UTILIZATION OF WASHERY REJECTS IN GENERATION OF POWER IN CENTRAL COALFIELDS LIMITED

by

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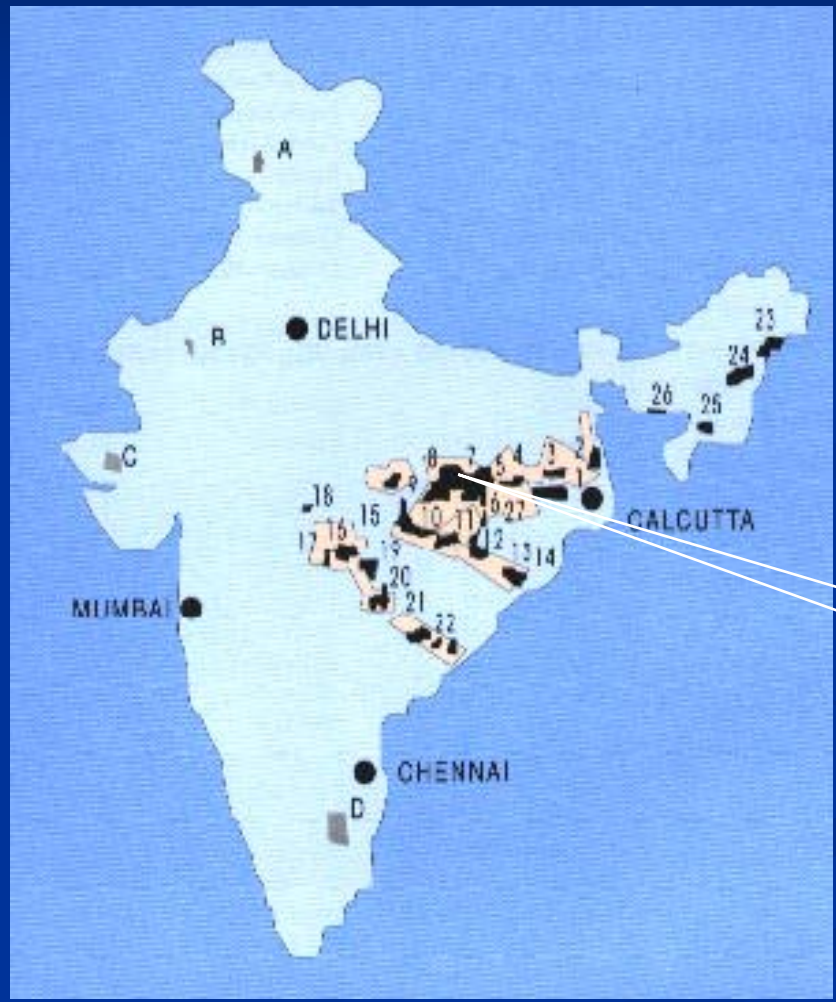
Central Coalfields Limited



CCL – LOOKING AHEAD

2016-17 : 115 MT Coal
(Terminal Year of XII Plan)

2011-12 : 78 MT Coal
(Terminal Year of XI Plan)

2006-07 : 41.32 MT Coal
(Terminal Year of X Plan)

2001-02 : 33.81 MT Coal
(Terminal Year of IX Plan)

Central Coalfields Limited …… THEN & NOW

THEN

1956 : Formation Of Public Sector Company – National Coal Development Corporation Ltd.

1972 : Nationalisation of Coking Coal Mines.

1973 : Nationalisation of Non-Coking Coal Mines.

1975 : CENTRAL COALFIELDS LIMITED – Reorganised under Coal India Limited - Holding Company

1986 : Truncation of CCL , Formation of NCL(Singrauli) & MCL (Talcher)

INHERITED

- a large number of small mines WITH Large workforce

RESULTED

- ✓ CCL was left with 55% production capacity with 85% manpower of erstwhile Company
- ✓ Large and productive mines producing high volume (45% production) with less men (15% men) have gone to other Companies

NOW : 11 Areas , 63 Mines

Presently CCL has …

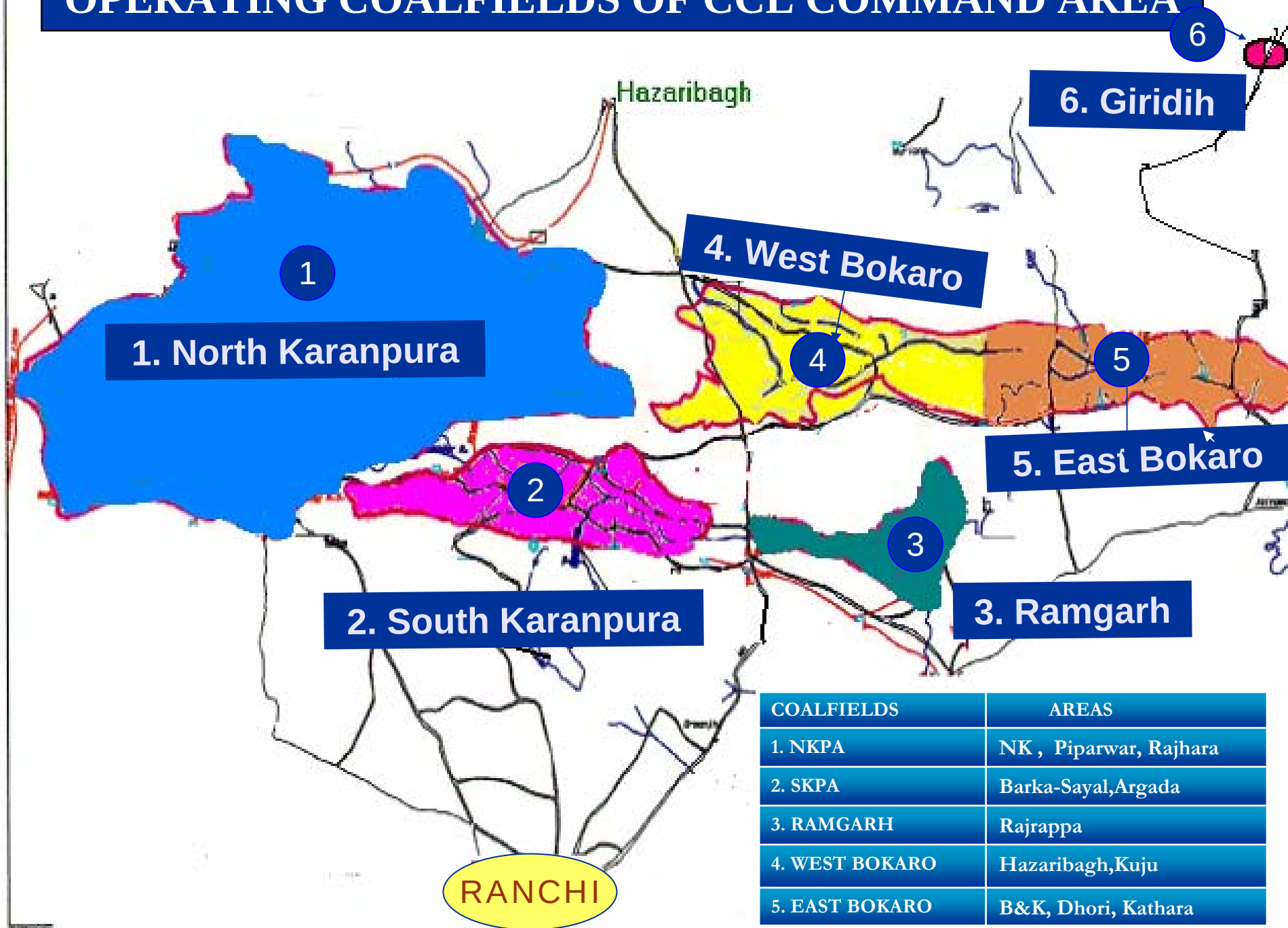
Operating Mines : 63 Mines grouped in 11 Areas
(26 Underground + 37 Opencast)

Washeries : 7 (4 Medium Coking Coal + 3 Non-Coking Coal)

Operating Coalfields: 6 (East Bokaro, West Bokaro, North Karanpura , South Karanpura, Ramgarh, & Giridih)

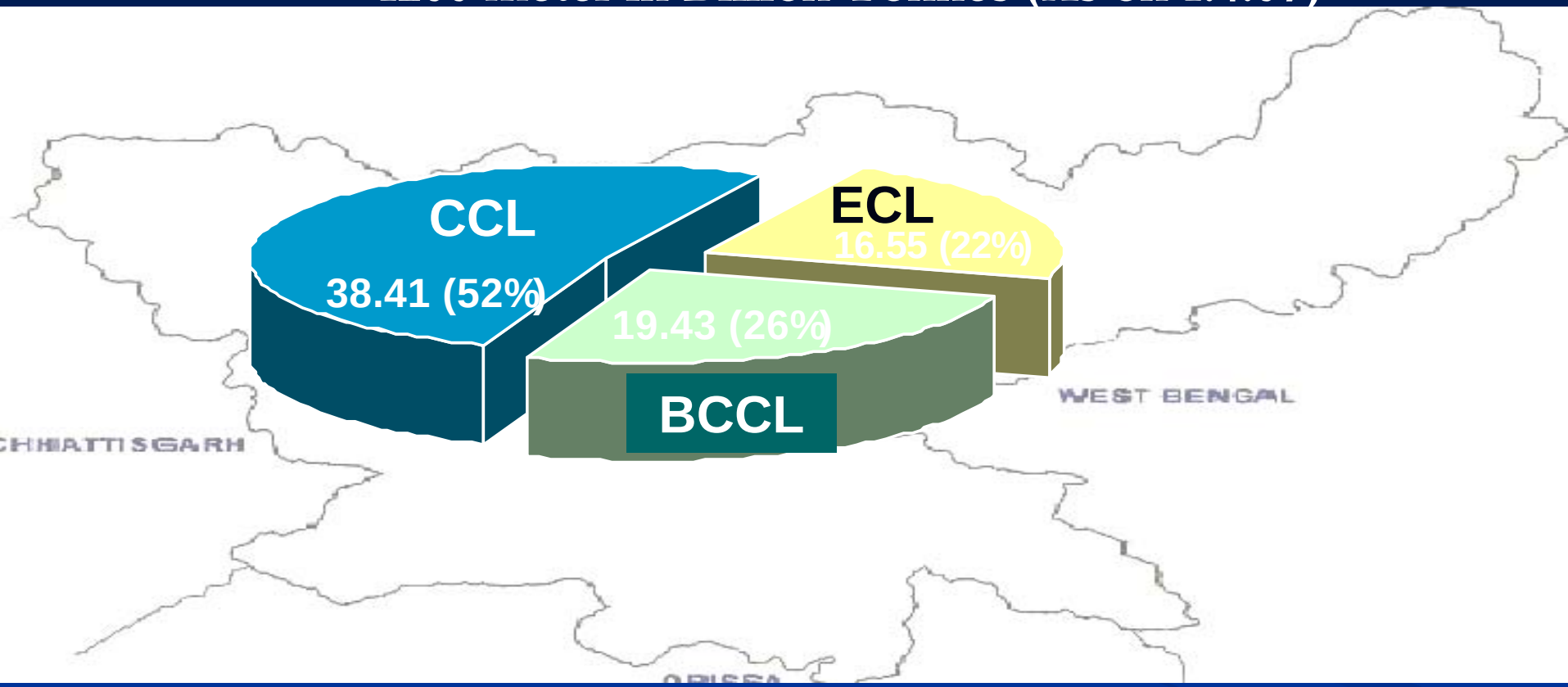
Workshop : 1 Central Workshop (ISO 9001 Certified) + 5 Regional Workshops (3 of them ISO 9001 Certified)

OPERATING COALFIELDS OF CCL COMMAND AREA



COALFIELDS	AREAS
1. NKPA	NK , Piparwar, Rajhara
2. SKPA	Barka-Sayal,Argada
3. RAMGARH	Rajrappa
4. WEST BOKARO	Hazaribagh,Kuju
5. EAST BOKARO	B&K, Dhori, Kathara

Coal Reserves of CCL, BCCL & ECL in Jharkhand State up to 1200 meter in Billion Tonnes (As on 1.4.07)



CCL Coal Reserve is 38.41 billion tonnes as compared to country coal reserve of 257.38 billion tonnes (i.e. 15% of the country total Coal reserve)

Geological Coal Reserves in CCL Command Area Up to 300m & above depth **(as on 1.4.2007)**

Reserve	Depth 0-300m				Depth 300-1200 m				Total (BT)
	Proved (BT)	Indicated (BT)	Inferred (BT)	**Total (BT)**	Proved (BT)	Indicated (BT)	Inferred (BT)	**Total (BT)**	
Coking Coal	**5.871**	**3.731**	**0.048**	**9.650**	**0.960**	**4.962**	**1.613**	**7.475**	**17.125**
Non-Coking Coal	**10.533**	**3.490**	**1.090**	**15.113**	**0.576**	**3.481**	**2.115**	**6.172**	**21.285**
Total	**16.404**	**7.221**	**1.138**	**24.763 (65%)**	**1.536**	**8.383**	**3.728**	**13.647 (35%)**	**38.410**

Depth 0 -1200 m			
Proved (BT)	**Indicated (BT)**	**Inferred (BT)**	**Total (BT)**
17.940	15.604	4.866	38.410

BACKGROUND

- India is embarking on transformation from developing economy to developed economy.
- Electricity Act 2003 and National Electricity Policy created conducive environment for growth of Power Sector commensurate with economy.
- Need of the hour – Strategic planning of energy resources for sustainable development over long time horizon.
- Washing of non-coking coal for power utilization may become the norm in future.
- Gainful utilization of reject produced by beneficiation of raw coal has evoked considerable interest in recent / future times.

INTRODUCTION

- Indian economy has grown at 6.1 per cent during Xth and IXth Five Year Plans
- Projected growth rate of economy at 8 per cent and 9.3 per cent respectively for the Xth and XIth Five Year Plans
- Rate of growth demands a commensurate growth in power generation. Hence required to produce 1029 Bkwh unit of electricity by 2011-12 (the terminal year of 11th Plan)
- For growth, power is essential but with minimum impact on environment. Hence, clean coal technology is required.

NEED FOR BENEFICIATION

- Less quantity of high quality coal reserves in relation to growing demand
- High cost of transportation of dirt along with coal and its subsequent disposal as ash or slag adding to the cost, thus, more captive investment. Disposal of ash by consumers is a difficult problem
- Increased demand of lower ash coal i.e. high calorific value fuel.
- Environmental awareness and requirement at users end.
- Greater concern and consciousness of consumers about quality.

BENEFITS OF USING WASHED NON-COKING COAL

- Improved Plant performance, Plant utilization factor (PUF), Capacity utilization.
- Reduction in specific fuel consumption
- Reduced down time and less corrosion, increased life and operating efficiency of boilers
- Reduced capital cost on coal handling plants, down time, auxiliary power consumption
- Reduced maintenance of boiler and its auxiliaries
- Reduced smoke and dust omission
- Increased electricity generation
- Saving in land area for ash dumping
- Improvement in environment by reduction of emission of GHG.

Advantages of using beneficiated coal

(study conducted by CMPDI at Satpura TPS)

SN	Parameters	Benefits
1.	CHP	Frequent jamming that was taking place with ROM coal was avoided with beneficiated coal due to uniform size, absence of foreign materials.
2.	Coal Mills	Low ash content in the beneficiated coal resulted in reduction of down time and the No. of mills in use.
3.	Furnace, Boiler tube etc.	With beneficiated coal furnace wall slagging / boiler tube leakage / clinker formation /abnormal erosion, etc. was not reported.
4.	Low grade coal reserves.	Exploitation of low-grade coal reserves which the country has in plenty is possible and which otherwise could not be utilized without beneficiation.
5.	Environment	Contribution to better surrounding environment at power station due to less emission of smoke and dust.
6.	Railway utility	Better utilization of railway rolling stock

Study conducted by CMPDI at Dadri TPS

S. NO.	Parameters	Qualitative Impacts
1	Saving in demurrage to Railways	Re 1/te of coal received
2	Increase in operating hours	Upto 10%
3	Increase in PLF	Upto 3.78%
4	Increase in PUF	Upto 11.78%
5	Reduction in breakdown period	Upto 60%
6	Increase in overall efficiency	Upto 1.2%
7	Increase in generation / day	2.4 MU
8	Reduction in support fuel oil	0.35 ml/kwh
9	Reduction in sp. Coal Consumption	0.048 Kg/kwh
10	Reduction in heat rate	Upto 87 K.Cal/kwh
11	Reduction in sp.Coal Consumption	0.048 Kg/kwh
12	Increase in total units sent out / day	2.3 MU
13	Saving in land area for ash dumping	1 acre in a year
14	Reduction in CO emission on account of transportation & combustion of coal	>6,00,000 te in a year

PROCESS FOR BENEFICIATION

Depending upon the quality, washability characteristics and coal dirt size , the beneficiation process shall be selected which shall incorporate either in separation or in combination the following washing equipments:

- Improved type jig
- Heavy media bath
- Heavy media drum separator
- Heavy media cyclone
- Dry processes

Piparwar Washery (Non Coking Coal)

COST SHEET OF A NON COKING COAL WASHERY

S.NO.	COST/Te (clean coal)	AMOUNT (In Rs.)
1	Raw coal cost	717.73
2	Process cost	380.56
3	Administrative cost	86.50
4	Depreciation	15.95
5	Interest	6.11
6	Total Cost	1204.86
7	Sale value of product	1337.00
8	Total Profit	132.22

Source : Cost Sheet of Kagali Washery , May'07

❖If reject value is Rs 400 per tonne the profit will enhance by Rs. 80 per tonne.

ISSUES TO BE ADDRESSED

- The MoEF stipulation of using coal having Ash below 34% in the power plants located at distance beyond 1000 Km. needs to be implemented in view of the savings on account of railway freight as well as environmental requirement particularly reduction of CO_2 emissions for reducing greenhouse gas effect
- Long term agreement between the consumer and the coal producer to pay additional cost of the beneficiated coal must be entered into at the time of investment decision
- CIL has directed to off-load the work of construction of new non-coking coal preparation plants on BOM basis

ISSUES TO BE ADDRESSED

- Utilization of rejects produced from the beneficiation plants at mine-head in PBC Boilers for Power Generation instead of back filling of voids in open cast mines . has to make the beneficiation of non-coking coal more attractive
- As Coal beneficiation makes feasible the adoption of advanced power generation technologies such as integrated gasification and combustion cycle (IGCC) system and pressurized fluidized bed combustion (PFBC) attractive for the Engg., Economic and Environmental perspective, the futuristic approach should be for adoption of these technologies to enhance the overall capacity of electricity generation and gainful utilization of even inferior grade of coal / by-product, to the extent possible

WASHERY REJECTS

- Coal beneficiation plants produce rejects in coking as well as non-coking coal washeries varying from 10 to 20% of the feed
- Rejects contain around 15-20% carbon and 1600 to 3100 Gross calorific value
- Due to non availability of suitable technology for use of such low heat value coal washing rejects, CCL piled up a stock of 12.81 million tones(coking coal washeries 8.15 million tones and at non-coking coal washeries 4.66 million tonne.)
- Existing washeries are producing about 2.3 million tonne of reject every year

REJECT GENERATION BY EXISTING WASHERY

Name of washery	Capacity in MTY	Reject generated per year
(A) Coking Coal		
KATHARA	3.00	0.36
SWANG	0.75	0.09
RAJRAPPA	3.00	0.36
KEDLA	2.60	0.312
TOTAL	9.35	1.122
(B) NON COKING COAL		
GIDI	2.5	0.5
PIPARWAR	6.5	1.3
KARGALI	2.72	0.544
TOTAL	11.72	2.344

REJECT GENERATION BY PROPOSED WASHERY

PROPOSED WASHERIES

Name of washery	Capacity in MTY	Rejects generated per year
(A) Coking Coal		
DHORI	2.5	0.306
TOTAL	2.5	0.306
(B) NON COKING COAL		
ASHOKA	10.0	2.00
PIPARWAR EXPANSION	3.5	0.70
KARO	2.5	0.50
KONAR	3.5	0.70
TOTAL	19.5	3.90
Grand Total (Existing & Proposed)		7.720

Existing and proposed capacity of washery in CCL

	Non Coking	Coking	Total
Existing	11.72	9.35	21.07
Proposed	19.50	2.50	22.00
Total	31.22	11.85	43.07

TOTAL POWER REQUIRED BY CCL BY 2011-12

The estimated power demand of CCL is anticipated to go up from the present demand of 137 MVA to 215 MVA by the year 2011-12 (terminal year of XI th Plan)

AREAWISE ANNUAL AVERAGE ENERGY CONSUMPTION & COST FOR THE YEAR 2006-07

Area	Average Power consumption in MKWH	Average Power cost in crores
ARGADA	66.33	22.247
BARKA-SYL	95.81	32.135
N.K.	56.49	18.946
PIPARWAR	56.49	18.946
RAJHARA	3.23	1.083
RAJRAPPA	37.07	12.433
KUJU	42.52	14.433
HAZARIBAGH	67.65	22.689
B&K	89.13	29.894
DHORI	41.15	13.794
KATHARA	95.64	32.077
OTHERS	16.46	5.520
TOTAL CCL	667.97	224.029

PRESENT UTILIZATION OF WASHERY REJECTS BY CCL

CCL HAS INSTALLED 3 CAPTIVE POWER PLANTS OF 2X10 MW CAPACITIES EACH AT FOLLOWING PLACES BASED ON FBC TECHNOLOGY UTILIZING WASHERY REJECTS. ALL THESE CPPs ARE BASED ON MODERN FLUIDISED BED COMBUSTION TECHNOLOGY BURNING WASHERY REJECTS CONTAINING ASH > 60% AND GCV VARYING FROM 1600 TO 3100 KILO CAL. PER KG.

S.NO.	LOCATION	SIZE OF THE PLANT	REJECT G.C.V. (KCAL/KG)	REMARKS
1	KATHARA	2X10MW	2500	The plant erected by BHEL on turnkey basis in 1995
2	GIDI	1X10 MW	2100	M/s.DLF Power Co. Commissioned the plant on Build, Own & Operate basis for CCL in 1999
3	RAJRAPPA	1X10 MW	2550	M/s.DLF Power Co. Commissioned the plant on Build, Own & Operate basis for CCL in 2000

FINANCIAL BENEFITS FOR CCL FROM EXISTING 40 MW CPP's UTILISING WASHERY REJECTS FOR GENERATION OF POWER

2X10 MW KATHARA CPP

- TOTAL ENERGY GENERATED BY 2X10 MW KATHARA CPP=80.95 MKWH
- TARIFF AT WHICH PAYMENT IS MADE=Rs.2.75/UNIT
- AVERAGE TARIFF OF SUPPLY AGENCY AS ON TODAY=Rs. 3.35/UNIT
- SAVING PER ANNUM=Rs. 4.85 CRORES

1X10 MW GIDDI & 1X10 MW RAJRAPPA CPP's

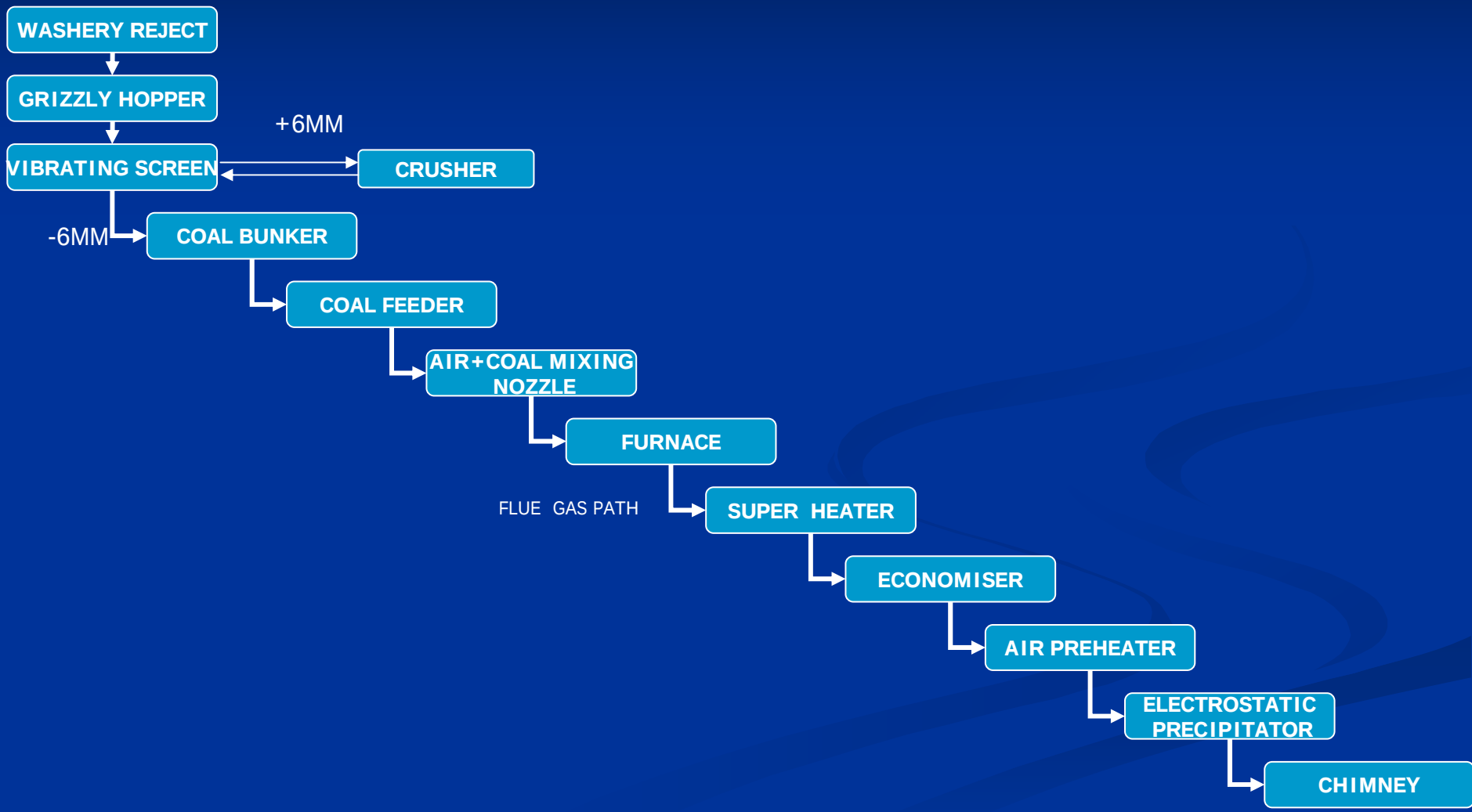
- TOTAL ENERGY GENERATED BY 1x 10 MW GIDI & 1X10 MW RAJRAPPA CPP's PER YEAR=58 MKWH
- TARIFF (ADHOC) AT WHICH PAYMENT IS MADE =RS. 2.07/UNIT
- AVERAGE TARIFF OF SUPPLY AGENCY AS ON TODAY=Rs. 3.35/UNIT
- SAVINGS PER ANNUM =Rs.7.42 CRORES

TOTAL PROFIT FOR CCL = Rs.12.27 CRORES

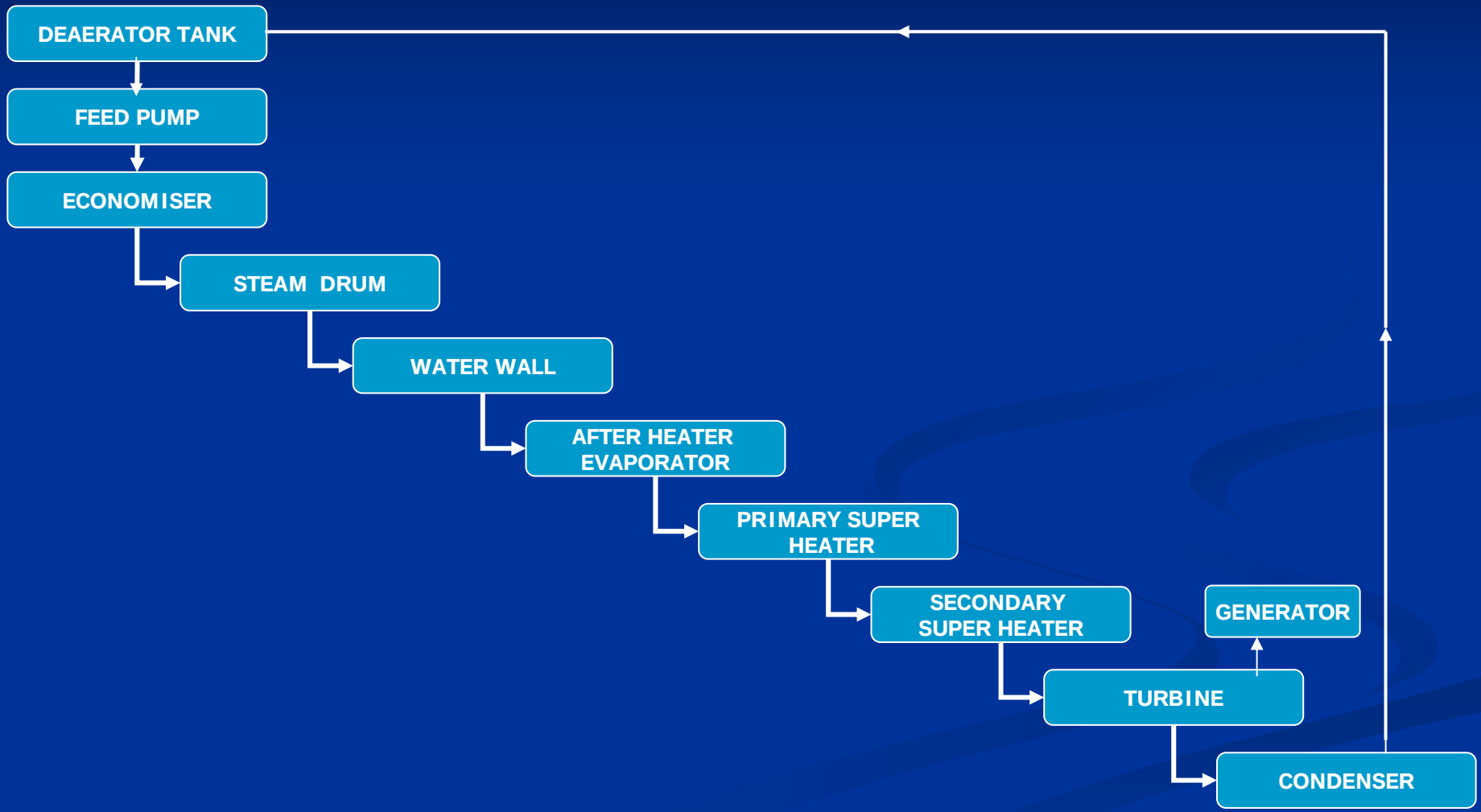
Kathara CPP

PROCESS FLOW CHART OF FBC TECHNOLOGY BASED CPP

1. WASHERY REJECT CIRCUIT



2.WATER CIRCUIT



ECONOMICS OF POWER STATIONS IN DIFFERENT CASES

Case I - Comparison of Economics for coal based Thermal Power Station using Raw Coal /Clean Coal

S. No.	ASH PERCENTAGE OF COAL	COST OF ELECTRICITY GENERATION
1	40 % ASH CONTENT ROM	RS. 1.55 PER UNIT
2	44 % ASH CONTENT ROM	RS. 1.52 PER UNIT
3	40 % ASH CONTENT ROM WASHED TO 34 %	RS. 1.61 PER UNIT
4	44% ASH CONTENT ROM WASHED TO 34 %	RS. 1.64 PER UNIT

ECONOMICS OF POWER STATIONS IN DIFFERENT CASES

CASE-II. Cost of generation for 20 MW FBC thermal Power Plant without fuel cost for Power generation 1 Crore unit/ month at Kathara

		Amount in Rs.
(A)	Fixed Cost	
	i) Interest & Depreciation of the Plant	0.70
	ii) Repair & maintenance including store	0.30
	iii) Salary & Wages	0.12
	TOTAL	1.12
(B)	Variable Cost	0.08
(C)	Total cost of generation without Considering fuel(Reject) Cost	1.30

ECONOMICS OF POWER STATIONS IN DIFFERENT CASES

CASE –III. Cost of generation for 20 MW FBC Plant including fuel(Reject) Cost for generation 0f 1 Crore unit / month

i) Consumption of fuel (Reject) - 2.3 Kg/ unit
ii) Cost of reject/tonne including taxes as applicable - Rs 400/ tonne
iii) Fuel (Reject) charge for generation of one unit - Rs. 0.92
iv) Cost of generation - Rs. 1.30
v) Total Cost of generation with fuel (Reject) - Rs. 2.22

FINANCIAL BENEFITS FOR CCL AFTER PROPOSED UTILIZATION OF REJECTS IN GENERATION OF POWER:

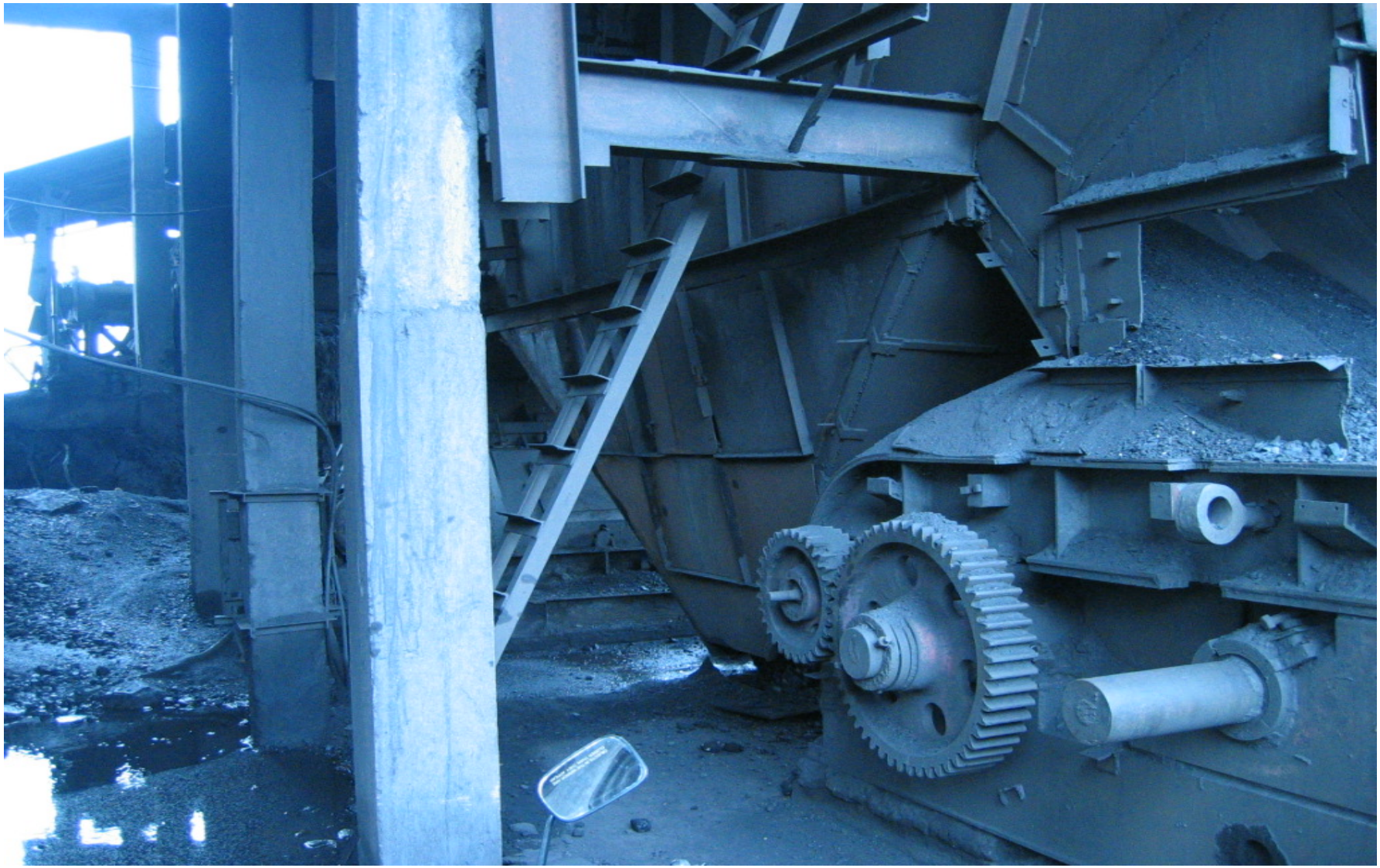
- Captive Power Plants to be installed : 140 MW (including existing 40 MW)
- Assuming PLF of 80%, the net capacity would be : 112 MW
- Total energy to be generated by the CPPs : 967.68 M.units
- Average tariff of supply agency as on today: Rs.3.35/Unit
- Total amount to be paid : Rs.324 Crores
- Total amount to be paid @Re.2.75/unit :Rs.266 Crores (Present interim tariff to CPP Operator)

- **NET SAVING** :Rs.**58 Crores**

Photographs
of
Non coking coal washery
and
linked power plant
based on reject
at
Argada Area in CCL

Giddi Washery (A Non coking coal washery)

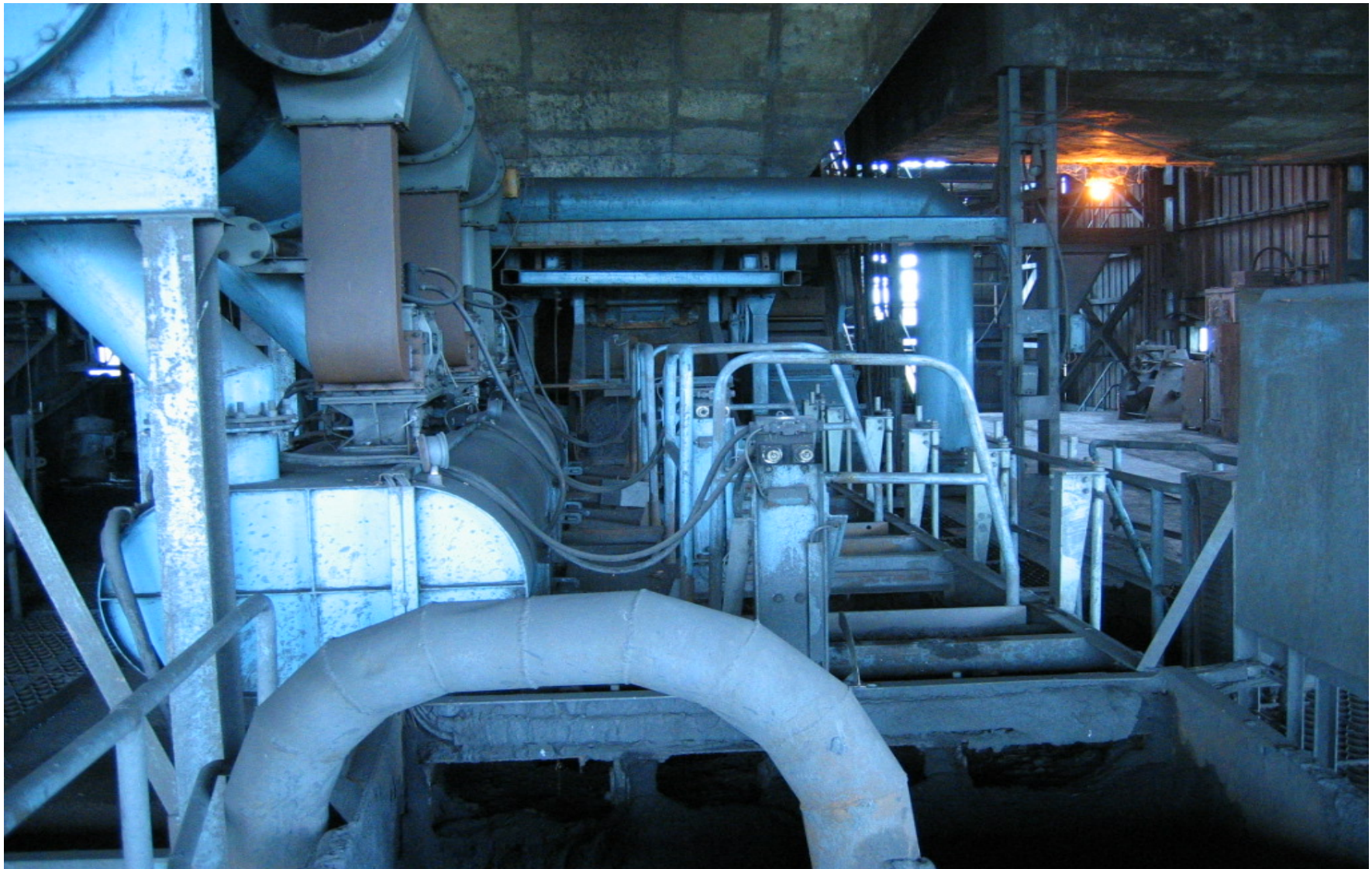
Primary Crusher



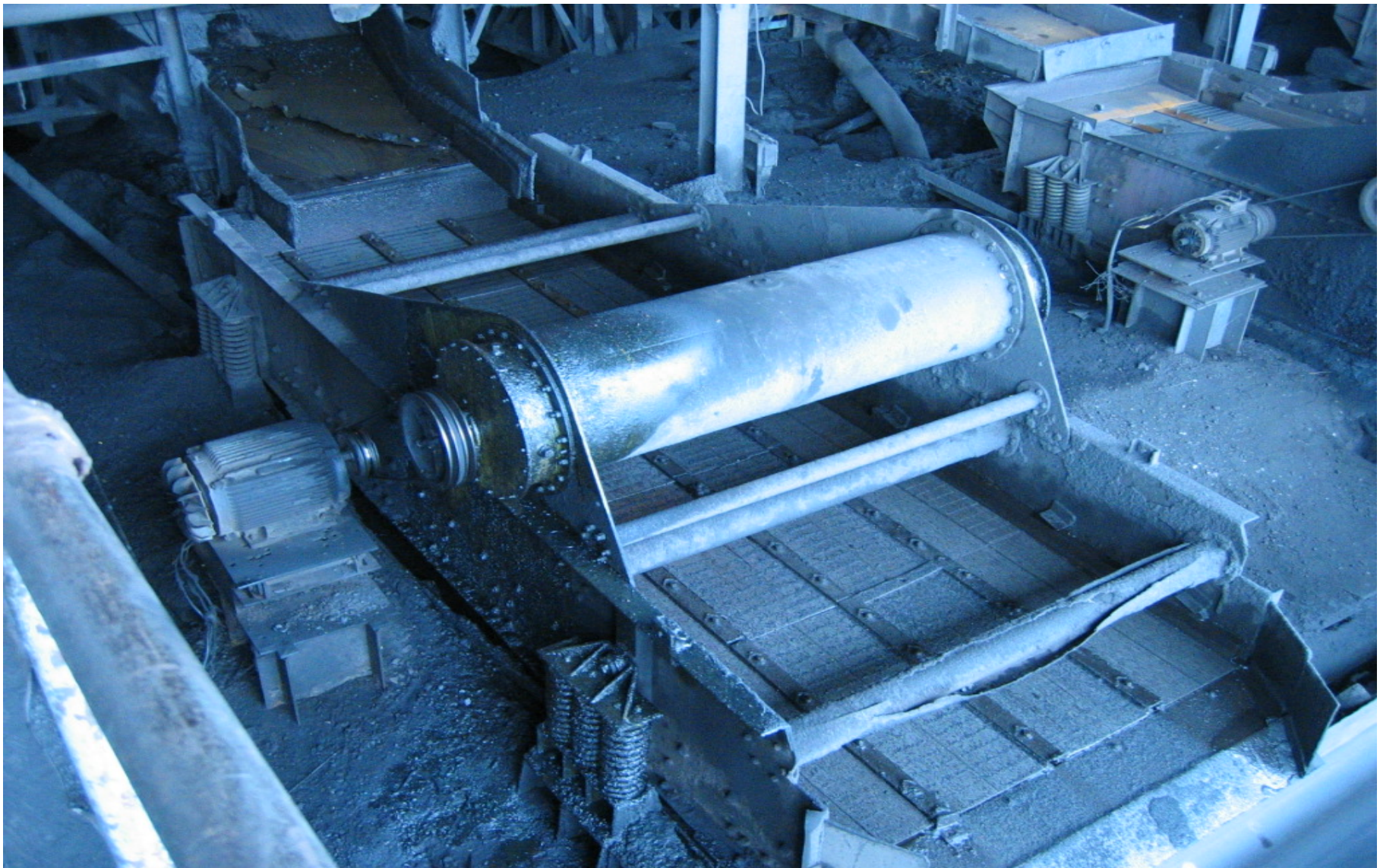
Raw Coal receive section

Heavy Media Disha bath

Komag Jig



Vibrating screen



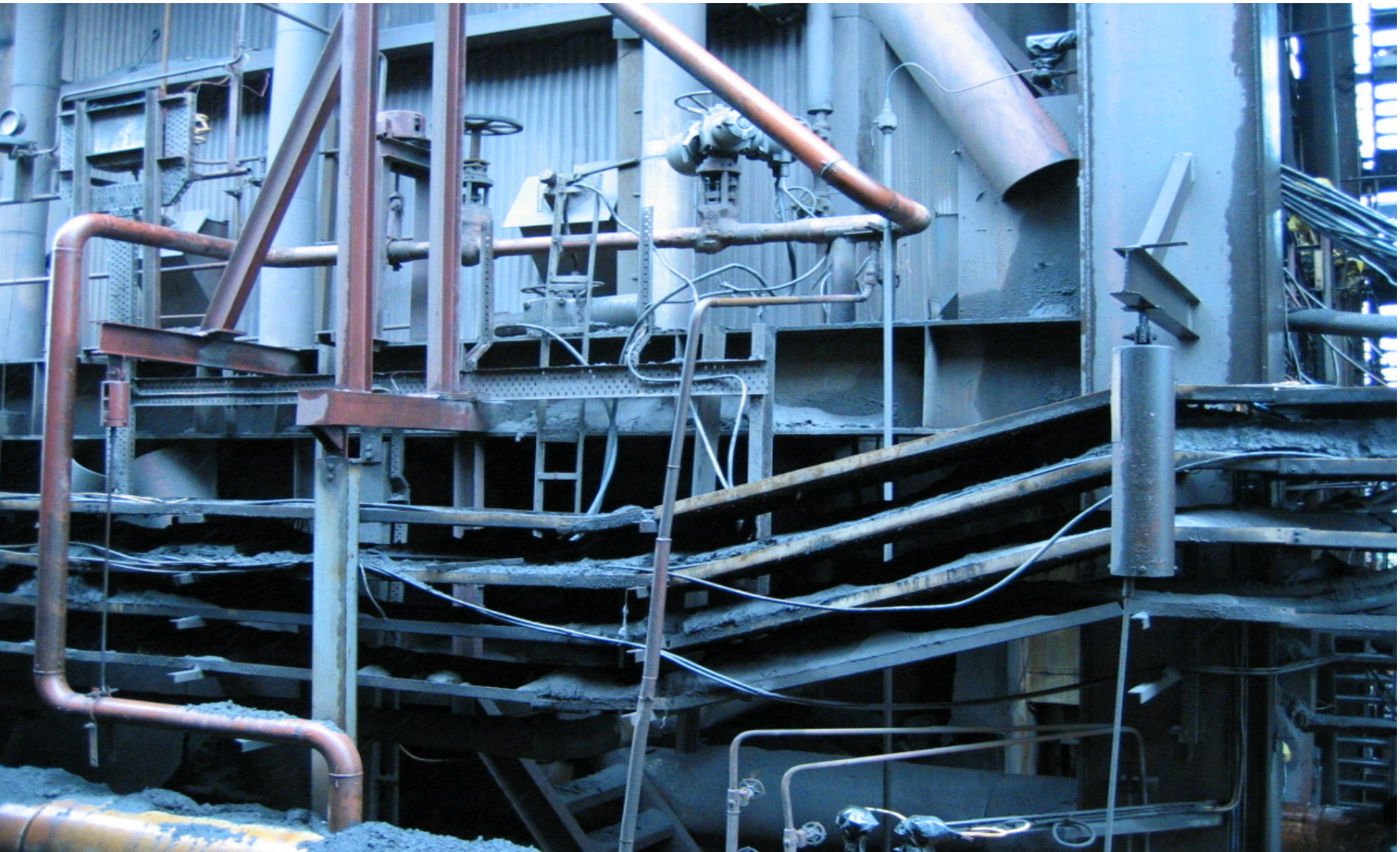
Thickner

Loading of clean coal

Reject heap

Power plant based on utilisation of Reject generated from Non coking coal washery

Coal bunkers and Boiler



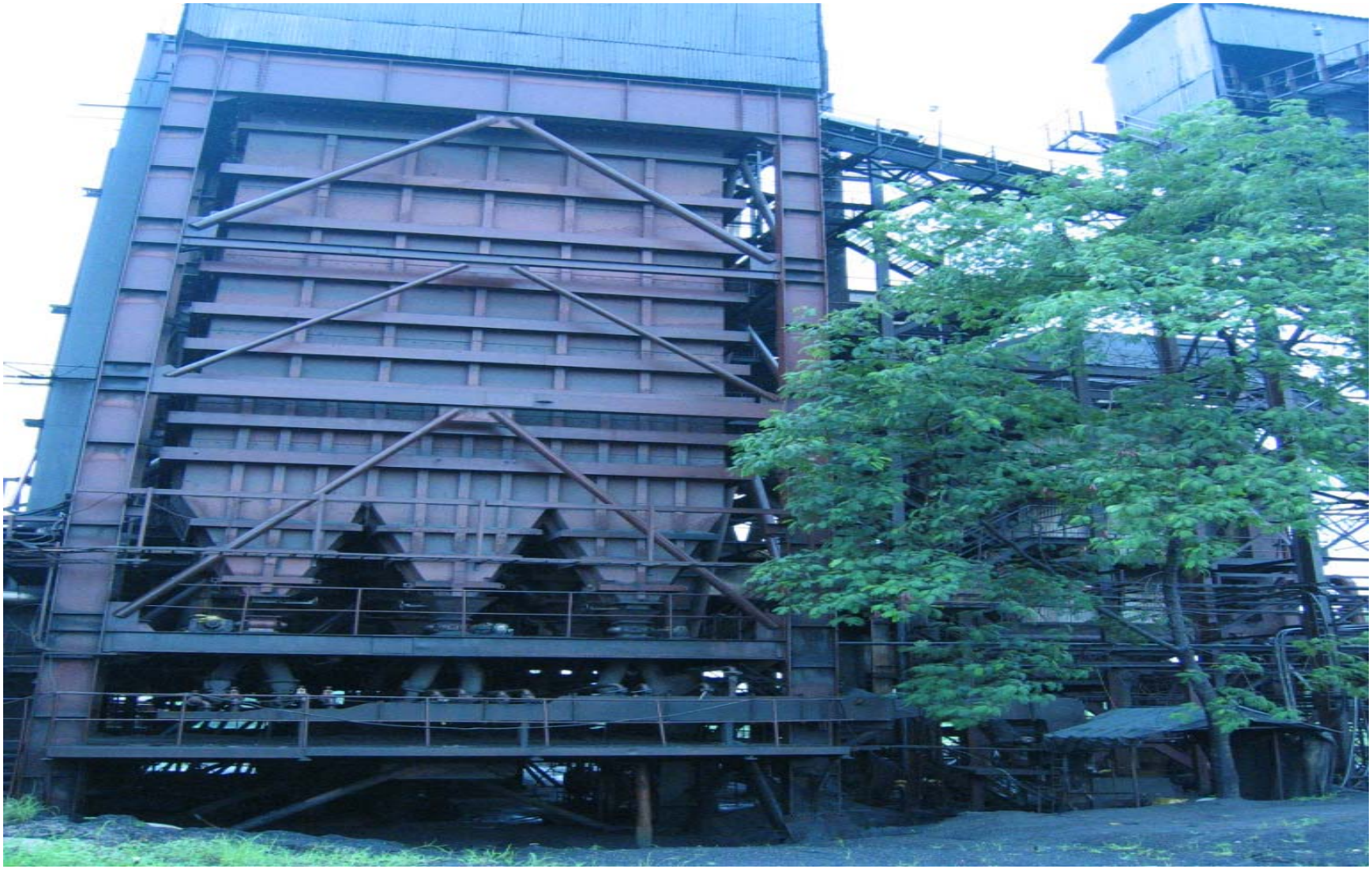
Inside view of boiler

Burnt coal from Power plant

Steam Propeller

Generating unit

Coal bunkers at CPP



CONCLUSION

- For the economic growth of country, one has to depend on coal and its reserve.
- To enhance the life of reserve, gainful utilization of washery rejects must be thought which is having 10-20% carbon.
- As the existing utilization of reject coal is very meager ,more capacity addition is required to stop the drainage of energy as such effective reject utilization has been considered a thrust area with the following emphasis
- Adoption of super critical technology
- Circulating Fluidised bed combustion technology
- Pressurised Fluidised bed combustion technology

CONCLUSION

- This will also facilitate pollution free atmosphere.
- Instead of using washery reject for filling the voids of mines, fly ash produced by FBC power plant can be utilized and top layer should be covered by soil for proper plantation.

SUGGESTION

- Assistance from partner countries for development of suitable economical technology for utillization of low value Coking/Non Coking washery rejects which will ultimately help the improvement in environment by reduction of emission of GHG.
- Assistance from Govt. in the form of tax–rebate & other commercial duties in order to establish low cost FBC Technology power Houses to make them Commercially Viable
- Assistance from partner countries is needed for adoption of Super Critical Technology ,so that utilization of washery Rejects having Gross Calorific value varying from 1600-2100 kcals/kg. may be efficiently utilized

THANKS