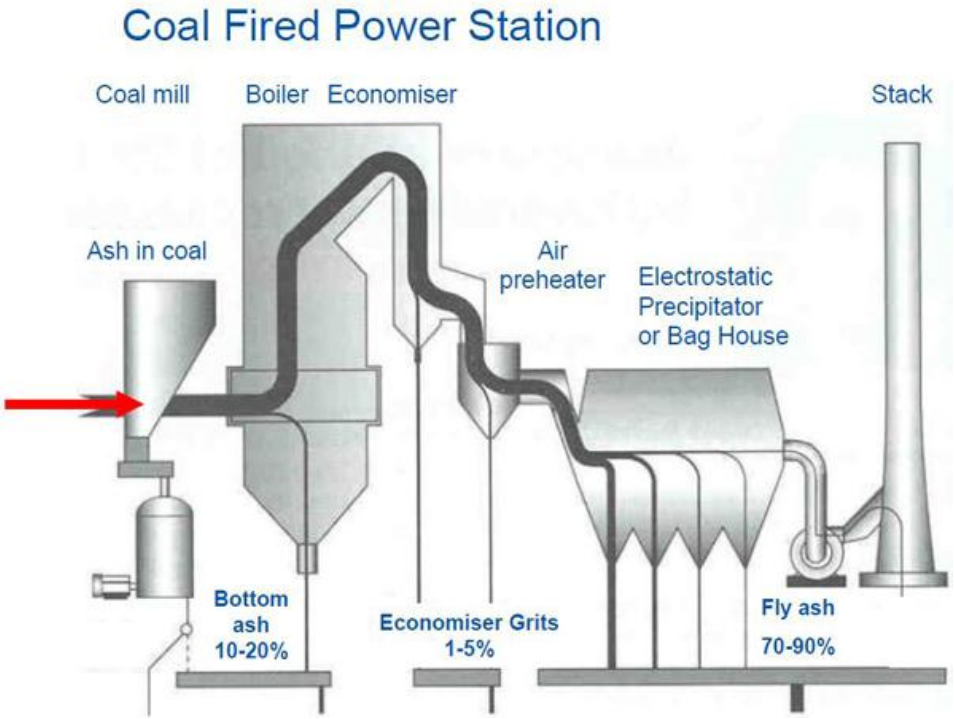
3. Fly-Ash

3.1 Chemical Composition & Production

Fly-Ash is a by-product of electricity generation by burning coal. In its essence, Fly-Ash is an unburned residue carried away by flue gases from the burning zone in a boiler. It is then collected by electrostatic and mechanical separators. Other heavier unburnt matter is collected at the bottom of the furnace, but is unsuitable for use.

Fly-Ash particles are almost spherical in shape and the sizes vary from 0. 5 to 300. Fly-Ash in general is a heterogeneous material. The main components of Fly-Ash is silicon dioxide, aluminium oxide and ferrous oxide. Occasionally calcium oxide is also one of the main chemical component. Fly-Ashes have a very diverse mineralogy. Fly-Ashes also have a mercury content of 1 ppm but in general varies in the range of 0.01 to 1 ppm for bituminous coal.

Based on the chemical composition of coal, the combustion of coal and lead to traces of other elements in Fly-Ash. The American section of the International Association for testing materials, ASTM C618 classifies Fly-Ash into two classes: class F Fly-Ash and class C Fly-Ash. Classes very in the amount of silica, alumina, iron content and calcium in the ash. Other chemical properties of Fly-Ash are also heavily influenced by the chemical content of the coal.



3.2 Types of Fly-Ash

Not all Fly-Ash produced adheres to ASTM C618 standards as depending on Fly-Ash application it might not even be necessary. Fly-Ash used in cement plant must adhere to strict standards however no such standard regulations have yet been established in countries like the United States.

Class F Fly-Ash
This type of Fly-Ash is produced by the burning of older and harder bituminous coal and anthracite. The resulting Fly-Ash contains less than 7% calcium oxide and also is pozzolanic in nature. Because of this pozzolanic properties, the alumina and silica in class F Fly-Ash requires components such as quicklime, hydrated lime or Portland cement (basically cementing agents) and water to produce cementitious compounds. In addition to this, a Geo polymer can also be octane by adding sodium silicate (chemical activator).

Class C Fly-Ash
This type of Fly-Ash produced by burning subbituminous coal or younger lignite. Class C Fly-Ash, apart from having pozzolanic properties also has self-cementing properties. By adding water, class C Fly-Ash can harden and get stronger over time. This means that unlike class F Fly-Ash, class C Fly-Ash doesn't need and activator.

3.3 Applications of Fly-Ash

Fly-Ash has numerous uses, some of these have been mentioned below:

1. Fly-Ash is used in production of concrete. Here Fly-Ash acts as a substitute for Portland Cement & Sand. Specifically, Fly-Ash is used in the process of manufacturing of ready-mix concrete. Ready-mix concrete gives the builders better control over the quality, reduces wastage etc.

2. It is used in Cement Clinkers production, mostly to substitute clay. The cement thus produced has low heat of hydration, lesser permeability which gives it more strength and more durability

3. It is used in construction of Road Sub-base (pictured below). These can be prepared using even coarser variety of bottom ash. Addition of Fly-Ash improves strength characteristics

4. It is used in brick production as an aggregate substitute material (pictured below). This is possible due to the similarity in the properties of clay and Fly-Ash.

5. Fly-Ash has also found an application in waste solidification and stabilisation

6. Fly-Ash is used in asphaltic concrete as a mineral filler

7. It is also used in Wallboard (also known as Gypsum Wallboard) as a replacement for gypsum(mined)

8. It has also been found to be useful as embankment and mine fill

9. Fly-Ash is also used in paving roads

10. Fly-Ash also has the potential to improve the physical health of soil.

11. It can improve the nutrient and water intake of plants.

12. In agriculture, Fly-Ash can in fact increase the yield of oil seeds, cereals, cotton etc, by 10-15% and in case of root vegetables by close to 40%.

13. Eroded soils and degraded lands can also be reclaimed by the use of Fly-Ash

14. Fly-Ash also detoxifies contaminated soil

15. Similar to Fly-Ash bricks, Fly-Ash can also be used to make hollow blocks and mosaic tiles.

3.4 Disposal of Fly-Ash

Back in the day, Fly-Ash produced from power plants after burning coal was dispersed into the atmosphere. Off late power plants have found alternate ways of disposing Fly-Ash- Wet System and the Dry System.

Wet System:

In the Wet System, the Fly-Ash is mixed with water and using pipes is transported in slurry form. Ponds and lakes are identified, or an artificial lake is created where this slurry is then dumped. Given the low cost involved in the Wet System, it is the most commonly adopted method of disposal.

Dry System:

In the Dry-System, using Electrostatic Precipitation, the dry Fly-Ash is collected. This dry Fly-Ash is then transported using trucks or conveyors to a sight nearby where an artificial embankment is created.

Even after knowing the advantages of re-using Fly-Ash, only 65% of the Fly-Ash produced worldwide is actually re-used. The situation is worse in India.

3.5 Disadvantages of disposing Fly-Ash

Disposing Fly-Ash by either of the methods only magnifies the problem further as it effects the environment in numerous ways:

a. It causes Air-Pollution which may have health implications

b. Dumping the Fly-Ash to a nearby pond renders the pond useless

c. Surface run-offs from both the above-mentioned points effect the soil as well as ground water

d. It may also cause leaching in the soil

e. Additional cost implications, in India the cost of disposing a tonne of Fly-Ash would cost anywhere between Rs. 150- Rs. 200. Thousands of tonnes of Fly-Ash is disposed daily

3.6 Advantages of re-using Fly-Ash

1. First and foremost, re-using Fly-Ash saves space for disposal. Until now, Fly-Ash have been disposed of in lakes and ponds. Re-using Fly-Ash not only mitigates this process it all saves a lot of money in the form of disposal costs.

2. Using it as a substitute for other materials saves cost and energy that would have been required to produce the other material had there been no Fly-Ash

3. Disposing Fly-Ash effects the environment in numerous way, mostly by polluting the water

4. Fly-Ash in India

India has a vast coal reserve of over 200 billion tonnes, which has resulted in extensive use of this fossil fuel mostly to generate power. Coal found in India has 40-45% ash content which also raises the problem of ash-disposal. In India the finer Pozzolanic Fly-Ash and the bottom ash is generally mixed together and are then disposed of into some lake or pond. Close to 200 million tonnes of Fly-Ash is thus generated in India and is disposed of. The government of India expects this number to rise to 300 million tonnes each year by 2032.

4.1 Regulatory Environment

Fly-Ash generated from the power plants is to be disposed as upon the guidelines from MOEF (Ministry of Environment and Forest, Govt. of India) guidelines dated 25.01.2016.

Book-keeping: Thermal power plants to update on the websites the type of Fly-Ash that they have in stock (at least) once per month

Storage: Building separate dry ash silos having separate road access to ease the delivery of dry Fly-Ash.

Policy regarding Transport: The cost of transportation up to 100 kms to be borne by the thermal power plant while from 100-300km to be borne 50-50 by user and the thermal power plant.

Promoting Industries: Thermal power plants to promote support and assist in setting up of ash based product manufacturing industries so as to meet the requirement of bricks and other building construction materials and also to reduce the transportation

Road Contractors: The authority concerned with the building of roads would link the payment for the contractor after the certification from thermal power plant regarding the quantity of Fly-Ash utilized.

5. Problem Statement

Find feasibility of dry Fly-Ash usage in cement plants in and around Nagpur.

Under the problem defined a suggestion for alternative use of Fly-Ash for MAHAGENCO's thermal power plants which generate 3740 MW of electricity and which are located in Kaparkheda (1340MW) (Maharashtra) and Koradi (2400MW) (Maharashtra).

The feasibility of Fly-Ash usage is based on techno-logistic-economic feasibility study. The study is to indicate to the promoter(MAHAGAMS) the viability of usage of Fly-Ash generated from power plants at Kaparkheda and Koradi power station.

6. Evaluation of Alternatives

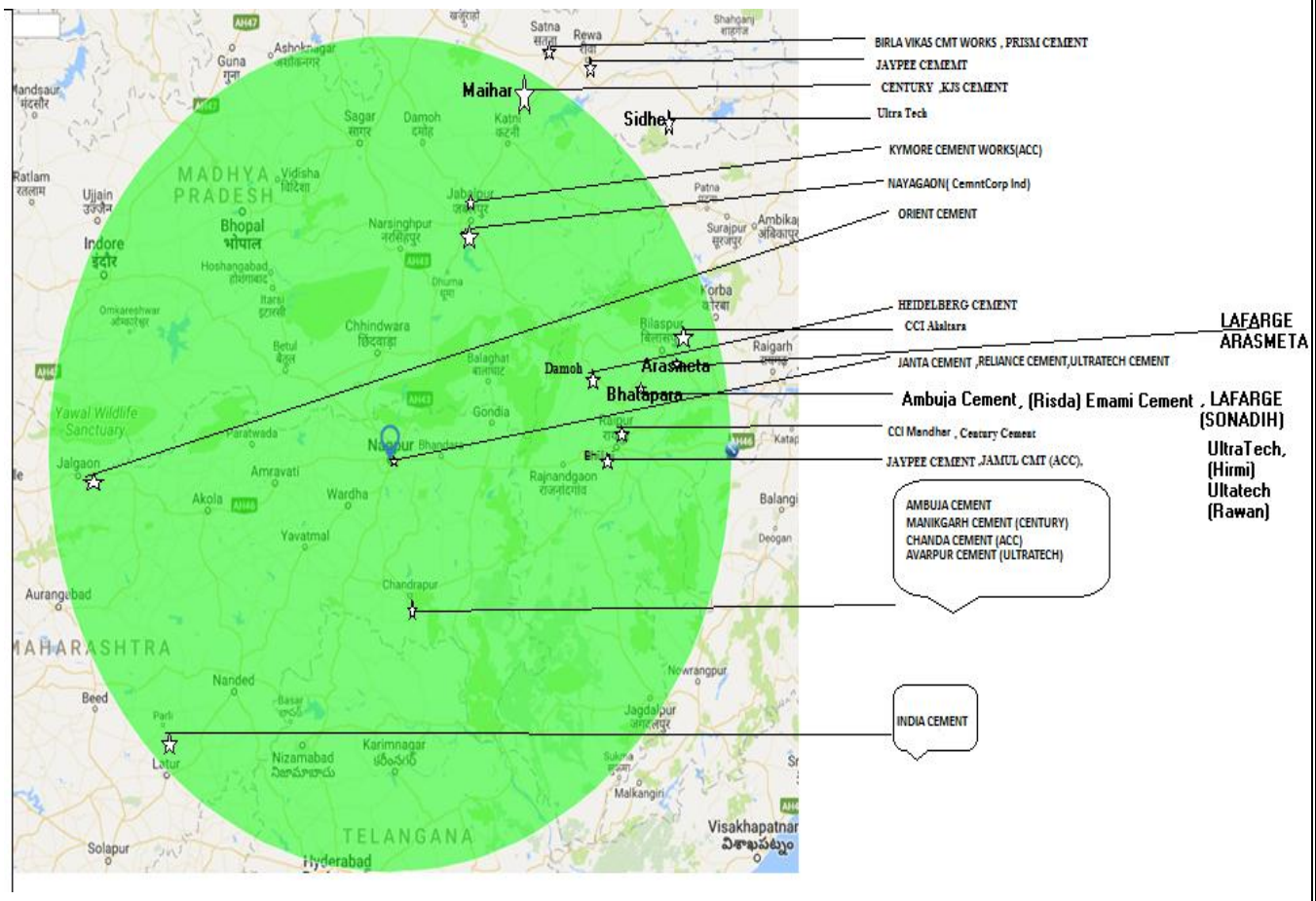
1. Utilizing Fly-Ash in already existing cement plants
2. Building a captive cement plants adjoining the power plant
3. Building capabilities and promoting other means to utilize Fly-Ash, till cement industry picks up *(Recommended)*

6.1 Utilize Fly-Ash in already existing cement plants

6.1.1 Study of Cement Plants in and around Nagpur (500Kms):

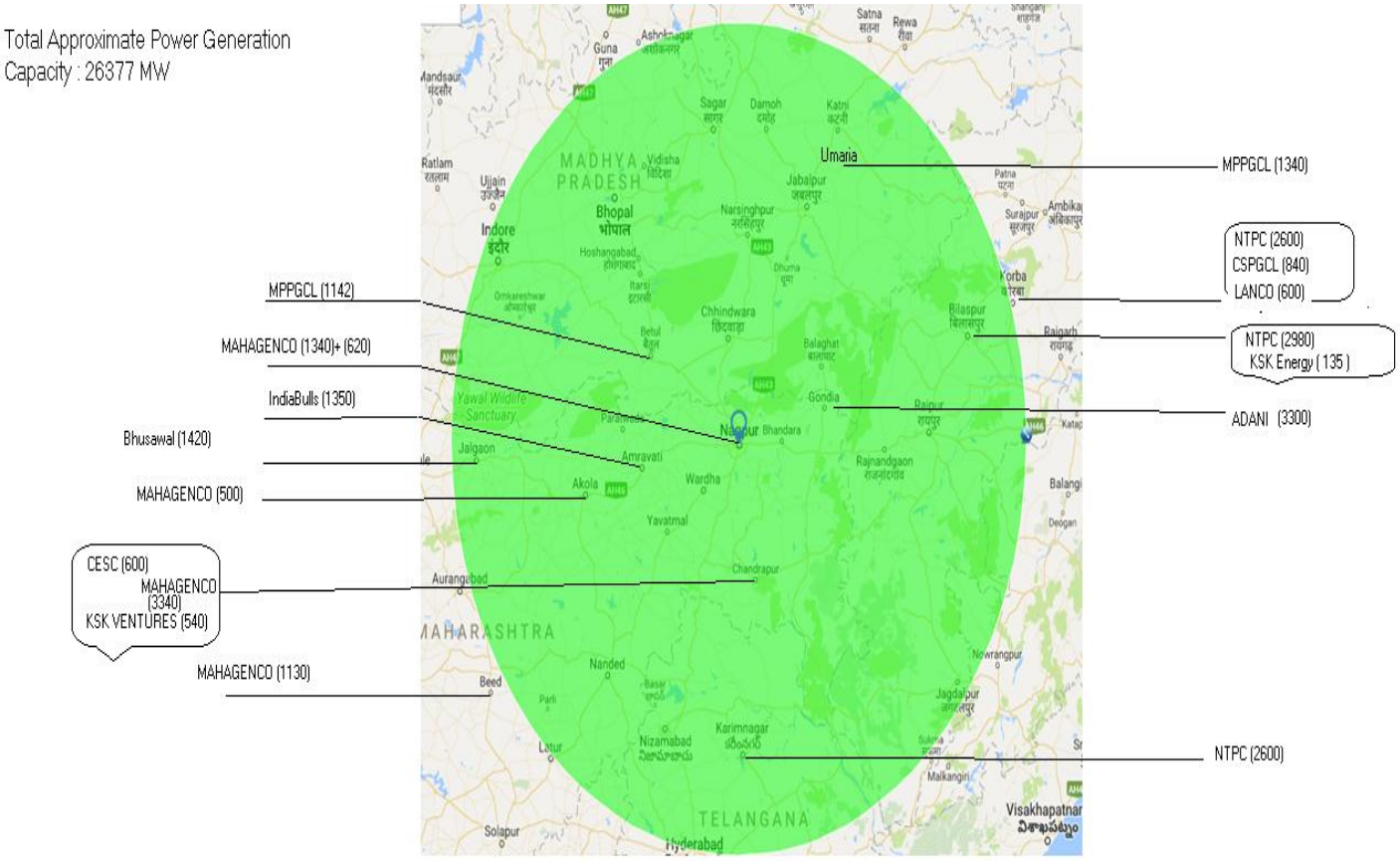
In total 31 Cement plants are located in-and-around Nagpur. With the Most number of Cement Plants in Bhatapara (5 Nos.), Chandarpur (4 Nos.) Exhibit 8.1. The total cement produced around the region is 92.176 Million Ton per year. On an average in producing cement, 30% Fly-Ash is required, **thus approximately 28.5498 Million Ton of Fly-Ash is needed when all the plants are working at full capacity.**

The Source of Fly-Ash for producing cement are the power plants, some of the cement producing plants have captive power plants which enables them to have a source of Fly-Ash readily available while others have to buy Fly-Ash. The Fly-Ash is generated from burning the coal which is used to fuel the thermal power plant.



6.1.2 Study of Thermal Power Plant in and around Nagpur (500Kms)

For producing 600 MW of electricity 440 tons/hr of coal is needed. (Calculation: Exhibit 8.4). The total power generated in and around Nagpur (500Kms radius) is 26377 MW which would need 19343.13 Tons/ Per hour of coal which equivalent to 117915741 tons per year of coal (19343.13 * 24 Hrs * 254 days). From Exhibit 8.4, 33.49% of coal is converted to Fly-Ash (depending on the quality of coal, Different type of Fly-Ash is produced). The 500 Km in and around Nagpur produces 39498298 tons of dry Fly-Ash, **39.49 Million Tons of dry Fly-Ash every year**.



Map drawn from Exhibit 8.2

6.1.3 Analysis

The cement plant in the region requires 28.54 Million Tons of Fly-Ash whereas the region is generating 39.49 Million tons of dry Fly-Ash (government power plants), whereas there are several private thermal power plants in the cement producing units which have captive thermal power plants and thus act as a source of dry Fly-Ash and electricity.

Thus, it is suggestive that Cement Plants as a consumer of Dry Fly-Ash are already fully utilizing the Fly-Ash (thus no demand-supply gap exists, on the other hand there is excess supply of Fly-Ash). Due to excessive need of electricity, the consumption of dry Fly-Ash lags the production. Cement plant as the primary source of Fly-Ash consumer is not recommended.

6.2 Building a captive cement plants adjoining the power plant

We visited cement retailers and distributors to understand the current market demand in and around Vidarbha region. Our approach for this study was expert interview oriented. During these interviews, we asked questions pertaining to supply of cement from cement

plants in the vicinity of Nagpur (Chanderpur cement cluster, Nagpur cement cluster) versus supply

from cement plants in adjoining states (Madhya Pradesh, Andhra Pradesh, Chhattisgarh etc.).

Our next line of questioning was around consumer demand in Nagpur in addition to consumer preferences. We also enquired about personal forecasts of the dealers for the upcoming years. Additionally, we also enquired about the impact of numerous government initiatives such as Smart City, GST etc.

	Distributor Perception (Excerpts)
Question Consumption pattern of cement in B2B context (Bulk buyers such as Builders, Government contractor)	-Cement demand is seasonal and currently with development also, he has the opinion that there is too much cement while low takers -Slack in market
Cement procured from long distance vs cement procured from Chanderpur and Nagpur (closest cement hub to Nagpur)	-Consumers have a preference for brands such as UltraTech while businesses prefer Birla A1. -Cement exported from regions (Andhra Pradesh) are cheaper by 5% in comparison to cement procured from Chandarpur.
Impact of GST?	With GST state borders have opened up and Cement in Nagpur come from Madhya Pradesh and Andhra Pradesh (bagged)

The cement brought from Other states are less expensive and there seems to be excess capacity of cement production, thus the need of a cement plant in the vicinity of Kaparkheda and Koradi are not suitable in the short timeframe. Setting up a cement plant is also not advisable based on the Marketing study and expert interview from distributors of cement

6.3 Building capabilities and promoting other means to utilize Fly-Ash, till cement industry picks up (Recommended)

1. Developing Vidarbha regions to enable setting up of industries such as Brick Making, which would enable utilization of Fly-Ash in construction, should be promoted for it being eco-friendly. Promotion to other industries linked for Fly-Ash utilization could be driven by giving financial concession, exempting them from import and export duties for equipment and spare parts
2. Enabling the existing infrastructure in Kaparkheda and Koradi to supply and store dry Fly-Ash to local infrastructure building contractors.
3. The MOFE guideline of 25.01.2016 states linking contractors' payment with Fly-Ash utilization for building roads. As building of new roads, metro is currently in nascent stage in Nagpur, it is recommended for MAHAGAMS to build delivering capabilities and MoU signups with the contractors of the government projects to deliver Fly-Ash to their construction sites.
4. Use of Fly-Ash in the Landfills. Maharashtra region is rich in mineral resources; according to Western Coal Fields Maharashtra has 5576.70 Million tons of coal, 1371.42 Million tons of Limestone[1], every year new mining activity is undertaken which leaves old mines empty. MAHAGAMS to form MOU with mining corporations such as WCL to enable them by using Fly-Ash as a source of mine filling.

7. Learning

This Field Immersion with MAHAGAMS gave us some valuable insights about the need for Fly-Ash utilization. Some of the key learnings from this project are:

1. The current Fly-Ash utilization in India: India is one of the biggest consumers of coal for generating power. Millions of tonnes of Fly-Ash are generated each year. The power sector is in a dire need of better policies which would help in optimum utilization of Fly-Ash.

2. Alternate uses of Fly-Ash: Although utilization of Fly-Ash in Cement sector is fairly well known, this project also acquainted us with other methods of re-using Fly-Ash with similar results be it in the field of Agriculture or Soil conservation.

[1]https://mahadgm.gov.in/InternalPage.aspx?Antispam=DEC73bdTNqb&MineralInformationID=6&MyAntispam=NXvppwf1Gpf

3. Fly-Ash disposal norms: Although now all the power plants have moved away from dispersing Fly-Ash in the atmosphere, the current disposal practices are still harmful and dangerous for the environment.

4. We learnt that thermal power plants need to bridge the gap between policy formulation and policy execution related to Fly-Ash by developing supporting infrastructure according to the guidelines set by Ministry of Forest & Environment dt. 25th January 2016.

8. Exhibits

8.1 List of Cement Producers (in and around Nagpur)

Cement Producer Name	Location	Capacity (in Million Tonnes)	Distance from Nagpur (in km)	Total in Number
India Cement	Latur	1.1	474	1
Orient Cement	Jalgaon	2	433	1
Ambuja Cement. Manikgadh Cement, Chanda Cement, Avarpur Cement	Chandarpur	2 + 1.9 + 3.8 +3.8	154	4
Kymore Cement Works	Jabalpur	2.2	281	1
Cement Corp India	Nayagaon	1	179	1
Century Cement, KJS Cement	Maihar	3.8 + 2.276	433	2
Junta Cement, Reliance Cement, UltraTech	Nagpur	5 + 1.6	0	3
Jaypee Cement, Jamul CMT (ACC)	Bhilai	2.2 + 16	254	2
CCI Cement, Century Cement	Raipur	3.8 + 2.1	284	2
Ambuja, Emami Cement, Lafarge (Sonadih), UltraTech(Hirmi), UltraTech(Rawan)	Bhatapara	4.42 + 2.4 + 2.5 + 3.3	358	5
Lafarge Cement	Arasmeta	2.2	418	1
CCI Cement	Bilaspur	1.2	392	1
Heidelberg Cement	Damoh	3.1	265	1
UltraTech	Sidhe	2.5	523	1
Jaypee, Century, KJS Cement Works	Rewa	2.4 + 2.1 + 2.27	512	3
Birla Vikas Cement Work, Prism Cement	Satna	2.20 + 7	545	2

8.2 List of Cement Producers (in and around Nagpur)- Consolidated

Cement Producer Name	Location	Capacity (In Million Tonnes Per Year)	Estimated Fly-Ash Utilization (In Million Tonnes Per Year)
India Cement	Latur	1.1	0.33
Orient Cement	Jalgaon	2	0.6
Ambuja Cement. Manikgadh Cement, Chanda Cement, Avarpur Cement	Chandarpur	11.5	3.45
Kymore Cement Works	Jabalpur	2.2	0.66
Cement Corp India	Nayagaon	1	0.3
Century Cement, KJS Cement	Maihar	6.076	1.8228
Junta Cement, Reliance Cement, UltraTech	Nagpur	6.6	3.48
Jaypee Cement, Jamul CMT (ACC)	Bhilai	18.2	5.46
CCI Cement, Century Cement	Raipur	5.9	1.77
Ambuja, Emami Cement, Lafarge (Sonadih), UltraTech(Hirmi), UltraTech(Rawan)	Bhatapara	12.62	3.786
Lafarge Cement	Arasmeta	2.2	0.66
CCI Cement	Bilaspur	1.2	0.36
Heidelberg Cement	Damoh	3.1	0.93
UltraTech	Sidhe	2.5	0.75
Jaypee, Century, Kjs Cement Works	Rewa	6.77	2.031
Birla Vikas Cement Work, Prism Cement	Satna	9.2	2.76
Total		95.166	28.5498

8.3 List of power plants and the capacity of electricity generation (In and Around Nagpur)

Name	Parent Company	Location	City	Capacity	Total
Chandrapur Super Thermal Power Station	MAHAGENCO	Urjanagar	Chandrapur	4 x 210, 5 x 500	3,340
Tirora Thermal Power Station[19]	Adani Power	Tirora	Gondia	5 X 660	3,300
Bhusawal Thermal Power Station	MAHAGENCO	Deepnagar	Jalgaon	2 x 210, 2 x 500	1,420
Trombay Thermal Power Station	Tata	Trombay	Mumbai	1 x 150, 2 x 500, 1 x 250	1,400
Amravati Thermal Power Plant	Indiabulls	Nandgaonpeth	Amravati	5 X 270	1,350
Kaparkheda Thermal Power Station	MAHAGENCO	Kaparkheda	Nagpur	4 x 210, 1 x 500	1,340
Parli Thermal Power Station	MAHAGENCO	Parli-Vaijnath	Beed	3 x 210, 2 x 250	1,130
Nashik Thermal Power Station	MAHAGENCO	Nashik	Nashik	3 x 210	630
Koradi Thermal Power Station	MAHAGENCO	Koradi	Nagpur	1 x 200, 2 x 210	620
Wardha Warora Power Plant	KSK Energy Ventures	Warora	Chandrapur	4 x 135	540

Dahanu Thermal Power Station	Reliance Infrastructure	Dahanu	Thane	2x250	500
Paras Thermal Power Station	MAHAGENCO	Vidyutnagar	Akola	2 x 250	500
CESC Chandrapur Thermal Power Station	CESC	Chandrapur	Chandrapur	2 x 300	600

8.4 Coal needed to produce 600 MW of Electricity

- Modern sub critical power stations have a thermal efficiency of 39%
- Efficiency=860/Heat Rate.
- It thus takes 860 Kcal of heat to generate 1 unit of electricity, but as efficiency is 39% it takes 2200Kcal/KW-hr to generate 1 unit of electricity.
- In Thermal Power plants, various grades of coal are used, and coal has a Gross calorific value to be 3000 Kcal/Kg (taking average of all available grades of coal), the Gross calorific value is an indicative of 3000 Kcal of heat would be generated if 1kg of coal is combusted
- So, for a rating of 600 MW every hour 600 MW means 6000*1000KW-hr = 600000Kwhr.
- 600000(KW-hr) * 2200(Kcal/KW-hr) =132*10^7 Kcal of Heat is required to generate 600 MW of electricity.
- Now dividing this 132*10^7 Kcal of Heat with the Calorific value of coal we get the coal required per hour to generate this 600MW of electricity.
- 132*10^7(kcal)/3000(Kcal/Kg) =440000 Kgs of coal to generate 600 MW.

This translates to 440 Tons of coal per hour.

8.5 Fly-Ash content calculation - Maharashtra

TABLE-I

SUMMARY OF FLY ASH GENERATION AND UTILIZATION DURING THE YEAR 2014-15

Description		Year 2014-15
• Nos. of Thermal Power Stations from which data was received	:	145
• Installed capacity (MW)	:	1,38,915.80
• Coal consumed (Million tons)	:	549.72
• Fly Ash Generation (Million tons)	:	184.14
• Fly Ash Utilization (Million tons)	:	102.54
• Percentage Utilization	:	55.69
• Percentage Average Ash Content (%)	:	33.50

Of 549.72 Million Ton coal consumed 184.14 Million tons of Fly-Ash is generated, which is (184.14/549.72) **33.49%~35%.**

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