EXECUTIVE SUMMARY

INTRODUCTION

Moser Baer Power (Chhattisgarh) Ltd. (MBPCL) proposes to establish a 1320 MW (2 x 660 MW) coal fired thermal power plant in Janjgir Champa district, Chhattisgarh. MBPIL has appointed GIS Enabled Environment & Neo-graphic Centre (GreenC) to carry out Environmental Impact Assessment (EIA) study for preparation of Environmental Management Plan (EMP) for the proposed 1320 MW coal fired Thermal Power Plant (TPP).

Location: The proposed power plant site is located in the village of Birra, Siladehi and Gatwa. The site is well accessible by NH-200 which is 11 km from the site area. Champa is the nearest railway station at a distance of 32 km.

PROJECT DESCRIPTION

Land: Total land requirement for the proposed 2x660MW Thermal Power Plant is 1050 acres. This land has been acquired in the villages of Birra, Siladehi and Gatwa. The land for the project has been already optimized. The land is slightly undulating with the average altitude more than 226 m above MSL.

Coordinates: The site for the project lies within the latitudinal extent from 21°45'13.24" to 21°46'26.07" North and longitudinal extent of 82°44'24.92" to 82°45'59.57" East.

Water: The source of water for the plant is Mahanadi, which is a perennial river. The water drawal point will be 20 km away from proposed Mironi Barrage. The estimated requirement of make-up water for the 1320 MW capacity power project would be about 4110 m^3/hr with recovery. Chhattisgarh Water Resource Department has allotted 36 MCM of water annually from Mahanadi River.

Coal: Coal requirement for the proposed plant, is estimated at 7.29 MTPA considering average GCV of 3400 kcal/kg at 90% PLF. SECL Coalfield has been considered as source of coal. Coal is proposed to be transported through Indian Railways network from SECL source to Champa Railway Station (RS) and then to site through dedicated railway siding (to be constructed).

Power Evacuation: It is proposed to adopt the evacuation voltage as 400 kV. Power Generated from each 660 MW units would be stepped up to the evacuation voltage level through suitably rated Generator Transformer and will be evacuated through 400 kV transmission lines.

Raw Water System: The Raw Water System shall be designed to supply cooling water makeup and other consumptive water requirement like service water, potable water etc. for the proposed plant. Raw water shall be pumped from the intake to the raw water reservoir located in the plant boundary. It is envisaged to provide two raw water intake pumps in the raw water pump house.

Coal Handling System: The coal from mine will be transported through Bottom Opening Broad Gauge Rail (BOBR) wagons to the plant site. The coal will be unloaded, screened and crushed in coal handling plant. From there coal will be conveyed through belt conveyors up to the steam generator (SG) bunkers or stockyard for reclaiming. Two streams of conveyors and equipments will be provided for carrying coal from track hopper to the stockyard and to bunkers. Out of two streams, one will be normally operating and the other will be standby.

Ash Handling System: The quantum of ash generation has been estimated to be 3.21MTPA. It would depend on the plant load factor and the quality of coal being fed. Ash will be collected at the bottom of the furnace as bottom ash, economizer hoppers as eco ash, air-preheater hoppers as APH ash, electrostatic precipitator (ESP) hoppers as fly ash and stack hoppers as stack ash.

Steam Generator: The thermodynamic cycle for the 660MW units will consider super-critical steam parameters. The unit comprises the boiler, the steam turbine generator, the condenser, the condensate extraction and boiler feed system along with all other necessary equipment for single/double reheat-regenerative cycle. The steam parameters at the other end of the boiler have been considered to be 255 Kg/Cm^2 (abs.), 568°C with steaming capacity of about 2115 TPH as per the established practice of the units in 660 MW range. Corresponding steam parameters at the turbine inlet would be 247Kg/Cm^2 (abs.) and 566°C and reheated steam parameters would be about 55 Kg/Cm^2 (abs.) and 568°C. The MP/IP cylinders may be of single/double casing design as per manufacturers' standard. The exhaust from HP-IP turbine will further expand in the double flow LP Turbine.

Stack Characteristics: One bi-flue RCC Chimney of height 275m is planned. The flue gas emission point shall be at the top of the chimney. Internal and external platforms shall be of structural steel construction and shall be supported from the windshield. The floors/walkways shall be of chequered plate construction. The grade level slab shall be of reinforced concrete with a metallic hardener floor finish. Necessary protection and access systems like large roll up door, access door, line hatches, test ports, water drainage system, etc. shall be provided.

Project Schedule: The first 660 MW units will be commissioned in 42 months from the Zero Date i.e. Main Plant Award. The second unit will be commissioned at an interval of 6 months.

BASELINE ENVIRONMENT STATUS

Study Area: The study area is 10 km radial distance from center of proposed plant site. All the monitoring is done in various locations within the study area during the period of October-December 2009.

Baseline Study: The findings of the baseline environmental status on land (topography, geology, soil quality, land use pattern), meteorology (Temperature, Relative Humidity, rainfall, wind speed, wind rose), air (ambient air quality- SPM, PM10, PM2 .5, SO_2, NO_X. Ozone), water (surface water, groundwater), noise level, ecological environment (flora & fauna), socio economic conditions (demographic profile and households condition) were presented and interpreted with reference to environmental standards.

Topography: Topographic features of the study area are depicted in Survey of India's Topographical sheet No. 64 K/9. The land is slightly undulating with the average altitude more than 226 m above MSL. The average slope of the site varies from 220-230m. Overall there will be no requirements for cutting and filling. Leveling of land in some parts of the plot will be required before construction.

Soil: The soil cover of the study was found to be mostly brownish in colour. The texture of the soil in the study area was found predominantly sandy and silty in nature. The pH of the soil samples was found to be neutral to alkaline. Organic content of the soil samples was found to be in the range of 0.85 to 4.14 g/kg indicating moderate fertility of soil. The permeability of the soil was found to be about 1.83×10^{-4} K(cm/sec).

Geology: The area owns the oldest archaean rocks. E-W trending Central India Shear has divided the area into two parts, Satpura province in north and Bastar province in south. Bastar province comprises Archaean Gneissic Complex where as Satpura province comprises granite gneisses, metamorphic, Deccan traps and Gondwana group. The study area belongs to Satpura province comprises the rocks of metamorphic, Deccan traps and Gondwana group

Land-Use of Study Area: The major share of the land is under single crop agricultural land which is about 263.91 sq km covering (84%) of the total land cover. Water bodies (Mahanadi and Hasdeo) occupy 6.7 percent of the land use of study area. The scrub and open grasses land are predominant in the 10-km radius study area. There are 68 villages within the 10-km study area. The land-use of the Core Zone i.e the Project site is mainly covered by agricultural

land (85%) and barren land (15%). No forest land, major water bodies and settlement is present within the site.

Micro-meteorology: The maximum and minimum dry bulb temperatures recorded during the study period 32.9°C in October and 14.2°C in December respectively, while the average temperature was 22.6°C. During the study period, mean humidity was recorded at 66.2% while maximum and minimum humidity were observed as 78% and 43% respectively. The rainfall experienced during the study period was 8mm. The average wind velocity was observed to be 4.1 m/s and the predominant direction was North and North-West.

Ambient Air Quality: Ambient air quality at ten different locations was monitored during the study period. It was found that P_{98} value of SPM varied between 138.9 and 159.3 µg/m^3. The 24-hrs RSPM level of ambient air in all the stations during monitoring period was recorded in between 41.1 to 55.7 µg/m^3 as against allowable value of 100 µg/m^3 stipulated in National Ambient Air Quality Standards (NAAQS) for industrial, residential cum rural area. The PM 2.5 value (P_{98}) was found between 21.3 to 27.7 µg/m^3. Similarly values of SO_2 and NO_X ranging from 9.2 to 13.5 µg/m^3 and 10.5 to 13.6 µg/m^3 respectively are well within the stipulated levels of NAAQS. The range of ozone varied from 7.9 to 8.5 µg/m^3. On the whole, the prevailing ambient air quality within the study area is well within the NAAQS standard.

Ground Water: From the observation, it was found that the pH of the groundwater was found ranging from 7.18 to 7.93. The TDS values were found in the range of 72 to 348 mg/l. The hardness values were in the range of 52.6 to 352 mg/l and the calcium and magnesium were in the range of 12 to 85 mg/l and 5.5 to 37 mg/l respectively. The heavy metals such as Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, and Zinc are all found within drinking water standards. In general, the groundwater quality indicates that the groundwater bodies are not polluted and can be used for drinking purpose after necessary disinfection.

Surface Water: The pH and TDS of the surface water samples are found normal with pH range of 7.1 to 7.4 and TDS between 114 and 198. The values of hardness, calcium and magnesium, chloride, sulphate, nitrate values are also found well within the limits of drinking water standard prescribed by BIS (IS 10,500: 1991). The heavy metals such as Arsenic, Cadmium, Chromium, Copper, Lead and Mercury are all found below detection limits. Although low concentrations of iron and zinc are found, they are within drinking water standards. The BOD values observed as 3.2mg/l to 4.1mg/l are well within the prescribed limits.

Noise Level: The ambient noise levels monitored at five different locations indicate that they were within the standards. The L_{eq} were recorded between 38.5 to 45.0 dB (A) during daytime and 32.6 to 37.8 dB (A) during nighttime.

Area Drainage: The general drainage of the area is from north to south. All first and second order seasonal streams join the Mahanadi within the study area. In the core zone area there is a seasonal nala flowing in the southern part of the core zone. The nala finally drains into Mahanadi near its confluence with Hasdeo.

Ecology: There are no ecologically sensitive receptors within the study area except for one reserve forest within 5 km from the site. The flora in the study area mostly consists of khair and sal. Bamboo is also found in the area. Grasses and other undergrowths cover the maximum wastelands and vegetation of the area. Fauna in the area consists of mammals (such as wild dog, wild boar, monkeys, etc.) reptiles (such as snakes and lizards) and common avifauna (such as myna, crows, pigeons, sparrows etc). There are no Schedule I fauna in the area.

Social Background: It can be observed that in the villages within the project site area, there are 1,723 households covering a population of 10,041 persons as per secondary data. In the 10km study area, there is a population of 87,540 persons in 15,922 households. The population density in the study area (278.8) is higher than the core zone area (249.0). The literacy rate of the area is average although the female literacy rate was found to be low. The Scheduled Tribe population in study area comprises of 2.16% of the total population while it is 2.10% in the impact area

PREDICTION OF IMPACTS

Impact during Construction: Based on the impact analysis, it is predicted that there will be negligible impact on environment during construction phase. During construction the likely impacts include dust due to construction, movement of vehicles, gases from engine exhaust, noise from movement of material personnel, etc. During the construction period the impact on environment will be of temporary nature, localized and short term with changes in the surrounding land use as compared to the current conditions. The potential impacts on water environment will arise due to discharge of washing of construction materials stockpiled, washing of concrete batching plant and discharge of untreated sewage of construction labourers.

Impact during Operation:

Impact on Air Quality: The maximum resultant values (in operation phase) for SO_2 and NO_X were found to be 44.7 and 26.4 µg/m^3 respectively. The maximum resultant Ground Level

Concentration values were 159.9, 55.9 and 27.8 µg/m^3 for SPM, PM10, and PM2.5 respectively. It was found that the GLCs for all parameters in operation phase of the project will be well within the prescribed norms of CPCB.

Impact on Water Quality: Operation of the plant will not have any long-term impact on water quality as it is proposed to have a 'Zero Discharge' water system. The water system of the proposed project has been developed with maximum recycle and reuse of water, so as to minimize the water requirement for the project as well as to reduce the quantity of effluents generated from the plant.

Solid Waste: The ash disposal area for Thermal Power Plant is within the site. The ash generated (3.21 MTPA) from the power plant will be utilized in Cement Plant. All the fly ash will be utilized within the period of 4 years as per the new Notification on Fly-Ash Utilization 2008.

Impact on Noise: Noise modeling indicates the noise during daytime will be 67.5 dBA and during nights it is 55 dBA about 0.5 km from the plant site. At the boundary of the plant, it will be less than this value due to green belt proposed all around the plant site as well as the distance of plant from the boundary.

Impact on Ecology: No significant impact on terrestrial ecology is anticipated due to proper dispersion of pollutants through a chimney of 275 meters. As the area is mostly barren, there will be not much impact on terrestrial flora and fauna. As already mentioned, there are no Schedule I fauna in the area.

Impact on Socio-economic Status: Approximately 280 households across three villages will be getting affected by the project. All the affected will be land-oustees as there is no homestead displacement due to the project.

Mitigation Measures:

During the operation stage the main air pollutants will be from the Coal Handling Plants, coal crusher units and the flue gases. Furnaces and boilers would be operated with minimum excess air so that fuel consumption is reduced and NO_X emissions are minimized. Low NO_X burners should be installed for further reduction in NO_X emission. The fugitive emissions of coal dust from storage facilities, crushers and at coal transfer points should be reduced by adopting appropriate measures like cyclones /bag filters/water sprinklers/fog system.

Demineralization plant will be sized to meet the internal requirement of fresh water in the proposed power plant. Product water storage tank will be provided for distribution of potable water to various consumer points. The effluent treatment plant is proposed to treat all liquid effluent so as to meet the standards as per the MoEF / CECB standards. The treated water will be utilized for green belt development. A RO plant will be provided for treatment of Cooling Tower Blow Down. During ash water recovery CW blow down will be sent to RO plant. Recovered water from RO plant will be sent to Clarified Water storage tank for reuse and the rejects from RO plant will be led to tube settler.

All equipment that are major noise generating devices/machines like steam turbine generator, compressors and other rotating equipment will have material to absorb/ reduce the noise i.e. using noise absorbing material for enclosures or using appropriate design technology for fabricating/assembling machines. Proper noise barriers/ shields etc. shall be provided in the equipment whenever it required. Noisy equipment shall be adequately attenuated, by providing soundproof enclosure and insulation.

ALTERNATIVES

Site Alternatives: The site for the power plant was selected after exploring three options. The present site was selected based on various criteria such as proximity to the coal link, water source, no acquisition for forest land, extent of displacement etc.

Technology Alternatives: For the present plant super-critical technology will be used.

MONITORING PLAN

Monitoring System: A structured and certified Environment Monitoring System is suggested at the industry level for ensuring that all activities, products, and services conform to the environmental requirement. The Environment Management Cell will be responsible for managing following activities related to environment function of proposed Power Plant:

- Coordinate and manage the EMP implementation during pre-construction, construction and operation phase
- Appoint dedicated environment staff to manage environmental monitoring responsibilities
- Manage and coordinate environmental monitoring and control
- Coordination with other sections of the plant and government agencies in relation to environmental management activities
- Implement and monitor greenbelt development and plantation activities

- Safety specialist will ensure safe working practices in all the sections of the plant

Cost: The one-time cost for installing pollution control equipments, development of green belt and setting up of laboratory for sample testing will be approximately Rs. 285.8 crores. Other than the above the annual recurring cost for monitoring and green belt maintenance will be about Rs. 22.5 lacs excluding salaries and maintenance.

ENVIRONMENT MANAGEMENT PLAN

A separate environment management cell comprising of a team of experienced and qualified personnel reporting to a very senior level executive preferably an environmental engineer is proposed. He will be assisted by well trained staffs comprising of environmental and safety specialists. Staff will be trained for environment control measures like air, water quality monitoring, solid waste management, noise abatement etc. Staff would also be trained to operate ESP and other pollution control equipment at optimum efficiency. For the proposed thermal power plant, the Environmental and Social Management System and its set up, role and responsibilities will be based on the requirement of ISO 14000 certification.

During the construction process, the impact will be minimal and temporary in nature. So the scope of EMP during the construction phase will be limited to dust suppression and noise attenuation. Care has to be taken to reduce the SPM level of the project area.

Rainwater Harvesting: Rainwater harvesting will be implemented at proposed plant to conserve storm water. Rainwater harvesting typically has two different approaches which are collection and storage of rainwater and channeling surface run-offs to ground water recharging structure.

Ash Disposal: Fly ash will be disposed in form of Slurry form. The fly ash shall be extracted from main fly ash silo through a pneumatic operated valve and a Dozing Screw feeder provided with variable speed drive to control its output. Fly Ash will be utilized for brick making and cement manufacturing purposes. Fly ash will further be used as light weight aggregates and for paving of roads. MBPIL is also negotiating for MoU to use the Fly Ash with cement manufacturing companies. As per the latest ash utilization notification by MoEF, 100% fly ash utilization has to be achieved within 3 years.

Green Belt Development: With a view to attenuate air pollutants, to absorb noise and to care of uptake of water pollutants, it is recommended to develop a greenbelt as per norms all around

the boundary and at several locations within the power plant premises. For this project 160 acres of land has been earmarked for green belt development. Trees of local varieties, including fruit-bearing trees will be planted.

MBPIL will take the responsibility to take up community development work at the village level so as to improve the quality of life. Development of infrastructure, educational and health facilities will be given importance as part of CSR activities.

All compensation for land oustees will be paid as per the provisions of National R&R Policy 2007 and Chhattisgarh State R&R Policy.

RISK ASSESSMENT

Risks likely to pose a risk to man, environment or property associated with various activities are addressed in this report. Such activities include transport, storage; handling and usage of fuels (Coal & LDO/ HFO), chlorine and hydrogen, Precautionary measures to be taken for preventing any hazards due these materials are proposed in the report. However through risk modeling it was found that the impact of any accident related to fuel oil or chlorine will be only within the boundary of the plant. During detailed engineering it will be ensured that the storage tanks are placed in such a way that its impact will not go beyond the plant boundary.

The following precautions will also be taken:

- All equipment vulnerable to explosion or fire would be designed to relevant IS codes and statutory regulations.
- Specific prevention will be taken with respect to hazardous chemicals and regular mock drills should be carried out to enact accident scenarios with reports sent to the top management.
- Suitable fire protection system comprising hydrants and spray systems are provided for fire protection. Fire extinguishers should be tested periodically and to always be kept in operational mode.
- Surrounding population (including all strata of society) should be made aware of safety precautions to be taken incase of any mishap in plant.
- On-site disaster management and off-site emergency plans, commands communication and controls will be established and maintained.

- Adequate provisions like emergency response, response organization, response plan, material safety data sheet, command & control, capabilities, transportation, medical facilities, mitigation measures, training, education, public awareness emergency plan review etc. to control any disaster situation will be made available.

CLEAN DEVELOPMENT MECHANISM

India has high potential for CDM projects, particularly in the Power Sector. The Baseline Carbon Dioxide Emissions from power sector have been worked out by CEA based on detailed authenticated information obtained from all the operating power stations in the country. The Baseline would benefit all prospective CDM project developers to estimate the amount of Certified Emission Reduction (CERs) from any CDM project activity.

The Plant Carbon Intensity for the plant is 0.85 kg/kwh. The expected reduction in CO_2 emission is 688010 Tons/year. The intensity of the plant is quite less compared to the average of NEW NE grid. Hence, the proposed project will help to reduce the GHG emission, through using fuel efficient super-critical technology. However the PIN document of the project is under preparation and will be processed subsequently.