SUMMARY ENVIRONMENTAL IMPACT ASSESSMENT

TORRENT COMBINED CYCLE POWER PROJECT

IN INDIA

June 2004
ABBREVIATIONS

ADB – Asian Development Bank
AEC – Ahmedabad Electricity Company Limited
CCPP – combined cycle power project
COC – cycle of concentration
ED – executive director
EIA – environmental impact assessment
EMD – environment management department
EMP – environmental management plan
EMU – environmental management unit
EPC – engineering, procurement, and construction
GCC – general conditions of contract
GEB – Gujarat Electricity Board
GPCB – Gujarat Pollution Control Board
ICB – international competitive bidding
LNG – liquefied natural gas
MOEF – Ministry of Environment and Forest
NO$_2$ – nitrogen dioxide
NO$_x$ – nitrogen oxide
NOC – no objection certificate
PGCIL – Power Grid Corporation of India Limited
PRO – public relations officer
RLNG – regasified liquefied natural gas
ROU – right-of-use
RPM – respirable particulate matter
SEC – Surat Electricity Company Limited
SO$_2$ – sulfur dioxide
SO$_x$ – sulfur oxide
SPM – suspended particulate matter
TPGL – Torrent Power Generation Limited

WEIGHTS AND MEASURES

°C – degree Celsius
dB(A)Leq – decibel (A weighted) and equivalent
kmph – kilometer per hour
km – kilometer
kV – kilovolt
m – meter
m$^3$/s – cubic meter per second
mg/l – milligram per liter
µg/m$^3$ – microgram per cubic meter
MMSCMD – million standard cubic meters per day
MMTPA – million metric tons per annum
MW – megawatt
ppm – parts per million

NOTE

In this report, “$” refers to US dollars.
# CONTENTS

<table>
<thead>
<tr>
<th>MAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION</td>
</tr>
<tr>
<td>II. DESCRIPTION OF THE PROJECT</td>
</tr>
<tr>
<td>III. DESCRIPTION OF THE ENVIRONMENT</td>
</tr>
<tr>
<td>A. Physical and Biological Environment</td>
</tr>
<tr>
<td>B. Sociocultural Environment</td>
</tr>
<tr>
<td>IV. ALTERNATIVES</td>
</tr>
<tr>
<td>A. No Project</td>
</tr>
<tr>
<td>B. Alternative Fuel</td>
</tr>
<tr>
<td>C. Alternative Location</td>
</tr>
<tr>
<td>D. Alternative Technology</td>
</tr>
<tr>
<td>V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES</td>
</tr>
<tr>
<td>A. Physical and Biological Environment</td>
</tr>
<tr>
<td>B. Sociocultural Environment</td>
</tr>
<tr>
<td>C. Risk Analysis</td>
</tr>
<tr>
<td>VI. ECONOMIC ASSESSMENT</td>
</tr>
<tr>
<td>VII. ENVIRONMENTAL MANAGEMENT PLAN</td>
</tr>
<tr>
<td>A. Institutional Requirement</td>
</tr>
<tr>
<td>B. Monitoring and Reporting Requirement</td>
</tr>
<tr>
<td>C. Disaster Management Plan</td>
</tr>
<tr>
<td>D. Community Development Plan</td>
</tr>
<tr>
<td>VIII. PUBLIC INVOLVEMENT AND DISCLOSURE</td>
</tr>
<tr>
<td>A. Stage I</td>
</tr>
<tr>
<td>B. Stage II</td>
</tr>
<tr>
<td>IX. CONCLUSIONS</td>
</tr>
</tbody>
</table>

**APPENDIXES**

1. Applicable Environmental Legislation for Gas Based Power Plants | 22 |
2. Environmental Management Plan | 24 |
I. INTRODUCTION

1. Since 1947, the development of the power sector in India has been through the state electricity boards (SEB). To supplement efforts in accelerating power development, the Government of India has delicensed generation and introduced open access in transmission. To encourage economies of scale, it has also extended the mega power project status to all thermal projects above 1,000 megawatts (MW). Mega power project status involves exemption from customs duties and other local levies, multiple buyers, and convenience in inviting technical collaboration and financial investors to participate in project development.

2. Torrent Group is based at Ahmedabad in Gujarat State. The group holds controlling interest in Surat Electricity Company Limited (SEC) and Ahmedabad Electricity Company Limited (AEC). SEC is an electricity-distributing company supplying power to consumers in the licensed area of Surat City. Presently SEC is purchasing its entire power from Gujarat Electricity Board (GEB). The government of Gujarat has mandated SEC to set up its own generation plant. AEC is a power-generating and distribution company licensed to generate and distribute power and energy in Ahmedabad and Gandhinagar cities. AEC has a total installed capacity of 490 MW thermal power stations located at Sabarmathi and Vatva in Ahmedabad as against its peak requirement of about 690 MW. Presently AEC imports its additional requirement from GEB.

3. The demand for power and energy in the licensed areas of AEC and SEC is projected to increase steadily in the next few years. To meet this increasing demand, both SEC and AEC will have to import more and more power from GEB. However, as per the 16th power survey of India, Gujarat is expected to have a shortfall of both peak and base load power. In the above scenario, it is imperative for the Torrent Group to secure a reliable and long-term source of power to service its 1.5 million customers in a cost-effective manner.

4. Torrent Group has formed Torrent Power Generation Limited (TPGL) to set up a 1,050 MW combined cycle power project (hereinafter referred as CCPP) based on liquefied natural gas (LNG) based at village Akhakhol, Taluka Kamrej, Surat district. The referred capacity of 1,050 MW is a nominal nameplate rating and the actual generation capacity at site conditions will be known after the engineering, procurement, and construction (EPC) contract is finalized. The power generated will meet the future demand of SEC and shortfall of AEC. The total gas requirement is estimated at about 1 million metric tons per annum (MMTPA). The land for the project has already been acquired and construction activities have begun.

5. As stated in the Environmental Impact Assessment Notification dated 27 January 1994 issued under the Environment (Protection) Act 1986, a thermal power project of such magnitude requires environmental clearance from the Ministry of Environment and Forests (MOEF) of the Government. The prerequisite to environmental clearance is participating in a public hearing and, thereafter, obtaining no-objection certificate (NOC) from Gujarat Pollution Control Board (GPCB).

6. TPGL engaged the services of a consultant\textsuperscript{1} in November 2002 to prepare the environmental impact assessment (EIA) and risk analysis report as per the guidelines of MOEF. The consultant started the EIA on 4 December 2002, conducted stage I public consultation on 10 December 2002, 15 December 2002, and 28 December 2002, and submitted the EIA report and risk analysis report in June 2003. The reports were submitted to GPCB on 21 July 2003 and stage II public hearing was arranged on 11 September 2003. NOC was received on 10 December 2003 and subsequently amended on 9 January 2004 and application for obtaining the environmental clearance was filed before the MOEF along with the comprehensive EIA report. The reports were presented on 19 March 2004 to the appraisal committee of MOEF, which consists of external independent experts. The environmental clearance is expected soon.

\textsuperscript{1} EMTRC Consultants Private Limited, New Delhi.
II. DESCRIPTION OF THE PROJECT

7. The CCPP will be located in the village of Akhakhol, 28 kilometers (km) northeast of Surat. The CCPP site is at 72°59’ E and 21°22’ N. The CCPP site is 25 m above mean sea level. The map of the area showing surrounding places and Akhakhol site and their connectivity is in Map 1. The vicinity map of the CCPP site is in Map 2.

8. The nominal nameplate rating of the CCPP will be 1,050 MW. About 92% plant availability and about 80% plant load factor are expected from the plant. The 1,050 MW CCPP will consist of three blocks of approximately 350 MW each. Decision on the final configuration and make will be made after bids received under international competitive bidding (ICB) are evaluated. Each configuration comprises one gas turbine, one matching triple pressure heat recovery steam generator, and one steam turbine with one common generator. The auxiliary system of the CCPP comprises a river water pumping system, water treatment and demineralization plant condensing equipment, feed water system, chemical dosing system, compressed air system, air conditioning system, ventilation system, effluent treatment system, and chemical laboratory. The intake well, avenue road, and housing colony required for the CCPP will be constructed by TPGL. The process diagram of the CCPP is shown in Figure 1 and the layout of the CCPP, including description of different equipment, is shown in Figure 2. The main design and operational data for the plant is summarized in Table 1.

9. The Akhakhol site was selected from four shortlisted alternate sites for the CCPP primarily because 100 hectares of noncultivable land which is free from all encumbrances was available. The site meets the entire siting criteria guidelines issued by MOEF. The site is also close to the 220 kilovolt (kV) substation of GEB at Lindiyat (3 km north of the site) making evacuation of power to SEC and synchronization with the GEB grid easy. The site is also in the vicinity of the 400 kV power grid network of both GEB and Power Grid Corporation of India Ltd. (PGCIL), a national power transmission utility. The LNG pipeline passes 20 km west of the CCPP site.

10. The fuel for the CCPP will be regasified liquefied natural gas (RLNG) and the requirement is estimated at about 1 MMTPA. LNG projects with a total capacity of 60 million standard cubic meters per day (MMSCMD) have been planned along the Gujarat coast. Petronet LNG Limited has begun operations at its 5 MMTPA Dahej terminal from the beginning of the year 2004, while Shell’s Hazira terminal, with 2.5 MMTPA, is likely to start production in late 2004. The plant availability factor for regasification plants is said to be in excess of 98% and, therefore, the reliability of supply is expected to be satisfactory.

11. The Hazira LNG terminal is about 50 km southwest of the CCPP site. The main gas distribution hub at Mora is about 40 km southwest of the CCPP site. Potential fuel suppliers have agreed to supply RLNG to the CCPP through a dedicated pipeline tapped from the main gas line. A spur between Asarma and Masma has been considered as the best option for the tapping point. The CCPP site is about 20 km from this tapping point. The diameter of the pipeline is estimated at 18 inches and ROU and will be acquired by the fuel supplier for the purpose of laying the pipeline and inspecting it regularly.
Figure 1:
Process Diagram of the
Torrent Combined Cycle Power Project
Figure 2:
Layout of the
Torrent Combined Cycle Power Project

1. Generating Units
2. Control Room
3. 220 kV and 400 kV Switchyard
4. Natural Draft Cooling Towers
5. Gas Meeting and Conditioning Station
6. Storage Tanks
7. Raw Water Storage Reservoirs
8. Clarifier, Capacity: 1.575 M3/hr
9. Clarified/Fire Water Tank/Demineralized Water Storage
10. Canteen
11. Security and Time Office
12. Warehouse and Workshop
13. Black Start Diesel Generator Set Building
14. DM Water PLant
15. Guard Ponds
16. Gas Cylinder Storage
17. Storage for Lubricants, etc.
18. Switchyard Relay Room
Table 1: Main Design and Operational Data of Torrent Power Generation Limited Power Plant

<table>
<thead>
<tr>
<th>Item</th>
<th>Main Design Parameter Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Plant Location</strong></td>
<td></td>
</tr>
<tr>
<td>Plant Location</td>
<td>Village Akhakhol, Surat District, Gujarat state, India</td>
</tr>
<tr>
<td>Net power generation capacity</td>
<td>1,050 MW (3 blocks of 350 MW each)</td>
</tr>
<tr>
<td>Technology</td>
<td>Advanced class technology (combined cycle system)</td>
</tr>
<tr>
<td>No. of gas turbines</td>
<td>3</td>
</tr>
<tr>
<td>No. of steam turbines</td>
<td>3</td>
</tr>
<tr>
<td>No. of heat recovery system</td>
<td>3</td>
</tr>
<tr>
<td>No. of generators</td>
<td>3</td>
</tr>
<tr>
<td>Stack height</td>
<td>70 m, 3 nos</td>
</tr>
<tr>
<td>Type of fuel</td>
<td></td>
</tr>
<tr>
<td>Main</td>
<td>Regasified LNG</td>
</tr>
<tr>
<td>Emergency</td>
<td>Not envisaged</td>
</tr>
<tr>
<td>Cooling water</td>
<td></td>
</tr>
<tr>
<td>Demand</td>
<td>31,104 m³/day</td>
</tr>
<tr>
<td>Temperature rise across condenser</td>
<td>5 °C</td>
</tr>
<tr>
<td>Total intake (from river)</td>
<td>35,456 m³/day</td>
</tr>
<tr>
<td>Total discharge</td>
<td>5,650 m³/day</td>
</tr>
<tr>
<td>Emissions</td>
<td></td>
</tr>
<tr>
<td>NOₓ from Natural gas</td>
<td>50 ppm (each stack)</td>
</tr>
<tr>
<td>Naphtha (not envisaged now)</td>
<td>150 ppm (each stack)</td>
</tr>
<tr>
<td>SOₓ from Naphtha (not envisaged now)</td>
<td>100 ppm (each stack)</td>
</tr>
<tr>
<td>Noise level</td>
<td></td>
</tr>
<tr>
<td>CCPP boundary</td>
<td>75 dB(A) Leq during day time 70 dB(A) Leq during night time</td>
</tr>
<tr>
<td>Equipment</td>
<td>85 dB(A) Leq 1 m away from turbine</td>
</tr>
<tr>
<td><strong>2. Gas Pipeline</strong></td>
<td>The responsible entities for route survey for laying gas pipeline are being determined.</td>
</tr>
<tr>
<td>Size and length</td>
<td>The diameter of the pipeline is expected to be 18 inches. The distance to the tapping point will be approximately 20 kms.</td>
</tr>
<tr>
<td>Land acquisition</td>
<td>Land acquisition is not envisaged. Only ROU will be required for the purpose of laying the pipeline and regular inspection thereof.</td>
</tr>
<tr>
<td><strong>3. Transmission Lines</strong></td>
<td>Details of the construction of transmission line for evacuation of power from the project is being determined. As mentioned, power generated in CCPP will be evacuated by constructing the following:</td>
</tr>
<tr>
<td>400 kV lines</td>
<td>One double circuit 3 phase</td>
</tr>
<tr>
<td>220 kV lines</td>
<td>Three double circuit 3 phase</td>
</tr>
<tr>
<td>Land acquisition</td>
<td>Not required. Only ROU are required for erecting the tower.</td>
</tr>
</tbody>
</table>

°C = degree celsius, CCPP = combined cycle power project, dB(A) Leq = decibel (A weighted) and equivalent, km = kilometer, kV = kilovolt, LNG = liquefied natural gas, m³/day = cubic meter per day, MW = megawatt, NOₓ = nitrogen oxide, ppm = parts per million, ROU = right-of-use, SOₓ = sulfur oxide. 
12. The power generated from the CCPP will be evacuated by one 400 kV double circuit 3-phase transmission line and three 220 kV double circuit 3-phase transmission lines. The 400 kV line will connect the CCPP to state/western regional grid for transmission of power to AEC for distribution in Ahmedabad and Gandhinagar (200 – 250 MW) and to Power Trading Corporation of India Limited for interstate sale (270 MW). The Jhanor-Padghe 400 kV transmission line of PGCIL passes at about 15 km east of the CCPP site. A loop-in-loop-out (LILO) will be arranged by PGCIL to connect the CCPP to Jhanor-Padghe section, which will interconnect the CCPP with the power grid on Jhanor-Padghe section. Two of the 220 kV lines will connect the CCPP to the existing GEB lines interconnecting with Surat to evacuate power to SEC for distribution in Surat (500 – 600 MW). The third 220 kV line will connect the CCPP with GEB’s substation at Lindiyat, located north of the CCPP site for synchronizing with the GEB grid. This transmission line, about 3 km long, will be in the existing corridor and no new system is envisaged.

13. The power off-takers will be responsible for construction and operation of the transmission lines and the fuel supplier will be responsible for construction and operation of the gas pipelines. The necessary EIA will be conducted by the off-takers and the fuel supplier to identify and mitigate all potential impacts. The off-takers and the fuel supplier have all institutional mechanisms available in their organizations to monitor and implement the mitigating measures required for their respective portions. TPGL assures that all stipulations and legal requirements of GPCB and MOEF will be fully complied with.

14. The CCPP will be constructed under an EPC contract by a contractor to be selected through ICB. The auxiliary facilities including the external river water supply system, power evacuation, gas supply pipeline, approach road, housing colony, and plot boundary wall will be executed package-wise on turnkey basis by reputed contractors. The construction and commissioning of each module of the CCPP is expected to be completed in three phases of 24, 30, and 36 months duration, respectively.

15. The present setup in TPGL comprises adequate experienced personnel to handle the non-EPC contracts besides monitoring the EPC contractor during construction of the CCPP.

16. The CCPP has been designed to comply with all the applicable environmental quality standards for gas-based power plants stipulated by the regulatory authorities. The applicable air emission and wastewater discharge standards are given in Appendix 1. The project will not use any goods banned or scheduled to be phased out of production or use polychlorinated biphenyls, ozone-depleting substances, and hazardous chemicals listed in the expanded negative list of the Asian Development Bank (ADB).

III. DESCRIPTION OF THE ENVIRONMENT

17. Data on baseline environmental status was generated by following the prescribed guidelines of MOEF. The components included physical, biological, and socioeconomic environment that, inter alia, includes meteorology, ambient air quality, landform (topography, geology, and soils), hydrology, water quality, groundwater resources, ecology, flora, fauna (including identification of unique or sensitive natural habitats and endangered and threatened species) and socioeconomic conditions.
A. Physical and Biological Environment

1. Project Surroundings

18. The CCPP site is located on flat terrain at Akhakhol village, 2.5 km away from the national highway. The intake well is located on the Tapi River bank, about 2.5 km from the CCPP. Land for colony is located on the south side of the CCPP. For the purpose of the approach to the CCPP, an avenue road of about 3.0 km will be constructed. No physical displacement or rehabilitation issues are involved during land acquisition.

19. There is no national park, wild life sanctuary, biosphere reserve, or protected forests or any other ecologically sensitive area within a 25 km radius of the CCPP. There is no endangered or threatened wildlife in the area.

20. The terrestrial floral diversity of the study area is poor. The dominant cover in the area consists of scanty scrubland comprising acacia species of plants seen in patches along the riverbed and countryside. There is no endemic floral species in the area.

21. The nearest railway station (Sayan) is located about 9.0 km away from the site. Tapi River, from where raw water will be drawn for the CCPP, is located at a distance of about 2.5 km from the CCPP. Dokhar nala², a natural drain that passes near the proposed project site, traverses about 6 – 7 km and joins Tapi River at village Choryasi (about 4 – 5 km south of the proposed power plant site).

22. Construction of the transmission line does not require acquisition of land. ROU will be acquired for the purpose of erecting transmission towers. The 400 KV transmission lines (from CCPP to Jhanor-Padghe section) will be routed mostly through flat barren land. Some cultivable land that may lie along the way comprises sugarcane, banana and bajra fields. No ecologically sensitive area and wildlife corridor are present along the way of the transmission lines.

23. The gas pipeline (taking a spur between Asarma and Masma section to the CCPP) will be routed mostly through flat barren land and partly through cultivable fields of sugarcane, banana, and bajra. The pipeline route will not cross any populated residential area but will cross some roads and railway line, where the horizontal direct drilling method will be resorted to while laying the pipeline. No water body and ecologically sensitive locations are present along the pipeline route.

24. Geotechnical investigation indicates that the top layer consists of blackish yellow high plastic clayey silt up to 2.5 m deep below ground level followed by yellow intermediate plastic silty clay with sand. The third layer is of yellow medium-dense plastic clayey silt. Underneath this layer, plastic clay with sand is observed till the termination depth of 45 m. It is believed that all minor structures can be supported on open foundations with a soil bearing capacity of 15 to 17 tons per square meter at 4 m below the ground level and all major structures will be supported on pile foundation.

25. The CCPP site is categorized as Seismic Zone III as per National Building Code of India, and seismic forces will be considered accordingly.

---

² Nala is a drain.
2. **Meteorology**

26. Meteorological data generated at the site for 1 year (December 2002 – November 2003) reveals that December, January, and February have daily mean minimum temperatures around 17°C and daily mean maximum temperatures of around 28°C. May is the hottest month, with a daily mean maximum temperature of 33.5°C and daily mean minimum temperature of 30°C. In the remaining months, temperature is pleasant, with the daily mean maximum and minimum around 30°C and 25°C, respectively.

27. The air is generally dry in the region except during the southwest monsoon. March – April is driest with relative humidity below 38%. Maximum humidity during rainy season is 89%. In all months, humidity values are high during daytime and low during nighttime.

28. The annual average total rainfall is 1,209 millimeters. Over 90% of the total annual rainfall is received during the southwest monsoon between June – September. Clear weather prevails most of the time during the postmonsoon, winter, and summer seasons. Only during the monsoon months of July, August, and September are moderate to heavy clouds observed.

29. The mean wind speed ranges from 6.9 to 7.5 kilometers per hour (kmph) during winter months and 11 to 13.5 kmph during monsoon months. During April – May, the mean wind speed is around 8.3 to 11.9 kmph. The predominant wind direction in Surat is from northwest in all months, except the monsoon. During March to May, the most predominant wind direction fluctuates between southwest and west.

3. **Ambient Air and Noise Quality**

30. As per prescribed procedures, continuously for 1 year (December 2002 – November 2003), ambient air quality was monitored for suspended particulate matter (SPM), respirable particulate matter (RPM), sulfur dioxide (SO\(_2\)) and nitrogen oxide (NO\(_x\)) at six locations around the project site. The ambient air quality meets the prescribed national standards for residential areas. Based on the ambient air quality index, the baseline air quality of the area has been categorized as “fair” in two places and “good” in four places. The national ambient air quality standard is given in Appendix 1.

31. The mean SPM level is lower than the national standard of 200 micrograms per cubic meter (\(\mu g/m^3\)). Roadside dust and vehicular movement contribute to the present SPM levels. The standard deviation values of SPM are between 7 and 12.

32. The RPM levels are lower than the national standard of 100 \(\mu g/m^3\). The SO\(_2\) and NO\(_2\) levels are much lower than the national standard of 80 \(\mu g/m^3\). The standard deviations of SO\(_2\) and NO\(_2\) levels are even lower than SPM. The SO\(_2\) levels in the study area are significantly lower than NO\(_2\) levels.

33. Ambient noise was measured at the same six locations where ambient air quality was monitored. The observed noise levels [ranging from 41 to 55 dB(A) Leq] are well within the national ambient noise standards for residential areas. The national ambient noise quality standard is shown in Appendix 1.
4. Water Quality

34. Tapi is the major river in the area. Prominent obstructions on the river include Ukai dam, Kakrapar weir, and a Singapore weir cum causeway (at Rander-Surat). With this, the freshwater section of Tapi extends only up to Rander where all the river water is stored. Downstream of the weir in the river is only an inlet of the sea, which gets filled and drained during each tidal cycle. The water quality of Tapi River is good and suitable for all designated purposes. The groundwater has a high dissolved solids content and is not fit for drinking. No serious pollution of the surfacewater and groundwater resources was found in the area.

35. Biological monitoring of Tapi River and Dokhar nala reveals that the water is slightly polluted in Tapi River and moderately polluted in Dokhar nala. The species observed in the river are hemipterans, molluscans, coleopterans and odanates family. The saprobic score in Tapi River was between 6.2 and 6.6 and the diversity score in the range of 0.6 to 0.7. The saprobic score in Dokhar nala was 3.8 and the diversity score was 0.4. The primary productivity of Tapi River was estimated. The river showed a balanced ecosystem with photosynthesis-to-respiration ratio of 1.

5. Soil and Land Use

36. The Soil of the area is clayey black. It becomes sticky when wet and develops wide cracks upon drying. The cracks help in self-aeration and nitrogen absorption. The soil retains a high moisture content. It is deficient in phosphorus and organic matter and rich in potash, lime, calcium, magnesium, and aluminum. Food grains, groundnut, cotton, and bajra cover 54% of the cropped area. Other crops grown are sugarcane, rice, wheat, banana, and seasonal vegetables.

37. The land use patterns of the study area are estimated using remote sensing techniques and are shown in Table 2.

Table 2. Land Use Pattern of 10 km Radius Area Around the Project Site

<table>
<thead>
<tr>
<th>Description</th>
<th>Area in hectares</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-up area/habitation</td>
<td>2,077.70</td>
<td>6.60</td>
</tr>
<tr>
<td>Agriculture land</td>
<td>26,747.90</td>
<td>85.20</td>
</tr>
<tr>
<td>Water bodies (river)</td>
<td>841.31</td>
<td>2.70</td>
</tr>
<tr>
<td>Water bodies (ponds)</td>
<td>43.20</td>
<td>0.10</td>
</tr>
<tr>
<td>Land not suitable for agriculture</td>
<td>1,669.50</td>
<td>5.30</td>
</tr>
</tbody>
</table>

km = kilometer.  

38. Most of the land acquired for the CCPP, intake well, avenue road, and housing colony is not suitable for agriculture. No forestland is involved in the project.

---

3 Standard term used in biological monitoring. It refers to the volume of organisms in the water. High saprobic score denotes good quality of water and good number of organisms.
B. SocioCultural Environment

39. The population of Surat district (2001 census) is about 5 million: 2.73 million are male and 2.27 million are female. The overall literacy rate in the district is 75%: male literacy is 81.8% and female literacy is 66.7%. The overall population density of the district is 653 persons per square kilometer.

40. The population of Kamrej Taluka is 173,242 (2001 census): 88,303 are male and the rest are female. The Scheduled Caste population is 8,683 and Scheduled Tribe population is 47,611. The people of the surrounding villages depend mostly on agriculture and livestock rearing for their livelihood. The project siting does not affect the living conditions of the Scheduled Caste and Tribe population in any manner.

41. There are 2,102 industrial units in Surat district and 122,796 persons are directly employed in these industries. The 34,193 small-scale industrial units operating in Surat provide direct and indirect employment to over 0.2 million persons.

42. The study area comprises 30 villages. All the villages are electrified and connected by roads. Communication facilities like telephones, the post office, and infrastructure facilities in the villages are fairly developed.

IV. ALTERNATIVES

A. No Project

43. SEC for its basic need and AEC for its incremental need would have to rely on the GEB system for supply of power. The western region in India in general and Gujarat in particular have significant shortage of power in terms of both base load and peak load capacity. A secure and reliable source of power is a prerequisite for economic activity and growth. The non-availability of power will seriously hamper the country’s effort to ramp up to a higher level of economic activities. Several LNG regasification terminals are coming up in the western region and will require large anchor customers to sustain their operations. The do-nothing option is, therefore, not realistic in the circumstances.

B. Alternative Fuel

44. The potential power generation alternatives are coal-fired and gas-fired conventional power plants. TPGL had commissioned an independent study to select the appropriate fuel for the generation facility. Local coal was ruled out on account of long haulage required for transporting the coal from the eastern region, the high ash content, and large land area required for ash disposal. Imported coal would involve setting up independent port facilities and their associated infrastructure. Gas was therefore chosen as the ideal fuel for the facility. It must be noted that the environmental performance of the CCPP in terms of reduced emissions is better than that in the other alternatives.

45. A natural gas-fired CCPP, such as that proposed, has major advantages over other types of thermal plant that might be considered: (i) higher thermal efficiency, (ii) lower fuel consumption, (iii) lower emission of NOx, (iv) no SO2 and particulate matter emission, (v) no solid waste generated such as coal ash, (vi) lower cooling water required per unit of electricity generated, (vii) shorter lead time for electricity generated, (viii) smaller land area requirement, and (ix) lower capital cost.
46. There are several promising gas fields in the western region. Further, two LNG regasification facilities are also coming up in Gujarat. Hence LNG, which is an ecofriendly fuel, has been chosen as appropriate for the plant. The choice of fuel was reconfirmed by the independent study.

C. Alternative Location

47. TPGL has to primarily serve the requirement of SEC. Locating the power plant as close as possible to the regional demand will reduce power losses in transmission. Proximity to Surat was, therefore, a basic condition. From an initial list of more than 80 locations, 4 were shortlisted. The final selection of the site was based on availability of enough land; least resettlement and rehabilitation; topography and geological aspects of land; and nearness to resources like water, gas pipelines, and transmission facilities. The end use of the land for setting up the power plant was clearly spelled out in the acquisition process conducted by the state government. No zoning clearance is, therefore, necessary.

D. Alternative Technology

48. There are no suitable hydropower sites available in the vicinity of Surat. Construction of dams and reservoirs would also involve rehabilitation issues. Hence, the hydropower choice was not pursued. In India, nuclear power is controlled by the Government and was ruled out on account of legislative restrictions. The thermal power source was the only alternative left. As far as the generation technology was considered, TPGL proposes to use advanced class turbines having more than 55% thermal efficiency. This class of turbines has been in service all over the world and is well proven.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Physical and Biological Environment

49. The significant environmental impact and mitigating measures during the construction and operation of the project are given in Appendix 2.

1. During Construction

   a. Combined Cycle Power Project (CCPP)

50. Short-term, reversible impact will occur with the construction of the CCPP. There will be no physical displacement of people. Dust will be the main pollutant. Domestic wastewater will be generated. Existing trees will be retained during the design of plant and buildings, wherever feasible. No hazardous waste will be generated.

51. Uprooted trees will be replanted wherever feasible. Regular water sprinkling and stabilization of the road surface will minimize fugitive dust generation. Constructing garland drains, a sedimentation pit, septic tanks, and compacting loose surface and greenery development will mitigate interference with the drainage pattern, soil erosion, and water pollution. Safe drinking water and toilet facility will be provided to workers to mitigate water pollution. A greenbelt will be developed around the premises.
52. Empty cement bags will be sold for reuse and spent oil will be given to registered recyclers for reprocessing.

53. Earthmoving equipment will generate noise within the project site. Construction activities are likely to produce maximum noise levels up to 85 dB(A) Leq. However, noise generation will be confined to areas surrounding the construction site and is unlikely to affect areas 500 m away from the site. To limit noise pollution, construction activity will be avoided during nighttime.

54. The project commits to hiring construction workers who come from and live in the surrounding community. A base camp will be established for a skilled workforce to be brought from outside. To avoid or reduce the occurrence of diseases among its workers, the project will provide adequate sanitary and water facilities and garbage bins. Safety rules and regulations will also be implemented during construction. All workers will be required to wear protective gear and equipment that conform to safety standards.

55. The EPC tender specification makes it mandatory on the contractor to take steps to suppress dust, limit noise, and take appropriate measures to control water pollution.

b. Intake Well, Avenue Road, and Housing Colony

56. Short-term, reversible impact will occur with the construction of the intake well, avenue road, and housing colony. People will not be physically displaced. Dust will be the main pollutant generated during construction. Sedimentation of the river will occur if the riverbank is not protected during construction. Trees will be lost during site clearing.

57. The impact on the riverbank will be mitigated by stabilizing the bed slopes and making embankments along the riverbed. Uprooted trees, wherever feasible, will be replanted. Fugitive dust generation will be minimized by regular water sprinkling.

58. All land acquisition for the CCPP, avenue roads, intake well, and housing colony has been completed and 100% price paid to all the landowners at prevailing market rates. No dispute on account of land acquisition is registered with the Land Acquisition Officer.

59. The contract tender specifications will make it mandatory on the contractor to take steps to suppress dust generation, limit noise, and take appropriate measures to control water pollution.

c. Transmission Lines and Gas Pipeline

60. The likely environmental impacts with the erection of transmission towers and laying of gas pipelines are short term and reversible. People will not be physically displaced. No land acquisition will be involved and only ROU will be obtained from the landowner. The transmission tower will be erected on four poles only when the farmer undertakes no cultivation activity. The gas pipeline will be buried underground at a minimum depth of 2 m. Dust will be the main pollutant generated during construction.

61. It is the obligation of the power off-takers and the fuel supplier to take all mitigating measures required during the construction and operation stages. TPGL will ensure the off-takers and the fuel supplier take all necessary mitigating measures, including paying compensation to the farmers at prevailing market price for use of land and for causing damage to standing crops, and then restoring the land to its original condition after construction is completed.
2. During Operation

a. Combined Cycle Power Project

62. Water in the CCPP will be used mostly for cooling and steam-generating purposes. Hence, there will be no toxic chemicals in the wastewater. The cooling water system is designed on total water recirculation system with cooling towers and only makeup water will be used. The cooling water circuit will be based on six cycles of concentration.

63. No chromate-based and no phosphate-based chemicals will be used in the cooling water circuit; hence there will be no toxic chemicals in the blowdown and no eutrophication problems due to high concentration of phosphorus. Reusing the condensate as boiler feed water will lead to economizing in water usage.

64. The water requirement for the CCPP will be 35,456 m$^3$/day. Water will be tapped from Tapi River by means of an intake well and brought to the site by pipelines that will primarily follow the road route. The water balance of Tapi River demonstrates that adequate water is available for other users and only 4% of the available water is presently used for industrial purposes, including for the CCPP.

65. About 5,650 m$^3$ wastewater per day will be generated from the CCPP. The wastewater will receive preliminary treatment before it goes to a guard pond. Wastewater quality will be monitored and necessary treatment done in the guard pond. The treated wastewater from the outlet of the guard pond will conform to discharge limits prescribed by regulatory authorities. The treated wastewater will be reused to the maximum possible extent for gardening and the balance will be discharged into Dokhar nala after conforming to applicable discharge standards.

66. The storm water drains of the plant will be separate from the wastewater drains. Wastewater generated from the toilets and sanitary services will be taken to septic tanks and soak pits. During monsoon time, storm water will be drained into Dokhar nala. Because dilution is huge in the streams during monsoon, discharging storm water or wastewater into the nala will not affect in any manner the water quality in the nala.

67. The impact of the discharged wastewater will be insignificant on the water quality of the Dokhar nala and Tapi River. Water quality modeling results obtained after discharge of 0.07 m$^3$ of wastewater per second with a temperature of 5°C, 2 mg dissolved oxygen per liter, 1000 mg dissolved solids per liter, and 5 mg phosphate per liter into a 0.1 m$^3$/s flowing ambient temperature stream having 4.5 mg dissolved oxygen per liter, 305 mg dissolved solids per liter and nil phosphate are shown in Table 3. The modeling results show that the predicted constituents of Dokhar nala before confluence with Tapi River at 5 km show a negligible increase. With the flow rate of 48 m$^3$/s, treated wastewater of the CCPP discharged into Tap River will have insignificant impact on the water quality.
Table 3: Water Quality Modeling Results

<table>
<thead>
<tr>
<th>Distance (downstream)</th>
<th>Temperature Degrees Centigrade</th>
<th>Dissolved Oxygen, mg/l</th>
<th>Dissolved Solids, mg/l</th>
<th>Phosphate mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 m</td>
<td>20.683</td>
<td>2.6</td>
<td>435</td>
<td>0.78</td>
</tr>
<tr>
<td>500 m</td>
<td>19.346</td>
<td>2.9</td>
<td>402</td>
<td>0.60</td>
</tr>
<tr>
<td>2,000 m</td>
<td>17.210</td>
<td>4.2</td>
<td>385</td>
<td>0.45</td>
</tr>
<tr>
<td>4,000 m</td>
<td>17.000</td>
<td>4.5</td>
<td>343</td>
<td>0.28</td>
</tr>
<tr>
<td>5,000 m</td>
<td>17.000</td>
<td>4.5</td>
<td>315</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**mg/l** = milligrams per liter.


68. The natural gas that will be supplied by the fuel supplier will have no sulfur and heavy metal; therefore, there will be no emission of SPM and SO\(_x\) from the CCPP. The gas turbines will be equipped with dry low NO\(_x\) burners and the exhaust flue gas will be discharged through 70 m tall stacks.

69. Dispersion modeling predicted that the incremental concentration of NO\(_x\) dispersed by the CCPP would not violate the ambient air quality. NO\(_x\) is not considered of major concern as phytotoxicants, since several studies suggest that a concentration sufficient to injure vegetation would be far above known or monitored ambient levels and prescribed national ambient air quality standards. The maximum impact of NO\(_x\) emissions from the CCPP will occur at a distance of about 0.5 km – 2.0 km away from the stack. The modeling results are in Table 4. Emissions of NO\(_x\) from the CCPP will be well within the prescribed limits of the regulatory authorities.

Table 4: Modeling Results for Ambient Air Quality

<table>
<thead>
<tr>
<th>Item</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>NO(_2)</td>
</tr>
<tr>
<td>Incremental ground level concentration (worst case)</td>
<td>7.7</td>
</tr>
<tr>
<td>Background level maximum observed</td>
<td>33.6</td>
</tr>
<tr>
<td>Superimposed value</td>
<td>41.3</td>
</tr>
<tr>
<td>National standard (µg/m(^3))</td>
<td>80.0</td>
</tr>
</tbody>
</table>

µg/m\(^3\) = micrograms per cubic meter, NO\(_2\) = nitrogen dioxide.


70. During the operation phase, high noise from turbines and air compressors is expected but it will be confined to the closed building and the plant boundary is sufficiently large. The CCPP equipment will comprise well-designed and tested noise-deadening equipment and enclosures so that the acoustic level of noise at a distance of 1 m from the equipment enclosure will be limited to 85 dB(A) Leq. Field noise levels will be well below 70 dB(A) Leq. The noise model shows the predicted noise levels of 51, 45, and 38 dB(A) Leq, respectively at a distance of 0.5 km, 1 km, and 2 km from the source. Hence, the impact on ambient noise will be below the prescribed ambient noise standards for industrial areas and will comply with the standards for residential areas as well.
71. The CCPP will not generate any solid waste, except some sludge from the water treatment plant. The sludge will be dewatered in the sludge dry beds. The dried sludge is nontoxic and will be used as landfill material on the premises. The soils have low permeability; hence, there is no chance of percolation of solid waste material. Since the solids content of Tapi River water is very low, the quantity of sludge generated from clariflocculators will be very small.

b. Intake Well, Avenue Road, and Housing Colony

72. During the operation of the intake well, there will be no impact. Vehicular movement on the road may cause noise and dust problems. The housing colony will generate domestic wastewater.

73. The road surface will be kept clean and the avenue road sides will be planted. Wastewater generated in the housing colony will be treated in septic tanks and soak pits.

c. Transmission Lines and Gas Pipeline

74. There will be no adverse environmental impact during the operation of the transmission lines and gas pipelines.

B. Sociocultural Environment

1. During Preconstruction

75. Land for the CCPP, intake well, avenue road, and housing colony was acquired in accordance with the Land Acquisition Act. Land acquired by the government was handed over to TPGL. TPGL paid the government at the prevailing market rates and the government paid the landowners. Most of the land was non-cultivable.

76. Only seven families were affected by land acquisition. The land losers were paid compensation at the prevailing market rates. Payment of 100% was made to the landowners. Land acquisition was completed successfully and no dispute was registered with the government against TPGL on account of land acquisition.

2. During Construction

a. CCPP, Intake Well, Avenue Road, and Housing Colony

77. The project will be constructed by contractors and the general conditions of contract (GCC) stipulate contractor compliance with all legislative norms in relation to sanitary, canteen, drinking water, workers safety, accidents, and compensation for all workers.

78. The contractors will employ about 500 people during the construction stage. The bulk of the workers will be recruited from the surrounding villages. Only the skilled workforce will be brought in from outside and for whom the base camp will be set up. Wastewater generated from the toilet and sanitary services will go to a septic tank and soak pits.

79. TPGL will monitor the size of the base camp and contractor compliance with all legislative requirements. On completion of the contract, the contractors will dismantle the base camp and hand over the site in its original condition to TPGL.
b. Transmission Lines and Gas Pipelines

80. Similarly the power off-takers and the fuel supplier will also comply with the rules applicable to their portion and pay compensation to the affected people at prevailing market rates for damage to standing crops and use of the ROU. TPGL will ensure that the land under ROU is restored to its original condition by the off-takers and the fuel supplier after construction is over.

3. During Operation

81. There will be a significant positive impact on the overall socioeconomic pattern of the area during the operation of the project. About 100 people comprising skilled and unskilled workforce will get direct employment.

82. More and more amenities will come up in the area and infrastructure for business opportunities will improve significantly. The cost of land around the project site will rise. Overall, the quality of life of people living around the project site will improve due to the increase in gross economic yield and the resultant market-multiplier effect.

83. The treated wastewater discharged from the project will not contain any harmful chemicals. The temperature of wastewater will return to normal after traveling 2 km along the Dokhar nala. The water will be then suitable for cattle bathing, washing clothes, and irrigation. Making suitable use of the available extra water in the nala will benefit the villagers and farmers.

84. On account of the project, several infrastructure facilities will come up in the area — schools, hospitals, market, roads, recreation facility, etc. The local people will have access to these facilities and have a better exposure and improved quality of life.

C. Risk Analysis

85. The plant will handle LNG, a flammable chemical. The handling facilities for LNG will be designed as per applicable guidelines and standards.

86. Jet fire, vapor cloud fire/explosion have been identified in a maximum credible accident scenario while handling LNG.

87. Consequence modeling predicted that minimum damage is within 96 m of the LNG metering station. The failure frequency probability rate is $10^{-6}$ incidents per year.

88. All passive and active risk mitigating measures have been considered in the plant layout and design. Passive mitigating measures include firewalls, enclosures, berms, and drains. Active mitigating measures include technological design, water sprinkler system, and emergency shutdown system. Elaborate fire protection systems by means of fire hydrants, fire extinguishers, and fire tenders will be established and maintained.

89. The CCPP is located in a rural and remote area. Population density within 2.5 km of the CCPP is less than 100 persons/km². There is only one village with about 500 population within 2.5 km of the site. There is no environmental and public receptor within 500 m radial distance from the CCPP.

90. The fuel supplier will follow standard design and operating practices for operating the gas pipeline. The entire pipeline will be buried under the ground and as such there will be no water, air,
or noise pollution; and solid waste generation. As standard practice, epoxy coating, sectionalizing valves, cathodic protection, and supervisory control and data acquisition system will be installed. In case a leak is detected during pipeline inspection or due to pressure drops, pumps will automatically stop and the particular section of the pipeline will be isolated for rectification. TPGL will monitor compliance with all safety regulation by fuel supplier.

91. No hazardous materials will be stored in the CCPP. LNG will be taken from the gas metering station and used in the turbines. No hazardous waste will be generated from the CCPP. Spent oil and lubricants will be collected in metal drums, stored in a specifically identified area and then auctioned to registered recyclers.

VI. ECONOMIC ASSESSMENT

92. The proposed plant will lower the cost of providing additional power to AEC and SEC. The cities of Surat and Ahmedabad have a large population of residential, commercial, and other low tension consumers who are generally large in number with lower individual consumption. Thus the benefit would accrue to a larger section of society. A CCPP of advanced class as proposed is recognized internationally as an environment-friendly as well as cost-effective solution to power generation. An alternative fossil fuel power plant will not only have a higher cost per kW installed, but will also significantly add to the ecological constraints. In developing countries like India, effective use of scarce capital resources is very important.

93. The investment in the TPGL project will generate significant benefits to the nation. It will (i) provide an anchor customer to nascent LNG plants coming up in the region; (ii) enhance the flow of capital into the country, thus releasing scarce national resource for investment in other projects; and (iii) generate tax revenues for the government and reduce the cost of power to a significantly large population.

94. The estimated total quantifiable income is approximately $10.451 billion for 25 years of operation. From this income, TPGL is expected to pay $387 million as corporate tax. Total value addition by the company over a period of 25 years will be approximately $1.342 billion.

95. The estimated total project cost is $740 million, $200 million of which is expected to be invested into the project through foreign direct investment, thereby increasing the unquantifiable benefits to the country by stabilizing the investment climate.

96. As per the Central Electricity Authority in 2003, peak shortage of electricity has been around 12.2% and demand for energy has been growing faster than the gross domestic product. Continued expansion of the energy and electricity supply and infrastructure will allow rapid growth in the agriculture and industry sectors. To meet the economic growth targets, electricity supplies will need to grow at a substantial rate. The development of natural gas-fired generating capacity will introduce greater diversity in the sources of electricity supply.

97. The project site is basically barren and opportunity cost in terms of loss of agricultural production or recreational value is minimal. Site acquisition involved compensating seven affected farmers. The alignment of the pipeline and transmission line routes may involve compensation during construction. The expected compensation will be insignificant since the loss of any standing crops and trees will be temporary and the land will be restored. The project will generate significant environmental benefits due to reduced impacts from air pollution and the resulting reduced impacts on health. Due to lack of health data in the project areas, health benefits could not be quantified.
VII. ENVIRONMENTAL MANAGEMENT PLAN

98. TPGL is committed to minimizing any adverse impacts that could arise from the construction, operation, and decommissioning of the project. As a corporate citizen in the communities, TPGL is also committed to community development. To achieve this, an environmental management plan (EMP) was formulated to manage impacts, to adopt the best available proven control technologies and procedures, to ensure a continuing process of review and positive action in the light of available monitoring results, and to consult with local communities on a continued basis. The EMP consists of (i) the institutional requirement, (ii) monitoring and reporting requirements, (iii) a disaster management plan, and (iv) a community development plan.

A. Institutional Requirement

99. During construction, compliance with applicable laws in tune with the EMP will be embedded into the contract documents. The said terms are already incorporated in the GCC of the EPC tender specification under ICB, which has been circulated to potential bidders. TPGL will monitor, control, and inspect the effectiveness of mitigating measures applied by the contractor vis-à-vis relevant provisions of the contract document.

100. To implement mitigating measures during construction, suitable institutional mechanisms and capability are available with TPGL. The flow chart of such institutional system for EMP in TPGL is in Appendix 3. A department called environmental management unit (EMU) has been created within TPGL and the executive director (ED) is in charge of all environment-health-and-safety-related issues during the construction phase. The ED will be assisted by two engineers, whose primary task is to check and supervise the working procedure followed by the contractors and to ensure that all clauses related to environment, health, and safety as mentioned in the tender specification/contract are fully adhered to. EMU will (i) conduct environmental sampling, and assess and document observations; (ii) coordinate with the regulatory agencies and financial institutions, and provide them required data; and (iii) take corrective actions wherever required. The ED, through the public relations officer (PRO), will implement all community development plans. The PRO will oversee that the power off-takers and the fuel supplier pay compensation to farmers at prevailing market rates for ROU of land as well as for damage to standing crops if any and then restore the land to its original condition after the construction activity is completed.

101. To implement mitigating measures during the operation stage, a full-fledged Environment Management Department (EMD) will be created by TPGL. The EMD will have infrastructure facilities like laboratory, monitoring equipment, and testing instruments. The head of EMD will report to ED. A trained and qualified environmental professional will be recruited in the EMD. The primary task of the professional will be to monitor the mitigating measures; conduct routine monitoring and testing of air, water and noise; and prepare reports and take corrective actions, whenever required.

102. The project has a suitable budgetary provision to implement the EMP. Approximately $15 million has been earmarked as capital cost and $0.772 million as recurring cost per annum toward environmental management and mitigating measures.

B. Monitoring and Reporting Requirements

103. Environmental monitoring is an important component of the EMP. It provides information for periodic review and refinement or modification of the EMP as and when necessary, ensuring that...
environmental protection is optimized at all project phases. Through monitoring, undesirable effects are detected early and remedied effectively. Monitoring will also validate the impacts predicted in the summary environmental impact assessment and the effectiveness of the proposed mitigating measures. Lastly, it will also demonstrate compliance with regulatory requirements.

104. A comprehensive monitoring program for the project has been developed, covering measurement of relevant environmental indicators. At the plant, it will involve safety measures relating to ambient air, air emissions, noise, water, and wastewater. Details of monitoring program are in Appendix 2. The results of the program, which will be implemented by the EMD, will be used to optimize plant operations and adjust to management practices.

105. If monitoring indicates that any environmental quality is deteriorating beyond acceptable levels, TPGL will correct the operational procedures contributing to the problem and undertake necessary engineering installations.

106. All data generated during monitoring will be compiled, assessed, and documented by the EMD. Semiannual reports on implementation of the EMP will be submitted to ADB. The documents will be ready for inspection by the regulatory authorities.

C. Disaster Management Plan

107. During construction of fuel-handling facilities, all necessary approvals from competent authority will be obtained by the EPC contractor. The EMU will ensure that the contractor has implemented all safety measures. Relevant clauses in this respect have been included in the GCC to tender specification. During plant operation (when all designated staff recruitment is complete), on-site and off-site disaster management plan will be prepared as per applicable guidelines and submitted to the competent authority for approval. The safety department of TPGL, directly under the control of ED, will be responsible for implementing and operating all safety-related issues.

D. Community Development Plan

108. TPGL is committed to develop the surrounding area in a well-coordinated and balanced manner while safeguarding the environmental and social aspects. TPGL will employ locals wherever possible, buy local goods and services, encourage local entrepreneurship, involve women participation in conservation efforts, create awareness about environmental health, and encourage respect for local traditions and religious beliefs.

109. Some community development schemes to be promoted by TPGL include tree planting along avenue roads, providing free health checkup facility and medicine to poor villagers, donating building materials and furniture for school building renovation, etc. These steps are meant to improve the livelihood of the community.

110. During the construction and operation of the project, TPGL will implement an effective public relations strategy through which locally available services like those of farmers, plumbers, masons, vehicle repair shops, electricians, shopkeepers and traders, and hotels and eateries will be utilized to the maximum.

111. The community development plan during the construction stage will be implemented by the EMU, which is directly under the control of ED. The community development plan during the operation phase will be implemented by the PRO of the administration department, which will be under the direct control of EMD.
VIII. PUBLIC INVOLVEMENT AND DISCLOSURE

112. Public consultation and disclosure were undertaken in two stages during the EIA process.

A. Stage I

113. The EIA began on 4 December 2002 and public consultation was held thrice in the month. Consultation held at Akhakhol village on 10 December 2002 was attended by 10 persons. Information about the consultation was disseminated by personal door-to-door contact by the EIA team members and people were invited. The consultation process was repeated at Navi Pardi and Kamrej on 15 December 2002 and 28 December 2002, with 5 and 20 persons in attendance.

114. During the consultation process, the public was informed about the objectives of the CCPP. The project overview and environmental impact were explained. The public was requested to express their opinion and concerns.

115. The main concerns raised by the public were related to emissions of toxic gases, river water pollution, job opportunities for local people, lack of greenery in the area, fire hazards, scarcity of river water during lean periods, proper compensation for land acquisition, and peripheral community development measures. The concerns were documented and discussed with TPGL.

116. The public concerns were considered in the project design and also while preparing the EIA.

B. Stage II

117. Stage II of the public consultation and information disclosure process was also conducted in accordance with the regulations. The public hearing for the project was organized by GPCB as per the procedures prescribed under EIA Notification 1994 issued by the Government of India under Environment (Protection) Act 1986.

118. Two advertisements were released in local newspapers (Sandesh dated 7 August 2003 and Indian Express dated 8 August 2003) giving the objective, date, time, and venue of the public hearing. Public suggestions, objections, and opinions were invited through the advertisement. The public was invited to attend the public hearing at Umamangal Hall, near Kamrej Charrasta, at 11.00 a.m. on 11 September 2003 to record their views.

119. The EIA report (35 copies) including the executive summary in the Gujarati language was made available at the Regional Office of the GPCB. The reports were distributed to local panchayat (village council) offices at village level, district collector office, and Taluka office for wide circulation. Copies of the EIA report were made available to the interested public free of charge.

120. Under the chairmanship of the district collector, a public hearing panel was constituted comprising seven members from government and eminent citizens. About 60 persons from the surrounding villages attended the public hearing. Six nongovernment organizations also attended and had their views recorded.

121. The main concerns raised during the two public hearings were common and related to emissions of toxic gases, discharge of wastewater into Tapi River, guarantee of employment, safety, scarcity of river water during lean periods, free electricity and gas.
122. The inputs of the stage I public consultation were considered in the project design and EIA preparation. It was ensured that the concerns of the potentially affected people were effectively included in the EIA. During the stage II public hearing, all issues and concerns raised by the public were answered. TPGL’s inability to accede to demands, like free electricity and gas, and guarantee of employment, was made known to the public.

123. Based on the public consultation process, TPGL has taken major project-related decisions: (i) not to discharge wastewater directly into Tapi River, (ii) discharge treated wastewater into the nearby nala so that people can benefit from its use, (iii) use of treated wastewater for greenery development to the maximum extent feasible, (iv) adoption of water conservation by going for six cycles of concentration in the cooling towers, (v) procure turbines generating low NOx and less noise, (vi) use only LNG as fuel, (vii) reserve 25% land for greenery development, (viii) use best available risk control systems, and (ix) give compensation at prevailing market rates to project-affected persons.

124. To obtain feedback from the project-affected people or groups, TPGL will institutionalize the mechanism to redress all grievances from the communities, and respond to the public and community concerns by taking steps to promote community livelihood. The mechanism will ensure continuous public consultation throughout the construction and operation stages of the project. In the future, TPGL commits to undertake several community development schemes in consultation with the local people.

IX. CONCLUSIONS

125. The project will help meet the rapid growth of demand for electricity in Gujarat State and the western zone of India. It will strengthen the regional power supply system, stimulate industrial development, and improve living standards of the people.

126. The location of the CCPP meets the siting criteria guidelines issued by MOEF and the Government. The site is technically and economically feasible for the establishment and operation of a power plant.

127. The advanced class technology chosen for the CCPP is environment friendly and proven and is more advanced than that in most units operating in India. The environmental compatibility of the CCPP can be justified by the fact that the impacts of the CCPP are amenable to technological control and can be foreseen and minimized through necessary preventive and control measures and, finally, through effective environmental management.

128. The air emissions, noise generated, and wastewater quality will meet the prescribed limits of regulatory authorities. No hazardous solid waste will be generated. There will be no odor and fugitive dust nuisance from the CCPP.

129. Ambient air and noise quality will remain well within the prescribed national standards. The CCPP will have no adverse impacts on agriculture, crops, ecology, and human health. The CCPP will comply with all the applicable environmental legislation and regulations of the Government.

130. The overall impact of the CCPP is likely to be beneficial to the society. The positive economic output will improve the overall quality of life of people living in the area.
APPLICABLE ENVIRONMENTAL LEGISLATION FOR GAS-BASED POWER PLANTS

Table A1.1: Emission Standards

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Generation Capacity</th>
<th>Emission Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxides of nitrogen</td>
<td>400 MW and above</td>
<td>i) 50 ppm for units burning natural gas</td>
</tr>
<tr>
<td>(volume-by-volume at 15% oxygen level)</td>
<td></td>
<td>ii) 100 ppm for units burning naphtha</td>
</tr>
</tbody>
</table>

Stack Height
Based on sulfur content of naphtha or liquid fuel

Stack height (m) = 14 Q^{0.3}
Where Q is the SO\(_x\) emission rate in kg per hour

Wastewater Discharge Standards

<table>
<thead>
<tr>
<th>Source</th>
<th>Parameter</th>
<th>Max. Concentration (mg/l except for pH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined effluent</td>
<td>pH</td>
<td>6.0 to 8.5</td>
</tr>
<tr>
<td></td>
<td>Suspended solids</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Free available chlorine</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Copper (total)</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Iron (total)</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Chromium (total)</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Chromium (VI)</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Zinc</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Phosphate</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>Oil and grease</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>Less than 5°C of recipient water temperature</td>
</tr>
</tbody>
</table>

Guidelines for Treated Wastewater Discharge Points
The discharge point will preferably be located at the bottom of the water body at midstream for proper dispersion of thermal discharge

No cooling water discharge will be permitted in estuaries or near ecologically sensitive areas such as mangroves, coral reefs, spawning and breeding grounds of aquatic flora and fauna.

kg = kilogram, m = meter, mg/l = milligram per liter, MW = megawatt, pH = measure of acidity or alkalinity, ppm = parts per million, SO\(_x\) = sulfur oxide.

Source: EPA notification 22-12-98, Government of India, Indian Environmental Quality Standard.

Table A1.2: National Ambient Air Quality Standard

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Time Weighted Average</th>
<th>Concentration in Ambient Air</th>
<th>Method of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Industrial</td>
<td>Residential</td>
</tr>
<tr>
<td>SO(_2)</td>
<td>Annual avg</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>24-hour avg</td>
<td>120</td>
<td>80</td>
</tr>
<tr>
<td>NO(_2)</td>
<td>Annual avg</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>24-hour avg</td>
<td>120</td>
<td>80</td>
</tr>
<tr>
<td>SPM</td>
<td>Annual avg</td>
<td>360</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>24-hour avg</td>
<td>500</td>
<td>200</td>
</tr>
<tr>
<td>RPM</td>
<td>Annual avg</td>
<td>120</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>24-hour avg</td>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>

Annual avg = Annual arithmetic mean of 104 measurements per year taken twice a week 24 hourly at uniform interval, m\(^3\)/min = cubic meter per minute, Na = sodium, NO\(_2\) = nitrogen dioxide, RPM = respirable particulate matter, SO\(_2\) = sulfur dioxide, SPM = suspended particulate matter, UV = ultraviolet.

Notes: All values in µg/m\(^3\). 24-hour avg = 24 hourly or 8 hourly values should be met 98% of the time in a year.

Table A1.3: National Ambient Noise Quality Standards

<table>
<thead>
<tr>
<th>Area Code</th>
<th>Category of Area</th>
<th>Daytime Limit [dB(A) Leq]</th>
<th>Nighttime Limit [dB(A) Leq]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Industrial area</td>
<td>75</td>
<td>70</td>
</tr>
<tr>
<td>B</td>
<td>Commercial area</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>C</td>
<td>Residential area</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>D</td>
<td>Silence zone</td>
<td>50</td>
<td>40</td>
</tr>
</tbody>
</table>

dB(A) Leq = decibel (A weighted) and equivalent.
Notes: daytime = 6 a.m. to 9 p.m., nighttime = 9 p.m. to 6 a.m.
Silence zone is defined as areas up to 100 meters around such premises as hospitals, educational institutions and courts. The silence zones are to be declared by competent authority.
Mixed category should be declared as one of the four above categories by competent authority and the corresponding standard will apply.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Potential Impact (Without Mitigating Measures)</th>
<th>Activities</th>
<th>Mitigating Measures</th>
<th>Overall Impact</th>
<th>Monitoring Requirement</th>
<th>Responsible Entities</th>
</tr>
</thead>
</table>
| Construction Phase | | Land | - Flooding during rainy season  
- Increase in soil erosion  
- Loss of trees and habitat  
- Sediment deposition  
- Interference with natural drainage pattern  
- Visual alteration of landscape | - Site clearing  
- Soil excavation  
- Mobilization of plant and heavy machinery  
- Construction of civil structures | - Making garland drain along plant boundary to collect storm water runoff will avoid flooding.  
- Proper compacting of backfill areas will reduce soil erosion.  
- Greenbelt and horticulture development will create natural habitat.  
- Adequate sloping of dumped earthworks and building materials will reduce wind losses and siltation of drains.  
- Restoring land surface consistent with existing contour conditions will not alter drainage pattern.  
- Using the excavated soil for greenbelt and horticulture and landscaping purpose will improve the general aesthetics of the landscape. | Long-term positive impact | - TPGL will ensure that all the mitigating measures are incorporated in the contract documents. Technical Department/EMU will check that all documented measures are effectively implemented by the contractor.  
- The supervision will be done daily. | EPC contractor, EMU/Technical Department of TPGL will monitor and supervise. |
| | | | | | | |
| | | Surface water | | | | |
| | | - Water pollution  
- Waterborne diseases  
- Siltation of water course | - Wastewater generated from domestic services and surface runoff | - Safe drinking water will be provided to workers.  
- Toilets will have septic tanks and soak pits.  
- Sedimentation pit will be made to collect the runoff water and it will be reused for dust suppression. | Short-term, negative impact | - These clauses are already incorporated in GCC of EPC tender specifications. TPGL will ensure that all the mitigating measures are incorporated in the EPC contracts.  
- Technical Department/EMU of TPGL will ensure the quality of drinking water as per contract document. | EPC contractor, EMU of TPGL will monitor and supervise. |

continued on next page…
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Potential Impact (Without Mitigating Measures)</th>
<th>Activities</th>
<th>Mitigating Measures</th>
<th>Overall Impact</th>
<th>Monitoring Requirement</th>
<th>Responsible Entities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality</td>
<td>• Dust nuisance from site due to vehicular movement and windborne surface dust</td>
<td>• Vehicular movement, haulage of building materials and earthworks</td>
<td>• Water sprinkling will be done for dust suppression. • Service road will be suitably stabilized for smooth traffic flow. • Road surface will be swept regularly. • Vehicle wheels will be cleaned to dislodge soil prior to entering the public utility road. • Air around the site will be monitored regularly to ensure compliance with ambient air quality standard.</td>
<td>Short-term, negative impact</td>
<td>• TPGL will ensure that all the mitigating measures are incorporated in the EPC contracts. Technical Department /EMU of TPGL will also check the efficacy of water sprinkling measures adopted by the contractor and will ensure that the public roads are not soiled. • By appointing approved lab, the ambient air quality will be monitored at three locations (120º to each other) at the plant boundary. Level of particulate matter, ( \text{SO}_2 ) and ( \text{NO}_2 ) in air will be measured twice a week.</td>
<td>EPC contractor, EMU of TPGL will monitor and supervise.</td>
</tr>
<tr>
<td>Solid waste</td>
<td>• Soil contamination and degradation</td>
<td>• In appropriate waste disposal</td>
<td>• Empty cement bags will be sold for reuse. • Spent oil will be given to registered recyclers for reprocessing.</td>
<td>Long-term, negative impacts</td>
<td>• TPGL will ensure that all the mitigating measures are conveyed in the contract documents.</td>
<td>EPC contractor, EMU of TPGL will monitor and supervise.</td>
</tr>
<tr>
<td>Noise</td>
<td>• Nuisance to surrounding population due to increased noise level</td>
<td>• Vehicular movement, construction machinery, piling work</td>
<td>• Construction activity will be done only during daytime. • Vehicular movement during nighttime will be avoided. • Earplugs will be provided to workers exposed to high noise level.</td>
<td>Short-term, negative impact</td>
<td>• TPGL will ensure that all the mitigating measures are conveyed in the contract documents. • By appointing an approved lab, the noise quality will be monitored at three locations (120º to each other) at the plant boundary. Noise level (in dB[A] Leq) will be measured for day and night time twice a week.</td>
<td>EPC contractor, EMU of TPGL will monitor and supervise.</td>
</tr>
</tbody>
</table>
### Environmental Management Plan – continued...

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Potential Impact (Without Mitigating Measures)</th>
<th>Activities</th>
<th>Mitigating Measures</th>
<th>Overall Impact</th>
<th>Monitoring Requirement</th>
<th>Responsible Entities</th>
</tr>
</thead>
</table>
| Socio-economic and cultural environment | • Direct job creation for about 500 people during construction period  
• Indirect economic development due to market multiplier effect  
• Creation of infrastructure facilities  
• Immigration of outside labour force  
• Friction between workers and local population  
• Development of squatter slums  
• Stress on natural resources like wood, water, sanitation  
• Inducement of traffic congestion and road safety hazards. | • Deployment of construction workers  
• Development of infrastructure facilities like roads and residential quarters  
• Deployment of contract vehicles | • Locals will be deployed during construction to the extent the same are available in line with requirement of skill.  
• Effective public relations strategy will be maintained and the locals will be allowed to use the developed infrastructure facility. There will be regular interaction with locals to solve their problems. | Long-term, positive impact | • TPGL will ensure that locals are deployed during the construction phase.  
• TPGL will interact with the local population. | EPC contractor, PRO of TPGL will monitor and supervise. |

### Operation Phase

| Water drawn from Tapi River | • Stress on existing users of river water | • Plant operation (cooling, service water and steam generation) | • Historical water balance of the river is positive.  
• Sufficient water is always available in the river and will continue even after allocating water to the CCPP. | Negligible impact | • EMD of TPGL will monitor water availability in Tapi River on monthly basis.  
• It will also keep proper records of water availability and drawn. | EMD of TPGL |
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Potential Impact (Without Mitigating Measures)</th>
<th>Activities</th>
<th>Mitigating Measures</th>
<th>Overall Impact</th>
<th>Monitoring Requirement</th>
<th>Responsible Entities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface water quality</td>
<td>• Discharge of treated wastewater into Dokhar nala, which ultimately joins Tapi River after traveling 6-7 kilometers.</td>
<td>• Boiler and cooling water blowdown. • Demineralized water plant regeneration, filter backwash and other washing during plant operation.</td>
<td>• Wastewater will be treated to conform to prescribed discharge standards and then discharged into Dokhar nala. • The assimilative capacity of the nala will be utilized to create negligible impact on Tapi River water quality. • Regular monitoring of water quality and quantity and ensuring compliance with prescribed discharge standard will be done.</td>
<td>Insignificant impact on Tapi River water quality</td>
<td>• EMD of TPGL will develop in-house facilities required to check wastewater quality. It will record the flow meter readings every day. • Wastewater quality readings from online instruments (acidity/alkalinity, conductivity, dissolved oxygen, and temperature) will be recorded every hour. The wastewater quality will be tested every day for oil, suspended solids, dissolved solids, residual chlorine and phosphate.</td>
<td>EMD of TPGL</td>
</tr>
<tr>
<td>Groundwater</td>
<td>• Rainwater harvesting structures and water reservoir will improve the quality and quantity of groundwater.</td>
<td>• No ground water will be used during construction or plant operation.</td>
<td>Rooftop rainwater harvesting structure will be made. Seepage, if any, from reservoir will improve the quality and quantity of groundwater.</td>
<td>Long-term positive</td>
<td></td>
<td>EMD of TPGL</td>
</tr>
<tr>
<td>Air quality</td>
<td>• Air emissions in the form of oxides of nitrogen in excess of stipulated limits can cause problems to biological and physical environment.</td>
<td>• Firing of LNG</td>
<td>• NOx emissions from turbines will be limited to 50 parts per million. • Regular monitoring of air and ensuring compliance with emission standard will be done.</td>
<td>Insignificant impact on existing ambient air quality</td>
<td>• On-line NOx monitors will be installed in each stack. • The monitors will be capable of giving continuous readings of NOx emissions, which will be recorded by the EMD.</td>
<td>EMD of TPGL</td>
</tr>
</tbody>
</table>

continued on next page...
ENVIRONMENTAL MANAGEMENT PLAN – continued …

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Potential Impact (Without Mitigating Measures)</th>
<th>Activities</th>
<th>Mitigating Measures</th>
<th>Overall Impact</th>
<th>Monitoring Requirement</th>
<th>Responsible Entities</th>
</tr>
</thead>
</table>
| **Noise quality**             | • Increased noise generation due to operating turbines and compressors.  
• Increased traffic flow will add to existing noise level. | • Turbines, compressors         | • Low noise turbines [85 decibel (A weighted) and equivalent] will be selected for the plant.  
• Plant vehicles will be maintained and serviced at regular intervals. | **Insignificant impact**        | **Insignificant impact**         | EMD of TPGL         |
| **Solid waste**              | • Indiscriminate disposal of solid waste will create leaching and affect soil and groundwater quality. | • Water treatment plant sludge, spent oil, and lubricants | • Sludge from water treatment plant is not hazardous or toxic.  
• It will be dewatered in centrifuge and used as landfill material inside the premises.  
• Spent oil and lubricants will be collected in drums and given to authorized recyclers for reprocessing as per rules. | **Insignificant impact**        | **Insignificant impact**         | EMD of TPGL         |
| **Biological environment**   | • There will be insignificant impact because there is no ecologically sensitive area, no | • Plant operation               | • 100% compliance with applicable discharge standards for air emissions and wastewater quality will be ensured. | **Insignificant impact**        | **Insignificant impact**         | EMD of TPGL         |

continued on next page…
## Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Potential Impact (Without Mitigating Measures)</th>
<th>Activities</th>
<th>Mitigating Measures</th>
<th>Overall Impact</th>
<th>Monitoring Requirement</th>
<th>Responsible Entities</th>
</tr>
</thead>
<tbody>
<tr>
<td>forest cover, no national park, no wildlife sanctuaries, no sensitive or endangered species in and around the project area.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Tapi River is impounded by two dams/weirs; upstream and downstream of Surat; hence aquatic diversity is poor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public health and safety</td>
<td>Accident and damage to life and property due to handling flammable gas</td>
<td>LNG receipt and use in power generation</td>
<td>Fire fighting facility Water reservoir, pumps, and hydrant network On-site and off-site emergency plan Active and passive accident control equipment and risk mitigation measures will be implemented.</td>
<td>Long-term negative</td>
<td>yearly basis from the Taluka office.</td>
<td>Safety Department of TPGL</td>
</tr>
<tr>
<td>Socio-economic and cultural environment</td>
<td>Threat to traditional agriculture practices Loss of livelihood for people dependent on agriculture Pressure on resources from unplanned peripheral development</td>
<td>Project development and operation</td>
<td>Peripheral development will occur due to population influx and increased business opportunities. Community development plan will be introduced, which will encourage local entrepreneurship, provide employment to locals depending upon their skills. Training programs for developing self-sufficiency among the local youths will be organized.</td>
<td>Long-term, positive</td>
<td></td>
<td>Public relations officer (PRO) of TPGL will ensure that qualified locals are preferred for employment. He will also interact with the local population and take appropriate steps to solve their problems. He will implement the community development schemes in surrounding villages.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Potential Impact (Without Mitigating Measures)</td>
<td>Activities</td>
<td>Mitigating Measures</td>
<td>Overall Impact</td>
<td>Monitoring Requirement</td>
<td>Responsible Entities</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------</td>
<td>------------</td>
<td>---------------------</td>
<td>----------------</td>
<td>------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td></td>
<td>• Increased access of outsiders disturbing traditional beliefs and religion.</td>
<td></td>
<td>and religious beliefs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Community development schemes like tree planting, free health checkup and medicines, donating building materials and furniture for school building renovation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Locally available services of farmers, plumbers, electricians, vehicle repair shops, shopkeepers and traders, hotels and eateries will be utilized to the maximum.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EMD = environmental management department, EMU = environmental management unit, EPC = engineering, procurement, and construction, GCC = general conditions of contract, LNG = liquefied natural gas, NO₂ = nitrogen dioxide, NOₓ = nitrogen oxides, PRO = public relations officer, SO₂ = sulfur dioxide, TPGL = Torrent Power Generation Limited.

Environmental pollution, occupational health and hygiene, safety, social issues, and community development

Coordinate with MOEF, GPCB, ADB and other regulatory authorities during construction and operation stages of project

Executive Director
TPGL

Environmental Issues
Supervision of Environment, Health and Safety

During Construction

emu
- Two engineers
- Responsible for supervising contractors and overseeing the implementation of EMP

During Operation

EMD
- Environmental professionals (scientists, engineers, chemists, field attendants) and safety officer
- Responsible monitoring and reporting the progress of EMP

Social Issues
Social Issues and Community Development Plan

During Construction and Operation

PRO
- Public Relations Officer
- Responsible for addressing community concerns and overseeing the power off-takers and the fuel supplier on their resettlement issues

EMD = environmental management department, EMP = environmental management plan, EMU = environmental management unit, GPCB = Gujarat Pollution Control Board, MOEF = Ministry of Environment and Forests, PRO = public relations officer, TPGL = Torrent Power Generation Limited