EXECUTIVE SUMMARY

1.0 INTRODUCTION

Hindustan Electricity Generation Company Private Limited (HEGCPL) "Project Proponent" is intending to set-up a Combined Cycle Gas based Power Plant Project at Village Navlakhumbre and Badhalwadi, Taluka Maval, District Pune, Maharashtra state. It is proposed to construct a **355±10% MW Combined Cycle Gas Based Power Plant ("Project/ CCPP / Power Plant")** as well as all ancillary and related facilities required for the Project.

The proposed Project is categorized under Category – B, Schedule 1 (d) of **EIA Notification, 2006 and subsequent amendments (Notification SO 1533, of 14th September 2006 and amendment dated 1st December 2009) "EIA Notification"**, which provides that Coal/Lignite/Naphtha and Gas based power plants with capacity less than 500 MW shall obtain the Environmental Clearance from the **State Environment Impact Assessment Authority (SEIAA)** and general conditions shall apply.

The Project Proponent received Environmental Clearance dated 22nd February 2012 post recommendations of the **State Expert Appraisal Committee (SEAC)** on 16th April 2010 in response to Project Proponent's application dated 30th September 2009, approved **Terms of Reference (ToR)**, EIA Studies and Public Hearing. Based on SEAC recommendations, the Project Proponent received a deemed clearance in terms of the EIA Notification.

Subsequently, as a follow up to the order of the Hon'ble Supreme Court of India dated 10th December 2012, the SEAC directed the Project Proponent to resubmit the updated Form-I. HEGCPL submitted updated application dated 19th January 2013 along with updated Form-I, PFR and proposed ToR (based on the standard TOR approved by SEAC in its 55th meeting which in turn are based on EIA Technical Manual for Thermal Power Plants issued by MOEF dated September 2009) to SEAC, Maharashtra for approval of ToR. The ToR was approved on 15th February 2013 by SEAC along with additional points.

An Environmental Impact Assessment (EIA) study report has been prepared for this Project based on one year baseline environmental quality data from **February 2012 to January 2013** in the study area. The methodology for EIA is to establish the baseline environmental setting in the 10 km radius area, assess the potential impacts of the proposed Project components on different environmental components, develop adequate and feasible mitigation measures so as to keep residual impacts within acceptable limits and develop monitoring and other measures as necessary to ensure

successful implementation. Identification & prediction of significant environmental impacts due to proposed Project along with Environmental Impact Statement followed by delineation of appropriate Environmental Management Plan are included in the EIA Report. HEGCPL has retained **M/s Anacon Laboratory Private Limited, Nagpur** in association with **M/s. Green Circle Inc., Vadodara and M/s Netal, Pune** to conduct the Environmental Impact Assessment study for the proposed Project.

The purpose of this Environmental Impact Assessment (EIA) study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the proposed Project and the related activities.

For the purpose of the EIA study, the Impact Zone for the proposed implementation shall cover a study radius of 10 km around the Project site. One year data from February 2012 to January 2013 has been used as per the approved ToR.

The Executive Summary summarizes the findings of the EIA study undertaken in accordance with the TOR assigned by SEAC Maharashtra, interdisciplinary team discussions, criteria questions and professional judgment. This summary is intended to provide an overview of the prevailing baseline conditions, key environmental issues and their likely impacts and also list the major recommended mitigation measures to attenuate the impacts.

2.0 JUSTIFICATION FOR SETTING UP THE PROJECT AND SALIENT FEATURES

- Infrastructure is one of the basic inputs for overall economic growth and an efficient infrastructure in power in particular, is a necessary prerequisite for the growth of the overall economy.
- With an installed capacity of c. 200 Giga Watts (GW) as at 31 March 2012, India has the fifth largest generation capacity in the world after US, China, Japan and Russia. However, the per capita electricity consumption in India is considerably low as compared to the world average.
- At the end of the XIth five year plan, as per estimates of the Central Electricity Authority (CEA); India still faces an energy deficit of 8.47% and a peak deficit of 11.06%.
- With rapid economic growth, the requirement for power is set to substantially increase and amongst other power sector reforms, India will need to make considerable capacity addition to meet its power requirements and capture the potential of its economy.

TABLE E-1 REGIONAL POWER SCENARIO AS PER LGBR

Region	Actual Energy Scenario 2011-12				Actual Peak Scenario 2011-12			
	Requirement	Availability	Surplus / Deficit (-)		Demand	Met	Surplus / Deficit (-)	
	(MU)	(MU)	(MU)	(%)	(MW)	(MW)	(MW)	(%)
North	2,76,121	2,58,382	-17,739	-6.4	40,248	37,117	-3,131	-7.8
West	2,90,421	2,57,403	-33,018	-11.4	42,352	36,509	-5,843	-13.8
South	2,60,302	2,37,480	-22,822	8.8	37,599	32,188	-5,411	-14.4
East	99,344	94,657	-4,687	-4.7	14707	13,999	-7,08	-4.8
North-East	11,011	9,964	-1,047	-9.5	1,920	1,782	-138	-7.2

Source: *Load Generation Balance Report (LGBR) 2012-13 issued by the Central Electricity Authority*

As many as 30 of the 28 States and 7 Union Territories faced a peak deficit and 25 faced an energy deficit in the year 2011-12.

TABLE E-2 PEAK ENERGY DEFICIT STATES IN INDIA AS PER LGBR

Range	No. of States / UTs	
	Energy	Peak
Deficit		
Above 20%	8	13
10°% - 20°%	9	9
5°% - 10%	4	2
0% - 5%	4	6
Total	25	30
Surplus		
Above 20%	2	2
10% - 20%	2	2
5% - 10%	1	0
0% - 5%	4	0
Total	9	4

Source: *Load Generation Balance Report (LGBR) 2012-13 issued by the CEA*

- Western Region witnessed an energy shortage of 11.4% (33,018 MU) and a peak power shortage of 13.8% (5,843 MW). Approximately 72% of the energy deficit and 80% of the peak deficit in the Western Region is on account of the deficit prevalent in Maharashtra.
- Maharashtra is the most power starved state in India with an actual Peak Power deficit of 22.1% (4,652 MW) and an energy deficit of 16.7% (23,660 MU) in the year 2011-12.

TABLE E-3 PEAK ENERGY DEFICIT IN MAHARASHTRA AS PER LGBR

State	Energy				Peak			
	Requirement	Availability	Deficit (-)		Demand	Met	Deficit (-)	
	(MU)	(MU)	(MU)	(%)	(MW)	(MW)	(MW)	(%)
Maharashtra	1,41,382	1,17,722	-23,660	-16.7	21,069	16,417	-4,652	-22.1

Source: *Load Generation Balance Report (LGBR) 2012-13 issued by the Central Electricity Authority*

- Mumbai itself faces a shortage of around 500 MW till FY 16 as per the Draft 18th EPS issued by CEA.

TABLE E-4 PROJECTION OF MUMBAI PEAK LOAD DEMAND AS PER ACTUAL FOR 2012

Particulars	FY 2011-12 (MW)	FY 2013-14 (MW)	FY 2014-15 (MW)	FY 2015-16 (MW)
Mumbai Peak Load	3,260	3,732	3,993	4,273
Shortfall		532	617	472

Source: *Draft 18th Electric Power Survey of CEA*

- The proposed Project is located in Pune District, which is a fast growing industrial hub, hence a load centre and has been facing acute power shortage. The district has witnessed a growth of ~26% (YoY 2010-11) in the average power demand. Number of industrial units in close proximity of the company's Power Project has increased by ~31% (YoY 2010-11) most of which are power intensive units.
- The Project will use Natural Gas for generation of power which has globally been recognized as one of the cleanest fuels for power generation and will be able to meet 75% of Pune's industrial load demand / Mumbai's peak power shortfall.
- Close proximity to load centres such as Pune and Mumbai will also help reduce the transmission charges and losses thereby bringing down the cost to the end consumer.
- Quality and reliable power using the cleanest fossil fuel available will help in reducing the number of Diesel Generating (DG) sets currently being operated during load shedding hours where customers are paying between Rs 16 to Rs 20 per unit of power, not to mention the harmful effects of burning diesel (Refer Chapter on Project Benefits).
- As per the Working Group on Power for the 12th Plan (WGOP), gas-based power plants have the potential to lead to carbon reduction efficiencies even higher than renewable and will be encouraged. A case in point is the United States which has

made more reductions in greenhouse gas emission than any other nation over the past six years, achieved by gradually migrating from coal based plants to gas based plants and reduced carbon dioxide emissions to an estimated 5.2 billion metric tons, a level not seen since 1992 (as per the EIA).

- The CEA in the National Electricity Plan (NEP) has recommended that peaking plants must be able to start up (and stop) instantaneously and ramp up quickly, and in required steps, to match the spike in load, and that their efficiency curve must be high and flat at different plant loads. Further, they must meet environmental norms so as to be located close to load centres. In India, hydro capacity addition is beset with problems such as long gestation periods, rehabilitation and resettlement (R&R) issues, delayed environmental clearances (EC), geological and hydrological risks, flash floods and resistance to large storage projects and cannot be located close to load centres.
- Therefore, gas based combined cycle power plants remain the best option to address the ever growing peak demand in an environmentally friendly manner while fulfilling all the requirements laid down by CEA. Further, gas-based power generation is also the best option to complement the ever increasing wind based power generation in India to ensure a uniform output of power throughout the day and help in reducing the overall cost of generation.
- Thus, there is an urgent need to address this ever increasing power deficit scenario in India and especially in Maharashtra keeping in mind the objective of the Government of Maharashtra to make it a load shedding free State by 2012. Further, WGOP has also said in its recommendations that there is a need for promotion of new gas based capacity in the country (of at least 20,000 MW during 12th plan and immediately implement at least 400 MW capacity each at the 5 metro cities) due to the inherent advantages of gas based plants and also to reduce our carbon footprint.

The Salient features of the project are discussed in **Table E-5**.

TABLE E-5 – SALIENT FEATURES OF THE PROJECT

S.No	Particulars	Details
1	**Capacity**	355±10% MW Combined Cycle Gas Based Power Plant
	Total Project Coast	~ Rs. 1850 crores as assessed by the bankers
	Total Land Area	267 Acres
	Period of Construction	36 Months
2	**Configuration of CCPP**	
2a	CTG Technology	Advanced F-Class Technology with dry Low NOx Burners.
2b	Heat Rejection System	Air Cooled Condenser to convert STG exhaust steam to condensate.
2c	Natural Gas system	Measuring station, gas separator, startup heater, regulation station, performance heater and scrubber tank.

2d	Power Evacuation	Through 400 kV transmission network of PGCIL / MSETCL
2e	Nearest EHV substation for Power Evacuation	PGCIL 400 / 220 kV Substation south of site at Talegaon or 765 kV Substation at Shikrapur or MSETCL 400 kV Lonikand Kalwa transmission line south of the site.
3	**Fuel**	
3a	Type of fuel	Natural Gas
3b	Source	**Gas Supply** The Project will utilise imported and/or domestic gas for the Project. Agreement executed with BPCL for supply of gas for the Project. **Gas Transportation** Primary Source: GAIL DUDPL (Dahej - Uran -Dabhol Gas) pipeline network and/or Secondary Source: East-West Gas Pipeline of Reliance Gas Transportation Infrastructure Limited (RGTIL) **Storage** No storage of Natural Gas envisaged in the Project.
3c	Length of pipeline to be laid down	GAIL supply: ~6.5 km or RGTIL supply: ~2 km
4	**Water Requirement**	
4a	Raw water source	Maharashtra Jeevan Pradhikaran (MJP)
4b	Water Allocation	MJP: 9 MLD
4c	Water Requirement for project	During Construction Phase: 500 m^3/day During Operation Phase: 14.29 m^3/hr
5	**Power Requirement**	
5a	Auxiliary Power Requirement	Approximately 12 MW
5b	DG set for Backup	Construction Phase - 3x600 kVA Operation Phase - 2x1000 kVA
6	**Solid Waste Generation**	
6a	Domestic solid waste	~ 70 kg/day
	Hazardous solid waste	

S. No.	**Source of Waste**	**Hazardous Waste Category**	**Quantity (p.a)**
1	Used Oil	5.1	2.84 (tons)
2	Waste rags	5.2	1 (tons)
3	Used lead acid batteries	Batteries Rules, 2002	20 (Nos.)
4	E-waste	E- waste Rules, 2011	10 (Units)

3.0 PROJECT LOCATION & SETTINGS

The proposed site is located at Village Navlakhumbre and Badhalwadi in Pune District of Western Maharashtra. It is located at a distance of about 12 km from Talegaon. Pune lies at a distance of about 40 km from the Project site.

Latitude	:	18°49.292' N
Longitude	:	73° 40.976' E
Site Elevation	:	620 to 670 meter above MSL.

The site is approachable from Pune city national highway. Talegaon is the nearest railway station at a distance of about 12 km (south) from the site. Pune airport is at a distance (by road) of about 40 km (South) from the site. J.N.P.T. is the nearest sea port at Mumbai.

The proposed site area generally consists of black clay cotton soils overlying reddish brown or yellow clay. The average elevation for the plant area is between 620-670 meters.

4.0 POWER PLANT DETAILS

4.1 CONFIGURATION

Configuration of 1x1x1 combined cycle is proposed comprising of one Combustion Turbine Generator (CTG), one Heat Recovery Steam Generator (HRSG) and one Steam Turbine (ST) with Air Cooled Condenser (ACC) and auxiliary balance of plant systems including fuel gas system, de-mineralized (DM) water system, waste water system, compressed air, service water and fire protection system.

The plant process is described as below:

- Within the gas turbine unit, ambient air will be filtered and compressed in an air compressor and then would enter the combustor. The fuel gas will be injected into the combustor where it is combusted in a clean manner to minimize emissions. Low NOx burners will be used for optimum combustion and to minimize emissions. The hot gases generated in the combustor will rotate the gas turbine which will drive an electric generator to generate electricity. The turbine will also drive the turbine air compressor to compress the air required for combustion of fuel gas;
- The hot gases that leave the turbine will still have a lot of energy. To utilize this energy, the hot gases will be passed through the HRSG. This heat from the gas turbine exhaust gases will be used to produce steam from water;
- Water will be pumped into the HRSG at high pressure by boiler feed pumps and it will get converted into steam by extracting the heat from the flue gases;
- Flue gas will be expelled to the atmosphere via 60 meters stack after extracting the heat in the HRSG. The temperature of the flue gases coming out the stack will be around 95-100°C.

- The steam generated in the HRSG will be supplied via steam lines to drive a steam turbine which will also be coupled to the electric generator that would generate electricity;
- The steam coming out of the steam turbine of the plant will have low energy. After doing the work in the steam turbine, this steam will be condensed back to water by using Air Cooled Condenser (ACC). To conserve water, a dry condenser system commonly referred to ACC is designed. In such a system, the exhaust steam from the steam turbine is condensed using air as the cooling medium. This condensed water called as condensate will be recycled again in the system to produce steam and will be used to drive steam turbine to generate electricity. This cycle will keep on repeating. The use of Air Cooled Condensers reduces the water requirement of the plant by almost 10 times as compared to traditional water-cooled power plants;
- The waste water and effluents generated from the facility will be collected at the Central Monitoring Basin (CMB) for further treatment to recycle back the treated waste water to service the water system. Water reject from central monitoring basin will be further treated in the Effluent Treatment Plant (ETP) and this treated waste water will be used for plant gardening purpose and/or disposed to existing natural stream only during monsoon season at ambient temperature, conforming to World Bank Standards which are more stringent than MPCB/CPCB permissible standards;
- A 400 kV switchyard will be used to transfer the power generated to PGCIL Pune (PG) / MSETCL. The voltage level of generated power from the generators will be stepped-up at 400 kV voltage level through Generator Step-up Transformers and connected with the 400kV switchyard located inside the Plant boundary;
- For supplying power to plant auxiliary loads, two voltage level will be used i.e. 6.6 kV for large size motors and 415V for small size motors. The auxiliary power to run these 6.6kV large size loads will be taken from generator thorough step down Unit Auxiliary Transformers. Further distribution at 415 V voltage level will be done from 6.6 kV switchboards through step down 6.6 kV/415V small rating dry type transformers;

  220 V DC system will be provided along with 415 V Diesel Generator Set to cater to emergency loads for safe shut down of the plant when AC power supply system is not available;
- The overall control of the plant will be through Distributed Control System (DCS). Functions of DCS includes alarming, recording, periodic report building, historical data storage, remote indication and recording of plant operating parameters. Control of balance of plant equipments / systems will be through separate Programmable Logic Controllers (PLC). Such systems include demineralised water treatment system, effluent discharge collection and treatment system, etc.

4.2 GAS TURBINE

For the proposed plant, it has been decided to adopt gas turbine with modular type suitable for outdoor installation of industrial, heavy duty type rated for **355±10%** MW at ISO conditions with natural gas as fuel. It will be suitable for quick start with fast acceleration time from startup to full load. One static converter for start-up of gas turbine will also be provided.

4.3 HEAT RECOVERY STEAM GENERATOR (HRSG)

HRSG is a set of energy recovery heat exchangers that recovers heat from hot gases from the Gas Turbine. It produces steam that can be used to drive a steam turbine. This combination produces electricity more efficiently and economically as compared to the gas turbine alone.

5.0 PROJECT UTILITIES / AMENITIES

5.1 LAND REQUIREMENT

267 acres of land has been acquired for the Project at village Navlakhumbre and Badhalwadi, Taluka Maval, Dist. Pune. NA has been obtained for 233 acres of land which is sufficient to execute the Project. NA process for balance area is in progress. The permission from Directorate of Industries for setting up a gas based power plant on the said land has also been obtained by the Project Proponent. The past land use of the project area was of mixed type comprising mostly of uncultivable and fallow land.

5.2 FUEL REQUIREMENT

5.2.1 Natural Gas

The fuel requirement for the proposed 355±10% MW combined cycle power plant will be approx 2,312.6 MM Btu / Hr. The Company will use imported and / or domestic gas for the Project and has executed an agreement with BPCL for supply of gas. The gas shall be transported from the GAIL DUDPL (Dahej - Uran -Dabhol Gas) pipeline network (primary source) or the East-West Gas Pipeline of Reliance Gas Transportation Infrastructure Limited (RGTIL). No storage of natural gas is envisaged in the Project.

5.3 WATER REQUIREMENT

Water will be supplied by Maharashtra Jeevan Pradhikaran (MJP) for the proposed Project. Total water requirement for the proposed project as estimated is 14.29 m^3/hr during operation phase. MJP has confirmed supply of upto 9 MLD of water for the Project.

5.4 EMERGENCY POWER SUPPLY

To enable safe unit shut down during complete A.C power supply failure in the station, certain important plant auxiliaries will be provided with a reliable A.C Power supply through a separate source. For this purpose, 2x1000 kVA quick starting Diesel-Generator set with automatic mains failure (AMF) feature will be provided for unit. AC Auxiliary system will be based on:

- Normal loads,
- Essential loads requiring alternative feeds and
- Loads requiring DC/AC conversion to feed critical loads in addition to alternative AC feeds

5.5 MANPOWER REQUIREMENT

To the maximum extent possible, local labour would be employed during construction phase. However, semi-skilled manpower and technical personnel would be hired as required from available sources. It is proposed that the operational staff will be housed in the residential colony existing within the premises of the Plant.

About 1000 labour will be deployed during the construction phase, out of which 700 will camp at the labour camp to be provided within the Project site near village Badhalwadi and about 300 will come from surrounding area.

5.6 FIRE PROTECTION SYSTEM

The fire detection / protection module will be designed to meet TAC requirement. The gas turbine / generator module will be provided with suitable fire-alarm system and carbon dioxide fire protection system as an integral part of the package. Central control room will be provided with suitable fire alarm system and fire protection system. Fire protection system for the gas station, will be provided as per standard practices approved by TAC. Switchgears and other strategic locations, offices will be provided with suitable fire alarm and detection system supported with portable fire extinguishers. Additionally, portable fire extinguishers will be provided at all strategic points.

5.7 WATER SUPPLY

The daily water requirement of proposed 355±10% MW CCPP is estimated to be about 14.29 m^3/hr. The source of water is Maharashtra Jeevan Pradhikaran (MJP).

6.0 ENVIRONMENTAL SETTING OF THE STUDY AREA

The baseline environmental status was assessed based on primary and secondary data collected either through on-site field observation or obtained from agencies such as Indian Meteorological Department, Geological Survey of India, State Ground

Water Department, Central Ground Water Board, State Pollution Control Board, Census of India and Local Forest Department. The following environmental components were focused for this study:

- Air Environment (Meteorology, Ambient Air Quality, Noise Levels etc.)
- Water Environment (Quality and Quantity of all potential water sources: Surface and Groundwater)
- Land Environment (Geology, Geo-hydrology, Landuse, Solid Waste generation and characteristics)
- Ecological Environment (Terrestrial and Aquatic Flora & Fauna)
- Socio-economic environment (Demographic profile, Occupational structure, Educational status, Literacy status, etc.)

The baseline status collated from analysis of secondary and primary data is summarized in the **Table E-1** below.

TABLE E-6 BASELINE ENVIRONMENTAL STATUS

ATTRIBUTE	BASELINE STATUS
Climate	The study region has dry climate for most of the part of year. It becomes hot and humid in summer and monsoon. Summer months are from April to May, Monsoon from June to September, Post monsoon from October to November and Winter from December to February. The region receives south-west monsoon. Annual average Maximum Temperature : 37.9° C Annual average Minimum Temperature : 11.0° C Annual average Rainfall : 720 mm Maximum average humidity: 85% Minimum average humidity: 20%
Ambient Air Quality	Ambient air quality was monitored at twelve (12) locations upto 10 km radius of the Project site. Observed concentration of PM_{10} are well within the NAAQS at all the identified locations. Observed concentration of NOx & SO_2 are also well within the specified standards at all the identified locations.
Noise Levels	Noise levels were observed at 10 locations within the impact zone of 10 km radius from the Project site. The results of the monitoring program indicated that both daytime and night time levels of noise measured in dB (A) are within the AAQSRN at all ten locations selected for noise monitoring.
Water Quality	The groundwater and surface water sampling was done as per

ATTRIBUTE	BASELINE STATUS
	CPCB water monitoring guidelines at 5 locations each within the 10 km study area. The surface water from Project site, Sudha river, Bhama Askhed Dam, Pond at village of Navlakhumbre, Indrayani River was analysed for the parameters like Colour, Turbidity, Total Hardness, Calcium, Magnesium, Chloride and Sulphate. This water sample was compared against IS: 10500 standards. The groundwater quality parameters are within the IS: 10500 desirable limits for drinking water except Phenolic Compounds at few locations in Ground Water as well as in Surface Water.
Soil Quality	Soil samples were collected at 10 locations within the 10 km study area. Water-Holding Capacity (field capacity) is the amount of water that the soil can hold against the downward force of gravity. Soil texture, structure, porosity, and organic-matter content determine soil water-holding capacity. Water holding capacity of different soil samples is less. Soil of the area varies from neutral to alkaline with its pH value ranges from 7.5 – 8.09. Porosity: The non-solid portion of a volume of soil, consisting of air- or water-filled pore space. Soil porosity, both the total amount of pore space and the distribution of pore sizes, controls soil water content, air movement and water movement. The rates of air exchange and water movement depend on both the volume and continuity of pore spaces within the soil. Analysis of soil samples shows that porosity value of the soil samples ranging from 61.02% to 72.3% which indicates that porosity of the area is average. The Sodium Absorption Ratio (SAR) measures the relative proportion of sodium ions in a water sample to those of calcium and magnesium. The SAR is used to predict the sodium hazard of high carbonate waters especially if they contain no residual alkali. High concentration of sodium disperses soil colloidal particles, rendering the soil hard and resistant to water penetration. The potential of sodium hazards increases in soil with higher SAR values. SAR values of the four soil samples studied are ranging from 0.98 to 2.36 respectively. A detailed soil investigation study has been carried out for the proposed site.
Ecological Environment	The ecological survey has been done to establish the baseline ecological conditions of the study area (within 10 km radius), to assess the potential ecological impacts due to the proposed Project on ecology, to develop adequate and feasible mitigation measures, to keep residual ecological impacts within acceptable limits and also

ATTRIBUTE	BASELINE STATUS
	to develop ecological monitoring parameters. This part of Pune District and Maharashtra falls under Arid and Semi-Arid climate (Near Western Ghats). Plantation of the study area is characterised by annuals and shrubby vegetation. Natural forest covers are not significant in the study area.
Land-use	Major land use of this area is Fallow land and cultivation is practiced in the nearby villages. Considerable area in core study zone is covered by Dam. However, the proposed Project will be developed on the land acquired by the Project Proponent which is under industrial land use.
Socio-economy	Total population of the villages studied is 87,457 with 16,955 households in total. Schedule caste and schedule tribe contribute to 4.92% and 9.16% respectively of the total population. There are 87% rural and 13% urban population in the area. Male population is 52.51% whereas female population is 47.49%. The total literacy rate is 62.33% out of which 39.61% are females and 60.39% are males. In study area, approximately 45.51% people out of total population are workers, with males outnumbering the female workers.

7.0 MAJOR ENVIRONMENTAL ISSUES

Before impact assessment of different environmental components is undertaken, it is pertinent to highlight the major issues of concern emerging from the analysis of the prevailing baseline environmental conditions and all Project activities planned during construction and operational stage. The major Project activities can broadly be categorized under construction and operational phase of the Project implementation. The major issues are summarised below:

7.1 AIR

During construction phase, the major air pollutant of concern is PM as it impacts of other emissions such as SO_2, NOx and PM10 will not be significant because the nature of sources is such that the emissions are distributed spatially as well as temporal.

During the operation phase, stack emissions due to burning of fuel and Natural Gas set emissions were predicted. The cumulative ground level impact of NOx emissions from total 1 stack has been predicted in terms of 24 hourly concentrations keeping in view the prescribed National Ambient Air Quality Standards (NAAQS). The ground level concentrations are predicted in the impact zone covering 10 km radius from the centre of the Project site.

Sixty (60) meter high stack shall be provided for proper dispersion of pollutants. The stack height of D.G. Sets (~9 m) above the roof level would be sufficient for proper dispersion of the pollutants so that they are well within the permissible limits. Water sprinklers will be used to suppress dust during construction.

The Project Proponent has engaged IIT Kanpur to carry out Air Modeling Study of the proposed Project. IIT Kanpur has issued report on "Air Quality Modeling of 355 +/- 10% MW Gas-based Combined Cycle Power Plant" dated April 2013.

IIT Kanpur has concluded that:

"It may be noted that at such a low concentration of NO_2, probability of formation of fog or secondary pollutants (photochemical smog, ozone) is negligible or visibility concerns are remote.

The modeling has been performed with and without consideration of hills (horse shoe shape). Although there are chances of pollutant build up due to hills, at the proposed site, even the yearly maximum concentrations of NO2, CO and PM10 remain very low (0.602 µg/m^3, 40.134 µg/m^3 and 0.188 µg/m^3) because of low emissions and prevailing meteorology.

Even after consideration of maximum existing pollution levels, the net concentrations will be well within the NAAQS and thus compliance with NAAQS will be ensured".

7.2 NOISE

The results of the monitoring program indicated that both daytime and night time levels of noise measured in dB(A) are within the AAQSRN at all ten locations selected for noise monitoring.

The noise emitted from heavy-duty construction equipments during construction period being high shall require occupational preventive measures and temporary noise barriers for noise attenuation. The construction period being about 36 month's duration, mitigation requirement becomes significant.

During normal operation phase, the major noise generation sources include Gas Turbine & Steam Turbine Generators, Air Intake and Exhaust Gas plenum, Boiler feed pumps, other rotating equipment like major and large pumps, air compressor, DG sets, ventilation fans, exhaust from steam line safety valves etc.

In a gas based power plant, moderate noise will be generated from gas turbines, steam turbines, cooling towers, transformers, compressors, pumps etc during operation phase. The noise emission standards for these units are prescribed in the comprehensive Industry Document and National Environmental Standards for Gas based Thermal Power Plants published by Central Pollution Control Board (CPCB).
The prescribed limits are as follows:

- 85 dB(A) at 1 m from the turbine

The major noise sources identified for the proposed Plant (CGT &A, ST, CG, HRSG, ACC, BFP, CP, CYCWP, ACHE and AC) have been considered for prediction of impact on ambient noise levels.

The impact assessment due to above-mentioned noise sources has been performed using DHAWANI noise model. The modelling results depict the maximum incremental noise level at 1 m from source is 85 dB (A) due to aforesaid sources. It is proposed that enclosures of CGT &A, ST, CG, HRSG, ACC, BFP, CP, CYCWP, ACHE and AC shall be designed for noise attenuation to reduce noise levels within the prescribed limits.

7.3 WATER ENVIRONMENT

During construction activities at site, water will be required for construction purposes and also for domestic consumption by the construction personnel. Construction water will be arranged from the Maharashtra Jeevan Pradhikaran (MJP). It is anticipated that approximately 500 m^3/day of water would be used during the construction phase of the proposed power plant.

7.4 WASTEWATER GENERATION

Approximately 32 m^3/day of sewage is expected to be generated during construction phase (by engaging 1,000 construction labour onsite) which will be disposed off in package sewage treatment plants and remote locations will be connected through septic tanks as per specifications given in IS 2470 1995 Part I and Part II. Treated wastewater from package sewage treatment plants will be used in irrigation onsite.

An Effluent Treatment Plant (ETP) is envisaged for the project to control the quality of effluent which will be diverted to Central Monitoring Basin and the treated water will be reused for plantation purpose. There will not be any discharge outside plant boundary except the monsoon season.

Following pollution control measures are envisaged:

- Effluents from water treatment plants will be treated in neutralising pits before discharge to the Central Monitoring Basin.
- Blow down from HRSG HP/IP drums will be routed to the CMB.
- Floor drains & Fuel oil area drains will be treated in API separators and recovered oil or sludge will be disposed off separately. Clear water complying with CPCB/MPCB norms will be routed to CMB.
- Collected effluents at CMB will be treated, as required, to control the pH, BOD and COD. The effluents after CMB will be used for green belt irrigation within the plant boundary except monsoon season.

Liquid effluents generated from the Plant consist of water pre-treatment plant waste, de-mineraliser regeneration waste etc. The de-mineraliser waste would be neutralized in the neutralization pit. Clarifier sludge would be taken separately to a sludge press for removal of solids. Clear water from the sludge press system would be recycled back to the clarifiers. Oil separators for oil streams would be provided. The plant would operate on a closed cycle cooling system with air cooled condensers thus minimizing discharge from the plant. The treated wastewater from ETP will be used for gardening during non monsoon period and will be discharged to existing natural steams during monsoon period conforming to World Bank Standards which are more stringent than MPCB/CPCB prescribed limits. STP will also be provided for treatment of sewage. The supernatant water discharged from STP will be diverted to effluent treatment pond for further disposal.

7.5 WASTE MANAGEMENT

Natural gas, a clean fuel, is used for proposed Project. Hence, the conventional solid waste generation is negligible. However, the proposed Project is expected to generate some solid/semi solid wastes during operation apart from the domestic solid waste from plant area.

About 0.5-1.0 tonne/ day of construction debris is expected to be generated during construction phase. Construction debris would mainly comprise of bricks, iron pipes, concrete rubble, stone, plastic etc.

The recyclable waste such as metal scrap and plastics will be sold out to vendors and remaining waste will be used to level low lying areas within the Project site and in road construction on-site.

Packaging Waste

Packaging waste of approximately 10-15 Kg/day is likely to be generated during construction includes cardboard, blister plastics, thermocol, cellophane, paper, wood and multilayer containers and strapping. The waste will be sold out to vendors.

Municipal Solid Waste

The total domestic solid waste likely to be generated during construction phase is 0.5 tonne/day. About 70% of the domestic waste is expected to be biodegradable waste from kitchen as food waste. It will be disposed of into a vermi-composting pit for use as manure or in Excel supplied package municipal waste treatment unit for final use in landscaping. Remaining waste will be disposed of at site as approved by local authority.

Solid waste generation during operation phase

Municipal Solid Waste

The total domestic solid waste likely to be generated during operation phase is in the range of around 70-80 kg/day. The waste will be segregated into biodegradable and non-biodegradable waste. Biodegradable waste will be used for vermin-composting or in Excel supplied package municipal waste treatment unit for final use in landscaping (on site as well as off site). The non-biodegradable waste will be disposed off as scrap.

- E-waste comprising of approximately 10 used computers, which will be disposed off through authorized e-waste scrap vendors; and
- Lead- acid batteries will be disposed off through vendors supply batteries on buy back arrangement.

7.6 BIOLOGICAL ENVIRONMENT

The prevailing ecological environment in the study area (terrestrial/ aquatic) is not of significance as no notified Ecologically Sensitive Areas (ESA) are located in close proximity to the site. The plant species, most notably is dominated by annuals and shrubs. There is no impact of the WGEEP / HLWG Report on the Project as villages Navlakhumbre and Badhalwadi (where the Project is proposed to be set up) do not fall in the list of ESAs proposed in the said report. The Project will provide quality ambience with natural setting, well planned green belt comprising more than 12,000 trees and open spaces with water fountains so that it not only enhances the quality of life of the residents but also improve the micro-climatic conditions. As on date, more than 4,000 trees have already been planted at site.

8.0 ENVIRONMENTAL ASSESSMENT

Environmental impact due to the construction and operation stages of the Project were predicted quantitatively using models such as Lakes Environmental Software for air dispersion calculations and noise propagation equations for noise impacts. Impacts were also evaluated qualitatively using engineering judgment and best management practices.

9.0 ENVIRONMENTAL MANAGEMENT PLAN

Adequate environmental management measures will be incorporated during the entire planning, construction and operating stages of the Project to minimize any adverse environmental impact and assure sustainable development of the area. Summary of the EMP is presented in **Table E-2** along with the corresponding impacts. The EMP planned for the construction and operating stages of the Project will include the following elements:

- Air Pollution Control and Management
- Noise Control and Management
- Storm Water Management
- Hazardous and Solid Waste Management
- Plantation and Landscaping
- Sewage Treatment and Management
- Energy Conservation
- Emergency Response Plans for emergency scenarios
- Environmental Management System
- Environmental Monitoring

For the effective and consistent functioning of the campus, an Environmental Management System (EMS) will be established at the site. The EMS will include the following:

1. An Environmental Management Cell
2. Environmental Monitoring Program
3. Personnel Training
4. Regular Environmental Audits and Corrective Action
5. Documentation – Standard Operating Procedures, Environmental Management Plans and other records.

10.0 PROJECT BENEFITS

The Project will significantly contribute in alleviating the power deficit situation in the country / region and also help in improving the ecology and environment of the surrounding areas by replacing and reducing the number of DG sets currently being used by industries nearby as power backup. The Project will be using the cleanest fuel available for generating power, minimizing emissions through deployment of pollution control technologies, usage of the latest, state of the art technology and development of adequate green belt within and in the vicinity of the Project. Further, the Project will also significantly help in improving the infrastructure facilities and socio economic scenario of the area through various CSR measures, health, safety, education and welfare schemes proposed to be implemented in the villages located in the vicinity of the Project.

The Project Proponent, as part of this Project, through a sworn affidavit, has committed to various activities as part of its CSR programme which include provision of financial support / construction of english medium classrooms, garden and gymnasium for children at Navlakhumbre including equipments, training centre for youths of the area, dispensary and other health facilities, road from Navlakhumbre village to Narvade Vasti and Navlakhumbre village to Chavsar Vasti up to Inamthakar Vasti, shed for *Dashkriya Vidhi, Sabhagrah* for social and religious events, planting of more than 12,000 trees and beautification of mandirs in the villages in the vicinity of the Project. Further, the Project Proponent may also identify few villages in close proximity of the Project for providing treatment of drinking water (Navlakhumbre, Badhalwadi). This will be done in consultation with the local Gram Panchayat.

The Project Proponent has already planted in excess of 4,000 trees at the site and has also conducted various health, medical and educational camps in the vicinity of the Project Site.

11.0 CONCLUSION

Based on the environmental assessment, the associated potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the EIA and the EMP.

It can be concluded from the impact matrix that the Project will not have any significant negative environmental impacts. Instead, it is anticipated that the proposed Project would have an overall positive impact. The negative impacts, if any, would be mitigated with available know-how in technology. The Project will bring benefits at Local, Regional and National level. After incorporation of environmental management plans, the environmental sustainability will be improved.

TABLE E 7: SUMMARY MATRIX OF PREDICTED IMPACTS AND MITIGATION MEASURES

SN	Environmental Components	Potential Impacts	Potential Source of Impact	Controls through EMP & Design	Impact Evaluation	Remedial Measures
1.	Groundwater Quality	Ground water contamination	Construction Phase ▪ Waste water generated from temporary make shift Labor tents	▪ Septic Tank	No significant impact as majority of laborers would be locally deployed.	
			Operation Phase ▪ Sewage treatment, sludge disposal on land. Effluent treatment sludge disposal on land	▪ Sewage sludge to be treated and composted. Sludge to be kept at a specific location and to dispose off as per MPCB norms.	No negative impact on ground water quality envisaged.	In an unlikely event of soil and ground water contamination, remediation measures shall be implemented.
2.	Groundwater Quantity	Ground Water Depletion	Construction Phase ▪ Use of Ground Water for construction activity.	▪ No drawing of Ground water during construction.	No significant impact on ground water quantity envisaged.	In an unlikely event of non-availability of potable water supply, water will be brought using tankers.
			Operation Phase ▪ The source of water for the proposed Project is Maharashtra Jeevan Pradhikaran (MJP).	▪ Rain Water Harvesting Scheme. ▪ Storm water collection for water harvesting. ▪ An effective Effluent Treatment Plant (ETP) is envisaged for the project to limit the quality of effluent to be discharged from the plant within the norms of CPCB and MPCB. ▪ Wastewater from STP will be disinfected and will be used for development of greenbelt and landscaping. ▪ Awareness Campaign for reduced water use by workers.	No significant impact on ground water quantity envisaged.	

SN	Environmental Components	Potential Impacts	Potential Source of Impact	Controls through EMP & Design	Impact Evaluation	Remedial Measures
3.	Surface Water Quality	Surface water contamination	Construction Phase ▪ Surface runoff from site during construction activity.	▪ Silt traps and other measures such as, additional on-site diversion ditches will be constructed to control surface run-off during site development.	No off site impact envisaged as no surface water is present within the core impact zone of the site.	
			Operation Phase ▪ Discharge of domestic wastewater to surface water body/land. Discharge of effluent from ETP	▪ The Domestic wastewater will be treated in STP and the recycled water will be reused within the plant premises for green belt development. Collected effluents at CMB will be treated as required to control pH, BOD, COD. Treated effluent from CMB will be used for green belt development and landscaping except monsoon season.	No off site impact envisaged.	In case of any event of discharge of water from the site, the applicable water quality standards will be maintained as per Water Act based on discharge location on land /surface water body / sewer.
4.	Air Quality	Dust Emissions	Construction Phase ▪ All heavy construction activities. ▪ Operation of construction equipment and vehicles during site development. ▪ DG operation	▪ Suitable control measures will be adopted as per a dust control plan. ▪ Rapid on-site construction and improved maintenance of equipment.	▪ Not significant because dust generation will be temporary and will settle fast due to dust suppression techniques used. ▪ Not significant	▪ During construction phase the contractors will use dust masks for the employed labour. ▪ Water sprinkling for suppression of dust during construction phase. ▪ Regular maintenance of the construction equipment and vehicles will minimize emissions

S N	Environmental Components	Potential Impacts	Potential Source of Impact	Controls through EMP & Design	Impact Evaluation	Remedial Measures
		Emissions of PM, NOx and SO2 (stack emissions). Fugitive emissions from natural gas	<u>Operation Phase</u> ▪ Due to burning of natural gas (fuel for the proposed power plant)	▪ TPM and SO2 emissions will be very low as natural gas is a clean fuel. ▪ Dry low NOx burners to mitigate NOx emissions from fuel combustion ▪ Sixty (60) m hight stack per HRSG will be provided for proper dispersion of pollutants. ▪ Fuel quality monitoring on regular basis with special reference to H2S content in normal operation and sulfur content in emergency operation ▪ Online flue gas monitors including NOx, SO2, PM etc. (flue gas constituents) as well as flue gas flow rates and temperature shall be provided for all stacks	▪ Natural gas being a clean fuel will have low stack emissions as confirmed by IIT Kanpur.	▪ Adequate maintenance of all air pollution control equipments shall be carried out. ▪ Monitoring of stacks shall be carried out periodically. ▪ Regular monitoring of emissions and control measures to reduce the emission levels.
			▪ Power generation through DG Operations.	▪ Use of ultra low Sulphur diesel if available. ▪ DG will be used in emergency operation only. ▪ Footpaths and bicycle tracks would be provided.	▪ Not significant as DG would be used as power back-up only.	
			▪ Emissions from vehicular traffic in operation	▪ Plantation already provided with specific species to help reduce SPM levels.		

SN	Environmental Components	Potential Impacts	Potential Source of Impact	Controls through EMP & Design	Impact Evaluation	Remedial Measures
5.	Noise Environment	Noise emissions	Construction Phase ▪ Operation of construction equipment and vehicles during site development. ▪ DG operation (back up).	▪ Use of well-maintained equipment fitted with silencers. ▪ Providing noise shields near the heavy construction operations. ▪ Construction activity will be limited mostly to daytime hours only. ▪ Workers shall be provided with ear muffs	The nearest settlement is about 1Km from the proposed site. Moreover, there are no sensitive receptors located within or near the vicinity of site.	Use of Personal Protective Equipment (PPE) like earmuffs and earplugs during construction activities.
			Operation Phase ▪ Noise generation from Gas Turbine & Steam Turbine Generators, Air Intake and Exhaust Gas plenum. ▪ Boiler feed pumps ▪ Other rotating equipment like, major and large pumps, air compressor, DG sets, ventilation fans ▪ Exhaust from steam line safety valves etc. ▪ Noise from vehicular movement. Noise from DG sets operation.	▪ Enclosure of GTG and STG will be designed for noise attenuation to reduce noise level to 85 dB (A) at 1 m distance. The ambient noise level at 120 m from any part of the plant (far field) inclusive of GTG/HRSG/STG module shall not exceed CPCB prescribed limit. ▪ Plantation of specific species and development of silence zones for traffic movement. ▪ Providing Acoustic Enclosures for DG Sets.	Not significant as nearest receptor would be at a 1km distance from the site. Short-term exposure within permissible limit.	
6.	Land Environment	Soil contamination	Construction Phase ▪ Disposal of construction debris. ▪ Waste handling from DG Set. ▪ Hazardous waste like spent oil, lubricants, paint residues etc.	▪ Construction debris will be collected and suitably used on site as per construction waste management plan. ▪ Waste generation shall be monitored and managed in scientific manner with maximum stress on recycling of waste	Impact will be local, as any waste generated will be reused for construction activities. Not significant.	

SN	Environmental Components	Potential Impacts	Potential Source of Impact	Controls through EMP & Design	Impact Evaluation	Remedial Measures
			Operation Phase ▪ Solid waste will be generated from water pre- treatment plant and sewage treatment plant in the form of sludge. Waste oil	▪ Sludge from clariflocculators will be processed to produce cakes and will be utilized for area development. Sold to authorize agencies.	Since solid waste is handled on the site, waste dumping is not going to be allowed. Not Significant	
7.	Biological Environment (Flora and Fauna)	No displacement of Flora and Fauna on site.	Construction Phase ▪ Site Development during construction.	Suitable green area will be developed as per landscaping plan in and around the site using local flora, which will enhance the ecology.	No significant impact	--
			Operation Phase Increase of Green Cover.		Beneficial impact	
8.	Socio-Economic Environment	Population displacement and loss of Income	Construction Phase ▪ No displacement	▪ Pro-active social programs undertaken under Corporate Social Responsibility program	Beneficial impact	
			Operation Phase Site operation.	Project will provide employment opportunities to the local people in terms of labor during construction and service personnel during operations	Beneficial impact	--
9.	Traffic Pattern	Marginal increase in Vehicular traffic	Construction Phase ▪ Heavy Vehicular movement during construction.	▪ Heavy Vehicular movement will be restricted mostly to daytime only and adequate parking facility will be provided.	No negative impact	--
			Operation Phase Traffic due to proposed project once the site is operational.	Vehicular movement will be regulated inside the site with adequate roads and traffic management policies within the site.	Minor negative impact	Pollution under Control checks may be carried out for vehicles. Restricting of entry of vehicles causing excess pollution