NEYVELI LIGNITE CORPORATION LTD.

EXECUTIVE SUMMARY
OF
RAPID ENVIRONMENTAL IMPACT ASSESSMENT
AND
ENVIRONMENTAL MANAGEMENT PLAN
FOR
2X500 MW LIGNITE FIRED NEYVELI NEW THERMAL POWER STATION
AT
NEYVELI, TAMILNADU

SEPTEMBER, 2009

Prepared by:

MIN MEC CONSULTANCY PVT. LTD.

A-121, Paryavaran Complex, IGNOU Road, New Delhi – 110 030
Ph : 29534777, 29532236, 29535891 ; Fax: +91-11-29532568
Email :min_mec@vsnl.com; Web site : http://www.minmec.co.in

Estb. 1983

An ISO 9001:2000 approved company

EXECUTIVE SUMMARY FOR REIA/EMP OF 2 X 500 MW NEYVELI NEW THERMAL POWER PLANT AT NEYVELI TOWN, KURINJIPADI TEHSIL, CUDDALORE DISTRICT, TAMIL NADU.

1.0 INTRODUCTION

Neyveli Lignite Corporation Limited (NLC) has proposed to install 2 x 500 MW Lignite fired Neyveli New Thermal Power Project using sub critical boiler units at Neyveli town in Kurinjipadi Tehsil of Cuddalore District, Tamil Nadu. The selected site for the power plant has an area of about 178Hectares. The land is already under the possession of NLC except for a small portion of Govt. land of 2.86 Hectares (i.e. 7.07 acres). Additionally a separate 30 hectare area to the East of the B & C plant has been identified for lignite storage yard which is also in possession of NLC. The land towards the west side of the erstwhile fertilizer plant and B & C factories has been selected for the proposed plant. The estimated investment in the project will be approximately Rs. 5596.00 Crores. This new plant will be a replacement plant for the existing units of 600 MW power plant called TPS-1. The land requirement for 2x500 MW lignite fired thermal power station is given in Table 1.

TABLE 1
LAND REQUIREMENT FOR 2X500 MW LIGNITE-FIRED THERMAL POWER PLANT

Sl. No.	Particulars	Area in hectares
A	Main Power Plant	
	a) Main plant	36.60
	b) Lignite handling system	30.00
	c) Water system (including CW piping)	30.40
	Total	**97.00**
	Green belt for power plant	35.00
	Total	**132.00**
B	Ash dyke area including green belt	33.40
C	Land for other facilities	
	a) Transmission corridor	42.60
	b) Roads	
	c) Area for construction	
	Total = A+B+C	**208.00**

1.1 General background

Neyveli Lignite Corporation Limited, (NLC) is a Mini-ratna, Government of India enterprise registered under Indian Companies Act, 1956, engaged in commercial exploitation of the Lignite deposit available at Neyveli region. It is a Central Government Public Sector Undertaking (PSU) functioning under the Administrative control of the Ministry of Coal. It is an integrated complex, with three lignite mines having a combined production capacity of 24.0 million tonnes / annum feeding lignite to three thermal power stations having a combined generating capacity of 2490 MW. NLC is a leader in introducing state-of-the-art technologies in power sector using Lignite as a fuel. NLC has provided economical and reliable power for over 45 years to Tamil Nadu and its neighbouring states. Salient features of the power plant is given in Table 2 below:

TABLE 2
SALIENT FEATURES OF THE PROJECT

Configuration	2 x 500 MW i.e. 1000 MW
Source of fuel	Lignite from existing mines of Mine-1, Mine-1 expansion and Mine 1 A will be available for this plant. These mines have total reserves of 382 Million tonnes.
Fuel Requirement	6.839 million tonnes per annum and 0.984 Kg/Unit of power
Land Requirement	Approximately 208 Ha. Entire land except for 7.07 acres of Government land is owned by NLC. Hence no fresh acquisition
Power Requirement	The construction power would be catered by provision of a temporary power connection from the nearest HT power line of NLC.
Manpower	175 persons for construction management. 450 persons for O & M.
Water Requirement	86159 m^3 per day or 3589 m^3 / hour
Water Source	Ground water pumped from Mine – 1 to TPS – 1 lake and fertilizer lake is presently used by TPS-I & TPS-I Expansion units and once the TPS-I is closed, the same will be utilised for this new power station & TPS-I Expansion.
Project Cost	Approximately Rs. 5596 Crores
Project schedule	42 months for completion of trial operation and subsequent commercial operation for the first unit of 500. The second unit of 500 MW would be commissioned 6 months after the first unit commissioning. These periods are from the date of placement of order for main equipment. Placement of order for main equipment is in 6 months from the date of GOI sanction
Ash generated	0.546 Million Tonnes per annum at an average ash content of 8%
Ash Disposal System	About 80% (0.437 MTPA) of total ash would be fly ash and would be utilised by cement industry, road construction and for filling, reclaiming the land etc. and about 20% (0.109 MTPA) would be bottom ash which will be dumped in the ash dyke.
Power Evacuation	Through 400 KV in consultation with PGCIL.

1.2 Location and communication

The location of the project can be seen in Survey of India Topo sheet No. 58 M/6. The power plant site is approximately 200 kms south of Chennai and 50 kms south west of Cuddalore. It falls between Latitude 11° 34' 23" and 11° 35' 38" N and Longitude 79° 26' 35" and 79° 27' 28" E. The location of the plant can be seen in Fig 1.

The site is well connected by Chennai – Thanjavur NH 45C road and state highway connecting Cuddalore – Virudhachalam via Neyveli. Neyveli town is at a distance of 2.47 km in North-East direction. The site is located along South eastern side of TS-I Expansion to Neyveli railway line at a distance of 3.5 km. The nearest airport is at Trichy at a distance of approximately 130 km from the site. Nearest seaport is at Chennai at a distance of approximately 200km from the site.

2.0 PROJECT DESCRIPTION

2.1 Project site

The general elevation at the power plant site ranges from 61.65m to 74.53m.The land is flat. The selected site has an area of about 178 Hectares for the power plant and 30 ha for lignite storage and handling. The site is having flat terrain and presently vacant.

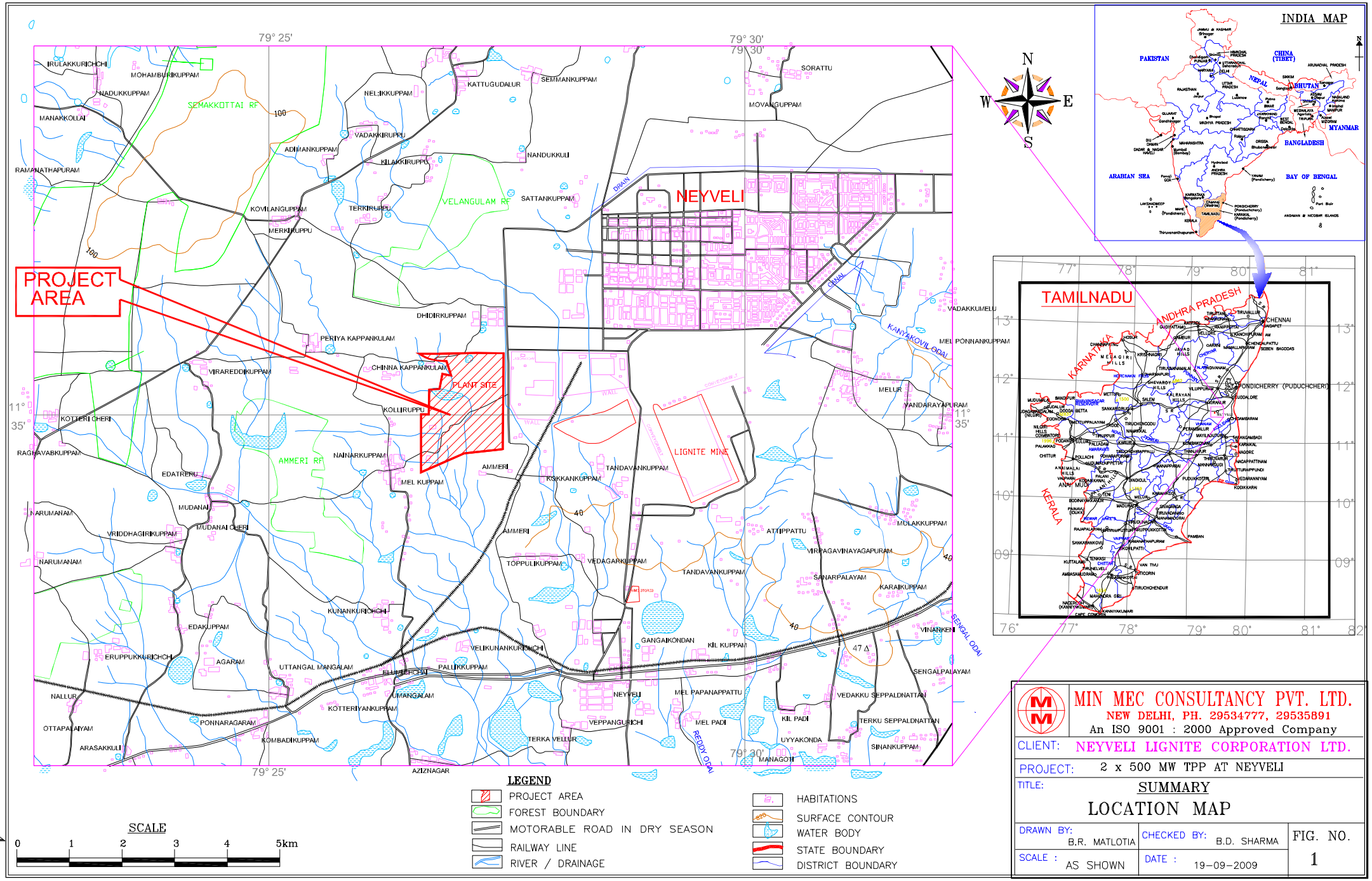
2.2 Process description

The power plant will use Pulverised fuel type (PF) fired sub critical unit. In a lignite based thermal power station, the heat of combustion is first converted into mechanical and then to electrical energy. The main units of a thermal power plant are steam generator, steam turbine and electrical generator which are discussed in brief in subsequent paragraphs below.

Steam generator and accessories: The steam generator (SG) would be of sub critical parameters and designed for firing 100% lignite fuel available from the existing Neyveli mines supplied with a complete set of draft equipment including, forced draft fan, induced draft fan, primary air fan seal/cooling air fan, damper and associated equipment.

.

Steam Turbine Generators and Accessories: The steam turbine would be a reheat extraction condensing type turbine. Steam turbine would be a three cylinder reheat extraction and condensing turbine. The turbine-generator would be complete with all accessories such as protection system, lube and control oil system, seal oil system, jacking oil system, seal steam system, turbine drain system, 60% BMCR HP / LP bypass system, electronic/electro-hydraulic governing system, automatic turbine run-up system, on-line automatic turbine test system and turbine supervisory instrumentation.



MIN MEC CONSULTANCY PVT. LTD.
NEW DELHI, PH. 29534777, 29535891
An ISO 9001 : 2000 Approved Company

CLIENT: NEYVELI LIGNITE CORPORATION LTD.

PROJECT: 2 x 500 MW TPP AT NEYVELI

TITLE: SUMMARY

LOCATION MAP

DRAWN BY: B.R. MATLOTIA	CHECKED BY: B.D. SHARMA	FIG. NO. 1
SCALE : AS SHOWN	DATE : 19-09-2009	

Plant Cycle: The regenerative cycle would consist of three low-pressure horizontal type heaters, a variable pressure de-aerator, two high-pressure horizontal type heaters and one gland steam condenser.

Condensate pump: The pumps would be vertical, cannister type, multi-stage centrifugal pumps driven by AC motors.

Boiler Feed pump: The boiler feed pumps would be horizontal, multistage, centrifugal pumps of barrel type.

Low Pressure Heaters and Drain cooler: The low pressure heaters would be of shell tube type with u-shaped stainless steel tubes, with their ends rolled in carbon steel tube sheets.

Deaerator: The deaerating feed water heater would be direct contact, variable pressure type heater with spray-tray type or spray type of deaeration arrangement.

High Pressure Heaters: The high pressure heaters would be of shell and tube type with stainless steel U-tubes welded to tube sheets.

Gland steam condenser: A surface type gland steam condenser would be used to condense the gland steam exhausted from the turbine glands.

Fuel oil System: The annual requirement would be about 15000 m^3 for a 500 MW Lignite based unit at a Plant load factor of 80 %. A total HFO storage capacity of 1000 m3 each with two tanks has been envisaged. LDO system would be designed for unit start-up purposes only and storage capacity of 2 tanks of 200 m^3 each has been considered adequate for the plant.

Chemical Dosing System: Hydrazine/ Morphaline and or ammonia dosing system would be provided to ensure chemical conditioning of the feed water by removing the dissolved oxygen and carbon dioxide present in the feed water.

Compressed air system: For catering to the instrument air requirement it is proposed to have Three (3) numbers of oil free screw type air compressors of 36 Nm^3/min, one for each unit and one as common stand by and two (2) numbers of air drying units are envisaged.

Air conditioning and ventilation system*:* Inside design conditions of 23 ± 2°C dry bulb temperature and relative humidity not exceeding 55 ± 5% would be maintained in all air-conditioned areas. Packaged air-conditioning units are envisaged for air-conditioning of ash handling, lignite handling control room and switch yard control room. For ventilation of station building, evaporative cooling system (air-washer) is envisaged.

Crane, hoists and elevators: Cranes/ electrical hoists/ manual hoists, would be provided for handling various pumps, compressors, fans, lignite

handling equipment, ash handling equipment, drive motors, fans, gates, screens, filters, heaters, etc. Two Elevators in each of the steam generators and two passenger elevators at both ends of the station building and one VIP elevators in the service building shall be provided. Also one passenger elevator in the ESP control room building for each unit will be provided.

Ash Dyke: Total of 33.4 Hectares of land including green belt has been earmarked for the ash dyke. The Ash dyke is sized to store 100 % bottom ash generated for 25 years and unutilized Fly ash for the first 9 years.Ash dyke is located on the south side of the proposed power plant.The ash disposal to ash dyke would be by slurry pumps.The ash dyke will be lined with suitable material such as Low Density Poly Ethylene (LDPE) with 60 micron thickness at the bottom and sides to prevent seepage of water or ash particles.After lining is done, the sides of the ash pond will be pitched using tiles/stones.

Pre-Treatment Plant: The purpose of Pretreatment System is to treat the raw water from TPS -1 and fertilizer lake water and reduce the suspended solids and any organics prior to downstream use.

DM Plant: The DM Plant would treat clarified water to produce Demineralized water for make up to steam cycle, closed cooling water system, H_2 Plant operation and miscellaneous use during maintenance operation.

DM make-up system: DM make-up pumps supply DM water to the condensate storage tanks (CST). The DM water Transfer system would be sized for 3% of BMCR.

Cooling water system and Treatment system: The cooling water system would comprise closed cooling system consisting of natural draft cooling tower, circulating water pumps and cooling water piping. The cooling tower would be designed for a cooling range of 10°C and to minimize recirculation resulting from prevailing winds. CW Treatment would be provided to limit the scale formation in the condenser due to circulating water by controlling the pH of water. A cycle of concentration of 3 will be maintained to prevent scaling in the condenser tubes.

ACW and DM Cooling water (DMCW) system: The DMCW system meets the cooling water requirements of all the auxiliary equipment of the TG and SG units. To minimize the corrosion, a corrosion inhibiting chemical solution would be added to the DMCW system.

Lake water & circulating water chlorination systems: Chlorination system is provided for chlorine dosing to remove organic matter present in the Circulating Water and to minimize biological growth on the Cooling tower fill and piping as this biological growth could promote corrosion, impair heat transfer and impair water distribution throughout the circulating water system.

Fire fighting System: The fire fighting system would be designed in conformity with the recommendations of the Tariff Advisory Committee of Insurance Association of India.

Lignite Handling System: It covers the lignite handling system from the mines conveyor to the bunker feeding system of the proposed units. The lignite storage yard is located on a separate 30 hectares plot of land. Lignite will be received by conveyors from the mine and stored in the stock pile. From the stock pile lignite will be transported to power plant by belt conveyor. The capacity of the system including conveyors, crushers and screens would be 2400TPH and crusher capacity would be 1,800 TPH.

Potable water treatment plant: The purpose of potable water treatment system is to treat the service water prior to downstream use.

Service water system: Service water would be pumped to the main Service water overhead tank with the help of 2 x 100% service water transfer pumps.

Effluent disposal system: Facilities in the form of chemical dosing system, effluent recirculation system, pH correction, etc would be provided to treat the effluent for further reuse.

Condensate polishing system: The condensate polishing(CPU) unit is used to treat the condensate from the discharge of condensate extraction pumps. A three tank regeneration station shall be provided for this.

Ash handling system: The ash handling system has been designed considering Bottom ash hopper 20% (maximum), Economiser ash hoppers 5% (maximum), Fly ash in ESP hoppers 80% (maximum), Fly ash in APH hoppers 5% (maximum), Duct Hopper 2.5 %(maximum).

Ash water recovery system: An approximate 50% sh water recovery system shall be provided to recover water from the ash dyke. Three nos (3 X 50%) recovery water pumps (2 working + 1 standby) shall be provided.

Chimney / Stack: The detail of the stack is given Table 3.

TABLE 3
DETAIL OF STACK

Stack	
Number of stacks (Chimneys)	1
Height of the stack	275 m
Number of flues in each stack (cylindrical flues)	2
Internal diameter of each flue	6.6 m
Flue gas exit volume	849.76 Nm^3/s
Flue gas temperature	125℃
Flue exit velocity	24.85 m/s

Emissions from one flue (to be doubled for stack)	
Particulate matter emission from each flue	29.14 g/s ~ 50 mg/Nm^3
SO_2 emission from each flue	2168.88 g/s ~ 3720 mg/Nm^3
NO_x emission from each flue	218.578 g/s ~ 375 mg/Nm^3
CO	218.578 g/s ~ 238610 mg/Nm^3

2.3 Raw material

The proposed 1000 MW plant would require about 23,424 tonnes of lignite per day based on the average Gross Calorific Value (GCV) of lignite as 2,715 kCal/kg and plant heat rate of 2666.3 kcal/kWh. This works out to about 6.839 million Tonnes/annum of lignite considering plant load factor of 80%. The annual requirement of support fuel would be about 15000 m^3 as per CERC norms.

2.4 Site services

2.4.1 Man power

The estimated manpower requirement is 175 persons for construction management and 450 persons for O & M.

2.4.2 Water requirement

The water consumption of the plant will be 91727 cubic meters per day but however the raw water required as makeup is 86159 m^3 /day, which will be met with from the TPS - 1 and fertilizer lake water.

The total plant water requirement is summarized in Table 4.

TABLE 4
TOTAL PLANT WATER REQUIREMENT

Sl. No.	Item	Estimated Quantity		Quality
		m^3/hr*	m^3/day	
1.	CW make up for condenser and other auxiliaries (COC* – 3.0)	3146	75504	Clarified water
2.	Main Clarifier blow down	182	4368	Sludge
3.	DM clarifier blow down	9	216	Sludge
4.	Service Water	322	7728	Clarified water
5.	Plant potable water	10	240	Filtered water

Sl. No.	Item	Estimated Quantity		Quality
		m^3/hr*	m^3/day	
6.	DM water for SG makeup, DMCW makeup, H_2 plant & DM Regeneration	150	3600	DM water
7.	Filter backwash	2 to 3	71	Waste water
	Total raw water requirement (Item 1 to Item 6)	**3821**	**91727**	**Lake/Pond water**
8.	Boiler blow down for reuse in system	120	2880	Service water
9.	Seal Water return for reuse in system	112	2688	Service water
10.	Actual raw water requirement **(Item 7-(8+9))**	3589	86159	Lake/pond Water

** The capacity in m^3/hr shown above is for both the units is inclusive of 10% as margin*

2.4.3 Fire alarm system

A fire alarm system would be provided to facilitate visual and audible fire detection at the incipient stage of fire in the power station.

2.4.4 Colony

Provision for additional housing in the existing township is done to accommodate the higher grade officials.

2.4.5 Site Grading

The various services / utility areas within the plant would be suitably graded to different elevations.

2.4.6 Power Evacuation

The power generated at the plant would be evacuated through a 400 kV system. Start-up power would be drawn from the 220 kV switchyard.

3.0 RAPID ENVIRONMENTAL SURVEY TO KNOW THE PRESENT ENVIRONMENT SCENARIO

The 10 km radius around the proposed project including the project area forms the study area i.e. the anticipated area of impact. Rapid environmental survey was done for one season (winter) i.e., from January to April 2009 to measure the existing environmental conditions.

3.1 Topography & drainage

The study area once formed a part of peninsular India which is highly table mass of land. Generally surface elevation ranges from 61.65m to 74.53m.

The drainage of the region is controlled, to a larger extent, by the Gadilam River (15.6 Km, North) and Vellar Rivers (17 Km, South) and their tributaries, which are seasonal in nature. The drainage pattern of the area is dendratic and subdendratic in nature.

3.2 Climate and micro-meteorology

The study area occupies warm climatic belt with moderate humidity. Data recorded from NLC Station (CARD) at Neyveli for the period 1997 to 2007 shows that temperature varied from 18.3 to 40.4°C, Relative humidity varied from 24 to 100%. The average annual rainfall is 1225.5 mm. mostly south-west, south-east and north-easterly wind blows in this region.

Micro-meteorological survey was undertaken from January to April 2009. Ambient air temperature was found to be between 20.0 to 39.00°C with an average of 27.92°C, Relative humidity varied from 16.70 to 90.00% with an average of 58.34%, wind speed from calm to 11.40 km/hr with an average of 3.37 km/hr and wind direction is E (14.66).

3.3 Ambient air quality

Ambient air quality study has been carried out at six (Kaikalakupam, Periakappanakulam, Block 23, Vanadirayapuram, Tandavankuppam, and Velikunakurichi) sampling stations, through Respirable Dust Samplers continuously for three months. The SPM was found to vary from 88 $\mu g/m^3$ to 190 $\mu g/m^3$, RPM from 26 $\mu g/m^3$ to 59 $\mu g/m^3$, SO_2 from 5.5 $\mu g/m^3$ to 11.9 $\mu g/m^3$ and NOx from 6.5 $\mu g/m^3$ to 13.9 $\mu g/m^3$.

3.4 Water resources

Surface water: Veeranam Eri, Perumal Eri and Walaja tank are the three major lakes in the alluvial plains of the Vellar river.

Ground water: The Neyveli Ground Water Basin comprises about 400m thick water bearing sands in Central part and extends to about 60 km in north-south direction between Gadilam and Vellar rivers and has a peculiarity of exerting upwards pressure of water. The total annual average recharge of water is about 210 million cubic metres.

3.5 Water quality

Water samples from ground and surface water of 6 locations (Surface water: Gongai kondam, TS-1 Lake, Prriakappakulam lake Ground water: Velikkunankurichi, Nainarkuppam and Neyveli colony) were collected. The result shows that physical and chemical parameters like colour, odour, taste, turbidity and temperature. pH, hardness, chloride, total solids are within the desirable limits.

3.6 Noise level and traffic density

Measurement of noise level was carried out at six locations. The noise level was found to be between 43.30dB [A] to 54.60dB [A] during day time and 37.30 to 41.70 dB [A] during night.

A traffic density survey was conducted round the clock on Virdhachalam to Cuddulore Road (SH-10) near conveyor belt bridge on 25th to 26th March, 2009. The total observed motorised vehicles were 7024 vehicles/ day while cycles were 594per day.

3.7 Land use and soil quality

3.7.1 Land use in core zone

The power plant is proposed to be set up over 178 hectares of area. The land is an unutilized barren land with shrubs in patches.

3.7.2 Land use study in buffer zone

Land use pattern of the study area has been assessed on the basis of 2001 Census data. It is found that about 24.95% of the total area is occupied by un-irrigated agricultural land while irrigated agricultural land is 13.52% out of the total area. The 10.36% is forest land area, area not available for cultivation is 36.05% and culturable waste land is 15.12%.

The soil is mainly brown in colour with normal conductivity. The quick weathering genesis has produced shallow, loam and sandy soil. The sandy soils are poor in organic contents and have low moisture retaining capacity. The pH of soil is slightly alkaline to neutral.

3.8 Ecology

In the buffer zone, the reserve/protected/ village forest cover is 4220.89Ha. i.e. about 10.36 % of the total area. According to the “Revised Classification of Forest Types of India” by Champion and Seth (1968), the forest of the study area has been observed as degraded Southern Dry Tropical Mixed Deciduous Forests (5A/C_3) and Southern Tropical Thorn Forests (6A/C_1). The main species existing in the forest are Eucalyptus, Bamboos, Acacia etc.

The core and buffer zone has avifauna such as Indian Owl, Blue Rock Pigeon, Indian Roller, House Crow, Grey Partridge, House Sparrow, The reptiles found are Common Indian Krait, Lizard, Northern House Gecko, Rat snake and Indian Chameleon. The Schedule-I animal found in both core zone and study is Common Indian Monitor.

3.9 Socio economic conditions

There are 49 inhabitated revenue villages in study area. Total population is 250487 with 127854 males & 122633 females. 67.20 % of total population is

literate. The composition of SC and ST in the study area is 20.03% and 0.88% respectively. 63.56% of the total populations are non-workers while main workers are 27.67% and marginal workers are 8.77%.

3.10 Industries in study area

There are a number of mines, thermal power plants and other industries around the proposed project.

3.11 Places of tourism / historical / archaeological importance

No specific place of tourist importance falls within the study area. No places of historical importance are present in the study area either.

4.0 ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

4.1 Topography and drainage

Impact: The northwest region of the area is a high ground with steep slopes. The elevation gradually lowers in the northern and central parts of study area. More or less, a flat topography exists in the southern and south eastern regions. During construction, these run off water will have to be collected in the storm water drainage system and transferred to the downstream natural seasonal drains. Therefore, the intial order streams will get diverted according to the storm water drainage.

Mitigation: The surface run-off and the storm water from the plant area will be directed to the rainwater harvesting structures proposed within the plant site. The pond area will be taken over by switchyards and the corridor for transmission line. It is a slightly low lying area which will be filled by the material excavated during the construction of foundations in the buildings.

4.2 Climate and meteorology

Impact: The proposed power plant project will be restricted to different type of activities within core zone covering the land area of about 178 acres. During the construction phase the activities will be restricted to construction of roads, buildings, erection of structures, plants and machinery, construction of oil/fuel storage areas etc. Thus, no effect on climate and meteorology of area is expected. During operation phase there will be stack emissions and thermal pollution.

Mitigation: No effect on climate and meteorology of area is expected. The thermal pollution will be restricted to the plant site while the stack emissions will only contribute incremental values of pollutants.

4.3 Air quality

Impact: Sources of air pollution, during the construction phase will be vehicle exhausts, dust generation due to excavation work, shifting of

construction materials (cement, sand and gravel), vehicle movement on unpaved roads and exhaust from non-mobile construction equipment like compressors. Primary impact will be high dust generation resulting into increased SPM levels in the surrounding areas and the secondary impacts of air emissions, dust as well as other emission will affect the health of the labour force working in close vicinity. During operation phase the air quality impacts of a source or group of sources is evaluated by use of mathematical models. GLC predictions have been performed for the emission source in three predominant directions. The results of modelled incremental GLC's due to stack have been calculated based on hourly average wind speed in each direction and summarised below in Table 5. (What is the model used – To be mentioned).

TABLE 5
CALCULATED GROUND LEVEL CONCENTRATION (µg/m^3)
(TOWARDS THREE PREDOMINANT WIND DIRECTIONS)

Direction	Concentrations (µg/m^3)			
	SPM	SO_2	NOx	CO_2
SE	0.30 (5.0 Km)	21.95 (5.0 Km)	2.21 (5.0 Km)	1407.50 (5.0 Km)
ESE	0.13 (4.0 Km)	9.42 (4.5 Km)	0.95 (4.5 Km)	603.79 (4.5 Km)
E	0.10 (4.5 Km)	7.73 (5.5 Km)	0.78 (5.0 Km)	495.79 (5.5 Km)

The three most predominant wind directions excluding calm conditions were observed during the monitoring period are towards W, WSW and NW directions for 14.99%, 9.76% and 9.72% respectively. The resultant GLC's due to the incremental superimposed upon the baseline are given in Table 6.

TABLE 6
RESULTANT GROUND LEVEL CONCENTRATION (µG/M^3)

Sl. No.	Location	Pollutant	Baseline concen-tration	Increment al GLC	Resultant concen-tration	Standard
1	Periakappanakulam (A2)	SPM	190	0.01	190.01	200
		SO_2	11.6	0.90	12.5	80
		NOx	13.9	0.09	13.99	80
2	Tandavankuppam (A5) (nearest station to peak concentration points)	SPM	189	0.30	189.3	200
		SO_2	11.9	21.95	33.85	80
		NOx	13.3	2.21	15.51	80

The incremental GLCs at stations Kaikalkuppam, Block 23, Vanadirayapuram and Velikunakurichi were calculated to be zero for all pollutants.

Mitigation: During construction, as the site is generally level the dust created by excavation, levelling and transportation activities will be controllable by sprinkling of water, construction equipment and transport vehicle will be maintained properly and regularly to minimize source emissions and spillage along with construction of pucca road. Electrostatic precipitators (ESP) will be installed to control the particulate emission. For

wider dispersal of SO_2, a stack of 275 m height will be constructed. Stack emission monitoring for SO_2, NOx and particulate matter will be carried out as per frequency mentioned in the consent. Water spraying system will be provided in lignite yard to suppress dust at suitable location including transfer points, loading and unloading points. Opacity meter will be installed for continuous monitoring of particulate matter. Bag filters will be installed at silo for dry ash extraction

4.4 Land environment

Impact: The project area will cover 178 ha of land for the main plant and 30 ha of land would be lignite storage area. Construction activities will contribute to the deterioration of environment but this will be for limited time. As all the activities related to the project will be restricted to core zone, no impact on buffer zone land use is anticipated.

Mitigation: During construction, regular water spraying shall be done on soil surfaces, excavated areas, mounds and heaps of soil and rubble as well as on the road used for movement. A green belt has also been envisaged all around the plant to the tune of 33%.

4.5 Water environment

Impact: During construction phase, rain water flowing through the construction area will carry loose soil, thereby increasing suspended solids of receiving water body. However, the impact will be temporary and reversible. During the operation there will not be any direct contact between shallow water table and effluent/ slurries.

Mitigation: The total requirement of raw water is 86159 cum/day. Treated effluents are reused for horticulture and removed oil is taken offsite for disposal. Waste water collected in the guard pond shall be utilised quantitatively for ash quenching and ash disposal and horticulture. Sewage from toilets and wash rooms shall be treated in septic tanks and disposed in soak pits. In order to conserve the rain water and use the available rain water a rain water pond is planned. The plant is designed on 100% recycle/ reuse of waste water to achieve the concept of zero discharge. To prevent water pollution by oil/grease, leak proof containers will be used for storage and transportation of oil, water quality monitoring will be done regularly, workshop effluent will be passed through pit/grease trap and recirculated and analysis of treated waste water will be carried out as per CPCB regulation. Domestic waste water from the plant and the colony will be treated in the sewage treatment plant based on activated sludge process and utilized quantitatively for irrigation of green belt and plantation. Rainwater falling on the rooftops of buildings will be harvested and used for recharging of ground water through recharge structures. The TDS is brought down from aprroximately 6000 to 2100 mg/l by dilution with the excess cooling tower blow down which has a TDS of <600 mg/l. The combined effluent TDS will be < 2100 and can be used for Horticultural

activities. The wastewater treatment systems will be designed to collect and treat the various effluents from the site, which are given in Table 7.

TABLE 7
WASTEWATER TREATMENT SYSTEMS

Effluents	Sources	Method of treatment	Disposal / Reuse
Oily wastes	• Transformer yard, • TG hall floor wash • Fuel oil handling area.	Tilted Plate interceptor, oil skimmer to bring down the treated water oil level to less than 10 ppm.	Treated effluents are reused for horticulture and removed oil is taken offsite for disposal.
Industrial waste with high suspended solid levels	• Boiler area floor wash • Service water wastes	Treatment through Tilted Plate Interceptors to reduce suspended solid levels to within PCB norms.	Treated effluents are reused for horticulture and sludge is disposed to ash pond.
Chemical contaminated waste	• DM Plant	Neutralization in a neutralizing pit to bring the pH to acceptable levels.	Treated effluents are reused for horticulture.
Sewage	• Canteen • Toilets	Sewage treatment Plant where that sewage is large and localized anaerobic treatment where generation of sewage is limited.	Treated sewage is reused for horticulture.

(Give a table for waste water quantity)

4.6 Noise and vibration

Impact: The noise level during construction will be due to construction machinery, which is of temporary nature, the unpleasant effects of which will be controlled by appropriate mitigation measures. The noise level at sources like the generator are anticipated to go as high as 95 dB(A).

Mitigation: The equipments shall be provided with acoustic shields or enclosures to limit the sound level inside the plant to acceptable level. The proposed green belt all around will also help to prevent noise generated within the plant from spreading beyond the plant boundary.

4.7 Ecology

Impact: No noticeable impact on land and soil is anticipated during the construction of the plant. Excavation and waste disposal will affect the land and soil within core zone only**.** Bright light and unusual noise during operation activity will shift the activity site of the birds and animals to little away from the location of plant site initially. With the progressive growth of greenery, biological terrestrial environment will improve in due course of time.

Mitigation: To reduce the impact of air pollution, it has been proposed to develop a Green belt to cover 33% of total land. A three tier greenbelt is proposed for establishment using different combinations of trees, shrubs, etc. Depending upon the local availability, soil and climatic condition, the selection of the suitable species for development of green belt will be made.

4.8 Solid waste

Impact: Total ash generated would be 0.546 MTPA, out of this, about 20% (0.109 MTPA) would be bottom ash which will be dumped in the ash dyke. About 80% (0.437 MTPA) of fly ash generated could be utilised by cement industry, road construction and for filling, reclaiming the land etc. There will be domestic solid waste generated from the plant which will be of predominantly organic and biodegradable in nature and converted into manure using vermi-composting. Sewage sludge of about 1.0 Tonnes per month will be generated, which will be vermin-composted and used as manure for greenbelt development

Mitigation: The bottom and coarse ash from each boiler will be collected in wet form and fly ash from the ESP hopper will be transported to fly ash silos. NLC has established a pre casting division for utilization of Fly ash. Fly ash Bricks, Solid Blocks, Fly ash Concrete Road, Fly ash Quarters, False ceiling boards with plaster of Paris and Fly ash, Pre cast RCC products and Ferro cement products are being manufactured by NLC at Neyveli, by utilizing Fly Ash.

4.9 Socio- economic conditions

Impact: Most of the work force required for construction and operation of the proposed project will be drawn from the surrounding areas. During the construction phase, no family is expected to migrate from the core zone. Therefore, no impact on demographic profile of the area is foreseen. The commissioning schedule of 39 months for synchronization, 42 months for completion of trial operation and subsequent commercial operation for the first unit of 500 MW from main plant equipment ordering date has been considered. The second unit of 500 MW would be commissioned 6 months after the first unit commissioning.

Mitigation: The direct employment potential during construction is 175 workers and 450 persons for O & M.would be involved. The share of local people in this is expected to be significant. The economic growth of the area in terms of employment generation, consumption behaviour and market-growth are expected outcome of the project. Indirect employment will be created by the plant for supply of daily domestic goods, Transportation & industrial requirements. The plant site area will be equipped with sufficient infrastructural facilities including drinking water, toilets, sanitation facilities, health center, etc.

4.10 Health and safety monitoring plan

All the potential occupational hazardous work places such as chlorine storage area, acid and alkali storage areas should be monitored regularly. The health of employees working in these areas should be monitored once in a year for early detection of any ailment due to exposure to hazardous chemicals.

Though effective measures are taken to combat pollution in ambient conditions, occupational health hazards are not overlooked. NLC provides well organised occupational health services to all its employees by taking responsibility for establishment and maintenance of safe and healthy working environment and assessment of the physical and mental capabilities to turn out specific work loads.

The Industrial Medical Centre (IMC) of NLC thus carries out the following functions:

1. Surveillance of workers health in relation to work
2. Surveillance of working environments
3. Identification and evaluation of environmental factors which may affect the workers health.
4. Assessment of conditions of occupational workers health
5. Observance of safety norms and reduce / eliminate exposure to hazardous environs.

The IMC, in coordination with CARD and Industrial Units takes up monitoring activities periodically to assess hazards due to gases, chemicals, dusts, vibrations, radiations, etc.

5.0 ANALYSIS OF ALTERNATIVES

The land towards the west side of the erstwhile fertilizer plant and B & C factories has been selected for the proposed plant. The selected sites for the proposed plant and the lignite yard are suitable for the project as the site is vacant and in possession of NLC and hence acquisition of fresh land is not required, Hence rehabilitation, resettlement matters will not be any issues, availability of lignite from the nearby mines. The location of the site will be suitable to get lignite conveyed from all the three mines through belt conveyors. Water is available in the two lakes (TPS I lake and Fertilizer lake), all basic infrastructure facilities like construction water, construction power, approach roads, construction materials and trained manpower are available nearby. The site's proximity to the Highway and railway line for transport of heavy equipment, terrain is reasonably flat, site does not fall under lignite bearing area, no sensitive area or places of archeological interest around the project site and no significant change in air quality / emission levels is expected as this project will be a replacement project for the existing plant which is in operation for over 45 years.

The best techno economic option shall be 2x500 MW PF fired sub critical unit. This will be cost effective, result in revenue gain and fuel economy.

6.0 ENVIRONMENTAL CONTROL AND MONITORING ORGANISATION

6.1 Centre for Applied Research & Development (CARD)

CARD Is the inhouse R&D centre of NLC and has been recognised by the Department of Science & Technology since 1975. CARD is carrying out various R&D works on lignite utilisation, diversification solid waste utilisation, waste land reclamation, etc. CARD has well established analytical facilities.

CARD is having an environmental Laboratory for measuring various pollution levels in air, water and soil. CARD is monitoring continuously ambient air-quality stations at 13 locations in and around Neyveli. It is also having facility of analysing effluents and soil parameters. CARD is also carrying out noise level measurements, dust level measurements etc.

A full-fledged Environment Management Department (EMD) shall be set up headed by Chief Executive Officer. This team will be also responsible for all environment management activities including environmental monitoring, developing greenbelt, ensuring good housekeeping, ensuring statutory compliance as well as creating environmentally aware work forces for proposed Thermal Power Plant. The schedule, duration and parameters to be monitored are described below in Table 8.

TABLE 8
MONITORING SCHEDULE AND PARAMETERS

Sl. No.	Description of parameters	Location	Schedule and duration of monitoring
1	**Air Quality**		
	Parameters: SPM, RPM, SO_2, NO_x	One sample within plant boundary and three in the vicinity of the project with atleast two in the predominant down wind direction, at 1500 m and 2500 m from plant respectively.	One 24 hourly sample per day, two days per week and 4 week per season or as per the MoEF/ CPCB/ SPCB guidelines, whichever are most stringent.
	Flue gas from stack for flow rate, SPM, RPM, SO_2 and NOx	sampling port of stack	Continous or as per MOEF/CPCB/SPCB guidelines
	Micro-meteorology		
	Wind velocity and direction	At site	At the time of air quality monitoring
	Temperature, humidity and rainfall	At site	Daily

Sl. No.	Description of parameters	Location	Schedule and duration of monitoring
3	**Water Quality/effluents**		
a	Effluents	At the Plant Boundary	As per MOEF/CPCB/SPCB guidelines
b	Water quality of surface and ground sources as per IS : 10500, 1991	One within plant, one on down gradient and up gradient of ash pond and three within 10 km radius	Once in a season
4	Ambient noise level	near power house, main plant building, near main gate and at four locations around the plant	Once a year
5	Inventory of flora (Tree plantation, survival etc.)	Green belt in and around plant	Once in two years within the green belt of the plant
6	Soil quality	Within plant area	Once in two years on all planted areas

6.2 Investment for environment control measures

The total capital investment on environmental improvement work is envisaged as Rs 41487.40 lakhs which is 7.41 % of the estimated cost of the project (Rs 559600.00 lakhs). The recurring expenditure estimated during the power generation is Rs. 1076.35 lakhs/year. The details are given in Table 9 & 10.

TABLE 9
CAPITAL INVESTMENT FOR ENVIRONMENTAL PROTECTION

Sl. No.	Particulars	No.	Cost (lakh Rs.)
I.	**AIR POLLUTION CONTROL**		
1	Electrostatic precipitator	2	22000.00
2	Chimney (twin flue)	1	3689.00
3	Dust collector- Bag filters	1	500.00
4	Water sprayer (Stationary)	LS	100.00
	Sub Total		**26289.00**
II.	**WATER POLLUTION CONTROL**		
1	Soak pit / Saptic tanks	LS	10.00
2	Industrial ETP	LS	500.00
3	Storm water drains	LS	300.00
4	Drains along roads	LS	500.00
5	Water drain culverts	LS	50.00
	Sub Total		**1360.00**

Sl. No.	Particulars	No.	Cost (lakh Rs.)
III	**SOLID WASTE DISPOSAL**		
	Ash Handling System		8443.90
	Ash dyke with LDPE lining(33.4 Ha)		2530.00
	Sub Total		10973.90
IV.	**NOISE POLLUTION CONTROL**		
1	Acoustics	LS	30.00
	Sub Total		**30.00**
V.	**ENV. MONITORING AND MANAGEMENT**		
1	High Volume air Sampler	5	2.50
2	Respirable Dust Samplers	4	3.00
3	Micro-meteorological station (Auto)	1	3.50
4	Laboratory for testing	1	10.00
5	Organic vapour sampler	1	2.00
6	SOx, NOx and SPM meter online analyser	1	100.00
	Sub Total		**121.00**
VI.	**OCCUPATIONAL HEALTH**		
1	Fire fighting equipment (Portable)	100	7.00
2	Fire fighting equipment (Fixed)	LS	2124.00
3	Fire fighting equipment (Mobile)	LS	70.00
4	Personal protective equipment	625	12.50
	Sub Total		**2213.50**
VII.	**GREEN BELT AND PLANTATION IN PLANT**	30 Acres	**500.00**
	GRAND TOTAL		**41487.40**

TABLE 10
RECURRING ANNUAL COST FOR ENVIRONMENTAL PROTECTION

Sl. No.	Particulars	Cost (Rs. Lakhs)
1	Air pollution control	657.00
2	Water pollution control	34.00
3.	Solid Waste Disposal	274.00
4	Noise pollution control	2.00
5	Environmental monitoring and management	12.00
6	Occupational health	55.00
7	Green belt	5.00
8	Others (Environmental studies, expert advice etc.)	6.00
	Overheads (3% of Dep., Energy, R&M & Interest)	31.35
	TOTAL	**1076.35**

7.0 DISASTER MANAGEMENT PLAN

All types of industries face certain types of hazards which can disrupt normal activities abruptly and lead to disaster like fires, inundation, failure of machinery, explosion to name a few. Lignite fired power plant also pose fire, electrocution and explosion hazards. Disaster management plan is formulated with an aim of taking precautionary step to control the hazard propagation and avert disaster and also to take such action after the disaster, which limits the damage to the minimum.

Disaster may occur due to fire, explosion, oil spillage, acid spillage, electrocution and hazardous waste. Design, manufacture and construction of all plant and machineries building will be as per national and international codes as applicable in specific cases and laid down by statutory authorities. Provision of adequate access way for movement of equipment and personnel shall be kept.

8.0 PROJECT BENEFITS

Most of the work force required for construction and operation of the proposed project will be drawn from the surrounding areas. Due to thermal power project there will be development of communication facilities in the area. In the plant area accommodation has been planned for the skilled/ semi-skilled employees and the managerial/ supervisory personnel. The plant site area will be equipped with sufficient infrastructural facilities including drinking water, toilets, sanitation facilities, health centre etc. The project would be fulfilling a part of the large power deficit that exists in the country. This in turn will be a service to the nation and electricity dependent industries as well as domestic users. Further, the company has a well developed Corporate Social Responsibility (CSR) plan which is enclosed with REIA report for the welfare of local communities and peripheral villages. The budgetary allocation for CSR activities has been provided for Rs.280 Lakhs and recurring annual expenditure estimate during power generation is Rs.197 Lakhs. The details are given in Table 11.

TABLE 11
ACTION PLAN AND BUDGETARY ALLOCATION FOR CSR ACTIVITIES FROM START OF PROJECT

Sl. No.	Activity and implementation target	Capital cost in Lakh	Recurring cost in lakh
A	Health	72	56
B	Education	65	55
C	Physically Challenged	2	12
D	Water	17	12
E	Capacity Building	48	17
F	Infrastructure	50	25
G	Sports and Culture	20	14
H	Miscellaneous	6	6
	Grand Total	**280**	**197**