Draft Environmental and Social Impact Assessment

Project Number: 49241-001
June 2016

Environmental and Social Impact Assessment of 25 MW Solar PV Project at Village Bareta, District Mansa, Punjab

Mytrah Wind and Solar Power Development Project (India)

Prepared by Voyants Solutions Pvt. Ltd. for the Asian Development Bank.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

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CURRENCY EQUIVALENTS

(AS OF 28.06.2016 @ OANDA.COM)

{The date of the currency equivalents must be within 2 months from the date on the cover.}

CURRENCY UNIT	**–**	**INR (₹)**
$1.00	=	₹ 68.027

Abbreviations

ADB	Asian Development Bank
BGL	Below Ground Level
BOD	Biological Oxygen Demand
BPA	Business Partnership Agreement
BPL	Below Poverty Line
CEA	Central Electricity Authority
CHC	Community Health Centre
CPCB	Central Pollution Control Board
CSR	Corporate Social Responsibility
CTE	Consent to Operate
CTO	Consent to Establish
DISH	Directorate of Industrial Safety And Health
EAC	Expert Appraisal Committee
EHS	Environment, Health and Safety
EPC	Engineering Procurement and Construction
ESIA	Environmental And Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESZ	Ecologically Sensitive Zone
FGD	Focus Group Discussions
GRM	Grievance Redressal Mechanism
IFC	International Finance Corporation
IMD	Indian Meteorological Department
IPP	Independent Power Producer
MAPPL	Mytrah Aadhya Power Pvt. Ltd.
MEIL	Mytrah Energy (India) Limited
MOEF&CC	Ministry of Environment, Forests & Climate Change
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NABL	National Accreditation Board for Testing and Calibration Laboratories
NOC	No Objection Certificate
O&M	Operation and Maintenance
OBC	Other Backward Caste
PHC	Primary Health Centre
PS	Performance Standard
RTFCTLARR	Right to Fair Compensation and Transparency in Land Acquisition and Rehabilitation & Resettlement

ROW	Right of Way
SC	Scheduled Caste
SCADA	Supervisory Control and Data Acquisition
SEIAA	State Environment Impact Assessment Authority
SEMS	Social and Environmental Management System
SPS	Safeguard Policy Statement
SPV	Special Purpose Vehicle
ST	Scheduled Tribe
TDS	Total Dissolved Solid
VSPL	Voyants Solutions Pvt. Ltd.
WPR	Work Participation Ratio

NOTES

i. The fiscal year 2016-17 of the Government of India ends on March 31, 2017.

ii. In this report, "$" refers to US dollars.

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0 EXECUTIVE SUMMARY

0.1 PROJECT PROPONENT

Mytrah Aadhya Power Pvt. Ltd. (MAPPL) is a part of the Mytrah Group, headquartered in London, which is focused on delivering sustainable energy in a world without subsidies. Mytrah Energy Limited (MEL) is a pioneer and one of the largest Independent Power Producer (IPP) in renewable energy in India with 543 MW power generations across six states. MEL currently has an active development pipeline of about 3500 MW. MEIL sells power mainly to state grid through 13 to 25 years Power Purchase Agreement.

0.2 THE PROJECT

Mytrah Aadhya Power Pvt Ltd. (herein after referred as 'Client or Proponent') is planning to set up 25MW grid-connected solar photovoltaic power plant at Bareta village, Budhlada Tehsil, Manasa District, Punjab State. Project is being developed on the basis of Power Purchase Agreement signed with Punjab State Power Corporation Ltd (PSPCL) for a period of 25 years. Poly-Crystalline silicon technology based solar PV modules with N-S axis tracking are proposed for the project.

0.3 BACKGROUND OF STUDY

MAPPL intends to invest in the Solar projects with financial assistance from lenders / multilaterals etc. In this context, the project requires evaluating the environmental and social risks associated with the proposed project and to implement mitigation measures to avoid adverse impacts during the project lifecycle. In addition to ADB guidelines, the project has to comply with the applicable International Finance Corporation (IFC) / World Bank (WB) guidelines, local laws and regulations relating to the environment, social issues and occupational health and safety matters. The aim of the study is to assess whether the project to comply with the requirements of the above mentioned guidelines as necessitated by financial investors.

ESIA study has been undertaken prior to any construction activities at the site. ADB Checklist approach was followed for project screening and categorization before starting of any construction activities. Site visit and screening was made prior to any influential / construction activities has taken place. Project is categorized as 'Category B Project' based on site specific environmental and social impacts screening checklist, the major observations of the proposed project are as follows.

- The project is a greenfield project. Land for the project is being taken on 30 years lease and rent will be paid annually. Hence, no resettlement and rehabilitation or involuntary resettlement is proposed for the project.
- The land for the project is devoid of any natural forest or ecology of great concern. Hence no significant impact on ecological balance of the area is expected. The project is away (10km surrounding the project boundary) from any ecologically sensitive areas like national parks, wildlife sanctuaries, scheduled areas and critically polluted areas.
- No specific / vulnerable group of community is likely to be affected by the project.
- The construction phase of the project will witness various types of activities such as slight leveling and grading, slight increase in vehicular movement for material transportation, erection of solar module, etc. All the above mentioned tasks contribute to fugitive dust emission and noise due to construction activity in the vicinity. So there may be a temporary impact on neighboring

agricultural plots, during construction phase. However close vicinity of the approach road is highly beneficial in reduction of impact associated with this aspect.

- The site is devoid of any settlement. The distance of nearest settlement area (Out-skirts of Bareta Town) is about 500m. Hence, no impact on nearby settlement is expected due to project activities.

Most of the impacts associated with this project are short term and reversible in nature.

0.4 OBJECTIVES

The ESIA study has been undertaken with the following objectives:

- To establish the environmental baseline in the study area and to identify any significant environmental issue;
- To analyze, quantify the impacts, and design project activities keeping into mind environmental social impacts.
- To prepare an inventory of biodiversity (Flora and Fauna) affected due to project activity.
- To mitigate adverse impacts by the provision of the requisite avoidance and compensation measures of proposed project activities
- To identify & design appropriate safeguards for associated risk & disasters with proposed management plan
- To develop Environment and Social Management and Monitoring Plan(ESMMP) for implementation & monitoring of the mitigation measures along with applicable and suitable Green /vegetation plan with proposed Budget.
- To integrate the environmental and Social issues in the project planning and design;
- Prepare a PAP profile through suitable survey using acceptable tool/s, as per the applicability
- Focused Group discussion to identify the needs, problems, if applicable
- Socio economic survey and need base assessment study on the basis of secondary / primary information
- Identify socio-economic indicators to help implement and monitor the R & R process, if applicable
- Formulate and suggest suitable R&R and CSR plan (if applicable) for the specific project
- Check and confirm if the project is properly following to the ESMS provision agreed with ADB.

0.5 ESIA PROCESS AND METHODOLOGY

The approach and methodology applied for the execution of the environment and social impact assessment study is as provided:

- Study and review of the Project Report including Justification, Technical Data and Implementation Schedule and Impact associated thereof
- A regulatory review was undertaken in order to understand the applicable, local and national legislation and regulatory frameworks
- Site visit, discussion with stakeholders, checklist preparation and project categorization as per standard practices
- A detailed social and environmental assessment of site and surrounding areas was undertaken through:
  - Reconnaissance surveys to understand site specific issues;

- Discussion with the local community and identification of key issues;
- Review of land documents and land leasing process;
- Baseline environmental data collection of the site through primary monitoring and secondary details;
- Ecological assessment on flora and fauna of the site and study area through primary surveys and secondary data (Forest Working Plan, Discussion with Locals, etc.);
- Assessment of ROW Impacts as associated with infrastructure facilities.

- Social Assessment through consultation with the local community to understand community perception with regard to the project and its activities
- Assessment of impacts, including cumulative impacts, based on understanding of the project activities and existing baseline status
- Determination of risk & disaster for the proposed project and its management measures system in totality
- Preparation of Environment and Social Management Plan (ESMP)

0.6 SITE SETTING

The project is proposed to be located in Village Bareta, Budhlada Tehsil of Punjab State. The project is in Southern Part of the Punjab State and project district shares a common border with Haryana State. The project site is approximately 8.0 km North-west from Haryana State border. The project site is well connected via State Highway-10 (Jakhal-Budhlada Road) as the Highway creates natural boundary of the site in Northern side. Bareta is the nearest railway station located at a distance of approx. 2.0km in South-western side of the project.

Area for locating the solar project is generally based on the climatic conditions with preference given to solar radiation, optimum use of sunshine hours and fewer cloud cover hours etc. About 183 acres of land is being leased for the project purpose. The whole land is the part of Bareta Revenue Village.

No protected areas like National Park, Wildlife Sanctuary or Bio-sphere Reserve is within 10 km radius from the project site. Bir Aishvan Wildlife Sanctuary is the nearest notified ecologically notified area. The distance of Bir Aishwan from project site is about 44km. Project site is flat land parcel with minor leveling requirement. The elevation of the site varies from 219m to 223m above msl. The study area is mainly irrigated by network of canal system.

0.7 CURRENT STATUS

The land identified for the project is primarily agriculture land with some patches of barren land. The total land requirement of the project is Private land. No forest or govt. land is involved for the project. This project does not involve any resettlement in terms of physical and economical aspects hence do not attract Resettlement plan as per applicable national / state legislation.

Land is being leased on a remuneration of INR 50000/- per acre on annual basis with an escalation of 5% per annum. The lease deed with the land owners is being made into in the name of the Company. The Lease period will be for 30 years. The lease price is decided after considering stakeholder negotiation and best of the market value in respect to existing lease rate.

0.8 POWER EVACUATION SCHEME

The energy generated from solar PV plant will be evacuated at 66kV to the nearest utility substation i.e. 11/66 kV Datewas sub-station. The distance between solar PV power plant and Datewas utility substation for is approximately 5.5 km. However, a transmission line of about 6.1 km shall be built for to connect the project from Datewas Sub-station. The approach route identified for the transmission line is based on to reduce the environmental and socioeconomic footprint of the transmission line. The shortest feasible route after considering following factors has been selected for the transmission line:

- Transmission line route does not fall under any habitations and thick vegetation
- No households or community structures are located in the route of the transmission line
- All environmentally sensitive sites, archaeologically significant sites, areas of ecological and cultural significance have been avoided while selecting the route

The land requirement for Tower area will be in tune of 16 to 49 m^2. About 30 nos. of towers are proposed to be erected for complete transmission path. The estimated distance between each tower varies from 70m to 260m based on the angle of tower. Lease / Purchase agreement will have the provision of compensation for temporary restriction on farming / ploughing during erection activities.

The proposal for transmission line has already been prepared by competent third party considering the alternatives on technical, environment and social aspects. Further as a part of the norm by State Govt., proposal from Mytrah is in active process for scrutiny and approval by PSTCL, Govt. of Punjab for considering the final transmission route.

After getting the final approval, exact tower footprint will be finalized by government authorized contractor and accordingly RoW will be considered as per the applicable norms in host country. The details of approval from statutory body i.e. PSTCL, Govt. of Punjab will be submitted along with ROW documents before commissioning of the plant as additional annexure of existing Final ESIA report.

0.9 PROJECT DEVELOPMENT

The erection of PV panels will require development of site which will involve soil investigation, site survey, site levelling, construction of internal paths etc. The proposed site is a plain agriculture land; it may not require extensive levelling.

0.10 CLIMATE CHANGE IMPACT ASSESSMENT

The comparison of the GHGs emission caused by solar power plant with the GHGs emission that would have been caused by fossil fuel burned to make the same amount of electricity has been made. Thus the purpose of the project activity is to generate power from zero emissions Solar PV based power project and thereby reduce the emissions associated with the grid. The project activity will export the Electricity to northern grid. The electricity generated by the plant will be monitored through energy meters connected to switchyard at project site. The calculation of the total GHGs emission reduction as 40871 tCO_2e/year. The technology of electricity generation from Solar PV Plant is environment friendly as it does not use any fossil fuel. It thereby reduces the greenhouse gas emissions associated with fossil fuel based electricity generation system. The availability and reliability of solar power

depend largely on current and future climate conditions, which may vary in the context of climate change.

0.11 BASELINE SCENARIO, IMPACT AND MITIGATION MEASURES

0.11.1 Land Resources

The project site is primarily agriculture land with patches of scrub waste land. SH-10 form the Northern boundary of the project site, whereas, waste water nallah is creating South-Eastern Boundary of the site. Site is devoid of any forest area, habitation, water-bodies, historical place, etc. Also no protected areas like National Park, Wildlife Sanctuary or Bio-sphere Reserve is within 10 km radius from the project site. The elevation of the site varies from 219m to 223m above msl.

0.11.1.1Impact and Mitigation Measures During Construction

Impacts: Land use of the project site will get changed from agriculture to industrial land. This will boost the price of land in the region.

No access road will be required for the project as site is well accessible by SH-10. ROW of 18m shall be required for the transmission line as per Ministry of Power Guidelines. However, no significant impact on land use is expected as land shall only be required for erection of towers.

Mitigation Measures: All the site suitability and selection criteria were followed while selecting the site. Efforts will be made to contained the construction activities within the project site, so that, no alteration of nearby land use is expected due to the project.

0.11.1.2Impact and Mitigation Measures During Operation

Impacts: Considering that the land will be used for some industrial activity and will result in generation of revenue, the change in land use is considered to be minor positive. Industrial activity will improve the aesthetic look of the project site.

Mitigation Measures: No industrial activities outside the leased area will be permitted.

0.11.2 Soil Quality and Characteristics

Two soil samples were collected to assess the soil characteristics and fertility potential of study area. The samples were collected by ramming a core-cutter into the soil up to 90-cm depth.

Clay loam was found the major soil formation in the study area. pH value of 6.95 to 7.08 presents neutrality of the soil. Nutrient exchanges between organic matter, water and soil are essential to soil fertility. Percentage of organic matter was found varying from 0.33 to 0.38%. NPK value suggest that soil is moderate in terms of fertility potential.

0.11.2.1Impact and Mitigation Measures During Construction

Impacts: Site clearing and leveling activities for installation for PV Module and Other facilities involve excavation and compaction of the soil. The waste handling area and transportation of hazardous material (If any) may have an impact on the soil quality. Also the movement of vehicle and construction machineries will further lead to the compaction of soil. The excavated soil may risk for the Wind and Water erosion if didn't covered or compacted. The refilling of the excavated soil may alter the original layer of the soil formation.

Mitigation Measures: The project site is flat agriculture land, therefore, leveling activities shall be limited for the bare minimum extent. This will reduce the potential for compaction and disturbance to soil layers due to backfilling at site.

Movement of trucks and other vehicles will be maintained along dedicated paths to avoid disturbance to land and soil. Regular water sprinkling will be carried out to settle down the excavated soil and protect from wind and water induced soil erosion. All construction and hazardous material having potential to contaminate the site will be stored in separate designated areas in scientific manner.

0.11.2.2Impact and Mitigation Measures During Operation

Impacts: Operation of solar photovoltaic panels for power generation will not have any direct impact on soil. However, the hazardous waste like used oil, transformer oil, hydraulic oils, etc. may contaminate the soil if not handled properly.

Mitigation Plan: All hazardous waste will be stored in a separate designated area in scientific manner.

0.11.3 Waste Generation and Handling

Site clearance, excavation, labor camp and installation of PV modules and associated facilities will produce different kinds of waste during construction, whereas, Industrial wastes are generated during routine operations (dielectric fluids, cleaning agents, and solvents).

0.11.3.1Impact and Mitigation Measures During Construction

Impacts: During construction major waste generating areas are Construction Debris, Domestic solid waste from labor camp, Packaging material of the plant parts, Waste oil from generator and other construction machinery, Metal scraps, Paint containers, etc. The debris generated due to construction activities may spread out in nearby areas with wind and run-off during rainy season. This may lead to the soil and water contamination.

Improper disposal of solid waste from the labor camps (If any) and lack of proper sanitation facility for labor can lead to unhygienic conditions and spread of diseases in the area. It can lead to discontent of local community and result in conflicts with the labor engaged at site. Hazardous wastes such as waste oil, lubricants, hydraulic oil etc. can cause contamination of soil and water bodies if adequate precautions for management and handling are not undertaken.

Mitigation Measures: Construction debris will be utilised for levelling of the land and unused debris shall be disposed-off to nearest waste disposal site. Proper sanitation and sewage facility in terms of septic tank with soak pit shall be provided in labor camp (If any). Hazardous waste like paint empty tin, used oils will be stored in separate designated space and will be given to CPCB / SPCB approved recyclers at regular interval during O&M.

0.11.3.2Impact and Mitigation Measures During Operation

Impacts: The defunct / damaged photo voltaic cells, cables, wires, etc. will be generated and storage/ disposal on unpaved ground can lead to contamination of soil. Hazardous waste such as transformer oil, hydraulic oil, etc. also has the potential of land and soil contamination.

Mitigation Measures: Separate designated area shall be earmarked for storage of hazardous waste. These waste will be given to the CPCB / SPCB approved recyclers.

0.11.4 Hydrology and Water Quality

The study area is mainly irrigated by network of canal system. No natural prominent drainage system in and around the project site was observed. However, few ponds are the part of study area. 2 Ground water and 1 Surface water samples were collected and analyzed for assessment of water quality in and around the project site.

The water of the drain (Surface Water) was found alkaline with pH value of 8.12. Discharge of the domestic waste and run-off containing fertilizer load from nearby farming field. All other parameters were found within prescribed standards except BOD where it found exceeding the standards due to biological growth in water.

Ground Water in the study area was found neutral in terms of pH ranging from 6.87 to 6.98. Turbidity and color was found well within the acceptable limits. No bad smell was observed in the ground water. Most of heavy metals was found below the detectable limit, whereas, slight concentration of Iron and Zinc were observed. However, concentration of Iron and Zinc was found well below the acceptable limits. In general water is suitable for drinking after necessary disinfection.

0.11.4.1Impact and Mitigation Measures During Construction

Impacts: The construction at site can alter the natural drainage pattern of the area at a micro level. There is potential of contamination of low lying areas and surface water quality due to sediment run-off from construction activities. Improper disposal of sewage and wastewater from labor camps and construction debris can contaminate the water resources in the area.

Mitigation Measures: Septic tank with soak pit will be provided so that no contamination due to discharge of sewage may take place. The natural slope of the site will be maintained to the extent possible in order to avoid any change in the drainage pattern. Storm water flow will be directed to the existing channels with silt traps to avoid sedimentation of the channels or the receiving water body.

0.11.4.2Impact and Mitigation Measures During Operation

Impacts: The water requirements for cleaning of PV modules will be met through groundwater after requisite permission or by tankers from nearby areas. As per 'Ground Water Information Booklet Mansa District, Punjab- Year 2013' prepared CGWB, Budhlada block comes under over exploited category.

Mitigation Measures: Bore-wells will be established after requisite permission from regulatory authority. Meters shall be installed at the bore-wells to monitor the abstraction of water. Wastage of water during cleaning of panels shall be avoided. Awareness campaign will be driven under project CSR activities for use of effective irrigation practices, scheduling of crops, change the crop pattern, awareness creation for effective use of water etc. as suggested by CGWB in above referenced Booklet.

0.11.5 Ecological Environment

No National Park, Wildlife Sanctuary, Bio-sphere Reserve, Notified Wildlife Corridor, etc. is located within 10km from the project site. The proposed project doesn't involved diversion of any forests area for the project purpose.

The general floristic composition of Mansa District has an overlapping of floral composition belonging to 'Semi-Arid Region' as a major part and scattered elements of 'Moister Plain Country'. The study area is dominated by agricultural activities with patches of scrub land having invaded growth of Prosopis *Juliflora*. Few local trees viz. Prosopis *Juliflora,* Azaradirata *Indica, etc.* were observed at the site.

The study area is a place of poor mammalian diversity. In absence of forest area in the district, no wildlife fauna is visited easily. 29 species of mammals have been recorded during visit from the study area. Three Schedule I mammalian species namely Indian Pangolin, Asian Small-clawed Otter and Four-horned antelope was reported by Forest Department in Mansa District. However, no symbol of the presence of such endangered fauna was observed in Study Area.

A total 23 reptile species and 6 Amphibians Species were reportedly present in the region, out of which 2 species namely Indian Flap shelled or Mud Turtle and Common Indian Monitor Lizard comes under Schedule I of Wildlife Protection Act, 1972.

0.11.5.1Impact and Mitigation Measures During Construction

Impact: Removal of vegetation may result in loss of habitat for small mammals and birds. However, the ecological survey carried out at site established that the site is primarily agriculture land and does not support any significant ground vegetation. The project may however involve removal of few trees. Noise from construction and frequent movement of vehicles can also disturb the avifauna of the area.

Mitigation Measures: The site is primarily agriculture land and devoid of any dense natural vegetation. Therefore, the loss of vegetation at site is considered to be limited. Efforts will also be made to retain some of the trees as presented at site. The noise generating activities shall be schedule during day time only. Movement of construction and transport vehicles will be restricted to dedicated paths to minimise any harm to small mammals within the site.

0.11.5.2Impact and Mitigation Measures During Operation

Impact: Glare / Reflection from solar modules may distract the avian fauna flying over the solar panel land. The impact to flora from the operation will be limited to the routine clearance of vegetation near the solar plant to avoid shadows and hindrance to sunlight on solar panels. No other impacts are seen on local ecological system due to the project.

Mitigation Measures: Solar panels will absorb most of light falling on them which will be then converted to electricity. Thus there will be very less impact due to glare from the panels. The glare is reported to be similar to that of a small water body, which implies insignificant distraction for the avifauna. Clearing of vegetation will be limited to removal of undergrowth or shrubs at the plant site. It will have no significant impact on the flora of the area.

0.11.6 Traffic and Transport Issue

The project site is well connected via State Highway-10 (Jakhal-Budhlada Road) as the Highway creates natural boundary of the site in Northern side. The density of the vehicle on SH-10 is quite low. Most of the vehicles running on this highway are private and owned by locals.

0.11.6.1Impact and Mitigation Measures During Construction

Impacts: The construction activities will require transportation of construction material PV modules and mounting structures components to the site. The additional traffic movement on the road due to project will increase accident related injuries in locals. Break down of vehicles and unplanned halt along the road can lead to traffic blockade and discomfort to community.

Mitigation Measures: The increase in traffic due to the project is however going to be marginal as no village roads will be used. The traffic density on the State Highway is low and has adequate carrying capacity to accommodate the additional traffic due to the construction activities.

No movement is proposed on village roads. The drivers will be asked to maintain a minimum speed limit in the area to avoid accidents to people and livestock. The traffic movement in settlement areas shall be limited for day time only. Only PUC certified vehicle shall be deployed for the project to keep the air pollution under check. Tool Box training will be arranged for the driver to create awareness about road safety.

0.11.6.2Impact and Mitigation Measures During Operation

No significant increment in the traffic nos. is expected during operation phase of the project.

0.11.7 Air Environment

0.11.7.1Baseline

Three different locations were chosen for assessment of ambient air quality in study area. One station was set-up near to the project site, whereas other two stations were set-up in up-wind and down-wind direction respectively.

No major source of air pollution was observed at site. Agricultural activities are the only source of pollution in study area. Agriculture activities results in generation fugitive dust. The PM10 and PM2.5 P98 concentration in the region found varying from 68.7 to 81.1 µg/m3 and 30.5 to 43.1 µg/m3 in respect to the prescribed standards of 100 and 60 µg/m3 respectively. No significant concentration of gaseous pollution was observed. In general air pollution was found within the prescribed standards at all the places.

0.11.7.2Impact and Mitigation Measures During Construction

Impacts: Construction activities shall lead to fugitive dust pollution from excavation, leveling, mixing of materials, transportation of the construction material, etc. Also the gaseous pollution is likely from Vehicular Exhaust, Machineries Engines, DG Set Operation (In emergency), etc. Increment in the number of vehicles shall also boost up the fugitive dust emission from road side bared soil.

Mitigation Measures: The scale of construction being small will require only a limited number of construction machinery and for limited duration, therefore emissions from heavy machinery are considered to be insignificant. Open burning of solid waste or packaging material will be strictly prohibited. Regular water sprinkling is proposed to reduce fugitive dust emission from construction activities in identified dust prone areas. All machineries shall be properly maintained and will meet the pollution standards. Only PUC certified vehicle shall be deployed for the construction purpose. The construction material shall be transported in covered trucks and tipplers.

0.11.7.3Impact and Mitigation Measures During Operation

The project is based on the power generation through Solar PV Technology. The Solar PV technology is environment friendly in terms of GHGs emission. Levels of carbon dioxide (CO2) and other greenhouse gases (GHG) in the atmosphere have increased dramatically in the past few decades. Solar energy is a renewable resource available with great potential to significantly reduce GHG emissions.

0.11.8 Noise Environment

Noise monitoring was carried out at two locations including project site. At each location, noise monitoring has been carried out once during the study period (May 2016) over a period of twenty-four hours to obtain Leq values at uniform time intervals of 1 hour. Day time Leq has been computed from the hourly Leq values between 6.00 a.m. - 10.00 p.m. and night time Leq from the hourly Leq values between 10.00 p.m. - 6.00 a.m.

No major source of noise was observed in the region. No heavy traffic was found at the road side too. The noise levels recorded in the monitoring locations during daytime were found in the range of 50.1 to 51.3 dB(A) and during night time the Leq value was between 36.5 and 36.6 dB(A). In general noise level was found within the prescribed standards in absence of any major noise source.

0.11.8.1Impact and Mitigation Measures During Construction

Impact: Noise and vibration will be caused by the operation of earth moving and excavation equipment, concrete mixers, and the transportation of equipment, materials and people. Movement of traffic during night hours can also disturb the local community. About 90 dB(A) of noise will be generated from construction activity which will attenuate to less than 45dB(A) i.e. night time prescribed noise level at about 100m. The nearest habitation is located at a distance of over 500m and therefore the impact due to the noise will not be significant.

Mitigation Measures: Considering the capacity and nature of the project, the use of construction machineries will be very limited. Most of noise generating activities like excavation, use of heavy earth moving machineries, etc. shall be limited for the construction phase. Only limited construction activities shall be carried out during night-time. The personnel involved in high noise generating activities shall be provided with personal protective devices to minimize their exposure to high noise levels. Construction vehicles and machinery will be well maintained and confirming the CPCB noise standards.

0.11.8.2Impact and Mitigation Measures During Operation

No major noise generating activities is expected during operation phase of the project.

0.11.9 Social Environment

The proposed, 25 MW Solar Power Project site is located in Barite, a small town, Tehsil Budhlada, District Mansa approximately 30 km to the SE from Mansa District Headquarter and 205 km NNW from National Capital, New Delhi. Nearest Railway Station is Bareta. The Study Area (5km Radius around the Project Site) is covering 9 Census villages of Mansa district of Punjab state.

As per Census of India 2011, the total population of the study area is 35,580 in which 53.12% are males and 46.88% are females. An average gender ratio of the study area is approximately 883 females per

1000 males, which is very poor than national average of 943 females per 1000 males. Approximately half of the population of the study are comes under rural settlement and half under semi-urban settlement. Approx. 11.12% of the total population belongs to 0-6 age group. The sex ratio of this age group is 831 female children per 1000 male children, which also much lower than the average sex ratio of the study area. The entire population of the study area has been grouped into 6956 households and the average size of household is approximately 5.12 persons/ household.

About 183 acres of land from 87 Khata Holders are being leased for the project. No SC and ST land is being leased for the project. Land for the project is being taken on 30 years lease agreement.

0.11.9.1Impact and Mitigation Measures During Construction

No structure found getting affected by the project. The remuneration / lease rent will be paid on annual basis. INR 50,000 per acre has been agreed as lease rent with 5% escalation every year. As discussed with the locals, the agriculture activities yield to the crop of value INR 30,000 to 50,000 per acre per year. The lease rent as agreed primarily feels better opportunity in terms of livelihood of the land owners. Also the right of land will remain preserved with the land owners.

In the construction phase, skilled workers might be engaged in the project to perform technical work and they might come from outside the area. The project proponent will have to arrange for the accommodation of these workers. However, Bareta is a resourceful village / town and influx of EPC Engineers will not create any significant pressure on available resources.

0.11.9.2Impact and Mitigation Measures During Operation

Project is likely to have a positive impact on the local social system in terms of economy and area development project. Project will boost up local employment opportunities based on skill and education, increased taxation revenue, increased demand for materials and services through local contracting. These things will ultimately improve the revenue generation opportunities in the project region. Some financial support for infrastructure development will also be provided by the project developer in line with their CSR activities.

0.11.10Impact during Decommissioning

0.11.10.1 Impacts

Decommissioning of the project involves dismantling of the solar modules and trackers, and all associated electrical infrastructure and site buildings. Land will be hand over to its original owners after completion of the lease period. Improper disposal of demolition waste and obsolete machineries will lead to contamination of soil and discontent of community. Land will lost-out his fertility potential during the year and will be of no use for agriculture.

0.11.10.2 Mitigation Measures

Dismantling activities will be taken care by experienced professionals under the guidance of plant EMS Head. All the dismantled infrastructures and debris shall be segregated and stored separately with cover facility to negotiate with contamination effects of such wastes. Water sprinkling would be the regular practice to reduce the dust generation from the plant decommissioning activities. After decommissioning MAPPL will weed out the seeds of Leucaena *leucocephala* and Prosopis *Juliflora* to make the land fertile in few years.

0.12 ANALYSIS OF ALTERNATIVES

The proposed 25 MW Solar Power Project at Bareta, District Mansa (Punjab) was allocated as part of the 500MW capacity planned under Phase 3 of solar power projects being set up under the New and Renewable Sources of Energy (NRSE) Policy, 2012 of the State of Punjab. Development of solar power in the project area will not only be based on green energy and resources but also have the potential of not having emission issues as compared with power plants based on conventional energy. The other added benefits from such project are that it will add values to the local as well as national grid.

Considering various factor such as solar resources potential in the project districts; favorable environmental and social settings, low GHG emission in the project life cycle, land availability, governmental assistance, and local community's acceptance of solar energy project, solar energy based power generation is the most alternative in Punjab state.

0.13 INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

From the stakeholder consultations conducted by the consultant, it can be concluded that the perception of land contributors / owners is positive about the proposed Solar PV Power Project. Villagers found satisfied with land leasing procedure as it will help them to preserve their ownership rights on land. During consultation, villagers expressed their positive expectations with proposed project. They are expecting for employment opportunity, community development programs, availability of drinking water etc.

0.14 GRIEVANCE REDRESSAL MECHANISM

This Grievance Redressal Framework (GRM) has been developed by Mytrah for managing grievances related to environmental and social performance arising from its operations in Solar / Wind Projects. The Corporate level Mytrah's Grievance Redressal Mechanism shall also be applicable for MAPPL.

This GRM shall serve as one of the component of MAPPL's Environmental and Social Management for managing overall performance of its projects as well as providing more accountability to its stakeholders.

0.15 ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

MAPPL is committed to execute all construction and operation related activities for the proposed Solar PV Project as per the best established environmental, health and safety standards and also it will be aligned with upcoming project to be implemented at asset level. Mitigation measures are proposed for impacts which are identified and quantified. Some residual impact will however persist after the all mitigation measures are employed, the Environmental and Social Management Plan intends to delineate monitoring and management measures to minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures during construction and operational phase.

0.16 CONCLUSION

Based on the ESIA study, as per ADB's Environment Categorization of Projects the proposed Solar PV power project can be classified as a Category B for Environment as the project will have adverse environmental impacts that are less in number, generally site specific and readily addressed through mitigation measures. In addition, the project is also classified as Category C for Involuntary

Resettlement and Indigenous People as no involuntary resettlement and indigenous people are anticipated to be affected by the project activities. In reference to IFCs categorization of projects the proposed project can be categorized as Category B, which specifies that the project can cause potential and limited adverse social or environmental impacts which are generally site-specific, largely reversible and readily addressed through mitigation measures.

The rationale for categorization being:

- Overall the project being a Solar PV Power Project is a green project and does not have significant adverse impacts associated with the construction or operation activities;
- The land required for the project is taken on lease basis and the project does not involve any physical / economic displacement, ownership rights of the land owners will remain preserved;
- There are no indigenous communities being affected in the project area;
- The project does not involve diversion of any forest land. Therefore, ensuring minimal impact on ecology during the construction and operation phase of the project

The project will throw opportunities to local people for both direct and indirect employment. The project will provide impetus to industrialization of the area. Ribbon development will increase the economy and revenue potential of the region. It is expected that project development will also be helpful in development of facilities like education, health, housing, water, electricity etc.

1 INTRODUCTION

1.1 THE PROJECT

Mytrah Aadhya Power Pvt Ltd. (herein after referred as 'Client or Proponent') is planning to set up 25MW grid-connected solar photovoltaic power plant at Bareta village, Budhlada Tehsil, Manasa District, Punjab State. Project is being developed on the basis of Power Purchase Agreement signed with Punjab State Power Corporation Ltd (PSPCL) for a period of 25 years. Poly-Crystalline silicon technology based solar PV modules with N-S axis tracking are proposed for the project.

1.2 PROJECT PROPONENT

Mytrah Aadhya Power Pvt. Ltd. (MAPPL) is a part of the Mytrah Group, headquartered in London, which is focused on delivering sustainable energy in a world without subsidies. Mytrah Energy Limited (MEL) is a pioneer and one of the largest Independent Power Producer (IPP) in renewable energy in India with 543 MW power generations across six states. MEL currently has an active development pipeline of about 3500 MW. MEIL sells power mainly to state grid through 13 to 25 years Power Purchase Agreement

1.3 CONSULTANT

Voyants Solutions Pvt. Ltd. (herein after referred as The Consultant) has been retained by Mytrah Aadhya Power Pvt. Ltd., Hyderabad to conduct an Environmental and Social Impact Assessment for their upcoming Solar Plants in Punjab State. The detailed designing assessment for the project has been carried out by M/s. Arbutus Consultants Pvt. Ltd. (Arbutus). Mytrah is all set to further consolidate its position in renewable power. The company aims to participate in renewable energy generation towards a sustainable and clean energy production.

1.4 PROJECT LOCATION

The project is proposed to be located in Village Bareta, Budhlada Tehsil of Punjab State. The project site is well connected via State Highway-10 (Jakhal-Budhlada Road) as the Highway creates natural boundary of the site in Northern side. Bareta is the nearest railway station located at a distance of approx. 2.0km in South-western side of the project. 183 acres of land is being leased for the project under the revenue boundary of Bareta Village.

1.5 PURPOSE AND SCOPE OF ESIA

This study is being undertaken as per the requirements of the ADB Safeguard Policies (In specific) to understand Environmental and Social impacts associated with proposed Solar Power Project. The study suggests appropriate mitigation measures and management plans to prevent and minimize adverse impacts identified. The environmental and social assessment has been carried out against the following reference framework.

- Applicable Indian national, state and local regulatory requirements;
- ADB Safeguard Policy Statement, 2009;
- IFC Performance Standards, 2012;
- IFC / World Bank General EHS Guidelines, 2007;
- IFC / World Bank EHS Guidelines for Electrical Power Transmission and Distribution, 2007.

1.6 BACKGROUND OF STUDY

MAPPL intends to invest in the Solar projects with financial assistance from lenders / multilaterals etc. In this context, the project requires evaluating the environmental and social risks associated with the proposed project and to implement mitigation measures to avoid adverse impacts during the project lifecycle. In addition to ADB guidelines, the project has to comply with the applicable International Finance Corporation (IFC) / World Bank (WB) guidelines, local laws and regulations relating to the environment, social issues and occupational health and safety matters. The aim of the study is to assess whether the project to comply with the requirements of the above mentioned guidelines as necessitated by financial investors.

ESIA study has been undertaken prior to any construction activities at the site. ADB Checklist approach was followed for project screening and categorization before starting of any construction activities. Detailed assessment is made under Chapter 2 of this report. Site visit and screening was made prior to any influential / construction activities has taken place. Project is categorized as 'Category B Project' based on site specific environmental and social impacts screening, the major observations of the proposed project are as follows.

- The project is a greenfield project. Land for the project is being taken on 30 years lease and rent will be paid annually. Hence, no resettlement and rehabilitation or involuntary resettlement is proposed for the project.
- The land for the project is devoid of any natural forest or ecology of great concern. Hence no significant impact on ecological balance of the area is expected. The project is away (10km surrounding the project boundary) from any ecologically sensitive areas like national parks, wildlife sanctuaries, scheduled areas and critically polluted areas.
- No specific / vulnerable group of community is likely to be affected by the project.
- The construction phase of the project will witness various types of activities such as slight leveling and grading, slight increase in vehicular movement for material transportation, erection of solar module, etc. All the above mentioned tasks contribute to fugitive dust emission and noise due to construction activity in the vicinity. So there may be a temporary impact on neighboring agricultural plots, during construction phase. However close vicinity of the approach road is highly beneficial in reduction of impact associated with this aspect.
- The site is devoid of any settlement. Hence, no impact on nearby settlement is expected due to project activities.

1.7 OBJECTIVES

The ESIA study has been undertaken with the following objectives:

- To establish the environmental baseline in the study area and to identify any significant environmental issue;
- To analyse, quantify the impacts, and design project activities keeping into mind environmental social impacts.
- To prepare an inventory of biodiversity (Flora and Fauna) affected due to project activity.
- To mitigate adverse impacts by the provision of the requisite avoidance and compensation measures of proposed project activities

- To identify & design appropriate safeguards for associated risk & disasters with proposed management plan
- To develop Environment and Social Management and Monitoring Plan(ESMMP) for implementation & monitoring of the mitigation measures along with applicable and suitable Green / vegetation plan with proposed Budget.
- To integrate the environmental and Social issues in the project planning and design;
- Prepare a PAP profile through suitable survey using acceptable tool/s, as per the applicability
- Focused Group discussion to identify the needs, problems, if applicable
- Socio economic survey by need base assessment study on the basis of secondary / primary information
- Identify socio-economic indicators to help implement and monitor the R & R process, if applicable
- Formulate and suggest suitable R&R and CSR plan (if applicable) for the specific project
- Check and confirm if the project is properly following to the ESMS provision agreed with ADB.

1.8 ESIA PROCESS AND METHODOLOGY

The approach and methodology applied for the execution of the environment and social impact assessment study is as provided:

- Study and review of the Project Report including Justification, Technical Data and Implementation Schedule and Impact associated thereof
- A regulatory review was undertaken in order to understand the applicable, local and national legislation and regulatory frameworks
- Site visit, discussion with stakeholders, checklist preparation and project categorization as per standard practices
- A detailed social and environmental assessment of site and surrounding areas was undertaken through:
  - Reconnaissance surveys to understand site specific issues;
  - Discussion with the local community and identification of key issues;
  - Review of land documents and land leasing process;
  - Baseline environmental data collection of the site through primary monitoring and secondary details;
  - Ecological assessment on flora and fauna of the site and study area through primary surveys and secondary data (Forest Working Plan, Discussion with Locals, etc.);
  - Assessment of RoW Impacts as associated with infrastructure facilities.
- Social Assessment through consultation with the local community to understand community perception with regard to the project and its activities
- Assessment of impacts, including cumulative impacts, based on understanding of the project activities and existing baseline status
- Determination of risk & disaster for the proposed project and its management measures system in totality
- Preparation of Environment and Social Management Plan (ESMP)

1.9 ESIA LIMITATION

The limitations of the ESIA study, pertaining to the availability of information regarding the project, the accessibility of villages and stakeholders and the secondary information for the project. The consultation undertaken during the site visit was based on the present understanding of the project and the project footprint area. This assessment may slightly change in case of a change in the plant location as finalized at the time of study. The documents like land records, and management system were limited for review at the time of visit.

The consultations undertaken as part of the impact assessment were restricted to the stakeholders who were available during the site visit. Also, due to the large number of the villages within the study area and the limited time in which the assessment had to be completed, the ESIA team undertook consultation in a sample of the villages with a focus for coverage of maximum number of stakeholder groups.

1.10 REPORT STRUCTURE

The full report presents the findings, analysis and recommendations for the proposed project which have been provided by environmental and social impact assessment (ESIA) team.

Chapter 0- Executive Summary: This section concisely describes the project critical facts, significant findings and recommended mitigate actions.

Chapter 1- Introduction: The chapter provides description of project background, objectives, scope and organization of the study and approach & methodology. Chapter also defines the structure of the full ESIA report.

Chapter 2- Policy, Legal and Administrative Framework: This chapter presents applicable legal provisions, National environmental and social (including labor) laws and policies as well as the relevant national and international standards and guidelines.

Chapter 3- Description of the project: This chapter deals with project details encompassing layout, land details, site settings, project components etc. Infrastructural development as a part of project during construction and operation phase and resources required are discussed in this chapter. This chapter also assess the climate change aspects related to project activities.

Chapter 4- Description of the Environmental and Social Baseline: This chapter presents an outline of Environmental, Ecological and Social baseline status of the study area and project site as well.

Chapter 5- Anticipated Environmental Impacts and Mitigation Measures: This chapter includes details of identified environmental impacts and associated risks due to the project activities, assessment and significance of impacts and presents mitigation measures to minimize adverse impacts identified.

Chapter 6- Analysis of Alternatives: This chapter presents the analysis of alternatives for the proposed solar project considering no project scenario, alternate methods for power generation and technology and alternate routes for transmission line.

Chapter 7- Information Disclosure, Consultation and Participation: This chapter addresses about the public consultation of the surrounding study area and elaborate the outcome result of public

consultation. Also briefly discuss about the stakeholder profiling, mapping and analysis, methods for consultation and stakeholder engagement of project.

Chapter 8- Grievance Redress Mechanism: This chapter addresses the description of the grievance redress framework and mechanism for resolving the complaints.

Chapter 9- Environmental Management Plan: This Section provides recommendation for environmental and social management plan aimed at minimizing the negative environmental and social impacts and monitoring requirements of the project.

Chapter 10- Conclusion and Recommendation: A brief conclusion drawn from the impact assessment study has been presented in this chapter.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 INTRODUCTION

This section highlights the environmental and social regulations applicable to the proposed solar PV project. The section broadly focuses on the institutional framework, applicable environment, health & safety, social legislative requirements and ADB Safeguard Policy Statement relevant to the proposed Project. The administrative framework for the project will focus on:

- Applicable environmental and social regulations and policies in India and the State of Punjab;
- Institutional framework for the implementation of the regulations; and
- International Standards and conventions including:
  a. Applicable Indian National, State and Local regulatory requirements;
  b. ADB safeguard policy statement, 2009;
  c. ADB policy on Social Protection Strategy, 2001;
  d. ADB policy on Public Communication Policy, 2011;
  e. IFC Performance Standard, 2012;
  f. IFC and World Bank General EHS Guidelines, 2007;
  g. IFC and World Bank EHS Guidelines for Electric Power Transmission and Distribution, 2007; and
  h. Relevant ILO conventions rectified by Host country covering core labor standards and basic terms and conditions of employment (limited to operational phase of the proposed project).

2.2 NATIONAL REGULATIONS

The environmental regulations, legislations and policy guidelines in respect to the proposed project are governed by various regulatory agencies. The principal environmental regulatory agency in India is Ministry of Environment, Forest and Climate Change (MoEF&CC), Delhi.

The Solar Photovoltaic Power Projects are not covered under the ambit of EIA Notification, 2006. Hence, it does not require preparation of Environmental Impact Assessment Report and pursuing Environmental Clearance from Central Government or State Level Environmental Impact Assessment Authority. Further, Ministry of Environment, Forest and Climate Change has included PV Projects under “White category” for Consent to Establish / Operate. Newly-introduced White category contains 36 industrial sectors which are practically non-polluting. There shall be no necessity of obtaining the Consent to Operate’’ for White category of industries. An intimation to concerned SPCB / PCC shall suffice. The copy of guidelines is attached as **Annexure I** of this document.

Environmental and safety related national regulations that are applicable to the proposed Solar Project are discussed **Table** below.

Table 2-1: National and International Regulation for Applicable in Solar Project

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
A	**ENVIRONMENT & FOREST**			
A-1	Environmental (Protection) Act, 1986 and amendment.	To protect and improve overall environment, this umbrella act imposes certain restrictions and prohibitions on new projects or activities, or on the expansion or modernization of existing projects or activities based on their potential environmental impacts. It is a comprehensive act covering overall objective to improve environment by prevention and control of air, water, soil pollution etc. Clearances from different authorities are independently obtained. The Act is Effective since 1986.	CPCB SPCB	Permissible limit for AAQ, Water Quality, Noise limits has been laid down by CPCB under EP Act 1986, which requires to be complied with, though it is not being enforced by SPCB due to exemption of Consent (It is exempt as a part of Consent Condition).
A-2	Environmental Impact Assessment (EIA) Notification, 2006 and amendment.	Environmental Impact Notification S.O.1533 (E), dt.14th September 2006, as amended in 2009, issued under Environment (Protection) Act 1986, has made it mandatory to obtain environmental clearance for scheduled development projects. The notification classifies projects under two categories 'A' and 'B'. Category A projects (including expansion and modernization of existing projects) require clearance from MoEF& CC, GoI and category B from State-level SEIAA, constituted by Government of India. 39	MoEF&CC Expert Appraisal Committee (EAC) and State Environmental Impact Assessment Authority (SEIAA)	Solar PV Power Plants are not in the ambit of EIA Notification, 2006.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		categories of projects are covered under this notification.		
A-3	Forests (Conservation) Act, 1980 and Rules 1981 as amended 2004	The Forest Conservation Act (FCA) was adopted in 1980 to protect and conserve forests. The Act restricts the powers of the State in respect of de-reservation of forests and the use of forestlands for non-forest purposes. The FCA is relevant for the for the siting guidelines for Solar Plant, and for passage of transmission line, since it may involve use of forestland for "non-forest" purposes. According to Section 2 of the Act "notwithstanding anything contained in any other law for the time being in force in a State, no State Government, or other authority shall, except with the prior approval of the Central Government, make any order directing: De-reservation of a reserved forest Use any forest land for any non -forest purpose Assign any forest land to any private person or entity not controlled by the Government Clear any forest land of naturally grown trees for the purpose of using it for reforestation	State Forest Dept./ MoEF& CC	Project doesn't involve deforestation of any forest land for project or associated facilities like substation and transmission line.
A-4	Wildlife (Protection) Act 1972, Wildlife (protection)	The Act provides for the protection of wild animals, birds and plants; and for matters	Chief Conservator Wildlife, State	No wildlife sanctuary or national park or eco-sensitive zone within 10 km radius from the project site.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
	Amendment Act 2002 and 2003 amendment.	connected therewith or ancillary or incidental thereto. The application of the Order of the Honorable Supreme Court in WP 460 of 2004 dated 04.12.2006 in the matter of Goa Foundation v. Union of India and other wherein the Honorable Supreme Court has directed that all projects which require environmental clearance and are located within the distance of 10Km of National Park and Sanctuaries must be placed before the standing Committee of the National Board for Wildlife constituted under the Wildlife (Protection) Act, 1972.	Forest Department and MoEF&CC	
A-5	Hazardous Waste (Management, Handling and Trans-Boundary Movement) Rules, 2008 as amended in 2009 and 2010 under EPA, 1986 (HWM Rules, 2008)	The Hazardous Wastes (Management, Handling and Tran's boundary Movement) Rules, 2008 are promulgated under Environment (Protection) Act 1986, which was further amended in July 2009, September 2009, March 2010 and August 2010. With the recent amendment, these rules have become quite comprehensive. The rules define responsibility of hazardous wastes generators, require safe handling practices and maintenance of manifest system during transport of hazardous waste and also describe technological aspects to be followed up by re-refiners and recyclers of hazardous wastes. The rules also cover liabilities	CPCB, SPCBs	Assurance for authorization of deputed O&M contractor for collection, reception, storage, transportation and disposal of hazardous wastes; Generation of waste oil & transformer oil at site attracts the provision of the rules and hazardous waste have to dispose as per the directives of MOEF&CC and CPCB, SPCB.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		of occupier, transporter and operator of a facility for any damages caused due to improper handling and disposal of hazardous wastes by reinstating or restoring environmental damages caused.		
A-6	The Air (Prevention and Control of Pollution) Act, 1981 Including Rules 1982 and 1983 and amendment	The Act prohibits the construction and operation of any industrial plant without the consent of SPCBs. The Act assigns powers and functions to the CPCB and the SPCBs for prevention and control of air pollution and all other related matters. For the prevention and control of air pollution, the State Government, in consultation with the SPCB has the powers to set standards for emissions from automobiles, impose restrictions on use of certain industrial plants and prohibit emissions of air pollutants in excess of the standards laid down by the SPCB. The CPCB, as well as the SPCBs are eligible for contributions from the Central as well as the State Government, respectively, to perform their functions appropriately. The Act also allows for appropriate penalties and procedures for non-compliance.	SPCB	Ministry of Environment, Forest and Climate Change has included PV Projects under "White category" for Consent to Establish / Operate. Newly-introduced White category contains 36 industrial sectors which are practically non-polluting. There shall be no necessity of obtaining the Consent to Operate'' for White category of industries. An intimation to concerned SPCB / PCC shall suffice. The copy of guidelines is attached as **Annexure I** of this document.
A-7	The Noise Pollution (Regulation and Control) Rules, 2000 and the	As per the Noise Pollution (Regulation and Control) Rules 2000, every facility is required to take all possible steps to meet the ambient noise	SPCB	There will be generation of noise during construction activities. Operation phase noise generation activity shall be limited to the

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
	Noise Pollution (Regulation and Control) Amendment) Rules, 2010	level standards prescribed in the Rules. The rules prescribe maximum permissible values of day and night time noise levels for zones A, B, C and D representing industrial, commercial, and residential and silence zone respectively.		Transportation activities only. The project is required to maintain the noise limits prescribed for residential (55 dB(A) for daytime and 45 dB(A) for night-time) at project boundary. However, noise level of Industrial Area (75 dB(A) for daytime and 70 dB(A) for night-time) shall be applicable inside the project limit.
A-8	Water Prevention and Control of (Pollution) Act, 1974 including Rules, 1975 (as amended up to 1988)	This Act provides for the prevention and control of water pollution and maintaining or restoring good water quality for any establishment. The Act assigns functions and powers to the CPCB and SPCBs for prevention and control of water pollution and all related matters. Subject to the provisions of the Act, the functions and powers of CPCB as well as the SPCBs have been delineated individually and with respect to each other.	Center Pollution Control Board (CPCB), State Pollution Control Board (SPCBs)	Ministry of Environment, Forest and Climate Change has included PV Projects under "White category" for Consent to Establish / Operate. Newly-introduced White category contains 36 industrial sectors which are practically non-polluting. There shall be no necessity of obtaining the Consent to Operate'' for White category of industries. An intimation to concerned SPCB / PCC shall suffice. The copy of guidelines is attached as **Annexure I** of this document. Though the Act is not applicable for the project but project proponent will ensure treatment of waste water (if any) due to proposed project activities.
A-9	The Water Prevention and Control of Pollution), Cess Act, 1977 including Rules 1978 and 1991	This Act provides for levy and collection of Cess on water consumed and water pollution caused. It also covers specifications on affixing of meters, furnishing of returns, assessment of Cess, interest payable for delay in payment of Cess and penalties for non-payment of Cess within the	SPCB	The water demand for operation phase will be in the tune of 0.0617 m^3/MWh i.e. about 8.7 m^3/day. Project proponent has to ensure treatment of waste water (if any) due to proposed project activities before disposal.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		specified time. Industries consuming water less than 10m^3/day have been exempted from levy of Cess provided they are not generating hazardous wastes.		
A-10	Electricity Act, 2003	The sections of the Electricity Act, 2003 that are relevant for laying (and repairs) of transmission lines for the supply of energy are described as following: Section 67 details the provisions (a) to open and break up the soil and pavement of any street, railway or tramway; (b) to open and break up any sewer, drain or tunnel in or under any street, railway or tramway; (c) to alter the position of any line or works or pipes, other than a main sewer pipe; (d) to lay down and place electric lines, electrical plant and other works;(e) to repair, alter or remove the same; (f) to do all other acts necessary for transmission or supply of electricity. Section 159 describes that no person shall be engaged in the generation, transmission, distribution, supply or use of electricity, in any way injure any railway, highway, airports, tramway, canal or water-way or any dock, wharf or pier vested in or controlled by a local authority,	State Electricity Regulation Committee	MAPPL shall obtain license under the electricity act and ensure that the Health and Safety requirements as per rule 29 and 46 under chapter 6.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		or obstruct or interfere with the traffic on any railway, airway, tramway, canal or water-way. Section, 160(1) describes that every person generating, transmitting, distributing, supplying or using electricity (hereinafter in this section referred to as the "operator") shall take all reasonable precautions in constructing, laying down and placing his electric lines, electrical plant and other works and in working his system, so as not injuriously to affect, whether by induction or otherwise, the working of any wire or line used for the purpose of telegraphic, telephone or electric signaling communication, or the currents in such wire or line. Section 34 describes that every transmission licensee shall comply with such technical standards, of operation and maintenance of transmission lines, in accordance with the Grid Standards, as may be specified by the Authority. Section 53 (1) describes that the Authority may in consultation with the State Government, specify suitable measures for –(a) protecting the public (including the persons engaged in the generation, transmission or distribution or trading) from dangers arising from the generation, transmission or distribution or trading of		

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		electricity, or use of electricity supplied or installation, maintenance or use of any electric line or electrical plant; (b) eliminating or reducing the risks of personal injury to any person, or damage to property of any person or interference with use of such property ; (c) prohibiting the supply or transmission of electricity except by means of a system which conforms to the specification as may be specified; (d) giving notice in the specified form to the Appropriate Commission and the Electrical Inspector, of accidents and failures of supplies or transmissions of electricity; (e) keeping by a generating company or licensee the maps, plans and sections relating to supply or transmission of electricity; (f) inspection of maps, plans and sections by any person authorized by it or by Electrical Inspector or by any person on payment of specified fee; (g) specifying action to be taken in relation to any electric line or electrical plant, or any electrical appliance under the control of a consumer for the purpose of eliminating or reducing a risk of personal injury or damage to property or interference with its use; Section 165 (1) In section 40, sub-section (1) of clause (b) and section 41, subsection (5) of the		

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		Land Acquisition Act, 1894, the term "work" shall be deemed to include electricity supplied or to be supplied by means of the work to be constructed. (2) The Appropriate Government may, on recommendation of the Appropriate Commission in this behalf, if it thinks fit, on the application of any person, not being a company desirous of obtaining any land for its purposes, direct that he may acquire such land under the provisions of the Land Acquisition Act, 1894 in the same manner and on the same conditions as it might be acquired if the person were a company.		
B. Land and Labor				
B-1	Land Acquisition Act 1894 (Amended in 1984) and The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	Land Acquisition Act 1894 was passed with the purpose of enabling the procurement of land for the purpose of activities which are in the interests of the country. These include procedures for the acquisition of land, declaration of acquisition intent, hearing of objections, and final possession of the land amongst others. In last decade, the LA Act 1894 has been debated over for its archaic characters, which do not fit into the current realities. The current reality surrounding the process of land acquisition has changed tremendously, and therefore, the need was felt for the passing of a new law. A new Land	Local Administration District Collector Revenue Officer	Land for the project is being taken on Lease for 30 Years. Land will be returned to the land owners after lease duration. No purchase or acquisition of land is proposed for the project. Hence, It does not involve any involuntary displacement; therefore, LARR 2013 is not applicable for this project.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		Acquisition Resettlement and Rehabilitation Bill (LARR) 2011, which was renamed to The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RTFCTLARR Act), was passed by both the houses of Parliament and given the President's assent on 26th September 2013. The new law came into force in January 2014 and is applicable to the project. The new law stipulates mandatory consent of at least 70% of affected people for acquiring land for Public Private Partnership (PPP) projects and 80% for acquiring land for private companies. It also requires that payment of compensation for the owners of the acquired land will be four times the market value in rural areas and twice in urban areas. It also stipulates that the land cannot be vacated until the entire compensation is awarded to the affected parties. The law has the provision that the companies can lease the land instead of purchasing it. Besides, the private companies will have to provide for rehabilitation and resettlement if land acquired through private negotiations is more than 50 acres and 100 acres in urban and rural areas, respectively.		

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
B-2	The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006 &rules 2007	The act basically vests the forest rights and occupation in forest land in forest dwellers (ST and other traditional forest dwellers) who have been residing in forests for generations but whose rights could not be recorded. The act provides a framework for recognizing the forest rights and the nature of evidence required for such recognition and vesting of forest land. Some of the key rights so vested are as follows • Right to hold and live in the forest land under the individual or common occupation for habitation or for self-cultivation for livelihood by a member or members of a forest dwelling Scheduled Tribe or other traditional forest dwellers; • Community rights such as NISTAR, by whatever name called, including those used in erstwhile Princely States, Zamindari or such intermediary regimes; • Right of ownership, access to collect, use, and dispose of minor forest produce which has been traditionally collected within or outside village boundaries; • Other community rights of uses or entitlements such as fish and other products of water bodies, grazing (both settled or transhumant)	Ministry of Tribal Affairs Tribal Welfare Department	Not applicable as proposed project doesn't involve diversion of Forest Land.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		and traditional seasonal resource access of nomadic or pastoralist communities; • Rights including community tenures of habitat and habitation for primitive tribal groups and pre-agricultural communities; • Rights in or over disputed lands under any nomenclature in any State where claims are disputed; • Rights for conversion of Pattas or leases or grants issued by any local authority or any State Government on forest lands to titles; • Rights of settlement and conversion of all forest villages, old habitation, un-surveyed villages and other villages in forests, whether recorded, notified or not into revenue villages; • Right to protect, regenerate or conserve or manage any community forest resource which they have been traditionally protecting and conserving for sustainable use; • Rights which are recognized under any State law or laws of any Autonomous District Council or Autonomous Regional Council or which are accepted as rights of trial's under any traditional or customary law of the concerned tribes of any State;		

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
B-3	The Provision of the Panchayats (Extension to the Scheduled Areas) Act, 1996	The Act provides extension of the provisions of Part IX of the Constitution relating to the Panchayats to the Scheduled Areas. Scheduled Areas are defined as per the Clause (1) of Article 244 of the Constitution. The act gives special powers to the Panchayats in case it has been classified as Schedule V area by the constitution. The Panchayats are expected to have special powers given to them through the state Legislatures like: • The power to enforce prohibition or to regulate or restrict the sale and consumption of any intoxicant; • The ownership of minor forest produce; • The power to prevent alienation of land in the Scheduled Areas and to take appropriate action to restore any unlawfully alienated land of a Scheduled Tribe; • The power to manage village markets by whatever name called; the power to exercise control over money lending to the Scheduled Tribes; • The power to exercise control over institutions and functionaries in all social sectors;	Gram Panchayat	A NoC will be obtained for the project from the Gram Panchayat Bareta for installation of proposed Solar PV Plant

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		• The power to control over local plans and resources for such plans including tribal sub-plans; • The administration and management of the Panchayat is similar to the non-schedule areas, but the Panchayat has immense powers in case of Scheduled Area.		
B-4	Punjab Panchayati Raj Act 1994	The act gives powers to the Panchayats in case there is any grievance arises by the project. There is Provision for application of consent from the respective panchayat body/village administrative officer etc., during the project life cycle.	Panchayat Union	MAPPL will ensure that all grievances raised by locals related to the project are addressed through grievance redressal process. O&M contractor shall be responsible for Grievance Redressal, however, MAPPL will ensure regular compliance.
B-5	The Indian Factories Act, 1948 and State Rules	The Indian Factories Act was promulgated in 1948, to ensure general welfare of the industrial workers. The Act is divided into nine chapters with three chapters exclusively on health and safety (H&S) issues. The Act in its preamble states that "it is the general duty of the occupier (defined in the act as person having the ultimate control over the affairs of the factory) to ensure as far as practicable health, safety and welfare of all workers while they are at work in the factory". A general policy with respect to H&S of the workers at work should be in the form of a	Directorate of Industrial Safety and Health (DISH)/ Deputy Chief Inspector of Factories	Project is not under the purview of factory act, however, other provision like child labor, workman compensation shall be followed in accordance to particular acts.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		written statement and brought to the notice of the workers per the provision of the Act. The Act in its Chapter 4 deals with the provisions relating to Safety. The specific areas of safety are those relating to the usage of machinery, handling of hazardous substances and the latest amendments include safety measures for hazardous processes. The Act also has regulations for working near machinery in motion; development of adequate safety measures during installation and various types of operation of the machinery. The Act also explains preventive and protective measures in safety including proper consideration of explosive or inflammable substances so that the workers are not exposed to hazards during operation. The factory occupier is responsible to maintain safety of the buildings and machinery per this legislation. The Act also gives power to States to make relevant rules to supplement the need of safety in the facility. The Act also covers provisions for hazardous processes for an occupier to take all practicable measures to ensure prevention of any sorts of explosion due to manufacturing process, which are hazardous. There are permissible limits for		

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		exposure of chemicals and toxic substances in the workplace. Workers have the right to know about imminent danger and their participation in safety management. The Act also requires medical check-ups of workers with access to workers to look for outcome of the medical reports. An occupier is to develop a safety policy and form safety committees and provide power to the Central Government to appoint inquiry committee if some extraordinary situation had occurred in the factory which is engaged in the hazardous process.		
B-6	The Bonded Labor System (Abolition) Act 1976	The Bonded Labor System (Abolition) Act 1976: States that all forms of bonded labor stands abolished and every bonded labor stands freed and discharged from any obligations to render any bonded labor (Chapter 2)	Ministry of Labor & Employment	MAPPL will ensure compliance.
B-7	Minimum Wages Act, 1948	Minimum Wages Act, 1948 requires the Government to fix minimum rates of wages and reviews this at an interval of not more than 5 years. The minimum wage as prescribed for the industry by the government is required to be paid by the employers to the staff.	Ministry of Labor & Employment	MAPPL will ensure that all the contracted workers are provided with condition of services, rate of wages, holidays, hours of work as stipulated in the rules as per applicability and tenure of service, by the deputed contractor.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
B-8	The Workmen's Compensation Act, 1923	The Workmen's Compensation Act, 1923 requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer shall be liable to pay compensation in accordance with the provisions of this Act. Applicable to employees with less than or equal to a maximum of basic salary of INR 8000 per month	Ministry of Labor & Employment	MAPPL will ensure compliance, as per the applicability. This condition will be the part of contractor agreement.
B-9	The Contract Labor (Regulation & Abolition) Act, 1970 and Rules	As per the contract labor act, every principle employer is required to get the establishment registered before employing any contract labor. The contractors are also required to provide at minimum amenities like canteen, urinals, restrooms or alternate accommodation (if night halting labor), first aid, safe drinking water, etc. in case of contractor's failure to provide these amenities, the principle employer is liable to provide such amenities at its cost.	Ministry of Labor & Employment	MAPPL will ensure compliance as per agreement with O&M Contractor.
B-10	The Child Labor (Prohibition and Regulation) Act, 1986	A child is defined as a person who has not completed 14years of age. The Act prohibits employment of children in certain occupation and processes (part II, Section 3). The Act also specifies conditions of work for children, if permitted to work. These include a	Ministry of Labor & Employment	MAPPL will ensure compliance through deputed O&M Contractor.

S. No.	Act/Law	Description/purpose	Responsible Authority	Applicability
		working day of maximum of 6 hours a day (including rest), no work period exceeding 3 hours at a stretch, and no overtime (Section 7). The Act requires maintenance of a register for employed children (Section 11).		
B-11	ESI Act, 1948 (Employees State Insurance Act, 1948)	The ESI Act provides for certain benefits to employees in case of sickness, maternity and employment injury. These includes periodical payments to any insured person in case of his sickness certified by a duly appointed medical practitioner, periodical payments to an insured woman in case of confinement or miscarriage or sickness arising out of pregnancy, confinement, premature birth of child, periodical payments to an insured person suffering from disablement as a result of an employment injury sustained as an employee, or periodical payments to such dependents of an insured person who dies as a result of an employment injury sustained as an employee amongst others. Applicable to employees with less than or equal to a maximum of basic salary of INR 15000 per month	Ministry of Labor & Employment	Applicable to Proposed Solar PV Plant and MAPPL will ensure compliance through O&M Contratcor as per the applicability.

2.3 INTERNATIONAL REGULATIONS

The Project is seeking financial support from ADB, IFC and other EPFIs, hence their environmental and social safeguards are applicable to this Project. Applicability analysis and compliance requirement for ADB SPs and EPFIs and IFC Performance standard are described in sections below.

2.3.1 ADB Safeguard Policies

Environmental and social safeguards are a cornerstone of ADBs support for environmentally sustainable economic growth. The Safeguard Policy Statement builds upon the three safeguard policies on the environment, involuntary resettlement, and indigenous peoples, and brings them into a consolidated policy framework to enhance effectiveness and relevance. The SPS lays out policy principles and outlines a set of specific safeguard requirements that ADB supported projects are expected to meet. The ADB Safeguard Policies cover the following aspects.

- Environmental assessment;
- Environmental planning, and management;
- Information disclosure;
- Consultation and participation;
- Grievance Redress mechanisms;
- Monitoring and Reporting;
- Unanticipated Environment Impacts;
- Biodiversity and sustainable natural resources management;
- Pollution prevention and abatement;
- Health and safety;
- Physical cultural resources; and
- Involuntary resettlement;
- Indigenous peoples

Applicability analysis of the ADBs in reference to proposed Solar PV Plant is Tabulated below.

Table 2-2: Application of ADB Safeguard Policies to the Project

ADB Safeguard Policy statement	Requirements	Project Information/ Application
1. Environmental assessment	Environmental assessment term is used to identify potential direct, indirect, cumulative, and induced impacts and risks at an early stage of the project	The assessment is made in reference to the ADB standard checklist
2. Environmental planning and management	As per this requirement, borrower should prepare an environmental management plan (EMP) that addresses the potential impacts and risks identified by the environmental assessment. The EMP should include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related	Management and monitoring plan for the project is based on the Impact Intensity in a particular aspect of environment. Performance Indicators are established for post project monitoring.

ADB Safeguard Policy statement	Requirements	Project Information/ Application
	institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.	
3. Information Disclosure	Under this requirement borrower shall establish regular interaction with the affected populations and stakeholders	Regular interaction with affected population and stakeholders are being made
4. Consultation and Participation	The borrower / client should carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.	Consultation is a regular practice at the project site. MAPPL will kept regular interaction with all the stakeholders.
5. Grievance Redress Mechanism	The borrower / client should establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints and grievances about the project's environmental performance.	Grievance Redressal Mechanism of some other subsidiary of Mytrah Energy is in process for approval by ADB. Once the mechanism is approved, same, shall be adopted for this project.
6. Monitoring and Reporting	The borrower / client should monitor and measure the progress of implementation of the EMP. The extent of monitoring activities should be commensurate with the project's risks and impacts. The borrower / client should prepare periodic monitoring reports that describe progress with implementation of the EMP and compliance issues and corrective actions, if any.	Monitoring plan is defined in this report and same shall be followed during operation of the project.
7. Unanticipated Environmental Impacts	Where unanticipated environmental impacts become apparent during project implementation, the borrower / client should update the environmental assessment and EMP or prepare a new environmental assessment and EMP to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts.	At this stage no such unanticipated impact is expected. However, If any unforeseen circumstance take place, corrective action shall be taken by MAPPL.

ADB Safeguard Policy statement	Requirements	Project Information/ Application
8. Biodiversity and sustainable natural resources management;	MAPPL should follow and need to identify measures to avoid, minimize, or mitigate potentially adverse impacts and risks and, as a last resort, propose compensatory measures, such as biodiversity offsets, to achieve no net loss or a net gain of the affected biodiversity.	The area is devoid of legally notified ecologically sensitive areas viz. National park, wildlife sanctuary etc. The project site is devoid of any endangered or epidemic ecological habitat.
9. Pollution prevention and abatement;	During the design, construction, and operation of the project the borrower / client should apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines.	Project is based on the Solar PV technology, which is in itself a clean technology of power generation. Further, efforts will be made by MAPPL to minimized the project impacts. Moreover, project will reduce the carbon emission as expected from similar capacity of power generation through conventional approach.
10. Health and safety;	MAPPL should provide workers with a safe and healthy working environment, taking into account risks inherent to the particular sector and specific classes of hazards in the work areas, including physical, chemical, biological, and radiological hazards. Borrower / client should take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v)	MAPPL will abide with National and International Safety Standards. Labor laws shall be followed in specific reference to Renewable Energy Scope.

ADB Safeguard Policy statement	Requirements	Project Information/ Application
	documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.	
11. Physical cultural resources	The borrower / client is responsible for siting and designing the project to avoid significant damage to physical cultural resources (Defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance.	As such the project does not impact any cultural property
12. Involuntary resettlement;	Borrower / client should provide adequate and appropriate replacement land and structures or cash compensation at full replacement cost for lost land and structures, adequate compensation for partially damaged structures, and relocation assistance. The rate of compensation for acquired housing, land and other assets should be calculated at full replacement costs. The calculation of full replacement cost should be based on the following elements: (i) fair market value; (ii) transaction costs; (iii) interest accrued, (iv) transitional and restoration costs; and (v) other applicable payments.	Land for the project is being taken on Lease for 30 Years. Land will be returned to the land owners after lease duration. No purchase or acquisition of land is proposed for the project. Hence, it does not involve any involuntary displacement or resettlement.
13. Indigenous peoples;	Borrower / client should explore to the maximum extent possible alternative project designs to avoid physical relocation of Indigenous Peoples that will result in adverse impacts on their identity, culture, and customary livelihoods. If avoidance is impossible, in consultation with ADB, a combined Indigenous Peoples plan and resettlement plan could be formulated to address both involuntary resettlement and Indigenous Peoples issues.	Land for the project is being taken on Lease for 30 Years. Land will be returned to the land owners after lease duration. No purchase or acquisition of land is proposed for the project. Hence, no displacement of people (including indigenous people) is required for the project.

2.3.2 IFC Performance Standard

IFC applies the Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards may also be applied by other financial institutions choosing to support them in the proposed project. These performance standards and guideline provide ways and means to identify impact and affected stakeholders and lay down processes for management and mitigation of adverse impacts. The IFC Performance Standards stipulates that any proposed project shall meet the following requirements throughout the life of an investment by IFC or other relevant financial institution

Table 2-3: Application of IFC Performance Standards to the Project

IFC Performance Standards	Requirements	Project Information/ Application
PS1: Social & Environmental Assessment and Management System	The project should have a social and environmental management system that incorporates the following: (i) policy; (ii) identification of risks and impacts; (iii) management programs; (iv) organizational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review.	This Performance Standard is applicable to the Project. The proposed project will have environmental and social impacts. PS1 is therefore applicable for the project and thus requires an Environmental and Social Impact Assessment (ESIA) study to be conducted before commencement of the project. MAPPL also needs to develop and implement a project specific Environmental and Social Management Plan to manage the impacts / risks associated with project's operations.
PS2: Labor and Working conditions	MAPPL requires to follow requirements on (i) working conditions and management of worker relationship (human resource Conditions policy, working conditions, terms of employment, worker's organizations, non-discrimination equal opportunity, retrenchment, grievance mechanism); (ii) protecting work force (not engaging child labor and forced labor); (iii) occupational health and safety; (iv) workers engaged by third parties; and (v) adverse impacts related to supply chain.	The applicability of PS2 will be more important during the construction phase as operation phase will only have limited number of staff. It not only covers the main plant employees, but all employees / workers, even those working through O&M contractors. Migrant workers be engaged for the project will stay in rented accommodation in nearby towns. Therefore, standards pertaining to camp sites will not be applicable. MAPPL should develop and implement procedures to

IFC Performance Standards	Requirements	Project Information/ Application
		manage and monitor performance of Contractors. These procedures should be integrated in day-to-day operations of the company and requirements should be clearly communicated to contractors, and if possible to workers engaged by contractors.
PS3: Pollution Prevention and Amendment	MAPPL requires to consider (i) sustainable resource utilization (water consumption); (ii) pollution prevention (wastes, hazardous materials management, pesticide use and management)	This Performance Standard is applicable to the Project. The proposed project is a clean energy project and will not have major pollution sources associated with it. The construction works for the erection of project will entail generation of wastes like waste water and construction debris. The operation phase will result in generation of minor quantities of waste such as transformer oil and used oil and waste water after module washing. MAPPL should monitor emissions / pollutions level appropriate the nature to ensure that the requirements of PS3 are being met.
PS4: Community Health, Safety and Security	MAPPL requires to follow requirements on i) infrastructure and equipment design and safety; (ii) hazardous materials management and safety; (iii) ecosystem services; (iv) community exposure to disease; (v) emergency preparedness and response; and (vi) security personnel.	The applicability of this PS shall be established during the ESIA process, resulting in preparation of an Action Plan to be disclosed to the community. The Applicability will be limited to some extent of construction period with movement of heavy machinery / vehicles. Waste water generation from the module washing will get evaporated or absorbed by the soil underneath. Worker / Labor and to be engaged from local

IFC Performance Standards	Requirements	Project Information/ Application
		community considering individual skill level. The Action Plan and any other relevant project - related information is to enable the influenced communities and relevant government agencies to understand these risks and impacts, and will engage the influenced communities and agencies as and when required.
PS5: Land Acquisition and Involuntary Resettlement	Specifies requirements on (i) project design to avoid or minimize physical and/or economic displacement; (ii) compensation and benefits for displaced persons; (iii) community engagement; (iv) grievance mechanism; (v) resettlement and livelihood restoration planning and implementation; (vi) physical and economic displacement; (vii) private sector responsibilities under government-managed resettlement	Land for the project is being taken on Lease for 30 Years. Land will be returned to the land owners after lease duration. No purchase or acquisition of land is proposed for the project. Hence, it does not involve any land acquisition and involuntary displacement. Lease rent shall be paid on annual basis, so that, people have a regular income as earlier was expected from agricultural activities.
PS6: Biodiversity Conservation and Sustainable Natural Resource Management	Specifies requirements on (i) protection and conservation of biodiversity (modified, natural, critical habitat, legally protected and internationally recognized areas, invasive alien species); (ii) management of ecosystem services; (iii) sustainable management of natural resources; and (iv) supply chain.	There is no legally notified ecologically sensitive areas viz. National park, wildlife sanctuary etc. within 10 Km of project site. The applicability of this PS shall be detailed out in the Environmental and Social Impact Assessment Study, while implementation of the actions necessary to meet the requirements of this PS shall be managed through the suggested mitigation measures. The operation phase of the proposed project shall ensure protection of fauna and flora of the site and surrounding. Baseline studies for ecological aspects have been described in

IFC Performance Standards	Requirements	Project Information/ Application
		Chapter 4 of the report. The study has been gathered through site survey, literature review and initial desktop analysis. The extent of the literature review depend on the sensitivity of the biodiversity attributes associated with the project's area of influence and the ecosystem services that may be impacted.
PS7: Indigenous Peoples	Specifies requirements on (i) Avoidance of adverse impacts; (ii) Participation and consent; (iii) circumstances requiring free, prior, and informed consent; (iv) mitigation and development benefits; and (v) private sector responsibilities where government is responsible for managing indigenous peoples issues	The project area or its surroundings is not native to any indigenous people. No material degradation or adverse impact is expected on land resources on which people are dependent. The lease rent shall be paid on annual basis, so that, people have a regular income as earlier was expected from agricultural activities. Hence, PS7 is not applicable for this project.
PS8: Cultural Heritage	Specifies requirements on (i) protection of cultural heritage in project design and execution (chance find procedures, consultation, community access, removal of replicable cultural heritage, removal of non-replicable cultural heritage, critical cultural heritage); and (ii) project's use of cultural heritage	As such the project does not impact any cultural property or structure of archaeological importance. This PS is applicable when tangible forms of cultural heritage, unique natural features or tangible objects that embody cultural values and certain instances of intangible forms of culture are impacted or are proposed to be used for commercial purposes. Hence, PS8 is not applicable for this project.

2.3.3 Equator Principles

The EPs, based on the IFC Performance Standards on social and environmental sustainability and on the World Bank Group Environmental, Health, and Safety Guidelines (EHS Guidelines), are intended

to serve as a common baseline and framework for the implementation by each EPFI. The applicability of EP to the project has been outlined in Table below.

Table 2-4: Application of Equator Principles to the Project

Equator Principles	Requirements	Project Information/ Application
Principle 1: Review and Categorization	Project seeking financing from EPFIs, the project has to be categorized based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of IFC.	Project is based on cleaner technology of power generation. Which will help in reduction of global carbon emission. Based on Section 2.4, project is identified as Category "B" project.
Principle 2: Social and Environmental Assessment	For each project assessed as being either Category A or Category B, the EPFI will require the borrower need to conduct an Environmental and Social Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of the proposed Project. The assessment should also propose measures to minimize, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed Project.	The social and environmental assessment and its management measures are discussed in this ESIA Report.
Principle 3: Applicable Social and Environmental Standards	The principle requires the Environment and Social Assessment to refer to the applicable IFC performance standards and then applicable industry specific EHS guideline including the project's overall compliance with or justified deviation from, the respective Performance Standards and EHS Guidelines. The assessment process also needs to address compliance with relevant host country laws, regulation and permits that pertain to social and environmental matters.	Applicability assessment of IFC Performance Standard is made in the earlier section. Compliance of the IFC standards shall be ensured by MAPPL.
Principle 4: Action Plan and Management System	For all Category A and B projects, an Action Plan (AP) need to be prepared which addresses relevant findings, and draws on the conclusions of the Assessment. The AP will describe and prioritize actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to	In accordance with the provision of this Principle, an Environmental and Social Management Plan has been drawn up as part of the ESIA study for the proposed project specifying appropriate plans and procedures which requires to be

Equator Principles	Requirements	Project Information/ Application
	manage the impacts and risks identified in the Assessment. In this regard, the borrower /proponent needs to maintain or establish a Social and Environmental Management System that addresses the management of these impacts, risks and corrective actions required to comply with applicable host country social and environmental laws and regulations, and requirements of the applicable Performance Standards and EHS Guidelines, as defined in the AP.	implemented during various phases in order to prevent, control and mitigate any potential environmental and social risks.
Principle 5: Consultation and Disclosure	According to this Principle, for all Category A and (as appropriate), Category B projects, the Government, borrower or third party expert to consult with project affected communities in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process will ensure their free, prior and informed consultation and facilitate their informed participation as a means to judge, vide EPFI norms, whether a project has adequately addressed the concerns of the affected communities.	Consultation with the stakeholders is a regular practice at the project site. MAPPL will kept regular interaction with all the stakeholders.
Principle 6: Grievance Mechanism	For all Category A and (as appropriate), Category B projects, it needs to be ensured by the proponent that consultation, disclosure and community engagement continues throughout construction and operation of the project and community concerns / grievances addressed through establishing a 'Grievance Redressal Mechanism'. In this regard, the proponent of the proposed solar PV project need to develop and implement a 'Grievance Redressal Mechanism (GRM)' to receive and facilitate resolution of any concern and grievance that may be raised by land loser groups and/or nearby village communities	Grievance Redressal Mechanism of some other subsidiary of Mytrah Energy is in process for approval by ADB. Once the mechanism is approved, same, shall be adopted for this project MAPPL will ensure that all grievances raised by locals related to the project are addressed by contractor through grievance redressal process.

Equator Principles	Requirements	Project Information/ Application
	during both construction and operational phase of the project. As part of this Principle, it is also imperative that the proponent maintains regular dialogue with communities through implementation of focused CSR programmes / initiatives.	
Principle 7: Independent Review	For all Category A projects and, as appropriate for Category B projects, an independent social or environmental expert not directly associated with the proponent will review the assessment, action plan and consultation process documentation in order to assist EPFI's due diligence, and assess Equator Principle Compliance.	As part of the loan approval for the project the respective EPFI may appoint an independent social or environmental expert for review of ESIA/ESMP report and its implementation.
Principle 8: Covenants	For Category A and B projects, the proponent will covenants in financing documentation: a) to comply with all relevant host country social and environmental laws, regulations and permits in all material respects; b) to comply with the action plans (where applicable) during the construction and operation of the project in all material respects; c) to provide periodic reports in a format agreed with EPFIs (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts, that i) document compliance with the action plans (where applicable), and ii) provide representation of compliance with relevant local, State and host country social and environmental laws, regulations and permits (where applicable) d) to decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.	E&S Covenants shall be embedded within the contracts drawn between proponent and the contractors hired for construction activities and technology providers and waste handlers. Periodic reporting to the project developers will have to be carried out by the contractors.
Principle 9: Independent	To ensure ongoing monitoring and reporting over the life of loan, EPFIs will,	The project will fall under Category B and the periodic

Equator Principles	Requirements	Project Information/ Application
Monitoring and Reporting	for all Category A projects and, as appropriate for Category B projects, require appointment of an independent environmental and/or social expert, or require that the proponent retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.	reporting mechanism will be done as agreed between EPFI and Project Proponent.

2.4 PROJECT CATEGORISATION

2.4.1 ADB Categorization Criteria

The project classification system of ADB is used to reflect the significance of potential environmental impacts understood as a result of the client's impact assessment and to establish ADB's safeguard requirements. The projects are screened on the following criteria:

Environment: Proposed project should be screened according to type, location, scale, sensitivity and the magnitude of their potential environmental impacts including direct, indirect, induced and cumulative impacts.

Involuntary Resettlement: The involuntary resettlement impacts of an ADB funded projects considered significant if 200 or more persons will be physically displaced from home or lose 10% or more of their productive or income generating assets.

For those involving involuntary resettlement, a resettlement plan should be prepared that is commensurate with the extent and degree of the impacts: the scope of physical and economic displacement and the vulnerability of the affected persons.

Indigenous People: The impacts of an ADB funded project on indigenous people is determined by assessing the magnitude of impacts in terms of:

- Customary right of use and access to land and natural resources;
- The right of cultural and communal integrity;
- The level of vulnerability of the affected Indigenous people's community;
- Socio-economic status;
- Health, education, livelihood and social security status; and
- The recognition of indigenous people[1]

As per these criteria projects are classified into any of the four categories: A, B, C and F1. The categories used by ADB are:

[1] As per Indian Regulatory Framework tribal population has been considered as Indigenous Population

Category A Projects: Projects which are likely to have significant adverse environmental and social impacts that are irreversible, diverse, or unprecedented.

Category B Projects: Projects with potential adverse environmental and social impacts that are less in number, generally site-specific, mostly reversible and readily addressed through mitigation measures;

Category C Projects: Projects with minimal or no adverse environmental and social impacts;

Category FI Projects: Projects which involve investment of ADB funds to or through a financial intermediary.

ADB Checklist approach was followed for project categorization. The REA checklist as filled for the project is as follows.

Rapid Environmental Assessment (REA) Checklist | **Solar Energy**

Country:	India
Project Title:	Mytrah Aadhya Power Pvt Ltd's 25 MW Solar PV Project at Village Bareta, District Mansa Punjab
Date:	6th May, 2016

Screening Question	Yes	No	Remark
A. Project Siting			
Is the Project area adjacent to or within any of the following environmentally sensitive areas?		X	There is no ecologically sensitive protected area within 10km from the project site
Physical cultural heritage site		X	No cultural heritage in or nearby the project site
Located in or near to legally protected area		X	No legally protected area in or nearby the project site
Located in or near to special habitats for biodiversity (modified or natural habitats)		X	No special habitats of bio-diversity in and nearby the project site.
Wetland		X	No notified wetland system is available in or nearby the project site.
Mangrove		X	Project is located in Inland Area, no mangrove ecosystem in near vicinity of the project
Estuarine		X	Project is located in Inland Area, no estuarine in near vicinity of the project
Offshore (marine)		X	Not Applicable as project is an Inland Project

Screening Question	Yes	No	Remark
B. Potential Environmental Impacts			
Will the Project Cause			
large scale land disturbance and land use impacts specially due to diversion of productive lands?	X		About 183 acres of land shall be utilized for installation of proposed solar plant. Prima-facie, it is agriculture land. Land is being rented on lease and will revert to original form after lease period.
Involuntary resettlement of people? (physical displacement and/or economic displacement)		X	Land for the project is being taken on Lease for 30 Years. Land will be returned to the land owners after lease duration. No purchase or acquisition of land is proposed for the project. Hence, it does not involve any land acquisition and involuntary displacement. Lease rent shall be paid on annual basis, so that, people have a regular income as earlier was expected from agricultural activities.
Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	No such impact is anticipated.
Noise, vibration and dust from construction activities?	X		Fugitive dust emission is expected due to construction activities. Regular water sprinkling is proposed to minimize the dust pollution.
An increase in local traffic during construction?	X		Considering the project magnitude, increment in traffic nos. will not be significant.
Environmental disturbances such as soil erosion, land contamination, water quality deterioration, air pollution, noise and vibrations during construction phase?	X		Air Pollution in terms of fugitive emission shall be controlled by regular sprinkling. Noise level will be maintained by scheduling of construction activities. Hazardous material having potential to contaminate soil or land will be store at designated place.
Aesthetic degradation and property value loss due to establishment of plant and ancillary facilities?		X	Project will improve aesthetic value of the area.
Changes in flow regimes of the water intake from surface water or underground wells due to abstraction for cooling purposes?		X	Project doesn't involve requirement of water for cooling purpose.

Screening Question	Yes	No	Remark
pollution of water bodies and aquatic ecosystem from wastewater treatment plant, from cooling towers, and wash-water during operation?		X	Water for the project is required only for washing of the panels and officials at site. A septic tank with soak pit is proposed for office area.
A threat to bird or bat life from colliding with the project facilities and / or being burned by concentrated solar rays?		X	Project is based on Solar PV Power Generation Technology. Therefore, no such incidence is likely due to this project.
Industrial liquid (dielectric fluids, cleaning agents, and solvents) and solid wastes (lubricating oils, compressor oils, and hydraulic fluids) generated during construction and operations likely to pollute land and water resources?	X		Some amount of lubricating oils and hydraulic fluids will be utilized during construction. However, the quantity of utilization will be very less and not likely to create any hazard on land and water resources. In operation phase lubricating oils will be required for axis tracker system smooth functioning. Oil collection pits and soak pits for the transformers shall also be constructed.
Soil / water contamination due to use of hazardous materials or disposal of broken or damaged solar cells (photovoltaic technologies contain small amounts of cadmium, selenium and arsenic) during installation, operation and decommissioning?		X	No land and soil contamination due to use of hazardous materials or disposal of broken or damaged solar cells (photovoltaic technologies contain small amounts of cadmium, selenium and arsenic) is expected during installation, operation and decommissioning as all waste will be stored on separate designated place, properly labeled, possibly stored briefly and referred to the approved recyclers of waste handlers.
Noise disturbance during operation due to the proximity of settlements or other features?		X	No noise is expected due to power generation activities.
Visual impacts due to reflection from solar collector arrays resulting in glint or glare?	X		The project is based on the PV based Power Generation Technology. Therefore, reflection would be slightly on lower side in comparison to the Concentrating Solar Power Technology.
Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	No such influx is expected as labor requirement for construction phase shall be met locally. The operation phase human resource requirement is limited for 10 nos., which is not likely to have any impact of local infrastructure.

Screening Question	Yes	No	Remark
Social conflicts between local labors and those from outside the area?		X	No such conflict is expected as effort will be made to meet the construction phase requirement locally.
Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during construction, installation, operation and decommission?	X		Occupational health and safety risk shall be avoided with the help of best industrial practices.
Risks to community health and safety due to the transport, storage, and use and/or disposal of materials and wastes such as explosives, fuel and other chemicals during construction, and operation?		X	No incidence is expected
Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		X	Power generation is based on the PV technology of Power Generation. No industrial operation is involved for the project.

2.4.2 IFC Categorization Criteria

As part of its review of a project's expected social and environmental impacts, IFC uses a system of social and environmental categorization. This categorization is used to reflect the size of impacts understood as a result of the client's social and environmental assessment and to specify IFC's institutional requirements. The following categories are used by the IFC:

Category A Projects: Projects with potential significant adverse environmental and social impacts that are diverse, irreversible or unprecedented;

Category B Projects: Projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures;

Category C Projects: Projects with minimal or no adverse social or environmental impacts, including certain financial intermediary (FI) projects with minimal or no adverse risks;

Category FI Projects: All Financial Intermediary (FI) projects excluding those that are Category C projects.

IFC therefore categorizes projects primarily according to the significance and nature of impacts. IFC defines the project's area of influence as the primary project site(s) and related facilities that the client (including its contractors) develops or controls; associated facilities that are not funded as part of the project (funding may be provided separately by a client or a third party including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project; areas potentially impacted by cumulative impacts from further planned development of the project; and areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.

2.4.3 Project Categorization

Based on site specific environmental and social impacts assessment and checklist as stated in above section, the major observations of the proposed project are as follows.

- The project is a greenfield project. Land for the project is being taken on 30 years lease and rent will be paid annually. Hence, no resettlement and rehabilitation or involuntary resettlement is proposed for the project.
- The land for the project is devoid of any natural forest or ecology of great concern. Hence no significant impact on ecological balance of the area is expected. The project is away (10km surrounding the project boundary) from any ecologically sensitive areas like national parks, wildlife sanctuaries, scheduled areas and critically polluted areas.
- No specific / vulnerable group of community is likely to be affected by the project.
- The construction phase of the project will witness various types of activities such as slight leveling and grading, slight increase in vehicular movement for material transportation, erection of solar module, etc. All the above mentioned tasks contribute to fugitive dust emission and noise due to construction activity in the vicinity. So there may be a temporary impact on neighboring agricultural plots, during construction phase. However close vicinity of the approach road is highly beneficial in reduction of impact associated with this aspect.
- The site is devoid of any settlement. Hence, no impact on nearby settlement is expected due to project activities.

Most of the project impacts are associated with construction activities and shall be limited for shorter duration. Most of these impacts are reversible and will be limited for construction period of six months. On the basis of above observations project is categorized as ‘Category B’.

2.5 APPLICABLE ENVIRONMENT STANDARDS

The central Pollution Control Board (CPCB) has stipulated different environmental standards w.r.t. Ambient Air Quality, Noise Quality, Water and Waste Water for the country as a whole under EP Act, 1986. IFC and WB EHS guidelines shall also be applicable for best international practices. Some of these standards shall be only be applicable either construction phase or operation phase of the proposed plant. The applicable environmental standards for the proposed project have been discussed in the subsequent sections. The ambient air quality standards will be applicable only during the construction phase of the project and the wastewater discharges from the project during both

construction and operation phases shall be as per the general discharge standards as sector specific standards are not available for solar power projects.

2.5.1 Ambient Air Quality Standards

Standards for Ambient Air Quality will only be applicable during construction phase only as no air major polluting process is expected during operation phase of the project.

National Ambient Air Quality Standards (NAAQS), as notified under Environment (Protection) Rules 1986 and revised through Environment (Protection) Seventh Amendment Rules, 2009 are given in **Table** below.

Table 2-5: National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concertation in Ambient Air	
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO_2), µg/m^3	Annual*	50	20
	24 Hours**	80	80
Nitrogen Dioxide (NO_2), µg/m^3	Annual*	40	30
	24 Hours**	80	80
Particulate Matter (size less than 10 µm) or PM10, µg/m^3	Annual*	60	60
	24 Hours**	100	100
Particulate Matter (size less than 2.5 µm) or PM2.5, µg/m^3	Annual*	40	40
	24 Hours**	60	60
Ozone (O_3), µg/m^3	8 Hours**	100	100
	1 Hour**	180	180
Lead (Pb), µg/m^3	Annual*	0.5	0.5
	24 Hours**	1	1
Carbon Monoxide (CO), mg/m^3	8 Hours	2	2
	1 Hour**	4	4
Ammonia (NH_3), µg/m^3	Annual*	100	100
	24 Hours**	400	400
Benzene (C_6H_6), µg/m^3	Annual*	5	5
Benzo (O) Pyrene (BaP), particulate phase only, ng/m^3	Annual*	1	1
Arsenic (As), ng/m^3	Annual*	6	6
Nickel (Ni), ng/m^3	Annual*	20	20

** Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly at uniform interval*

*** 24 hourly or 8 hourly or 01 hourly values as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed, but not on 2 consecutive days. Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the*

respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

No sector specific IFC guideline are in place for Solar Power Plant. Therefore, IFC general EHS guidelines are followed for comparison. As per IFC EHS guideline Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources. The WHO Ambient Air Quality Guidelines are presented in Table below.

Table 2-6: WHO Air Quality Guidelines

Pollutant	Averaging Period	Guideline Value in µg/m^3
Sulphur Dioxide (SO_2)	24 hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO_2)	1 year	40 (guideline)
	1 hour	200 (guideline)
Particulate Matter PM10	1 year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24 hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter PM2.5	1 year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24 hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8 hour daily maximum	160 (Interim target-1) 100 (guideline)

2.5.2 Water Quality Standards

The designated best use classification as prescribed by CPCB for surface water is as given in **Table** below**.**

Table 2-7: Primary Water Quality Criteria for Designated-Best-Use-Classes

Designated-Best-Use	Class	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or Less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organized)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20oC 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20oC 3mg/l or less
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25oC micro mhos/cm Max.2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l
	Below E	Not Meeting A, B, C, D & E Criteria

Source: Central Pollution Control Board

As per the IFC EHS guidelines, the treated sewage discharge shall meet the following guidelines:

Table 2-8: Treated Sewage Discharge Guideline IFC

S. No.	Parameter	Guideline Value
1	pH	6-9
2	BOD	30 mg/l
3	COD	125 mg/l
4	Total Nitrogen	10 mg/l
5	Total Phosphorus	2 mg/l
6	Oil and Grease	10 mg/l
7	Total Suspended Solids	50 mg/l
8	Total Coliform bacteria	400 MPN/100 ml

Notes: MPN = Most Probable Number

Table 2-9: Drinking Water Standard (IS 10500: 2012)

S. No.	Parameters	Unit	IS 10500:2012	
			Requirement (Acceptable Limit)	Permissible Limit in absence of alternative source
1	pH	--	6.5-8.5	No Relaxation
2	Turbidity	NTU	1	5

S. No.	Parameters	Unit	IS 10500:2012	
			Requirement (Acceptable Limit)	Permissible Limit in absence of alternative source
3	EC	µMho/cm	Not Specified	Not Specified
4	TSS	mg/l	Not Specified	Not Specified
5	TDS	mg/l	500	2000
6	Total Alkalinity as $CaCO_3$	mg/l	200	600
7	Chlorides as Cl^-	mg/l	250	1000
8	Sulphates as SO_4^-	mg/l	200	400
9	Nitrates as NO_3	mg/l	45	No Relaxation
10	Phosphates as PO_4	mg/l	Not Specified	Not Specified
11	Total Hardness as $CaCO_3$	mg/l	200	600
12	Calcium as Ca	mg/l	75	200
13	Magnesium as Mg	mg/l	30	100
14	Sodium as Na	mg/l	Not Specified	Not Specified
15	Potassium as K	mg/l	Not Specified	Not Specified
16	Fluorides as F^-	mg/l	1.0	1.5
17	Iron as Fe	mg/l	0.3	No Relaxation
18	Phenolic Compounds	mg/l	0.001	0.002
19	Cyanide as CN-	mg/l	0.05	No Relaxation
20	Residual Chlorine as Cl^-	mg/l	0.2	1.0
21	Cadmium as Cd	mg/l	0.003	No Relaxation
22	Total Chromium as Cr	mg/l	0.05	No Relaxation
23	Lead as Pb	mg/l	0.01	No Relaxation
24	Zinc as Zn	mg/l	5	15
25	Manganese as Mn	mg/l	0.1	0.3
26	Copper as Cu	mg/l	0.05	1.5
27	Nickel as Ni	mg/l	0.02	No Relaxation
28	Colour	Hazen	5	15
29	Taste	-	Agreeable	Agreeable
30	Odor	-	Agreeable	Agreeable
31	Boron	mg/l	0.5	1.0
32	Anionic Detergents	mg/l	0.2	1.0
33	Mineral Oil	mg/l	0.5	No Relaxation
34	Aluminium as Al	mg/l	0.03	0.2
35	Mercury as Hg	mg/l	0.001	No Relaxation

Source: Indian Standard DRINKING WATER-SPECIFICATION (Second Revision), May 2012

2.5.3 Ambient Noise Standards

Noise standards notified by the MoEF vide gazette notification dated 14 February 2000 based on the A- weighted equivalent noise level (Leq) are as presented in Table below.

Table 2-10: Ambient Noise Standards

Area Code	Category of Area	Limits in dB(A) Leq	
		Day Time*	Night Time*
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone**	50	40

*Note: * Day time is from 6 am to 10 pm, Night time is 10 pm to 6.00 am;*
*** Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones.*

As per EHS guidelines of IFC, for residential, institutional and educational area, the one hourly equivalent noise level (Leq hourly) for day time is 55 dB(A) while the Leq hourly for night time is prescribed as 45 dB(A). Noise impacts should not exceed the prescribed levels in a maximum increase in background levels of 3 dB(A) at the nearest receptor location off-site.

Table 2-11: Ambient Noise Standards by IFC

Receptor	One Hour LAeq (dBA)	
	Day Time (07:00 – 22:00)	Night Time (22:00 – 07:00)
Residential, Educational, Institutional	55	45
Industrial and Commercial	70	70

Noise standards in the work environment are specified by Occupational Safety and Health Administration (OSHA-USA) which in turn are being enforced by Government of India through model rules framed under the Factories Act.

Table 2-12: Standards for Occupational Noise Exposure

Total Time of Exposure per Day in Hours (Continuous or Short term Exposure)	Sound Pressure Level in dB(A)
8	90
6	92
4	95
3	97
2	100
3/2	102
1	105
¾	107
½	110
¼	115

Total Time of Exposure per Day in Hours (Continuous or Short term Exposure)	Sound Pressure Level in dB(A)
Never	>115

No exposure in excess of 115 dB(A) is to be permitted.

3 PROJECT DESCRIPTION

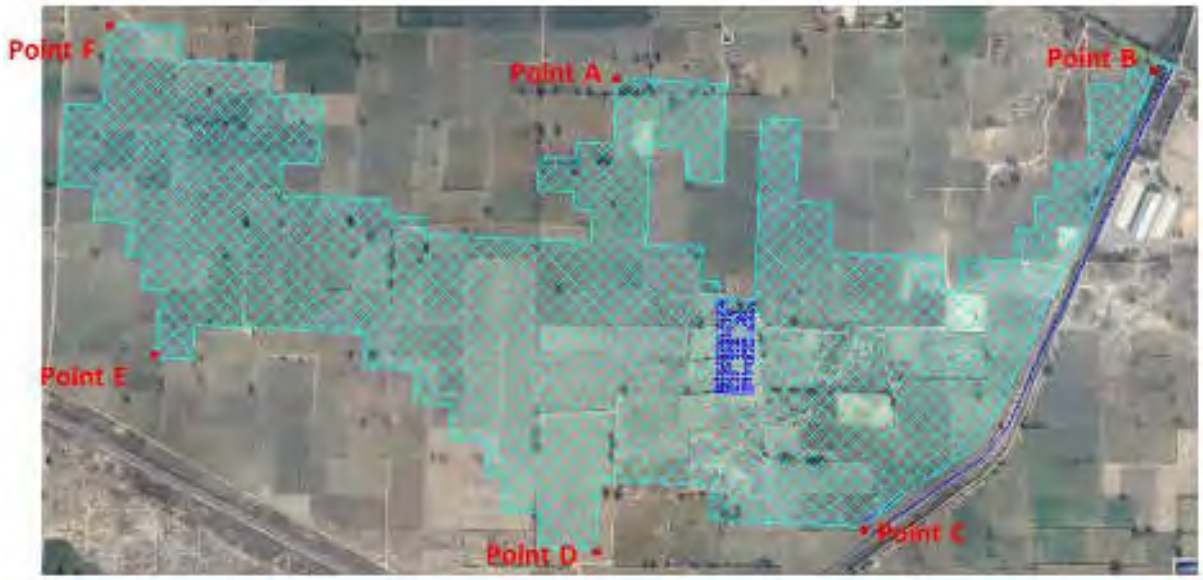
3.1 INTRODUCTION

The project is based on Solar PV technology of power generation. The ultimate capacity of the project is 25 MW and plant will be established in approximately 183 acres of land in Bareta Village of Punjab State. This Chapter will discuss about technology of the project related to the Environment and Social aspects. Some of the project salient features are as follows.

Table 3-1: Salient Features of the Proposed Site

S. No.	Parameters	Details	
1	Name of the project	25 MW Solar PV Project at Village Bareta, District Mansa Punjab	
2	Nature of the project	Solar PV	
3	Project Proponent	Mytrah Aadhya Power Pvt. Ltd.	
4	Village	Bareta	
5	Tehsil	Budhlada	
6	District	Mansa	
7	State	Punjab	
8	Latitude	29.875° N	Coordinate map is attached shown as Figure 3.1.
9	Longitude	75.676° E	
10	Nearest Airport	Chandigarh towards NE about 140 km	
11	Nearest Town	Bareta in East at about 1.5 km Budhlada in West at about 11.0 km	
12	Nearest Railway Station	Bareta	
13	Nearest major road	SH-10 in North adjacent to Project Site	
14	Land Requirement	183 acres	
15	Process Technology	Solar PV Power Generation Technology	
16	Annual global horizontal irradiation	1791.6 kWh/m^2/day	
17	Number of Modules	84680	
18	Total Module Area	164309 m^2	
19	No. of Inverters	25	
20	Capacity of Inverter	1000 KW	
21	First Year Energy Yield P50 (MWh/annum)	49843	
22	First Year Energy Yield P75 (MWh/annum)	48767	
23	First Year Specific Yield (kWh/kWp/year)	1899	
24	Cost of the Project (Including land cost)	163.95 Crore	

S. No.	Parameters	Details		
25	Human Resource	**Phase**	**Average**	**Peak**
		Construction	100 nos.	400 nos.
		Operation	10-12 nos.	
26	Proposed date of commissioning	Dec 2016		



Point	Latitude	Longitude
Point A	29°52'44.7"N	75°40'13.7"E
Point B	29°52'45.5"N	75°40'50.6"E
Point C	29°52'18.8"N	75°40'30.0"E
Point D	29°52'17.5"N	75°40'12.3"E
Point E	29°52'28.4"N	75°39'43.0"E
Point F	29°52'48.2"N	75°39'38.9"E

Figure 3-1: Coordinate Map

3.2 PROJECT SITE

The project is proposed to be located in Bareta Village of Mansa District. The project is in Southern Part of the Punjab State and project district shares a common border with Haryana State. The project site is approximately 8.0 km North-west from Haryana State border. State Highway 10 creates the natural Northern boundary of the project site. Chandigarh is the nearest airport located at a distance of about 140km from the project site towards North East. The location of project site is presented in Figure 3.2.

Figure 3-2: Project Location Map

3.3 LAND REQUIREMENT & COST

Area for locating the solar project is generally based on the climatic conditions with preference given to solar radiation, optimum use of sunshine hours and fewer cloud cover hours etc. About 183 acres of land is being leased for the project purpose. Land is being leased from 87 khatedar[2] / land owners. The whole land is the part of Bareta Revenue Village. The land identified for the project is primarily agriculture land with some patches of barren land. The total land requirement of the project is Private land. No forest or govt. land is involved for the project. This project does not involve any resettlement in terms of physical and economical aspects hence do not attract Resettlement plan as per applicable national / state legislation.

Land is being leased on a remuneration of INR 50000/- per acre on annual basis with an escalation of 5% per annum. The lease deed with the land owners is being made into in the name of the Company. The Lease period will be for 30 years. The lease price is decided after considering stakeholder negotiation, yearly crop value assessment and best of the market value in respect to existing lease rate. During consultation it was noted by the consultant that the land owner leased their land as per their own choice and got better compensation than the agriculture activities round the year. As informed by local community and client that no SC and ST land involved in land procurement process and none of the land owner has become marginal. The major land requirement for the project is associated with installation of solar panel. The layout plan of the site is shown as Figure 3.3 and land requirement of different component is tabulated below.

Table 3-2: Land Requirement Break-up Details

S. No.	Plant Component	Land Details (acres)
1	Module Area (Including Pitch)	142
2	LT/HT Room Switch yard	2
3	Road	3
4	boundary gap (Shadow area)	23
5	Open Area	13
Total Land Area		**183**

Right of Way (RoW) shall be taken for laying the transmission line. The width of Right of way will be limited to 18m as per Power Ministry guidelines for 66 kv transmission line. The land will be acquired for Tower area in tune of 16 to 49 m^2. About 30 nos. of towers are proposed for the complete transmission line. The estimated distance between each tower varies from 70m to 260m based on the angle of tower.

Compensation shall be made as per Ministry of Power 'Guidelines for payment of compensation towards damages in regard to right of way for transmission lines'. Guidelines are attached as **Annexure II**. As per this guidelines 'Compensation towards diminution of land value in the width of Right of Way (RoW) Corridor due to laying of transmission line and imposing certain restriction would be decided

[2] "khatedar" means a person whose name is included in the revenue records of the parcel of land under reference;

by the States as per categorization/type of land in different places of States, subject to a maximum of 15% of land value as determined based on Circle rate / Guideline value / Stamp Act rates.

Lease / Purchase agreement for tower area will have the provision of compensation for temporary restriction on farming / ploughing during erection activities.

The proposal for transmission line has already been prepared by competent third party considering the alternatives on technical, environment and social aspects. Further as a part of the norm by State Govt., proposal from Mytrah is in active process for scrutiny and approval by PSTCL, Govt. of Punjab for considering the final transmission route.

After getting the final approval, tower footprint will be finalized by government authorized contractor and accordingly RoW will be considered as per the applicable norms in host country. The details of approval from statutory body i.e. PSTCL, Govt. of Punjab will be submitted along with ROW documents before commissioning of the plant as additional annexure of existing Final ESIA report.

3.4 WATER REQUIREMENT

Major water requirement during construction phase is limited for civil work and domestic requirement for construction labor. An average 100 nos. of labor shall be required for construction activities with a peak of 400 nos. The water requirement for the construction phase shall be met through Tanker from authorized vendor.

For operation phase, the water requirement will be for domestic as well for cleaning of modules. The water requirement for cleaning of the whole plant is approximately 0.061 m^3/MWh, depending on the option chosen. Module cleaning needs to be carried out periodically (Per module 2 times in one month) to remove dust, bird droppings etc. on the module and enhance the energy generation. The domestic water requirement for operation phase shall be in tune of 36.5 m^3/annum. The generated waste water from site office toilets will be disposed in septic tank followed by soak pit. The water for cleaning purpose of solar PV modules to remove dust from it, is likely to get evaporate or absorbed by the vegetation and soil underneath the solar panels.

The total water requirement for the project is detailed out in Table below.

Table 3-3: Project Water Requirement during Operation Phase

S. No.	Activity	Water Requirement (m^3/MWh)
1	Industrial activity (Solar Module Washing)	0.061
2	Residential / domestic	0.0007
3	Greenbelt development / Environmental maintenance	0.001
Total		**0.0627 (Say 62 Litre/MWh)**

3.5 POWER EVACUATION SYSTEM

The energy generated from solar PV plant will be evacuated at 66kV to the nearest utility substation i.e. 11/66 kV Datewas sub-station. The aerial distance between solar PV power plant and Datewas

utility substation for is approximately 5.5 km. However, a transmission line of about 6.1 km shall be built to connect the project from Datewas Sub-station to avoid the structures in between plant and sub-station. The approach route identified for the transmission line is based on a criterion to reduce the environmental and socioeconomic footprint of the transmission line. The shortest feasible route after considering following factors has been selected for the transmission line:

- Transmission line route does not fall under any habitations and thick vegetation
- No households or community structures are located in the route of the transmission line
- All environmentally sensitive sites, archaeologically significant sites, areas of ecological and cultural significance have been avoided while selecting the route

Right of way shall be taken for laying the transmission line. The approximate land requirement for Tower area will be in tune of 16 to 49 m^2. About 30 nos. of towers are proposed for the complete transmission line. The estimated distance between each tower varies from 70m to 260m based on the angle of tower. Lease / Purchase agreement will have the provision of compensation for temporary restriction on farming / ploughing during erection activities. The draft route map of the transmission line is shown as Figure 3.4.

Figure 3-4: Power Evacuation Map

The proposal for transmission line has already been prepared by competent third party considering the alternatives on technical, environment and social aspects. Further as a part of the norm by State Govt., proposal from Mytrah is in active process for scrutiny and approval by PSTCL, Govt. of Punjab for considering the final transmission route.

After getting the final approval, tower footprint will be finalized by government authorized contractor and accordingly RoW will be considered as per the applicable norms in host country. The details of

approval from statutory body i.e. PSTCL, Govt. of Punjab will be submitted along with ROW documents before commissioning of the plant as additional annexure of existing Final ESIA report.

3.6 WORK-FORCE

Average 100 nos. labors will be employed for site leveling and fencing and will stay in labor camps. Peak labor requirement during the construction phase is estimated to be 400 nos. MAPPL will try to employ locals as per requirement based on their skills and expertise in the construction as well as operational phase.

The operation phase requirement shall be limited to 10 nos. The operation phase requirement is mainly for technician / skilled employees and Security Staff. One or two person shall also be required for module washing work.

3.7 CONSTRUCTION ACTIVITIES

3.7.1 Access Road

The plant will be set-up adjacent to the proposed SH-10 (Jakhal-Budlada Road), which is forming the northern boundary of plant site. Hence, there is no need to create a new access road for the project. Existing road is wide enough to transport construction equipment at site. However, traffic planning will be in place to reduce any congestion on the road.

3.7.2 Site Development

The erection of PV panels will require development of site which will involve soil investigation, site survey, site levelling, construction of internal paths etc. The proposed site is a plain agriculture land; it may not require extensive levelling. No big trees are observed at site. However, some shrubs of Prosopis *Juliflora* (Vilayati Babool) need to be cleared for setting-up the project.

3.7.3 Civil Work

MAPPL will sign EPC contracts with established contractors in this field. The project work shall involve the following activities:

- Erection of Solar PV Panels
- Erection of Inverters and SCADA Facility
- Construction of underground and/or overhead electrical collection lines to connect PV modules to the pooling substation
- Erection of other associated facilities

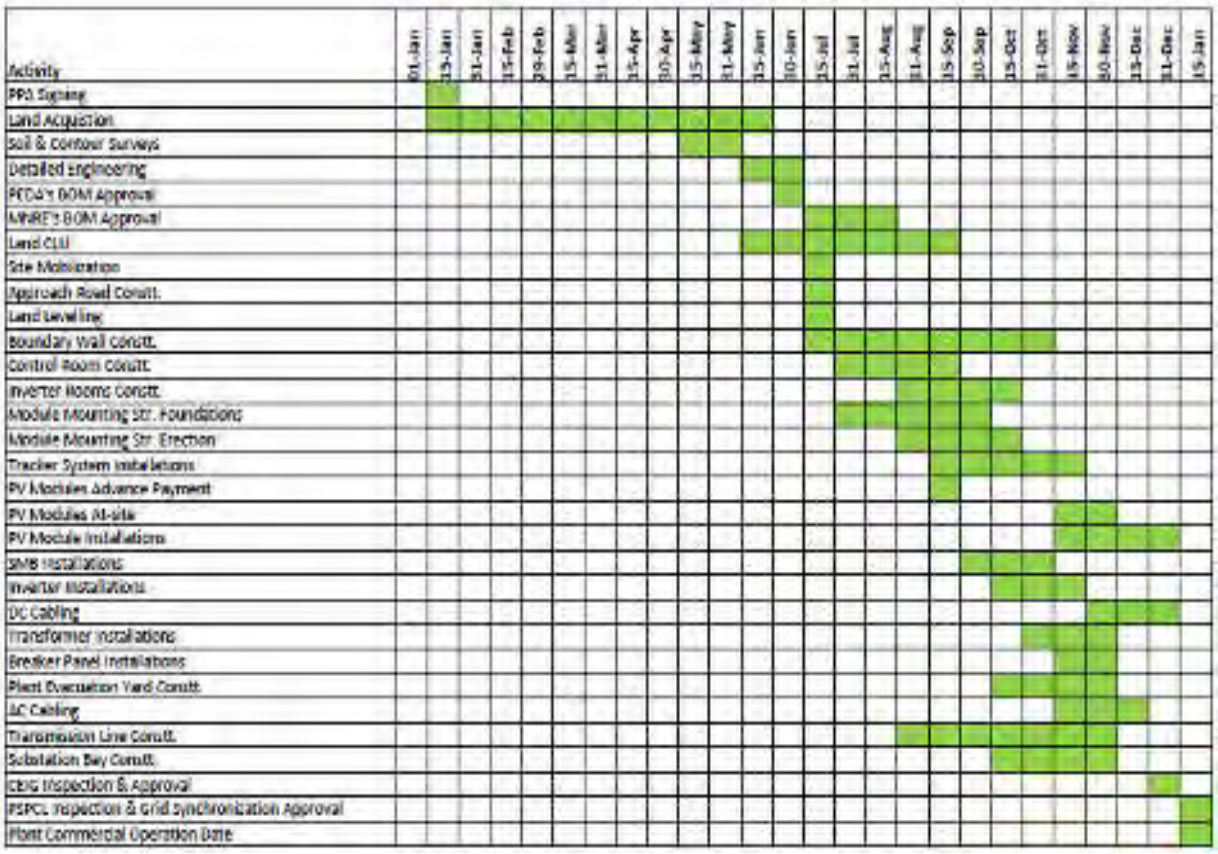
The major civil work involves PV Panel Foundation, erection, switch yard structure and equipment foundations including power transformer and control room cum administration building. Minor works involve security kiosks, collection substation, fencing and internal roads.

Construction of related structures will involve civil and steel work for installation of pooling stations, transformers, substation, and electric cables and signal wires.

3.7.4 Implementation Schedule

The construction and implementation schedule will take almost one complete year from Zero Date. The construction schedule for the proposed plant is shown in Table below.

Table 3-4: Project Implementation Schedule



3.7.5 Construction Waste

The main construction waste expected from the construction activities are packing and crafting material of solar panels, wires, inverters & other accessories, construction debris, defunct PV panels and construction debris. The major construction activities associated with proposed plant are erection and cementing of the base structure for module installation. Waste out material like used oil, empty paint's tin, etc. shall be stored at separate designated place and will be disposed of through approved recycler and dumping facility. As per the rules the hazardous waste generated shall be supplied to an authorized vendor.

3.8 OPERATION ACTIVITIES

Operation of Solar PV Plant require very less amount of Human Resource. The work force requirement for operation phase is required highly skilled expertise. Operation and Maintenance (O&M) facility shall be required for whole electrical system during operation phase. MAPPL will sign a O&M Agreement with established player in the field. MAPPL's EHS policies shall form the part of contract agreement. Mytrah is in process for introducing and implementation ESMS at corporate, strategic and policy level as well as in SPV level for implementation the same at assets level. Proposed Solar PV Power Plant will follow the same directives.

24 hourly onsite monitoring is proposed under the supervision of technically skilled and experienced staff to look after the O&M requirements of the entire Power Plant. There shall be a workshop facility

available at site to take care of regular maintenance requirement of the Power Plant. A tool room with sufficient stock of tools and spares as well as critical components will be maintained at the site.

There will be a remote O&M facility involving the supervisory control and data acquisition (SCADA) system. This system provides two-way communication with each PV Module. A SCADA system allows a central computer system to monitor and control each Module operation.

The typical maintenance and repair activity during operation phase involves preventive and breakdown maintenance of PV Module and/or the related equipment in accordance with the safety management plans and procedures as applicable and/or in accordance with accepted industry practices.

3.8.1 Preventive Maintenance

The O&M team will operate the solar facility in accordance with an Operations and Maintenance Agreement which shall provide for, at a minimum, the following services:

- Performing routine and non-routine maintenance on the solar facility during and after the EPC warranty period;
- Cleaning of Solar Modules;
- Operating the solar facility;
- Providing all materials and services necessary for solar facility maintenance;
- Monitoring the operations of the Project via the computer monitoring system;
- Performing all duties to the standard mandated by the PPA;
- Complying with all regulatory obligations;
- Developing operating and safety plans;

Solar photovoltaic systems are highly reliable and require minimal maintenance. Several maintenance activities need to be completed at regular intervals during the lifetime of the system. In order to maintain a solar PV plant there are a number of requirements which are discussed below.

The energy yield of the plant will be monitored using the remote data acquisition system connected to each inverter. Significant reduction in energy yield will trigger specific maintenance requirements, such as inverter servicing or module replacement. In addition to this, on-going maintenance of the plant may be required.

Typical activities are as described below.

Modules Maintenance: Visual inspection and replacement of damaged modules will be required. Cleaning of the module glass surface during long dry periods may be considered.

The water requirement for cleaning of modules is an important aspect to be kept in view. The water requirement for cleaning of the whole plant (84680 modules) is approximately 0.061 m^3/MWh, depending on the option chosen. Module cleaning needs to be carried out periodically (Per module 2 times in one month) to remove dust, bird droppings etc. on the module and enhance the energy generation. Along with the module cleaning, for the construction of various structures (like IR, MCR Rooms, Pile Foundation etc.) in the plant, water is required.

General maintenance: Vegetation will need to be cut back if it starts to cause a fire risk or introduce shading.

Module support structure: Frequent visual inspection for general integrity of the structure, corrosion, damage and fatigue. All frame connections should be checked for deflections or tears at the module and cross beams to assess the need for replacement.

Wiring and junction boxes: Visual inspection for corrosion, damage such as chafing, and damage by rodents and birds, and for overheating of cables and connections. This requires the skills of an electrical technician.

Inverters: Inverter maintenance requires the skills of an electrical technician. It involves: visual inspection of the fans, tightening leads and cleaning using a vacuum cleaner or brush.

3.8.2 Breakdown Maintenance

Breakdowns can occur due to lack of routine or preventive maintenance, bad climatic conditions, disturbance in utility grid etc. As breakdowns affect energy generation and hence revenue generation, these kinds of faults need to be immediately corrected. Breakdowns can occur at any part of the system between solar PV modules to substation end. Staff should take care of routine or preventive maintenance at those parts of the system where chances of occurrence of breakdown are more.

3.8.3 Predictive Maintenance

This is undertaken with the help of FLIR camera, which identifies hot spots in solar modules and other electrical appliances. The pictures from the FLIR camera indicate components and fitments which are hotter than the surrounding fitments, clearly implying that the 'hotter' component is under electrical stress. A quick analysis of the feeding and off taking sub systems would help in preventing a breakdown in the coming future.

3.9 TECHNOLOGY

3.9.1 Module Technology

PV modules are selected based on the integration of modules, voltage and current rating with the inverter voltage and current rating. The modules are selected to match the desired operating voltage level through parallel and series combinations.

Poly-Crystalline Silicon modules have higher commercial efficiencies than thin-film technology. This allows for lesser area requirement for accommodating a similar DC capacity. Land in the state of Punjab is expensive. Also, Poly-crystalline silicon technology enjoys over 85% of market share globally with the technology being field proven and most bankable. This has governed the choice of Poly-crystalline silicon technology over thin-film technology for this project.

3.9.2 Module Mounting System

The Sun's intensity is at its maximum on a PV module when it is striking it perpendicularly-the incident angle is 0^{o}. The mounting structure plays an important role in supporting and securing the module. It also deals with the module alignment with the sun at a particular angle at a certain time to maximize the solar power generation.

Mainly there are two modes of installation:

- Fixed installation Technology
- Installation with Sun tracking Technology

The structure must remain stable throughout the lifetime of the project. Aspects to be considered while designing and engineering a structural support system are -

- Wind, snow and seismic loading
- Dynamic resonance in response to wind excitation
- Soil properties and foundation design details
- Corrosion of the structures both subsurface and atmospheric
- Earth grounding (bonding) of the structure

The dominant factor affecting the design and cost of PV support structures is the loading due to wind. The force of the wind must be resisted by the glass of the PV modules, the module clamps, the structural members of the support system, the bolted connections, and the foundations. Each element of the support structure must be sufficient to withstand the maximum loading from the wind, combined with and other sources of loading, which may be expected over the lifetime of the project.

The type of mounting structure has been selected based on the energy generation analysis. The objective of the project is to set up power plants with maximum energy generation.

On comparing energy generation values with fixed and tracker mounting it was found that tracker based systems were providing higher energy. Considering all the parameters for tracker like land availability, maintenance requirement, required capital cost and generation over the life of the project it is inferred that tracker based mounting will be a good choice for the project. For this particular site we are using Horizontal axis tracking system.

Horizontal axis trackers are constructed of a framework of structural members mounted in bearings which are aligned in rows in the North-South direction. Each row of the structural framework can be rotated in the bearings such that the PV modules may be tilted in a typical range from 45^{o} facing east to 45^{o} facing west. There are several methods used to drive the tilting action of horizontal axis trackers with the most common being an electromechanical screw jack type actuator. Controllers for the tracker actuators are programmed in accordance with the exact position of the tracker and the time of day in order to follow the calculated position of the Sun.

Tracking also produces a smoother power output. This helps meet peak demand in afternoons, which is common in hot climates due to the use of air conditioning units. Single-axis tracking systems require a larger area for installation with Ground Coverage Ratio (GCR) varying between 30% and a high of about 50%. This may result in variation in cost of Balance of System.

3.9.3 Module Tilt Angle

The angle between the horizontal plane and the solar panel is called the tilt angle. The tilt angle of a photovoltaic (PV) array affects the amount of incident solar radiation exposed on the array.

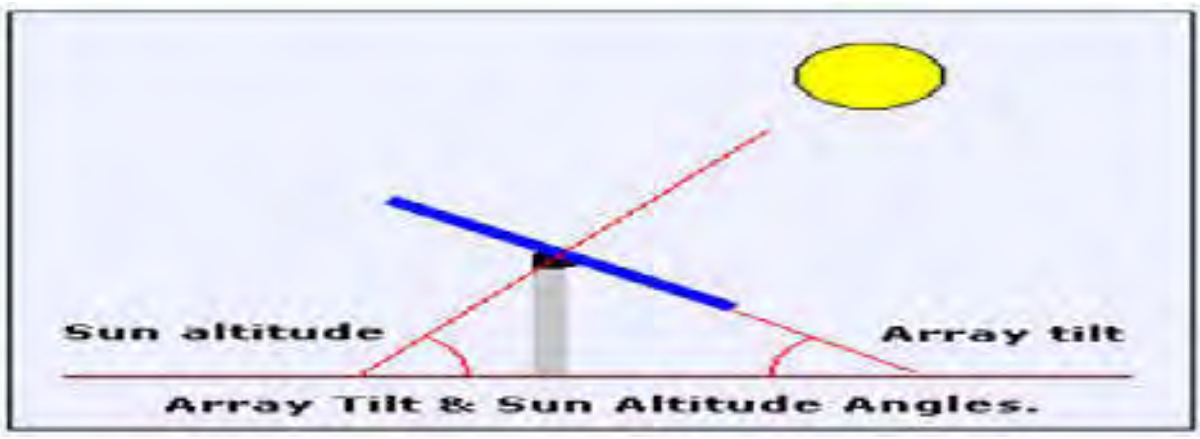


Figure 3-5: Array Tilt Angle

Due to the motion of the earth round the Sun there are also seasonal variations. In winter, the Sun will not reach the same angle as in summer. Ideally, in summer, solar modules should be placed more horizontally, to benefit most from the sun high in the sky. However, these modules will then not be placed optimally for the winter sun. To achieve an optimum year-round performance, solar modules should be installed at a fixed angle, which lies somewhere between the optimum angle for summer and for winter. For each site there is an optimum tilt angle. Solar modules, located at the equator, may be placed horizontally. Tilting the module on the tracking structure will result in good energy generation values. For the 25MW plant at Bareta Village, Mansa District, the optimum tilt angle has been computed to be 6° (modules facing true south) on the tracker axis.

3.9.4 Inverter Technology

Micro inverter and string inverters call for installation complexity with increase in number of cable terminations and additional components like AC combiner boxes. The numbers of inverters required are also large thereby increasing project cost.

On the other hand, Central inverters have efficiencies in the range of 98.5%, require less terminations and voltage is stepped up to intermediate voltage directly impacting the cost. Hence for this project we have used central inverters.

Governing Standards: Inverter should conform to IEC 61683 and UL standards for safety.

For design and calculation purposes, a 1000kW ABB inverter has been selected. This gives an insight into energy generation possibilities and consequent revenue generation. These are three phase inverter with compact enclosures and protection level suitable for indoor use. The company will choose inverter supplier like ABB or equivalent manufactures.

3.9.5 Transformer

Each Inverter transformer will be 3 phase, 50Hz, 4MVA. There will be 6 transformers of 4MVA capacities and 1 transformer of 1MVA to step up inverter voltage level from 400V to 11kV for 2X26.25 MWp plant. There will a power transformer in the Switchyard section each of 3-phase, 50 Hz, 11/66kV 25MVA, ONAN. The Impedance, bushing rating, HV/LV termination and neutral earthing will also meet the system requirement and will also be in line with applicable standards. Suitable bushing CTs will be provided to meet the system protection requirement. Transformer will be in accordance to IS: 2026.

3.10 CLIMATE CHANGE ASSESSMENT

3.10.1 Effects of the Environment on the Project

This section considers the potential effects of environmental (climatic) conditions on the Project. The respective climate events and conditions are discussed below and the potential effects are discussed, along with a brief assessment of the potential impact and measures to minimize or mitigate the risk. At the end, the beneficial effects of the Project in addressing climate change are briefly summarized. The Project is engineered and designed to integrate into its environmental surroundings and operate safely and reliably over the lifetime of the Project.

Solar photovoltaic panels have an operating lifetime of 25 and more years and photovoltaic systems are vulnerable to flood, wind and extreme temperatures (Patt et al. 2010). Solar cell output is rated at 25°C with output decreasing by about 0.39% for each temperature rise of 1°C. Cell temperatures for roof-mounted arrays in warm climates can easily reach 50°C–75°C. The module structure foundations will be designed to the current standards related to potential storm, and the risk is expected to be minimal based on the competent ground conditions and the modest potential for storm in the north Indian Region. The Project is located away from any major surface water body, therefore no flood hazard has been expected.

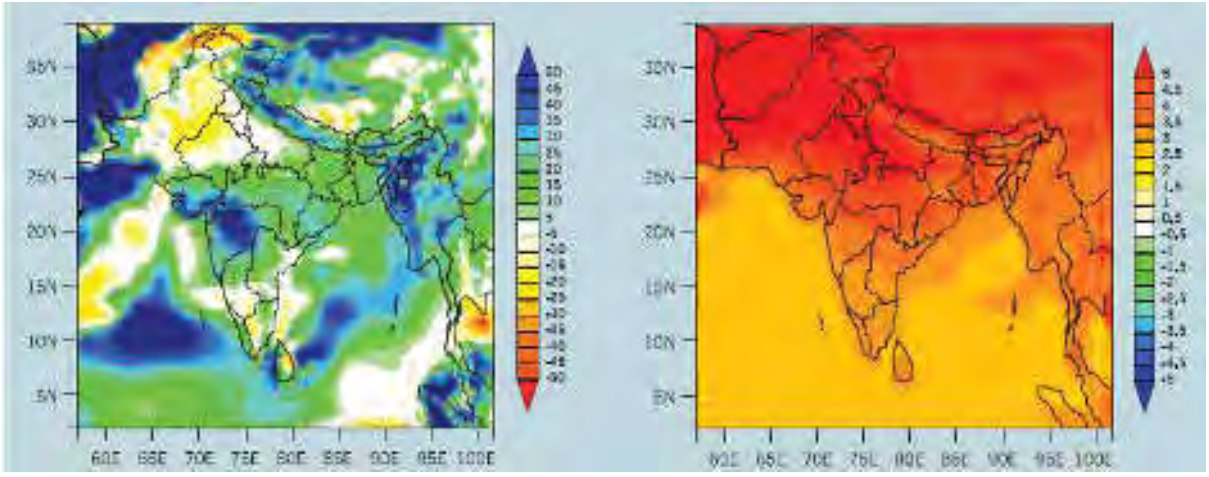
3.10.2 Climate Change Prediction

Climate change is predicted to impact India's natural resource base, including water resources, forestry and agriculture, through changes in precipitation, temperatures, monsoon timings, and extreme events. The Indian Institute of Tropical Meteorology (IITM) in collaboration with the Hadley Centre for Climate Prediction and Research, UK carried out an analysis of climate change scenarios for India. IITM used the Hadley Centre Regional Climate Models (RCMs) for the Indian subcontinent to model the potential impacts of climate change. Two different socioeconomic scenarios were incorporated into the model, both characterized by regionally focused development but with priority to economic issues in one (referred to as A2) and to environmental issues in the other (referred to as B2).

The RCMs have shown significant improvements over the global models in depicting the surface climate over the Indian region, enabling the development of climate change scenarios with substantially more regional detail. This project has generated high-resolution climate change scenarios not only for different states of India, but also for other South Asian nations. Some of the major results of this project are:

- Model simulations under scenarios of increasing greenhouse gas concentrations and sulphate aerosols indicate marked increase in both rainfall and temperature over India into the 21st century.
- The change in rainfall under the B2 scenario is relatively less than that under the A2 scenario.
- There are substantial spatial differences in the projected rain fall changes. The maximum expected increases in rainfall (10 to 30%) occur over central India.
- There is no clear evidence of any substantial change in the year-to-year variability of rainfall over the next century.

- Surface air temperature shows comparable increasing trends in A2 as well as B2 scenarios. The temperatures are projected to increase by as much as 3 to 4°C towards the end of the 21st century.
- The warming is widespread over the country, and relatively more pronounced over northern parts of India.



Spatial patterns of the changes in (a) summer monsoon rainfall (%) and (b) annual mean surface air temperature (°C) for the period 2071-2100 with reference to the baseline of 1961-1990, under the A2 scenario.

Above graphic presents that rainfall is expected to decrease by 5% and temperature is likely to increase in the tune 4-5^{o}C in the project region.

3.10.3 Futuristic Climate Change Effect

Climate change will make monsoons unpredictable. As a result, rain-fed wheat cultivation in South Asia will suffer in a big way. Total cereal production will go down. The crop yield per hectare will be hit badly, causing food insecurity and loss of livelihood. The rising levels of the sea in the coastal areas will damage nursery areas for fisheries, causing coastal erosion and flooding.

The Arctic regions, Sub-Saharan Africa, small islands and Asian mega deltas, including the Ganga and Brahmaputra, will be affected most.

Changes in climate around the globe are expected to trigger a steep fall in the production of cereals, Total agricultural land will shrink and the available land may not remain suitable for the present crops for too long. Farmers have to explore options of changing crops suitable to weather. He also pointed out that climatic changes could lead to major food security issues for a country like India.

India needs to sustain an 8 to 10 per cent economic growth rate, over the next 25 years, if it is to eradicate poverty and meet its human development goals, according to a 2006 report on an integrated energy policy prepared by an expert committee of the Planning Commission. Consequently, the country needed at the very least to increase its primary energy supply three or four-fold over the 2003-04 level.

As stated above Solar cell output is usually rated at 25°C with output typically decreasing by about 0.39% for each temperature rise of 1°C. Therefore, a reduction of 1.56 – 1.95% in output of solar cells

is expected due to climate change as presented in section above. However, panels are placed in such way to get free wind flow on the back of the modules to reduce the impact of temperature.

3.10.4 GHG Emission Reduction

The comparison of the GHGs emission caused by solar power plant with the GHGs emission that would have been caused by fossil fuel burned to make the same amount of electricity has been made. Thus the purpose of the project activity is to generate power from zero emissions Solar PV based power project and thereby reduce the emissions associated with the grid. The project activity will export the Electricity to northern grid. The electricity generated by the plant will be monitored through energy meters connected to switchyard at project site. The calculation of the total GHGs emission reduction as 40871 tCO_2e/year. The technology of electricity generation from Solar PV Plant is environment friendly as it does not use any fossil fuel. It thereby reduces the greenhouse gas emissions associated with fossil fuel based electricity generation system. The availability and reliability of solar power depend largely on current and future climate conditions, which may vary in the context of climate change.

3.10.5 Conclusion

The Intergovernmental Panel on Climate Change (IPCC) Assessment Report (http://www.ipcc.ch/) concluded that climate changes are already occurring at a measurable scale and include warmer temperatures, increases in sea levels (from melting of snow and ice), and an increased frequency of extreme weather events. Most PV mounting structures are designed to withstand occasional extreme wind and temperatures and any long term changes to wind patterns and temperature averages, potentially resulting from climate change, are not expected to adversely affect the Project. It is considered to install more robust structures, tracking motors, and mountings for the project to avoid any thunderstorm calamity. The mounting structure is design to withheld in a maximum wind speed of 47m/s. Lightning arresters are provided for avoiding direct lightning and surge protection devices are incorporated in electrical installations to protect from surges. During the time of high wind conditions, the panels will move to the stow position (180^o position).

4 DESCRIPTION OF ENVIRONMENT AND SOCIAL BASELINE

Baseline data generation forms an integral part of the ESIA study and helps to evaluate the predicted impacts on the various environmental and social attributes in the study area by using scientifically developed and widely accepted environmental and social impact assessment methodologies. Baseline data is also required in preparing an Environmental Social Management Plan (ESMP) outlining the measures for improving the environment quality and scope of future expansions for environmentally sustainable development.

4.1 STUDY AREA, PERIOD AND METHODOLOGY

Area of 10 km radius from the project site has been considered as study area for the project. The consultant team was conducted site study in the month of May, 2016. The consultant undertook a reconnaissance survey of the proposed site and surroundings in order to understand the environmental and social setting of the proposed solar power project. The reconnaissance survey was followed by primary baseline data generation for environment and social aspects of the study area.

Primary environment monitoring and secondary data collection was undertaken as per process Tabulated below.

Table 4-1: Attributes of Environment Data

S. No.	Attributes	Parameters	Source and Frequency
1.	Ambient Air Quality	PM10, PM2.5, SO_2, NO_X and CO	Two sample per week at Three (3) locations for one week
2.	Meteorology	Wind speed and direction, temperature, relative humidity and rainfall	From secondary sources of IMD station, Bhatinda
3.	Water quality	Physical, Chemical and Bacteriological parameters	Grab samples were collected at 1 ground water and 1 surface water locations once during study period.
4.	Ecology	Existing terrestrial and aquatic flora and fauna within 10-Km radius circle.	Primary inventory through site survey and secondary data from forest office
5.	Noise levels	Noise levels in dB(A)	Two sample per week at Two (2) locations for one week
6.	Soil Characteristics	Physical and Chemical parameters	Once at 1 locations during study period
7.	Land use	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery
8.	Socio-Economic aspects	Socio-economic and demographic characteristics, worker characteristics	Primary consultation & survey and secondary sources data like primary census abstracts of Census of India 2011

S. No.	Attributes	Parameters	Source and Frequency
9.	Hydrology	Drainage area and pattern, nature of streams, aquifer characteristics, recharge and discharge areas	Based on primary geo-technical investigation and data collected from secondary sources

4.2 PHYSICAL ENVIRONMENT

4.2.1 Land use

4.2.1.1 Project Site

The project site is primarily agriculture land with patches of scrub waste land. SH-10 form the Northern boundary of the project site, whereas, waste water nallah is creating South-Eastern Boundary of the site. Site is devoid of any forest area, habitation, water-bodies, historical place, etc. Also no protected areas like National Park, Wildlife Sanctuary or Bio-sphere Reserve is within 10 km radius from the project site. Bir Aishvan Wildlife Sanctuary is the nearest notified ecologically notified area. The distance of Bir Aishwan from project site is about 44km. One transmission line was found passing through the project site. Snaps of project site are shown in Figure 4.1 below.

Figure 4-1: Project Site

4.2.1.2 Study Area

As discussed above, area of 10 km radius from the project site has been considered as study area for the project. Agriculture activity is the dominant feature of the study area followed by settlements / built-up areas. Both together covers approximately 98.5% of total study area. No natural surface water body except some ponds is observed in the study area. Canal are the major source of irrigation in this area. However, some peoples also use ground water for irrigation purpose. The graphical presentation of land use break-up in study area is shown as Figure 4.2 and land use for study area is presented under Figure 4.3.

Table 4-2: Land use / Land Cover Break-up

S. No.	Land use Type	Area (ha)	Area (%)
1.	Built-up (Settlement and other structures)	2132.5	5.88
2.	Barren / Uncultivable / Wastelands	333.0	0.92
3.	Wetlands / Waterbodies	205.7	0.57
4.	Agriculture	33610.9	92.60
5.	Forest	10.5	0.03
Total		**36292.5**	**100.00**

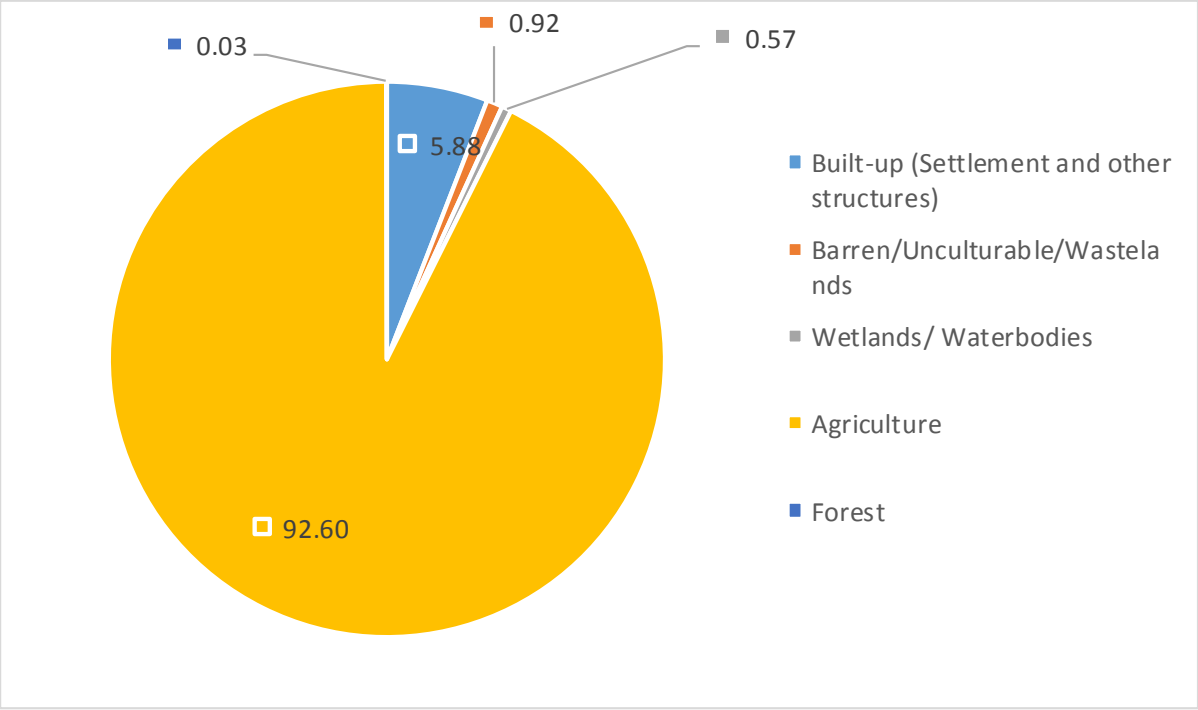


Figure 4-2: Land use / Land Cover Break-up of the Study Area

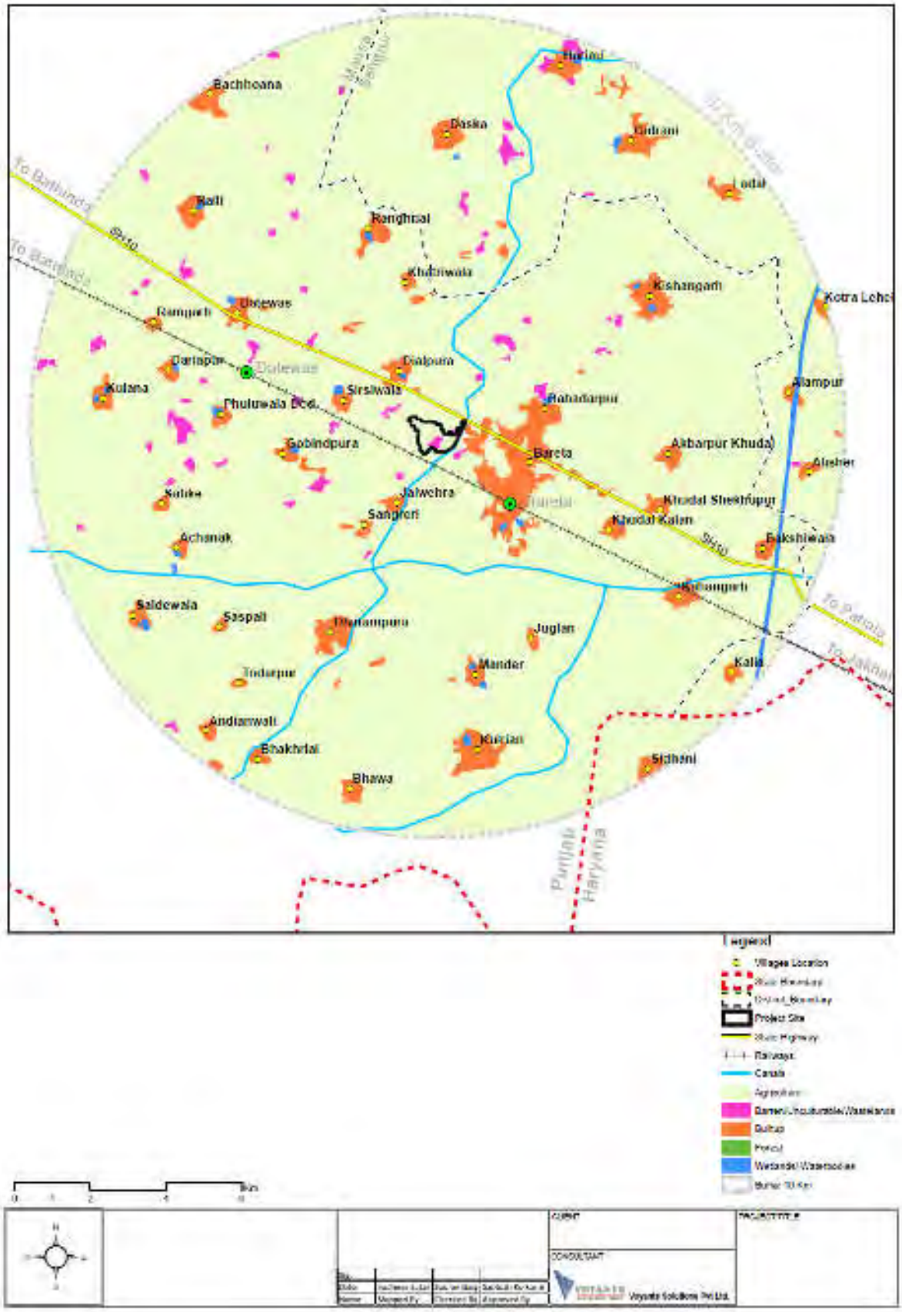


Figure 4-3: Land use / Land Cover of the Study Area

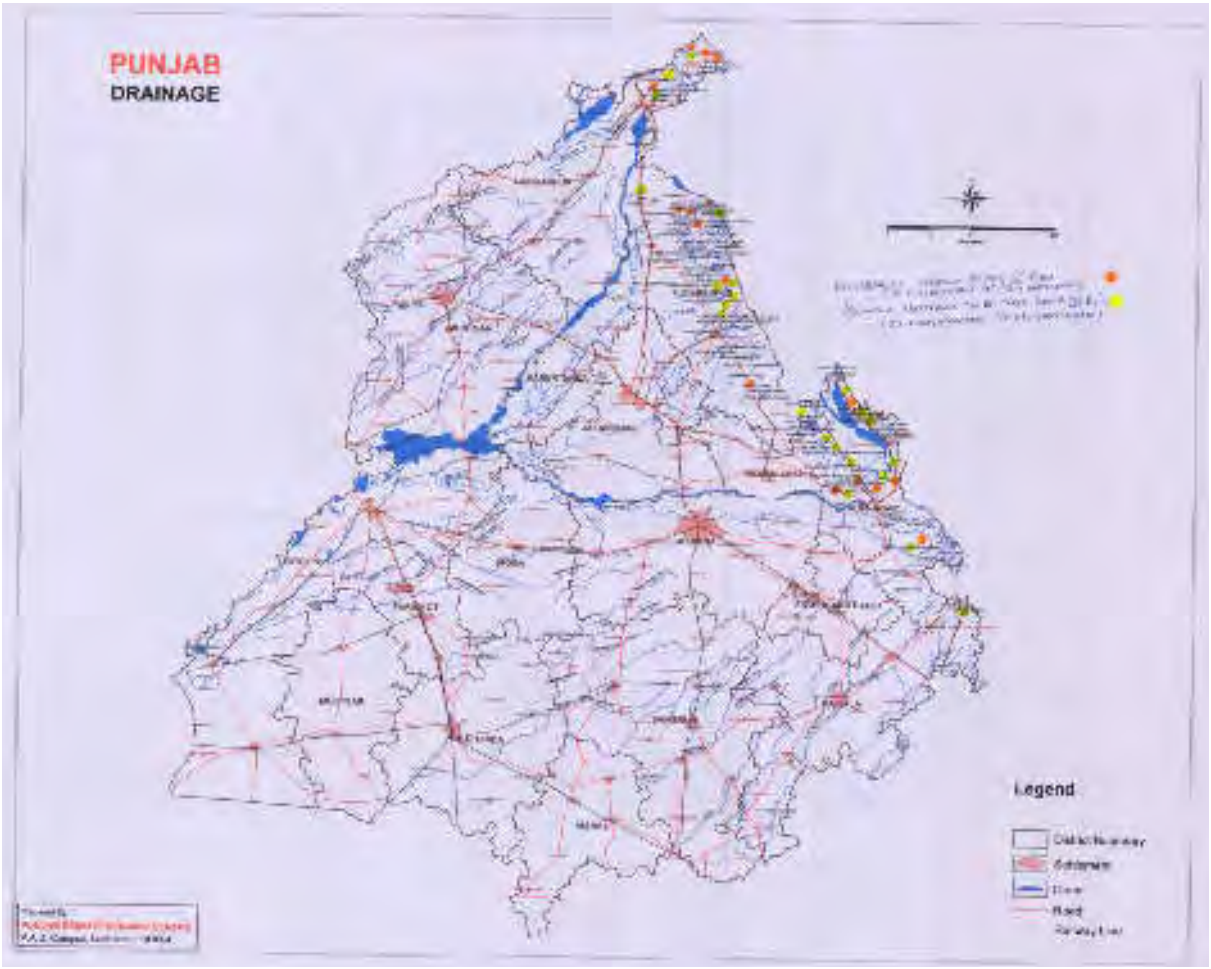
4.2.2 Topography and Drainage

Project site is flat land parcel with minor leveling requirement. The elevation of the site varies from 219m to 223m above msl. The study area is mainly irrigated by network of canal system. No natural prominent drainage system in and around the project site was observed. However, few ponds are the part of study area.

The Satluj, Beas and Ravi rivers form the main drainage system in the state of Punjab. The other main drainage channels in Punjab are Ghahhar river, White Bein, Black Bein, Kiran nala, Chakki River and Sakki Nala. In addition to these major drainage channels, these are numerous choes (seasonal rivulets), originating in the Siwalik hills and drain the Kandi area. The natural gradient of the drainage channels is generally from north-east to south-west direction. In areas, where natural drainage is lacking, artificial drains have been dug up for the disposal of storm water and seepage from waterlogged areas in the state.

In Punjab, out of the total irrigated area, 29 percent is irrigated by canals and remaining 71 percent by tubewells. There are six major canals system viz. Upper Bari Doab, Sirhind, Bikaner, Rajasthan, Bist Doab and Bhakra. Only Upper Bari Doab Canal is taking off from river Ravi and the other five canals from river Satluj. The drainage map of the Punjab State is shown as Figure 4.4 below.

Figure 4-4: Drainage Basin Map of Punjab State



4.2.3 Geomorphology and Geology

The area falls under the Indo-Gangetic alluvial plains. The geological formations met within the district comprise Alluvium of Quaternary age. It consists of alternating beds of sand, silt and clay. In the southwestern part, the alluvium is overlain by thin layer un-stratified loam.

The district mainly represents a flat alluvial plains interrupted by sand dunes in southwestern part. There is no perennial river in the district. The area is mainly irrigated by the network of canals. The area of Punjab can be divided into three regions which are the following:

Malwa is a region of Punjab and parts of Haryana between the Sutlej and Yamuna rivers. People of Malwa are known for being great fighters, and warriors. The Malwa area makes up majority of the Punjab region consisting 11 districts. Cities such as Ludhiana, Patiala, Bhatinda and Mohali located in the Malwa region.

Majha is a historical region of the Indian Punjab comprising the modern districts of Amritsar, Gurdaspur and Tarn Taran. It lies between two of the five great rivers of the Punjab: the Ravi and the Sutlej.

Doaba is the region of Indian Punjab surrounded by the rivers Beas and Sutlej. The name "Doaba" literally translates to "land of two rivers" ("Do" two, "Ab" river; Punjabi). It is one of the most fertile regions of the world, and was the centre of the Green Revolution in India. To this day, it remains one of the largest per capita producers of wheat in the world. The biggest cities in Doaba are Jalandhar, Hoshiarpur, Adampur, Nawansher and Phagwara.

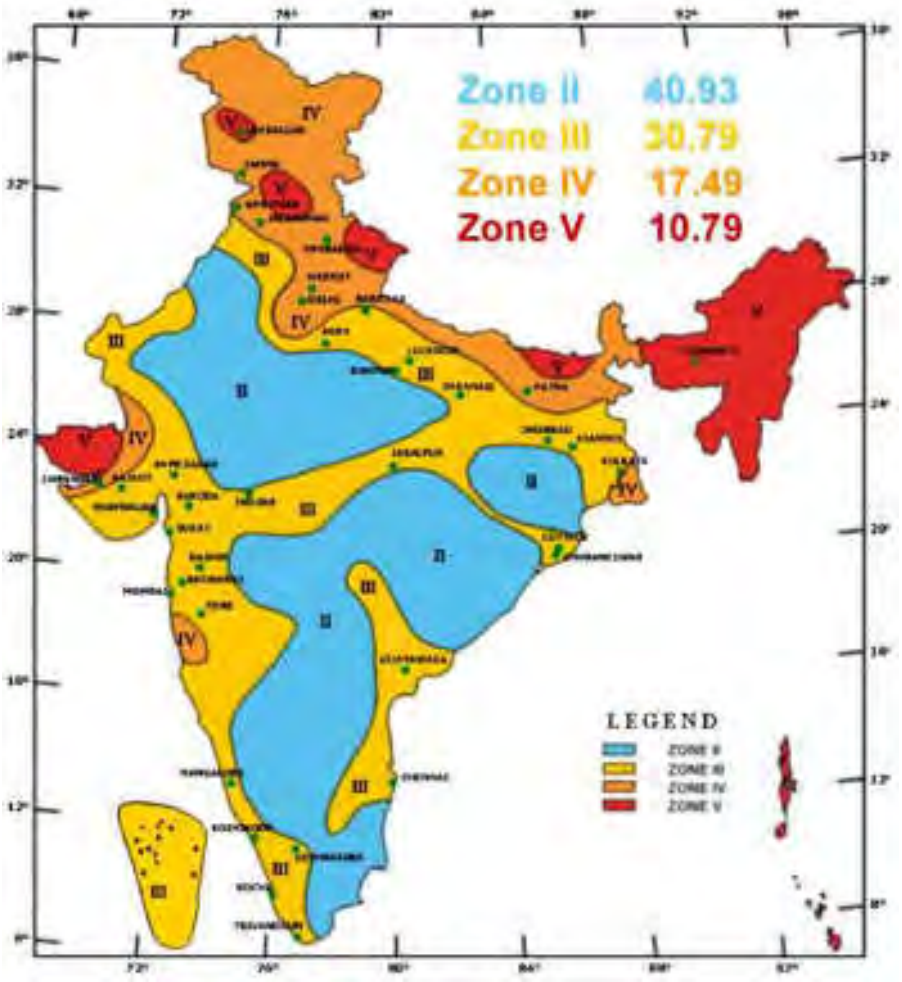
4.2.4 Hydrogeology

In reference to Mansa District Ground Water Brochure prepared by Central Ground Water Board, North Western Region, Chandigarh during 2012-2013, The pre monsoon depth to water level ranges from 5.56 to 15.01 m bgl, and post monsoon value ranges from 2.18 to 10.33 m bgl. In most of the area depth to water level occurs within 10m bgl. Primary geo-technical survey as undertaken in the month of March, 2016 presents that no water was found till 6m bgl. The area experiences a rise in water level from pre-monsoon to post monsoon periods due to recharge from rainfall occurred in the area. The long-term water level fluctuation over the past shows the rising trend in the northeastern part up to 5m. The rise in water table is due to less withdrawal of ground water owing to its bad quality and / or the intensive irrigation by network of canals. The decline in water level at few places may be attributed to withdrawal of ground water due to its fresh and marginal quality and / or non-availability of canal water to meet the requirement for agricultural purposes. The water table elevation ranges from 210 m to 217 m above mean sea level. The general ground water flow is from northeast to southwest direction. The yield of the shallow tube wells varies from 870 to 3000 litres per minute for 4 to 13m drawdown. The long-term trend of water level ranges in the district from 0.14 (Burj Bhalaike) to 0.82m/yr (Rar).

4.2.5 Seismicity

As per seismic zoning map of India, project district falls under Seismic Zone III, which is a moderate risk zone. Efforts will be made to design the structure according to intensity of the zone. Provision of IS 875 and IS 1893 will be followed for designing of structure. The seismic zoning map of India is shown in Figure 4.5.

Figure 4-5: Seismicity Map of India



4.3 SOIL CHARACTERISTICS

4.3.1 Samples and Methodology

Assessment of soil quality is an important aspect with reference to tree plantations, percolation of water, ground-water impact, etc. Two soil samples were collected to assess the soil characteristics and fertility potential of study area. The samples were collected by ramming a core-cutter into the soil up to 90-cm depth. Two locations were selected for soil sampling on the basis of soil types, vegetative cover etc., which would accord an overall idea of the soil characteristics near project site. Soil samples were collected from three different depths viz. 30 cm, 60 cm and 90 cm below the surface and homogenized. The homogenized samples were analyzed for physical and chemical characteristics. The sealed samples were sent to laboratory for analysis. The locations of the monitoring sites are depicted in Table below and shown in Figure 4.6.

Table 4-3: Soil Sampling Locations

S. No.	Village	Direction	Station	Selection Criteria
1	Bareta (Project Site)	-	N1	Project Site
2	Dayalpura Village	North	N2	Nearby Settlement

Source: Sampling done by Noida Testing Laboratory, Noida

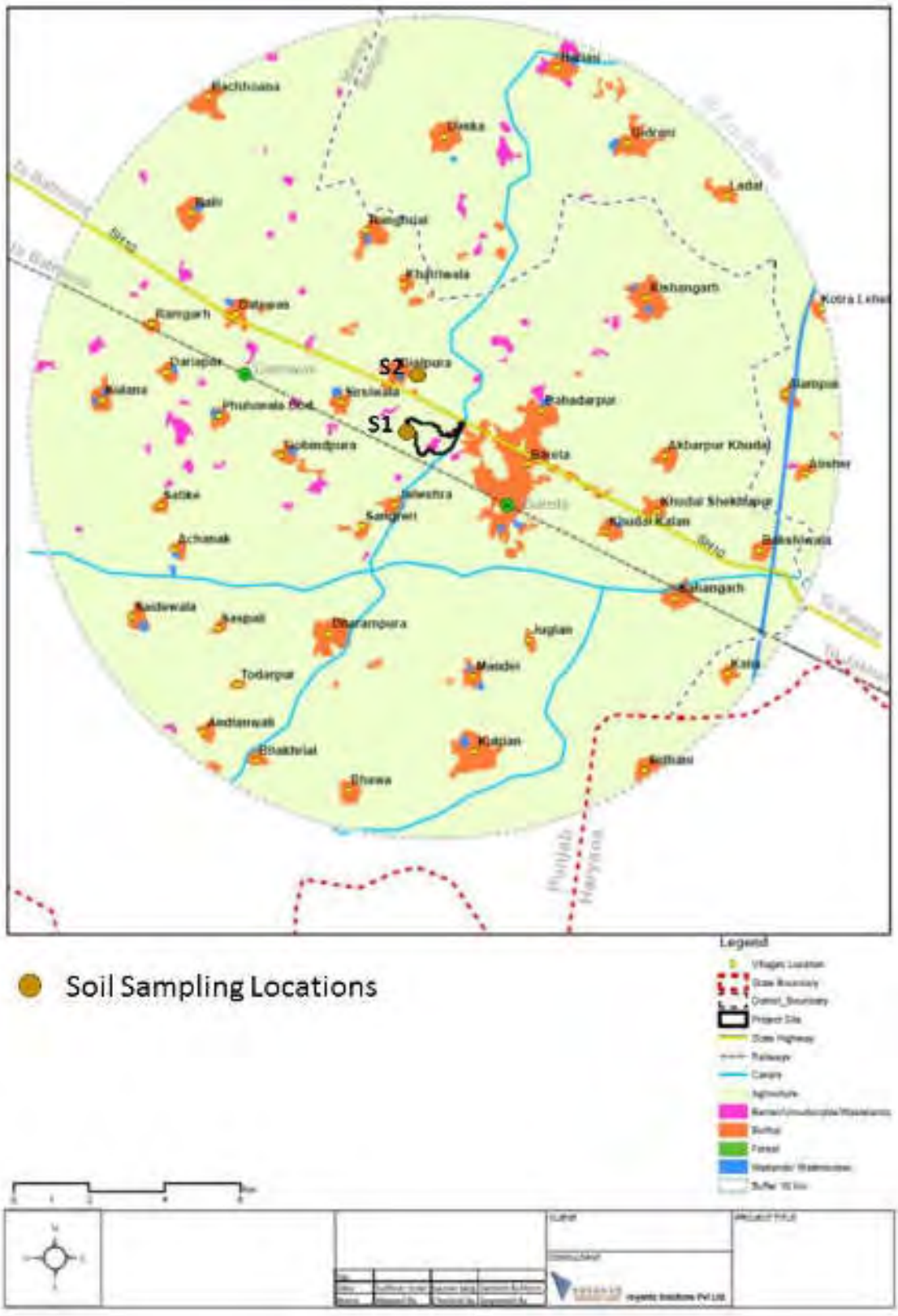


Figure 4-6: Soil Sampling Locations

4.3.2 Analysis Results

The physical and chemical characteristics of the soil of the study area have been assessed by analyzing various parameters as per the methods described in "Soil Chemical Analysis" (M.L Jackson) and Department of Agriculture and Cooperation. The Physico-chemical characteristics of the soils are presented in Table below.

Table 4-4: Soil Characteristics

S. No.	PARAMETERES	UNIT	S 1 (Bareta Village)	S 2 (Dayalpura)
1	Texture	-		
	Sand	%	32.50	30.80
	Silt	%	10.40	8.80
	Clay	%	57.10	60.40
2	pH (10% Slurry)	-	6.95	7.08
3	Conductivity	µmhos/cm	526	487
4	Moisture	%	4.25	4.58
5	Organic Matter	%	0.38	0.33
6	Bulk density	gram/cc	1.24	1.22
7	Porosity	% v/v	24.50	22.80
8	S.A.R	meq/kg	4.60	4.20
9	Infiltration capacity	mm/h	18.20	17.30
10	Carbonates	mg/kg	0.62	0.50
11	Sodium as Na	mg/kg	368.20	426.30
12	Potassium as K	%	143.65	187.50
13	Phosphorus as P	%	12.56	14.65
14	Chloride as Cl	mg/kg	87.50	78.59
15	Zinc as Zn	mg/kg	4.80	5.68
16	Copper as Cu	mg/kg	0.62	0.47
17	Iron as Fe	mg/kg	0.48	0.39
18	Nitrogen as N	%	0.05	0.04
19	Sulphate as SO4	mg/kg	14.50	17.85
20	Boron as B	mg/kg	0.07	0.06

Source: Sampling and Analysis done by Noida Testing Laboratory, Noida

Clay loam was found the major soil formation in the study area. pH value of 6.95 to 7.08 presents neutrality of the soil. Nutrient exchanges between organic matter, water and soil are essential to soil fertility. Percentage of organic matter was found varying from 0.33 to 0.38%. NPK value suggest that soil is moderate in terms of fertility potential.

As per Research Paper Published by Anupam Khajuria, Tokyo Institute of Technology, Tokyo, Japan 'Impact of Nitrate Consumption: Case Study of Punjab, India', In recent years a drop in productivity

has been observed mainly due to falling fertility of the soil, due to excessive use of fertilizers and pesticides over the years.

4.4 CLIMATE AND AMBIENT AIR QUALITY

4.4.1 Climatology

The climate in the area is typical semi-arid type with distinct wet and dry seasons. The normal average annual rainfall of the district is 444 mm (Bhatinda IMD Station). The rainfall occurs due to southwest monsoon which sets in the last week of June and withdraws towards end of September. The climate of Mansa district is classified as subtropical steppe, semi-arid and hot which is mainly dry except in rainy months and characterized by intensely hot summer and cold winter. During three months of monsoon season from July to September the district experiences high humidity, cloudiness and good monsoon rainfall.

The period from October to November Constitutes post monsoon season. The cold weather season prevails from December to February followed by hot weather season or Pre monsoon season which ends up to the last week of June. The normal annual rainfall of Mansa District is 444 mm (Bhatinda IMD Station) in 27 days which is unevenly distributed over the district. The southwest monsoon sets in last week of June and withdraws towards end of September and contributes about 77% of annual rainfall. July and August are rainiest month. Rest 23% of the annual rainfall occurs during Non-monsoon months of the year in the district increases from southwest to northeast.

4.4.2 Long term Climate Scenario

Long term climate data from 1981-2000 was collected from Nearest IMD station i.e. Bhatinda. The aerial distance of Bhatinda to the Project site is approximately 70 km. The wind-direction data was taken from Hissar IMD in absence of direction data at Bhatinda IMD Station as both the stations share common geography and equi-distant from the project site. The summary of long term meteorological data as collected are presented in Table below.

Table 4-5: Long-term Meteorological Data, IMD Bhatinda

Month	Temperature (°C)		Wind		Humidity (%)		Average Rainfall (mm)
	Monthly Max	Monthly Min	Pre-dominant Direction (Angle)	Speed (kmph)	Morning	Evening	
Jan	24.1	1.3	NW & N	2.2	73	47	15.6
Feb	27.8	2.3	NW & N	3.1	68	48	20.4
Mar	34.3	6.8	NW & N	3.5	62	41	16.4
Apr	41.6	13.9	NW & N	4.3	45	29	7.0
May	44.5	17.6	W & NW	4.4	43	28	15.0
June	46.2	21.2	W & NW	5.3	52	35	46.1
July	41.9	21.2	E & W	5.0	72	59	148.0
Aug	38.5	21.6	E & W	3.7	76	66	121.9
Sep	38.4	18.5	W & E	3.1	66	51	27.6
Oct	36.8	11.4	N & NE	2.0	59	44	6.2
Nov	32.6	6.0	N, W & NW	1.7	64	45	14.2

Month	Temperature (°C)		Wind		Humidity (%)		Average Rainfall (mm)
	Monthly Max	Monthly Min	Pre-dominant Direction (Angle)	Speed (kmph)	Morning	Evening	
Dec	26.6	1.8	NW and W	1.7	72	48	5.5
Average	36.1	12.0	NW & N	3.3	62.7	45.1	443.8

Source: Climatological Tables 1981-2000, Indian Meteorological Dept., Govt. of India

The maximum average temperature was recorded in the month of June at 46.2°C and the minimum average temperature was 1.3°C in January. The Relative Humidity was maximum during the monsoon season with the month of August recording the highest average at 76%.

The average wind speed in the region is low with an annual average of 3.3 kmph. The maximum average wind speed in observed in the month of June. The annual predominant wind direction recorded at the IMD station was from North-West followed by North. The annual average wind-rose diagram as sketched for the IMD Station is shown as **Figure 4.7**.

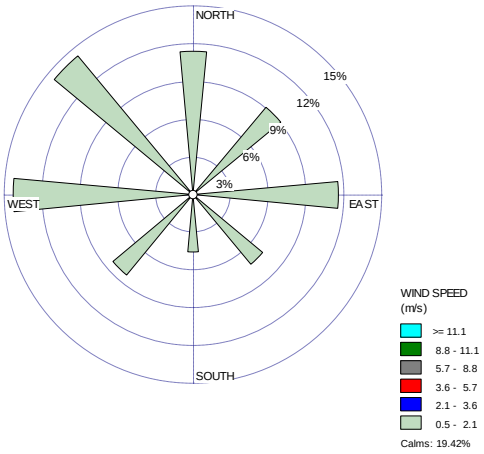


Figure 4-7: Wind-rose IMD Bhatinda (1981-2000)

4.4.3 Climate Change

As discussed under Section 3.10, rainfall is expected to decrease by 5% and temperature is likely to increase in the tune 4-5°C in the project region. Solar cell output is usually rated at 25°C with output decreasing by about 0.39% for each temperature rise of 1°C. Therefore, a reduction of about 2% in output of solar cells is expected due to climate change. However, design has been done is such a manner that sufficient air flow is maintained to keep the modules cool and in turn to decrease the efficiency loss due to temperature rise.

4.4.4 Ambient Air Quality

4.4.4.1 Monitoring Locations and Parameters

Air Quality monitoring of the project area is carried out by the Noida Testing Laboratory, which is accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) in accordance with ISO/IEC 17025:2005. Monitoring for the concentrations of the following parameters in the environment are measured:

- Particulate Matter 2.5 (PM2.5)
- Particulate Matter 10 (PM10)
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NO_X)
- Carbon Monoxide (CO)

Air pollution due to combustion of fossil fuels in vehicles, domestic cooking and other industrial activities is reflected in the level of SO_2, NO_X and CO, whereas Particulate Matter concentration is indicative of the amount of dust and other fine particles in the air.

Three different locations were chosen for assessment of ambient air quality in study area. One station was set-up near to the project site, whereas other two stations were set-up in up-wind and down-wind direction respectively. Monitoring has been carried out twice in a week manner after one week at each location. Details of sampling location is presented in Table below.

Table 4-6: Ambient Air Quality Monitoring Stations

S. No.	Village	Direction	Station	Selection Criteria
1	Bareta (Project Site)	-	AAQ1	Project Site
2	Dayalpura Village	North	AAQ2	Up-wind Station
3	Bareta near Market	South-East	AAQ3	Down-wind Station

Source: Onsite Monitoring done by Noida Testing Laboratory, Noida

Map for Ambient Air Quality Monitoring Locations are shown as **Figure 4.8**. Photographs presenting activities is shown in **Figure 4.9** below.

4.4.4.2 Analysis and Results

The ambient air quality samples as collected from the site was further analysed in laboratory for concentration analysis of pollutants. The analysis results further correlated mathematically and summarized below.

Table 4-7: Ambient Air Quality at Bareta near Project Site (µg/m3)

Parameter	SO2	NOX	PM10	PM2.5	CO
Minimum	5.8	10.4	71.5	30.6	<1.0
Maximum	6.6	12.4	62.6	26.7	<1.0
Average	5.8	10.4	62.6	26.7	<1.0
10 Percentile	6.6	12.4	71.5	30.6	-
20 Percentile	6.2	11.4	67.1	28.7	-
30 Percentile	5.9	10.6	63.5	27.1	-
50 Percentile	6.0	10.8	64.4	27.5	-
80 Percentile	6.0	11.0	65.3	27.9	-
98 Percentile	6.2	11.4	67.1	28.7	-
Arithmetic Mean	6.5	12.0	69.7	29.8	-
Geometric Mean	6.6	12.3	71.3	30.5	-
Standard Deviation	6.2	11.4	67.1	28.7	-
95 Percentile	6.2	11.3	66.9	28.6	-
NAAQS (24 hourly)	80	80	100	60	-

Source: Monitoring and Analysis done by Noida Testing Laboratory, Noida

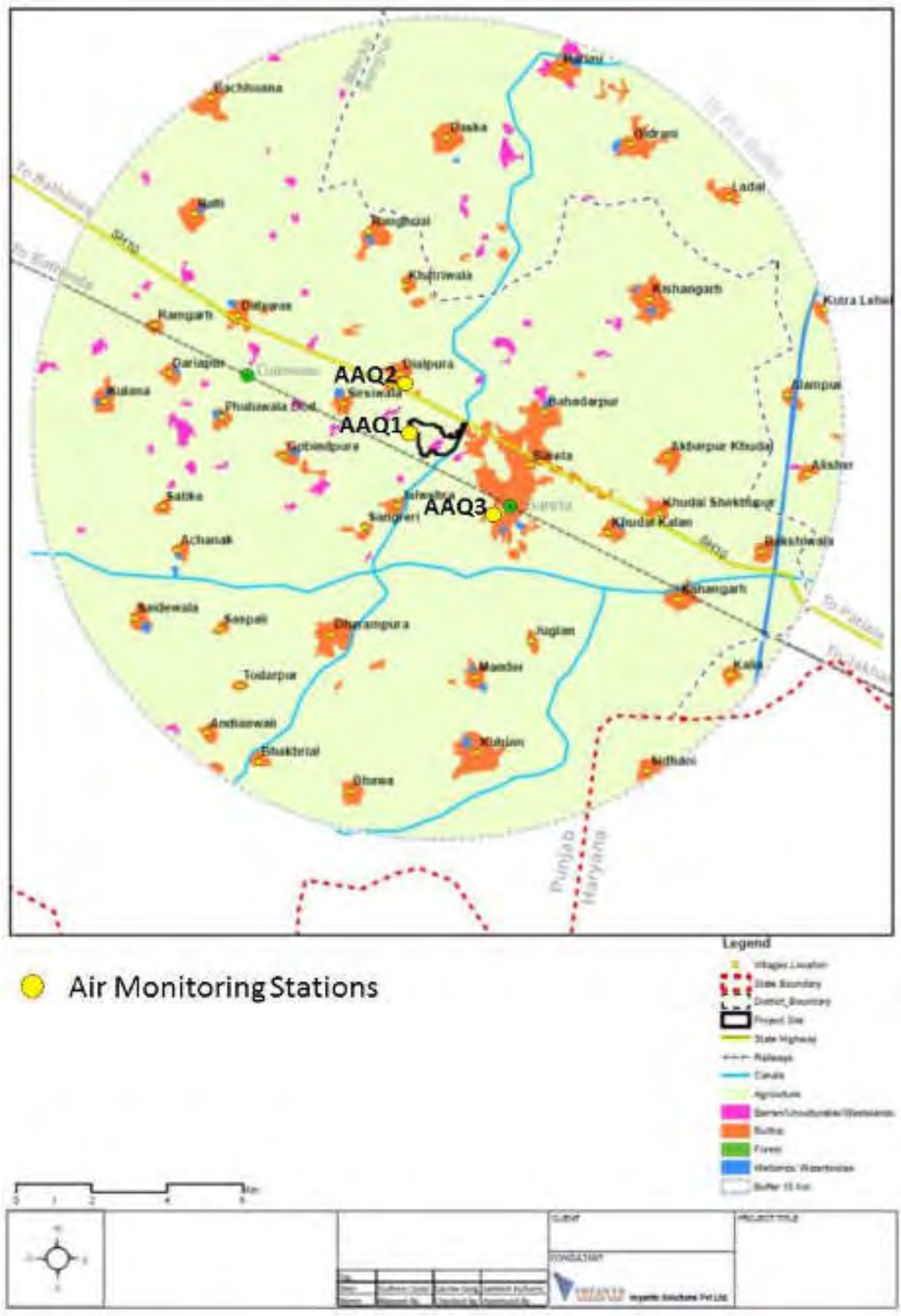


Figure 4-8: Air Monitoring Stations

Figure 4-9: Onsite Ambient Air Quality Monitoring Photographs

Table 4-8: Ambient Air Quality at Dayalpura (µg/m3)

Parameter	SO2	NOX	PM10	PM2.5	CO
Minimum	7.2	13.2	68.8	28.6	<1.0
Maximum	6.3	11.3	63.0	31.3	<1.0
Average	6.3	11.3	63.0	28.6	<1.0
10 Percentile	7.2	13.2	68.8	31.3	-
20 Percentile	6.7	12.2	65.9	30.0	-
30 Percentile	6.4	11.5	63.6	28.8	-
50 Percentile	6.5	11.7	64.2	29.1	-
80 Percentile	6.6	11.9	64.8	29.4	-
98 Percentile	6.7	12.2	65.9	30.0	-
Arithmetic Mean	7.0	12.8	67.7	30.8	-
Geometric Mean	7.2	13.1	68.7	31.3	-
Standard Deviation	6.7	12.2	65.9	30.0	-
95 Percentile	6.7	12.2	65.9	29.9	-
NAAQS (24 hourly)	80	80	100	60	-

Source: Monitoring and Analysis done by Noida Testing Laboratory, Noida

Table 4-9: Ambient Air Quality at Bareta near Market (µg/m3)

Parameter	SO_2	NO_X	PM10	PM2.5	CO
Minimum	7.2	15.0	71.6	33.0	<1.0
Maximum	7.8	15.9	81.3	43.3	<1.0
Average	7.2	15.0	71.6	33.0	<1.0
10 Percentile	7.8	15.9	81.3	43.3	-
20 Percentile	7.5	15.5	76.4	38.2	-
30 Percentile	7.3	15.1	72.5	34.1	-
50 Percentile	7.3	15.2	73.5	35.1	-
80 Percentile	7.4	15.3	74.5	36.1	-
98 Percentile	7.5	15.5	76.4	38.2	-
Arithmetic Mean	7.7	15.8	79.4	41.3	-

Parameter	SO_2	NO_X	PM10	PM2.5	CO
Geometric Mean	7.8	15.9	81.1	43.1	-
Standard Deviation	7.5	15.5	76.4	38.2	-
95 Percentile	7.5	15.5	76.3	37.8	-
NAAQS (24 hourly)	80	80	100	60	-

Source: Monitoring and Analysis done by Noida Testing Laboratory, Noida

No major source of air pollution was observed at site. Agricultural activities are the only source of pollution in study area. Agriculture activities results in generation fugitive dust. The PM10 and PM2.5 P98 concentration in the region found varying from 68.7 to 81.1 µg/m3 and 30.5 to 43.1 µg/m3 in respect to the prescribed standards of 100 and 60 µg/m3 respectively. No significant concentration of gaseous pollution was observed. In general air pollution was found within the prescribed standards at all the places.

4.5 AMBIENT NOISE LEVEL

4.5.1 Monitoring Station and Methodology

In the present study, sound pressure levels (SPL) have been measured by a sound level meter. Since loudness of sound is important for its effects on people, the dependence of loudness upon frequency must be taken into account in noise impact assessment. This has been achieved by the use of A-weighting filters in the noise measuring instrument which gives a direct reading of approximate loudness. A-weighted equivalent continuous sound pressure level (Leq) values have been computed from the values of A-weighted sound pressure level measured with the help of noise meter.

Noise monitoring was carried out at two locations including project site. These locations have been given in **Table** below and shown **Figure 4.10**.

Table 4-10: Noise Monitoring Stations

S. No.	Village	Direction	Station	Selection Criteria
1	Bareta (Project Site)	-	N1	Project Site
2	Dayalpura Village	North	N2	Nearby Settlement

Source: Monitoring done by Noida Testing Laboratory, Noida

4.5.2 Frequency and Results

At each location, noise monitoring has been carried out once during the study period (May 2016) over a period of twenty-four hours to obtain Leq values at uniform time intervals of 1 hour. In each hourly time interval Leq values have been computed from SPL readings taken at uniform time intervals of 15 minutes. For each location, day and night time Leq values have then been computed from the hourly Leq values so that comparison could be made with the national ambient noise standards.

Day time Leq has been computed from the hourly Leq values between 6.00 a.m. - 10.00 p.m. and night time Leq from the hourly Leq values between 10.00 p.m. - 6.00 a.m. The results are presented in Table below.

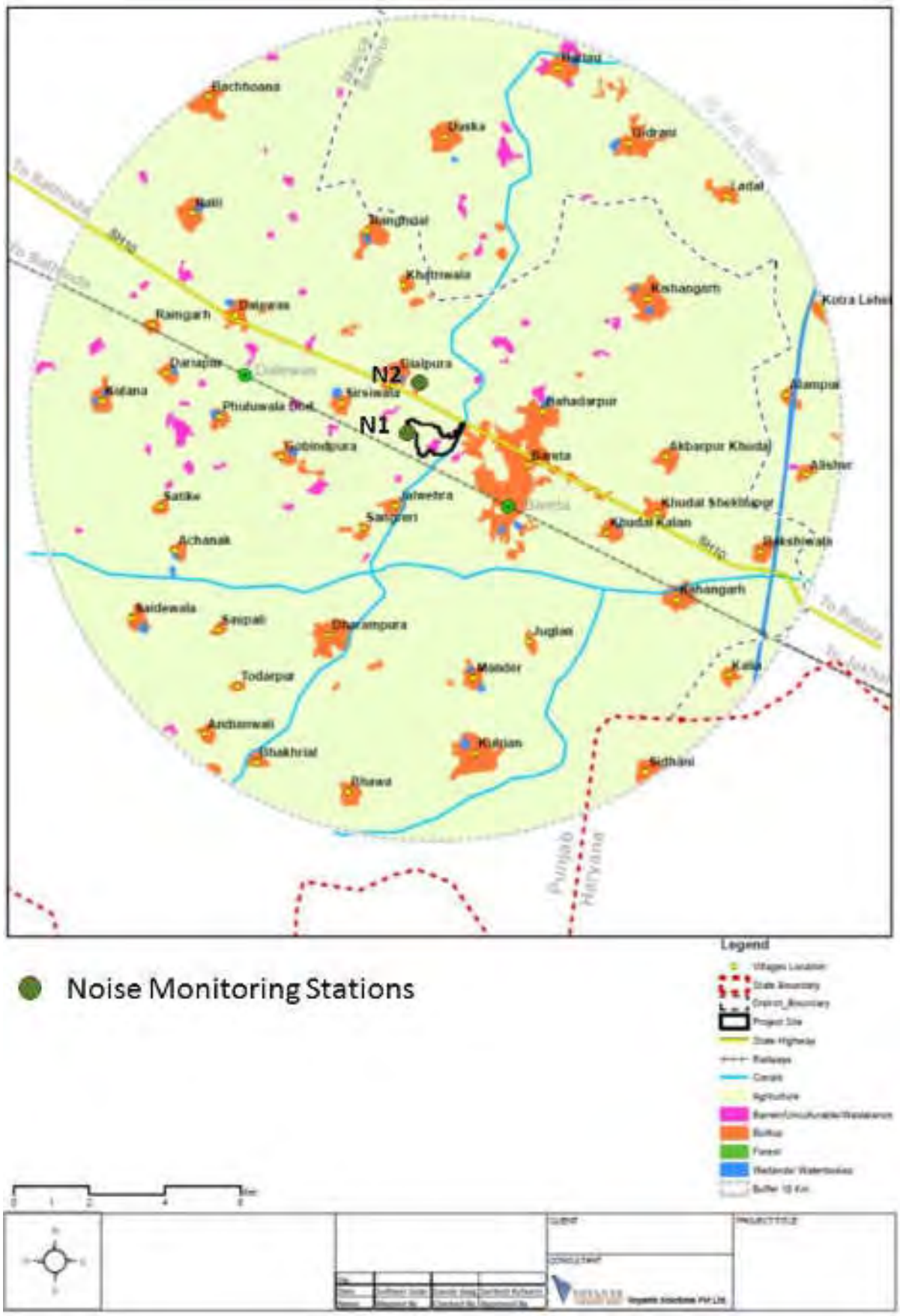


Figure 4-10: Noise Monitoring Stations

Table 4-11: Noise Level in Study Area

Location	Noise Level in dB(A)		
	Leq (day)	Leq (night)	Leq (dn)
N1- Bareta (Project Site)	51.3	36.8	50.3
N2- Dayalpura Village	50.1	36.6	49.2
Ambient Noise Standards for Rural and Residential Areas	55.0	45.0	-

Source: Monitoring done by Noida Testing Laboratory, Noida

No major source of noise was observed in the region. No heavy traffic was found at the road side too. The noise levels recorded in the monitoring locations during daytime were found in the range of 50.1 to 51.3 dB(A) and during night time the Leq value was between 36.5 and 36.6 dB(A). In general noise level was found within the prescribed standards in absence of any major noise source.

4.6 WATER QUALITY

2 Ground water and 1 Surface water samples were collected and analyzed for assessment of water quality in and around the project site. The locations of the monitoring sites are depicted in Table below and shown in **Figure 4.11**.

Table 4-12: Water Sampling Stations

S. No.	Village	Direction	Station	Selection Criteria
Surface Water Sampling Location				
1	Nallah near to Site	North	SW1	Surface Water nearest to Water Bodies
Ground Water Sampling Location				
1	Bareta (Project Site)	-	GW1	Project Site
2	Dayalpura Village	North	GW2	Nearby Settlement

Source: Sampling done by Noida Testing Laboratory, Noida

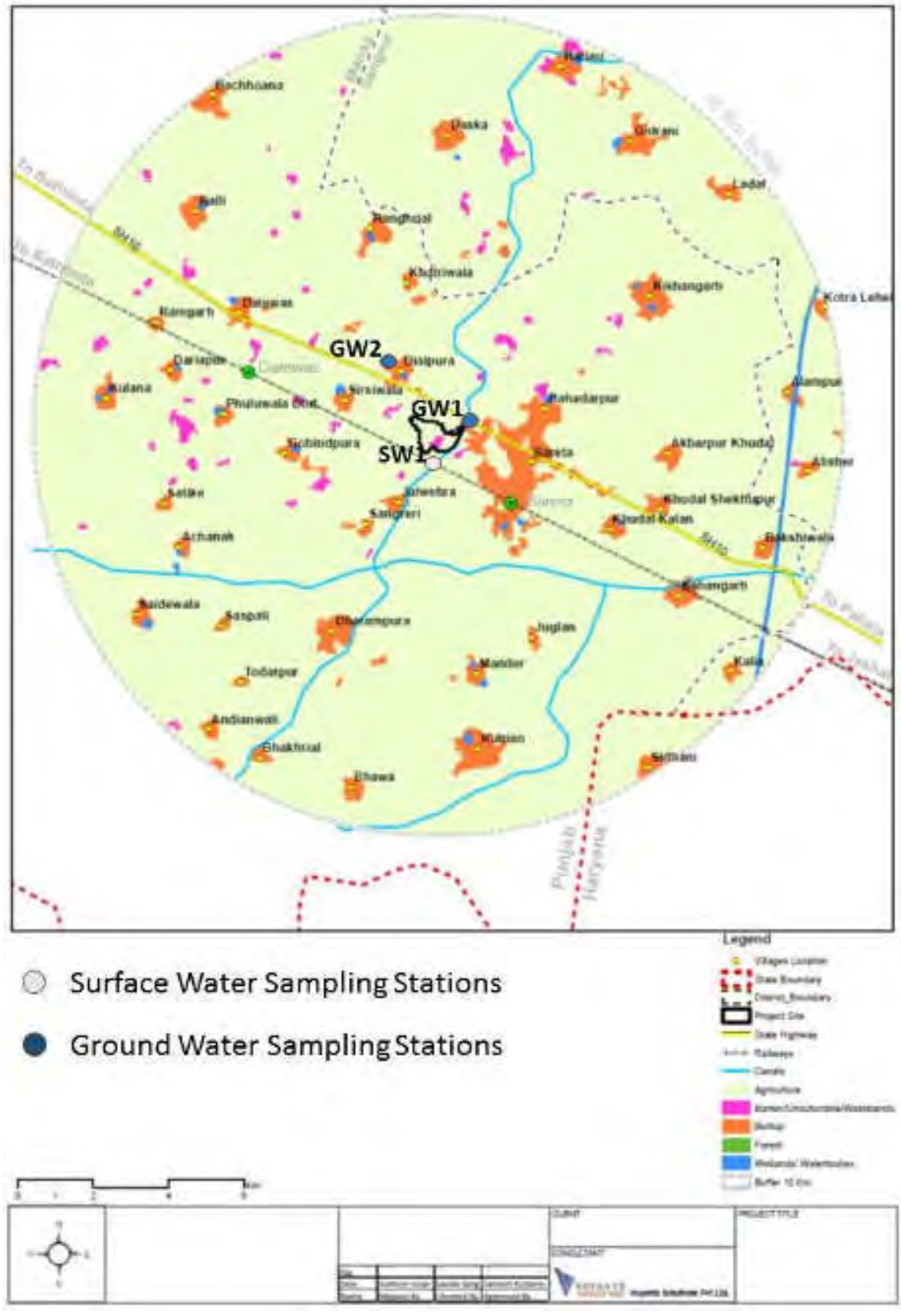


Figure 4-11: Water Sampling Locations

4.6.1 Surface Water Quality

Surface water quality was assessed through sample analysis of the drain (Nallah) flowing adjacent to the project site. Analysis of the sample was carried out as per established standard methods and procedures prescribed by CPCB IS 3025, IS 10500 and APHA 22nd edition, 2012.

The quality of water is determined with respect to the standard values provided by the Central Pollution Control Board (CPCB). The detail of the water quality is mentioned in Table below.

Table 4-13: Surface Water Quality

S. No.	Parameter	Units	IS:2296 Class C Limits	SW 1 (Drain Near Bareta)
1	pH	-	6.5 – 8.5	8.12
2	Color	Hazen units	300	<5
3	Conductivity	mS/cm	$	285.6
4	Dissolved Oxygen	mg/l	4 minimum	3.2
5	BOD (3 days at 27°C)	mg/l	3	5.6
6	Total Dissolved Solids	mg/l	1500	168.2
7	Total Hardness	mg/l	$	104
8	Chloride as Cl	mg/l	600	33.56
9	Fluorides as F-	mg/l	1.5	0.22
10	Sulphate as SO_4^{--}	mg/l	400	6.8
11	Alkalinity	mg/l	$	122.25
12	Nitrates as NO_3	mg/l	$	4.2
13	Cyanides as CN	mg/l	0.05	BDL
14	Calcium as Ca	mg/l	$	20.58
15	Magnesium as Mg	mg/l	$	6.85
16	Sodium as Na	mg/l	$	18.92
17	Potassium as K	mg/l	$	7.58
18	Iron as Fe	mg/l	50	0.07
19	Chromium as Cr	mg/l	0.05	BDL
20	Cadmium as Cd	mg/l	0.01	BDL
21	Lead as Pb	mg/l	0.1	BDL
22	Copper as Cu	mg/l	1.5	BDL
23	Arsenic as As	mg/l	0.2	BDL
24	Selenium as Se	mg/l	0.05	BDL
25	Phenolics as C_6H_5Oh	mg/l	0.005	BDL
26	Zinc as Zn	mg/l	5	BDL
27	Mercury as Hg	mg/l	$	Absent
28	Aluminum as Al	mg/l	$	BDL
29	Anionic detergents as MBAS	mg/l	0.12	BDL
30	Oil and grease	mg/l	0.3	BDL

S. No.	Parameter	Units	IS:2296 Class C Limits	SW 1 (Drain Near Bareta)
31	Sodium Absorption Ratio	meq/L	-	2.7
32	Insecticides	mg/l	Absent	Absent
33	Coliform Organisms	MPN/100 ml	Should not exceed 5000	3200

Source: Sampling and Analysis done by Noida Testing Laboratory, Noida

The water of the drain was found alkaline with pH value of 8.12. Discharge of the domestic waste and run-off containing fertilizer load from nearby farming field. All other parameters were found within prescribed standards except BOD where it found exceeding the standards due to biological growth in water. In general water need treatment before using any of the human purpose.

4.6.2 Ground Water Quality

The ground water selected for analysis was source from Tube-wells. Since the ground-water is used without treatment by a large portion of population. The ground water analysis results were compared with BIS standards and presented in Table below.

Table 4-14: Ground Water Quality

S. No.	Parameter	Unit	GW 1 (Bareta)	GW 2 (Dayalpura)	10500:2012	
					Acceptable	Permissible
1	pH	--	6.87	6.98	6.5-8.5	NR
2	Turbidity	NTU	<1.0	<1.0	1	5
3	EC	µMho/cm	642	562.2	-	-
4	TSS	mg/l	<1.0	<1.0	-	-
5	TDS	mg/l	392.2	324.5	500	2000
6	Total Alkalinity as $CaCO_3$	mg/l	152.2	120.2	200	600
7	Chlorides as Cl^-	mg/l	104.5	82.3	250	1000
8	Sulphates as $SO4^{-2}$	mg/l	27.5	21.2	200	400
9	Nitrates as NO_3	mg/l	4.2	3.6	45	NR
10	Phosphates as PO_4	mg/l	1.24	1.62	-	-
11	Total Hardness as $CaCO_3$	mg/l	187.3	162.5	200	600
12	Calcium as Ca	mg/l	48.2	41.3	75	200
13	Magnesium as Mg	mg/l	21.4	16.5	30	100
14	Sodium as Na	mg/l	23.6	26.5	-	-
15	Potassium as K	mg/l	8.45	7.85	--	
16	Flourides as F^-	mg/l	0.18	0.12	1.0	1.5
17	Iron as Fe	mg/l	0.06	0.07	0.3	NR
18	Phenolic Compounds	mg/l	BDL	BDL	0.001	0.002

S. No.	Parameter	Unit	GW 1 (Bareta)	GW 2 (Dayalpura)	10500:2012	
					Acceptable	Permissible
19	Cyanide as CN^-	mg/l	BDL	BDL	0.05	NR
20	Residual Chlorine as Cl^-	mg/l	<0.2	<0.2	0.2	1.0
21	Cadmium as Cd	mg/l	BDL	BDL	0.003	NR
22	Total Chromium as Cr	mg/l	BDL	BDL	0.05	NR
23	Lead as Pb	mg/l	BDL	BDL	0.01	NR
24	Zinc as Zn	mg/l	0.16	0.21	5	15
25	Manganese as Mn	mg/l	BDL	BDL	0.1	0.3
26	Copper as Cu	mg/l	BDL	BDL	0.05	1.5
27	Nickel as Ni	mg/l	BDL	BDL	0.02	NR
28	Colour	Hazen	<5	<5	5	15
29	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable
30	Odor	-	Agreeable	Agreeable	Agreeable	Agreeable
31	Boron	mg/l	BDL	BDL	0.5	1.0
32	Anionic Detergents	mg/l	BDL	BDL	0.2	1.0
33	Mineral Oil	mg/l	BDL	BDL	0.5	NR
34	Aluminium as Al	mg/l	BDL	BDL	0.03	0.2
35	Mercury as Hg	mg/l	BDL	BDL	0.001	NR
36	Pesticides	mg/l	Absent	Absent	Absent	NR

Source: Sampling and Analysis done by Noida Testing Laboratory, Noida

Water in the study area was found neutral in terms of pH ranging from 6.87 to 6.98. Turbidity and color was found well within the acceptable limits. No bad smell was observed in the ground water. Most of heavy metals was found below the detectable limit, whereas, slight concentration of Iron and Zinc were observed. However, concentration of Iron and Zinc was found well below the acceptable limits. In general water is suitable for drinking, after necessary disinfection.

4.7 ECOLOGICAL STATUS

4.7.1 Objective of Study

The study was undertaken with a view to understand the status of ecosystem along the following line:

- Review of secondary literature available with Botanical and Zoological Survey of India, Forest department etc. for determining historical trends
- To assess nature and distribution of the vegetation in the area
- Determination of type of forests
- Preparation of checklist of flora and fauna
- Listing of Trees, shrubs, climbers and herbs and other existing habit forms
- To recognize the plant community

- To identify the rare and endangered species in the project area
- To determine ecologically sensitive areas like national parks or wildlife sanctuaries
- Existing status of flora and fauna
- Disturbance due to human utilization and livestock

4.7.2 Ecology Survey

The surveys for ecology and biodiversity assessment were conducted in and around the proposed Bareta Solar PV Project. Team of ecology experts visited the site on 24th June, 2016 to 28th June, 2016 for floral and faunal survey. Secondary available information as also studied while finalizing the list of floral and faunal species.

To achieve the above objectives, general floristic and ecological survey covering 10 km radius around the proposed site was carried out. The survey included:

- Reconnaissance Survey
- Generation of primary data to understand baseline ecological status of floral elements, sensitive habitats and rare species
- Importance and status of plants

4.7.3 Ecological Sensitive Area

No National Park, Wildlife Sanctuary, Bio-spehere Reserve, Notified Wildlife Corridor, etc. is located within 10km from the project site. Bir Aishvan Wildlife Sanctuary is the nearest notified ecologically notified area. The distance of Bir Aishwan from project site is about 44km. The proposed project doesn't involved diversion of any forests area for the project purpose.

4.7.4 Forest Area

According to India State of Forest Report, 2015, the recorded forest area and tree cover of Punjab State is 3315 km^2 which constitute 6.58% of its total geographical area of 50362 km^2. The Reserve Forest, Protected Forest and Un-Classed Forests constitute 1.3%, 34.3% and 57.4% respectively of the total state forest and tree cover area. Figure 4.12 presents the Forest Cover Map of Punjab state.

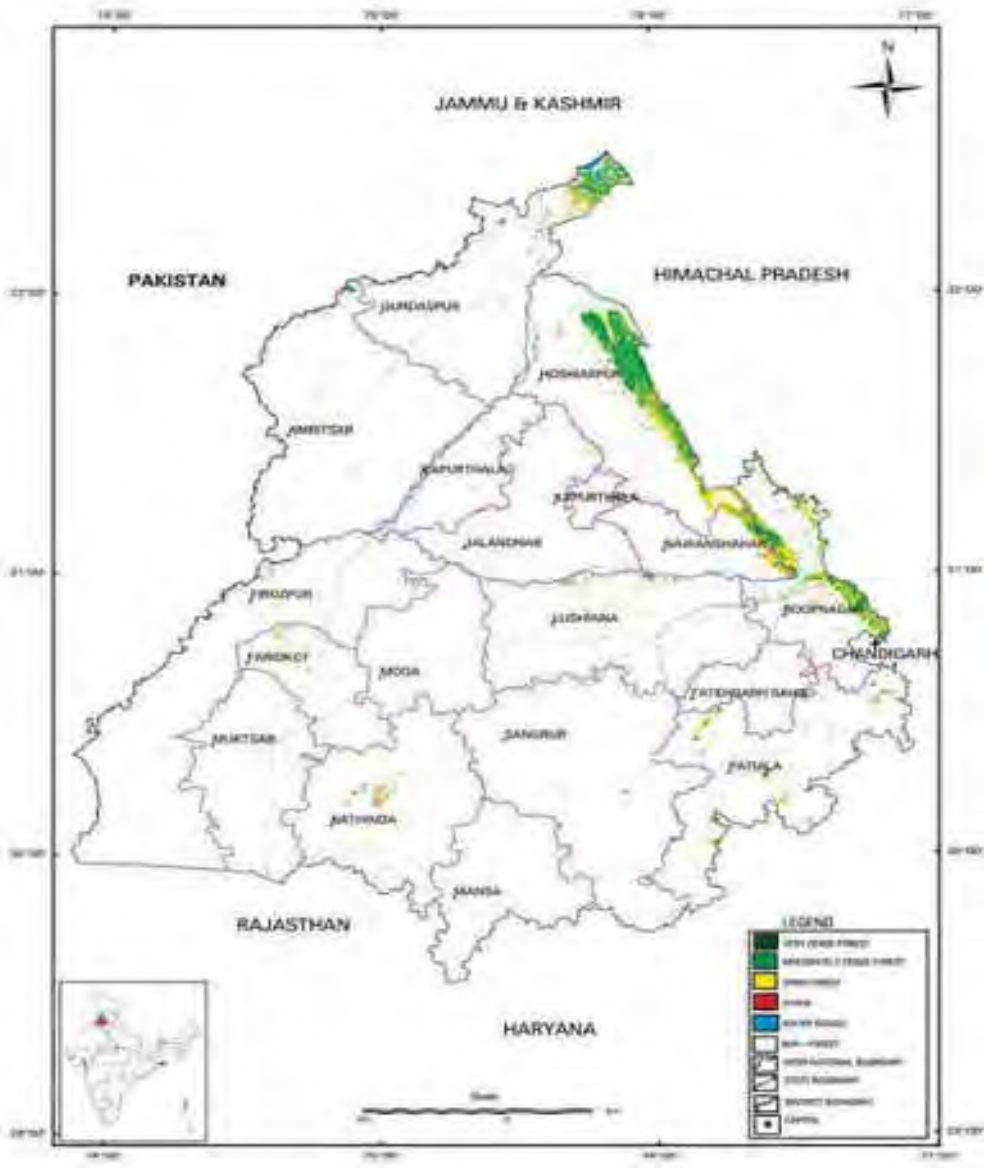


Figure 4-12: Forest Map of Punjab State

It was observed that the percentage of forest cover (On the basis of forest density) out of total geographical area in Mansa district is almost negligible in comparison to state's overall percentage. Comparative details between the Project Districts & State forest Cover have been presented in below table.

Table 4-15: Forest Cover in Project District and State as per Density

District / State	Area in Km^2					% of Geographical Area
	Geographical Area	Very Dense Forest	Moderately Dense Forest	Open Forest	Total	
Mansa	12847	0	1	5	6	0.27
Punjab	114865	0	735	1036	1771	3.52

Source: India State of Forest Report, 2015

Project site primarily consist the agriculture land with patches of scrub (barren) land. No forest area is being affected due to proposed project.

4.7.5 Floral Composition

The floristic studies were based on exploration of the study area. The field surveys involve the preparation of an inventory of different species of plants including trees, shrubs, economic plants in the plant community of the area. All plant species were identified correctly with the help of expert taxonomist and literature published by BSI. The observations were also made on the agricultural patterns, agricultural weeds and cultivated and introduced plant species. The documentation of the plant communities was done by random walk through the study area and visual observations.

4.7.5.1 Observations and Results

The general floristic composition of Mansa District has an overlapping of floral composition belonging to 'Semi-Arid Region' as a major part and scattered elements of 'Moister Plain Country'. The study area is dominated by agricultural activities with patches of scrub land having invaded growth of Prosopis Juliflora. Some of the glimpses of ecology present at site are shown as Figure 4.13 below.

Figure 4-13: Glimpses of Vegetation at Site

One patch of land at the site found consisting Prosopis Juliflora Plantation. The area of this patch is around 0.1 ha. The patch also consists one or two plants of Oak and Azaradirata Indica. Some of these trees are need to felled for the project purpose.

The inventory of the Floral Species as observed in Study area is presented in Tables below.

Table 4-16: Trees in Study Area

S. No.	Local Name	Scientific Name	Family
1	Subabul	*Acacia leucocephala*	*Fabaceae*
2	Babul	*Acacia nilotica*	*Fabaceae*
3	Arsua	*Adhatoda zeylancia*	*Acanthaceae*
4	Neem	*Azadirachta indica*	*Meliaceae*
5	Palash	*Butea monosperma*	*Fabaceae*
6	Khair	*Capparis decidua*	*Capparaceae*
7	Shisham	*Dalbergia sissoo*	*Fabaceae*
8	Katathohar,	*Euphorbia nivulia*	*Euphorbiaceae*

S. No.	Local Name	Scientific Name	Family
9	Peepal	*Ficus religiosa*	*Moraceae*
10	Indian Banyan	*Ficus benghalensis*	*Moraceae*
11	Bakain	*Melia azedarach*	*Meliaceae*
12	Sehtoot	*Morus alba*	*Moraceae*
13	Palm Tree	*Phoenix sylvestris*	*Arecaceae*
14	Jund	*Prosopis cineraria*	*Fabaceae*
15	Vann	*Salvadora oleoides*	*Salvadoraceae*
16	Plum	*Syzygium cumini*	*Myrtaceae*
17	Ber	*Ziziphus mauritiana*	*Rhamnaceae*

Source: Onsite field Survey and Botanical Survey of India

Some shrubs were also observed at site. Some of the dominant shrubs, climber and bushes as observed during site visit, is giving in Table below.

Table 4-17: Shrubs and Climbers in Study Area

S. No.	Scientific Name	Family
1	*Calatropis procera*	*Apocynaceae*
2	*Capparis decidua*	*Capparaceae*
3	*Crotolaria burhia*	*Fabaceae*
4	*Leptadenia pyrotechnica*	*Apocynaceae*
5	*Tecomella acmella*	*Bignoniaceae*
6	*Abrus precatorius*	*Fabaceae*
7	*Abutilon indicum*	*Malvaceae*
8	*Conostephium pendulum*	*Ericaceae*
9	*Caesalpinia bonduc*	*Caesalpiniaceae*
10	*Coccinia grandis*	*Cucurbitaceae*
11	*Cocculis hirsutus*	*Menispermaceae*
12	*Flacouritia indica*	*Salicaceae*
13	*Lantana camara*	*Verbenaceae*
14	*Leptadenia reticulata*	*Asclepiadaceae*
15	*Mimordica balsamina*	*Cucurbitaceae*
16	*Morus alba*	*Moraceae*
17	*Murraya Koenigii*	*Rutaceae*
18	*Pergularia daemia*	*Apocynaceae*
19	*Plumbago Zeylanica*	*Plumbaginaceae*
20	*Tinospora cordifolia*	*Menispermaceae*
21	*Ziziphus oenoplia*	*Rhamnaceae*

Source: Onsite field Survey and Botanical Survey of India

Ruderal Plants: Ruderal vegetation develops in places which are subjected to change from time to time, such as waste place around villages, railway tract and roadsides. The common species are

Xanthium stramonium, Cannabis sativa, Croton bonplandianum, *Cassia obtusifolia, Argemone mexicana, Amaranthus spinosus,* etc.

Economic Plants: The study area harbors number of plants which are being used locally and play important role in economic development. *Acacia catechu, Acacia nilotica* ssp*. indica* are used in tanning industry. Inedible oil extracted from *Argemone mexicana, Azadirachta, Vetiveria zizanioides* are economically exploited. Besides these, a large number of plants are also exploited for herbal medicines, home remedies and in the preparation of ayurvedic formulations. The common species are *Aegle marmelos,Linum usitatissimum, Azadirachta indica, Acacia catechu, Abrus precatorius, Datura stramonium, Solanum surantense, Adhatoda zeylanicus. Butea monosperma, Calatropis procera, Boerhovia diffusa, Asparagus racemosus, etc.* Project site is plain agricultural land, no naturally grown plant of economic importance was observed at the site.

4.7.6 Faunal Characteristics

4.7.6.1 Total Listing of Faunal Elements

Faunal studies help to understand the wellbeing of a nature and functioning of ecosystems. It helps to monitor biological richness or heritage quality, habitat change and quantifying threatening species. The faunal components such as Arthropods, Molluscs, Pisces, Birds and Mammals are very sensitive to the change in the ecosystem, therefore are best used as indicators of the ecosystem function and considered crucial in the ecology and management of the aquatic and terrestrial ecosystems.

Animals and birds in the study area were documented using following means:

- Secondary sources and published literature
- By interviewing local people
- Actual sighting
- Indirect evidence (pallets, dung, droppings, scat, mould, marking on the trunks etc.)
- Nesting (birds, burrows for small mammals)

The records for the birds, mammals and other faunal groups were made at the same site where vegetation sampling was carried out. Most of the records of the mammalian and reptilian fauna are opportunistic, nonetheless very useful to understand habitat specificity and interrelationship between certain floral and faunal elements and also between certain geological and faunal features.

4.7.6.2 Mammals

The study area is a place of poor mammalian diversity. In absence of forest area in the district, no wildlife fauna is visited easily. 29 species of mammals have been recorded during visit from the study area. The mammalian species recorded are listed in the following Table along with their schedule in which they are placed according to the Wildlife Act 1972 and IUCN status.

Table 4-18: Mammals in Study Area

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
1	Indian Rhesus Macaque	Macaca radiata	Schedule II	LC
2	Five-striped Palm Squirrel	Funambulus pennantii	Schedule IV	LC
3	Antelope /	Tatera indica	Schedule V	LC

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
	Indian Gerbil Rat			
4	Indian Mole Rat	Banidicota bengalensis	Schedule V	LC
5	Large Bandicoot Rat	Banidicota indica	Schedule V	LC
6	Common House / Roof Rat	Rattus rufescens	Schedule V	LC
7	Common House Mouse	Mus musculus casteneus	Schedule V	LC
8	Little Indian Field Mouse	Mus booduga	Schedule V	LC
9	Indian Crested Porcupine	Hystrix indica	Schedule IV	LC
10	Indian Black-naped Hare	Lepus (Indolagus) nigricollis	Schedule IV	LC
11	House / Grey Musk Shrew	Suncus murinus	Schedule V	LC
12	Greater Short-nosed Fruit Bat	Cynopterus sphinx	Schedule V	LC
13	Indian Flying Fox	Pteropus giganteus	Schedule V	LC
14	Greater Yellow House Bat	Scotophilus heathii	-	LC
15	Dormer's Pipistrelle	Scotozous dormeri Dobson	-	LC
16	Tickle's Bat	Hesperoptenus tickelli	-	LC
17	Indian Pangolin	Manis crassicaudata	Schedule I	Endangered
18	Jungle Cat	Felis chaus Schreber	Schedule II	LC
19	Indian Gray Mongoose	Herpestes edwardsii	Schedule II	LC
20	Small Asian Mongoose	Herpestes javanicus auropunctatus	Schedule II	LC
21	Striped Hyaena	Hyaena	Schedule III	NT
22	Asiatic Jackal	Canis aureus	Schedule II	LC
23	Feral Dogs	Canis domesticus	-	-
24	Indian Fox/ Bengal Fox	Vulpes bengalensis	Schedule II	LC
25	Asian Small-clawed Otter	Aonyx cinereus	Schedule I	Vulnerable
26	Wild Boar	Sus scrofa Linnaeus	Schedule III	LC
27	Sambar	Rusa unicolor	Schedule III	Vulnerable
28	Blue Bull	Boselaphus tragocamelus	Schedule III	LC
29	Four-horned antelope	Tetracerus quadricornis	Schedule I	Vulnerable

LC- Least Concern, NT- Not Threatened

Source: *Actual sightings, interactions with local people and Publication of ZSI, Kolkata*

4.7.6.3 Reptiles and Amphibians

A total 23 reptile species and 6 Amphibians Species were reportedly present in the region, out of which 2 species namely Indian Flap shelled or Mud Turtle and Common Indian Monitor Lizard comes under Schedule I of Wildlife Protection Act, 1972. The snakes mostly preferred open grassland to semi-arid rocky habitats whereas lizards and skinks also preferred open to scrub forest bushes. However, project

site doesn't found suitable for habitat of these species, thus, there is least probability of occurrence of these species at site.

Table 4-19: Reptiles Reported in Study Area

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
1.	Indian Roofed Turtle	*Pangshura tecta*	Schedule IV	LC
2.	Indian Flap shelled or Mud Turtle	*Lissemys punctata*	Schedule I	LC
3.	Brook's House Gecko	*Hemidactylus brookii*	-	LC
4.	Yellow House Gecko	*Hemidactylus flaviviridis*	-	LC
5.	Fan Throated Lizard	*Sitana ponticeriana*	-	LC
6.	Garden Lizard	*Calotes versicolor*	-	Lower Risk (NT)
7.	Hardwicke's Short Tail Agama	*Brachysaura minor*	Schedule IV	Data Deficient
8.	Bronze grass skink / mabuya	*Eutropis macularia*	-	Lower Risk (LC)
9.	Common Keeled grass skink/ mabuya	*Eutropis carinata*	-	LC
10.	Common Indian Monitor Lizard	*Varanus bengalensis*	Schedule I	LC
11.	Common Blind / Brahminy Blind / Worm Snake	*Indotyphlops braminus*	Schedule IV	Lower Risk (NT)
12.	Slender Blind Snake	*Typhlops porrectus*	Schedule IV	Lower Risk (NT)
13.	Indian Sand / Red Boa	*Eryx johnii*	Schedule IV	Lower Risk (NT)
14.	Trinket Snake	*Coelognathus helena*	Schedule IV	Lower Risk (NT)
15.	Dhaman / Rat Snake	*Ptyas mucosus*	Schedule II	Lower Risk (NT)
16.	Checkered Keelback Snake	*Xenochrophis piscator*	Schedule II	Lower Risk (NT)
17.	Barred Wolf Snake	*Lycodon striatus*	Schedule IV	Lower Risk (LC)
18.	Common Vine Snake	*Ahaetulla nasutus*	Schedule IV	Lower Risk (NT)
19.	Leith's sand snake	*Psammophis leithii*	-	Lower Risk (NT)
20.	Bi-ocellate Cobra	*Naja*	Schedule II	Vulnerable
21.	Oxus / Black Cobra	*Naja oxiana*	Schedule II	Data Deficient
22.	Common Indian Krait	*Bungarus caeruleus*	Schedule IV	Data Deficient
23.	Russell's viper	*Daboia russelii*	Schedule II	Lower Risk (NT)

LC- Least Concern, NT- Not Threatened

Source: *Actual sightings, interactions with local people and Publication of ZSI, Kolkata*

Table 4-20: Amphibians Reported in Study Area

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
1	Common Indian Toad	*Duttaphrynus melanostictus*	-	LC
2	Indian Skipper Frog	*Euphlyctis cyanophlyctis*	Schedule IV	LC

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
3	Indian Cricket / Paddy field Frog	*Fejervarya limnocharis*	Schedule IV	LC
4	Indian Bull Frog	*Hoplobatrachus tigerinus*	Schedule IV	LC
5	Burrowing Frog	*Sphaerotheca breviceps*	Schedule IV	LC
6.	Ornate microhylid / Ornate Rice / Black-throated Frog	*Microhyla ornata*	Not Listed	LC

LC- Least Concern, NT- Not Threatened

Source: *Actual sightings, interactions with local people and Publication of ZSI, Kolkata*

4.7.6.4 Avi-fauna

A total of 125 species of birds were identified or were reported to be present in the study area. As per the Wildlife Protection Act 1972, four Schedule-I species were identified. Detailed inventory of the avifauna is presented in Table below.

Table 4-21: Avifauna Reported in Study Area

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
1.	Little Grebe / Dabchick	*Tacthbaptus ruficollis*	Schedule IV	LC
2.	Great Crested Grebe	*Podiceps cristatus*	-	LC
3.	Dalmatian Pelican	*Pelecanus crispus*	Schedule IV	Vulnerable
4.	Darter	*Anhinga melanogaster*	Schedule IV	NT
5.	Little Egret	*Egretta garzetta*	Schedule IV	LC
6.	Cattle Egret	*Bubulcus coromandus*	Schedule IV	LC
7.	Pond Heron	*Ardeola grayii*	Schedule IV	LC
8.	Purple Heron	*Ardea purpurea*	-	LC
9.	Black-necked Stork	*Ephippiorhynchus asiaticus*	Schedule IV	NT
10.	Painted Stork	*Mycteria leucocephala*	Schedule IV	NT
11.	Lesser Adjutant Stork	*Leptoptilos javanicus*	Schedule IV	NT
12.	Oriental White/Black Headed Ibis	*Threskiornis melanocephalus*	Schedule IV	NT
13.	Black Ibis	*Pseudibis papillosa*	Schedule IV	NT
14.	Northern Pintail	*Anasacuta Linnaeus*	Schedule IV	LC
15.	White-headed Duck	*Oxyura leucocephala*	Schedule IV	Endangered
16.	Cotton Pigmy Teal	*Nettapus coromandelianus*	Schedule IV	LC
17.	Marbled Teal	*Marmaronetta angustirostris*	Schedule IV	Vulnerable
18.	Spot-billed Duck	*Anas poecilorhyncha*	Schedule IV	LC
19.	Ferruginous Duck	*Aythyanyroca*	Schedule IV	NT

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
20.	Common Pochard	*Aythya farina*	Schedule IV	Vulnerable
21.	Lesser Whstling Teal / Duck	*Dendrocygna jaanica*	-	LC
22.	Black Kite	*Milvus migrans*	Schedule IV	Vulnerable
23	Greater Spotted Eagle	*Aquila clanga*	Schedule IV	Vulnerable
24.	Greater Spotted Eagle	*Aquila hastata*	Schedule IV	Vulnerable
25.	Eastern Imperial Eagle	*Aquila heliaca Savigny*	Schedule IV	Vulnerable
26.	Cinereous Vulture	*Aegypius monachus*	Schedule IV	NT
27.	White-rumped Vulture	*Gyps bengalensis*	Schedule I	Critically Endangered
28.	Egyptian Vulture	*Neophron percnopterus*	Schedule IV	Endangered
29.	Red-headed Vulture	*Sarcogyps calvus*	Schedule IV	Critically Endangered
30.	Saker Falcon	*Falco cherrug Gray*	Schedule IV	Endangered
31.	Lagger Falcon	*Falco Jugger Gray*	Schedule IV	NT
32.	Pallid Harrier	*Circus macrourus*	Schedule IV	NT
33.	Grey Francolin	*Francolinus pondicerianus*	Schedule IV	LC
34.	Painted Francolin	*Francolinus pictus*	Schedule IV	LC
35.	Common Quail	*Coturnix*	Schedule IV	LC
36.	Indian Peafowl	*Pavo cristatus Linnaeus*	Schedule I	LC
37.	Sarus Crane	*Antigone*	Schedule IV	Vulnerable
38.	White Brested Waterhen	*Amaurornis phoenicurus*	Schedule IV	LC
39.	Common Moorhen	*Gallinula chloropus*	Schedule IV	LC
40.	Common Coot	*Fulica atra Linnaeus*	Schedule IV	LC
41.	Great Indian Bustard	*Ardeotis nigriceps*	Schedule I	Critically Endangered
42.	Lesser Florican	*Sypheotides indica*	Schedule I	Endangered
43.	Red-wattled Lapwing	*Vanellus indicus*	Schedule IV	LC
44.	Sociable Lapwing/Plover	*Vanellus gregarious*	Schedule IV	Critically Endangered
45.	Little Ringed Plover	*Charadrius dubius*	Schedule IV	LC
46.	Common Sand Piper	*Actitis hypoleucos*	Schedule IV	LC
47.	Wood Sand Piper	*Tringa glareola*	Schedule IV	LC
48.	Eurasian Curlew	*Numenius arquata*	Schedule IV	NT
49.	Black-tailed Godwit	*Limosa*	Schedule IV	NT
50.	Black-winged Stilt	*Himantopus*	Schedule IV	LC

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
51.	Indian Courser	*Cursorius coromandelicus*	Schedule IV	LC
52.	River Tern	*Sterna aurantia*	Schedule IV	NT
53.	Black-bellied Tern	*Sterna acuticauda*	Schedule IV	Endangered
54.	Indian Skimmer	*Rynchops albicollis*	Schedule IV	Vulnerable
55.	Yellow-footed Green Pigeon	*Treron phoenicopterus*	Schedule IV	LC
56.	Rock Pigeon	*Columbalivia Gmelin*	Schedule IV	LC
57.	Yellow-eyed Pigeon	*Columba eversmanni*	Schedule IV	Vulnerable
58.	Laughing / Little Brown Dove	*Streptopelia senegalensis*	Schedule IV	LC
59.	Spotted Dove	*Streptopelia chinensis*	Schedule IV	LC
60.	Eurasian / Indian Ring / Collared Dove	*Streptopelia decaocto*	Schedule IV	LC
61.	Emerald Dove	*Chalcophaps indica*	Schedule IV	LC
62.	Alexandrine Parakeet	*Psittacula eupatria*	Schedule IV	NT
63.	Rose-ringed Parakeet	*Psittacula krameri*	Schedule IV	LC
64.	Plum / Blossom Headed Parakeet	*Psittacula cyanocephala*	Schedule IV	LC
65.	Greater Coucal / Crow Phaesant	*Centropus sinensis*	Schedule IV	LC
66.	Indian / Asian Koel	*Eudynamys scolopaceus*	Schedule IV	LC
67.	Northern Spotted Owlet	*Athene brama*	Schedule IV	LC
68.	Common Barn Owl	*Tyto alba*	Schedule IV	LC
69.	Indian Common / Little Nigthjar	*Caprimulgus asiaticus*	Schedule IV	LC
70.	House Swift	*Apus affinis*	Schedule IV	LC
71.	Common Small Blue Kingfisher	*Alcedo atthis*	Schedule IV	LC
72.	White Breasted Kingfisher	*Halcyon smyrnensis*	Schedule IV	LC
73.	Lesser Pied Kingfisher	*Ceryle rudis*	Schedule IV	LC
74.	Little green Bee-eater	*Merops orientalis*	Schedule IV	LC
75.	Indian / Northern Roller / Blue Jay	*Coracias benghalensis*	Schedule IV	LC
76.	Common Hoopoe	*Upupa epops*	Schedule IV	LC
77.	Brown Headed / Northern Green Barbet	*Psilopogon zeylanica*	Schedule IV	LC

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
78.	Crimson-breasted Barbet / Copper-smith Barbet	*Psilopogon hemacephala*	Schedule IV	LC
79.	Northern Golden backed Woodpecker / Black-rumped Flame back	*Dinopium benghalense*	Schedule IV	LC
80.	Yellow fronted- pied / Mahratta Woodpecker	*Dendrocopos mahrattensis*	Schedule IV	LC
81.	Eastern Skylark	*Alauda gulgula*	Schedule IV	LC
82.	Redrumped Swallow	*Hirundo daurica*	Schedule IV	LC
83.	Western Swallow	*Hirundo rustica*	Schedule IV	LC
84.	Wire-tailed Swallow	*Hirundo smithii*	Schedule IV	LC
85.	Paddyfield/ Oriental Pipit	*Anthus rufulus*	Schedule IV	LC
86.	White Wagtail	*Motacilla alba*	Schedule IV	LC
87.	Grey Wagtail	*Motacilla cinerea*	Schedule IV	LC
88.	Citrine / Yellow Hooded Wagtail	*Motacilla citreola*	Schedule IV	LC
89.	White Browed / Large Pied Wagtail	*Motacilla maderaspatensis*	Schedule IV	LC
90.	Indian Bay-backed Shrike	*Lanius vittatus*	Schedule IV	LC
91.	Long-tailed / Rufous-backed Shrike	*Lanius schach*	Schedule IV	LC
92.	Indian / Common Wood-shrike	*Tephrodornis pondicerianus*	Schedule IV	LC
93.	Indian Large Cuckoo-shrike	*Coracina macei*	Schedule IV	LC
94.	Red-vented Bulbul	*Pycnonotus cafer*	Schedule IV	LC
95.	Oriental Magpie-Robin	*Copsychus saularis*	Schedule IV	LC
96.	Indian Robin	*Saxicoloides fulicatus*	Schedule IV	LC
97.	Pied Bushchat	*Saxicola caprata*	Schedule IV	LC
98.	White-browed Bushchat	*Saxicola macrorhynchus*	Schedule IV	Vulnerable
99.	Eastern Black Redstart	*Phoenicurus ochruros*	Schedule IV	LC
100	Yellow-eyed Babbler	*Chrysomma sinense*	Schedule IV	LC
101	Common Babbler	*Turdoides caudata*	Schedule IV	LC
102	Jungle Babbler / Saat Bhai	*Turdoides striata*	Schedule IV	LC
103	Long Tailed / Rufous-vented Prinia	*Prinia burnesii*	Schedule IV	NT
104	Plain Prinia / White-browed Wren-warbler	*Prinia inornata*	Schedule IV	LC

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
105	Zitting Cisticola	*Cisticola juncidis*	Schedule IV	LC
106	Common Tailor Bird	*Orthotomus sutorius*	Schedule IV	LC
107	Blyth's Reed- Warbler	*Acrocephalus dumetorum*	Schedule IV	LC
108	Streaked Fantail-Warbler	*Cisticola juncidis*	Schedule IV	LC
109	Bristled Grassbird	*Chaetornis striata*	Schedule IV	Vulnerable
110	Indian Great Tit	*Parus major*	Schedule IV	LC
111	Purple Sunbird	*Cinnyris asiaticus*	Schedule IV	LC
112	Common Rosefinch	*Carpodacus erythrinus*	Schedule IV	LC
113	Yellow Breasted Bunting	*Emberiza aureola*	Schedule IV	Endangered
114	Indian Spotted Munia	*Lonchura punctulata*	Schedule IV	LC
115	White Throated Munia / Indian Silverbill	*Lonchura malabarica*	Schedule IV	LC
116	House Sparrow	*Passer domesticus*	Schedule IV	LC
117	Baya Weaver Bird	*Ploceus philippinus*	Schedule IV	LC
118	Pied Myna	*Sturnus contra*	Schedule IV	LC
119	Indian Common Myna	*Acridotheres tristis*	Schedule IV	LC
120	Bank Myna	*Acridotheres ginginianus*	Schedule IV	LC
121	Indian Golden Oriole	*Oriolus kundoo*	Schedule IV	LC
122	Black Drongo	*Dicrurus macrocercus*	Schedule IV	LC
123	Indian / Rufous Tree Pie	*Dendrocitta vagabunda*	Schedule IV	LC
124	House Crow	*Corvus splendens*	Schedule IV	LC
125	Indian Jungle Crow	*Corvus culminatus*	Schedule IV	LC

LC- Least Concern, NT- Not Threatened

Source: *Actual sightings, interactions with local people and Publication of ZSI, Kolkata*

4.7.6.5 Aquatic Ecology

41 types of fish species were reported in the study area as per various published data. The detailed listing and their status as per IUCN and Wildlife Protection Act, 1972 is given in Table below.

Table 4-22: Fish Reported in Study Area

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
1.	-	*Notopterus*	-	LC
2.	Catla fish	*Catla*	-	LC
3.	Mrigal fish	*Cirrhinus mrigala*	-	LC
4.	Reba carp	*Cirrhinus reba*	-	LC
5.	Common Carp	*Cyprinus carpio*	-	Vulnerable
6.	Rohu	*Labeo rohita*	-	LC

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
7.	Bata/ Minor Carp	*Labeo bata*	-	LC
8.	Kalbasu/ Minor Carp	*Labeo calbasu*	-	LC
9.	Cotio Fish	*Osteobrama cotio*	-	LC
10.	Rosy/Red Barb	*Puntius conchonius*	-	LC
11.	Spot fin swamp barb fish	*Puntius sophore*	-	LC
12.	Two Spot barb fish	*Puntius ticto*	-	LC
13.	Peninsular Olive Barb	*Systomus sarana*	-	LC
14.	Swamp Barb	*Puntius chola*	-	LC
15.	Mola Carplet Fish	*Amblypharyngodon mola*	-	LC
16.	Giant danio	*Danio aequipinnatus*	-	LC
17.	Flying Barb	*Esomus danricus*	-	LC
18.	Slender Rasbora / Barb	*Parluciosoma daniconius*	-	LC
19.	Garra / Stone Sucker fish	*Garra gotyla*	-	LC
20.	Siver Headed Chela	*Chela cachius*	-	LC
21.	Indian Glass Barb	*Chela laubuca*	-	LC
22.	Large razor-belly minnow	*Salmostoma bacaila*	-	LC
23.	Guntea Loach / Mori	*Lepidocephalus guntea*	-	LC
24.	Mottled Loach, Striped Loach	*Acanthocobitis botia*	-	LC
25.	Gangetic Mystus	*Mystus cavasius*	-	LC
26.	Striped Dwarf catfish	*Mystus vittatus*	-	LC
27.	Seenghala Fish	*Sperata seenghala*	-	LC
28.	Magur	*Clarias batrachus*	-	LC
29.	Asian Stingining catfish	*Heteropneustes fossilis*	-	LC
30.	Indian Butterfly Fish	*Ompok bimaculatus*	-	LC
31.	Pabo Fish	*Ompok pabo*	-	LC
32.	Freshwater Shark	*Wallago attu*	-	LC
33.	Freshwater garfish	*Xenentodon cancila*	-	LC
35.	Maral / Giant Snakehead Murrel	*Channa striata*	-	LC
36.	Maral / Giant Snakehead Murrel	*Channa punctatus*	-	LC
37.	Elongate Glass Perchlet	*Chanda nama*	-	LC
38.	Himalayan Glassy Perchlet	*Pseudambassis baculis*	-	LC
39.	Freshwater Flathead Goby fish	*Glossogobius giuris*	-	LC
40.	Barred spiny freshwater eel fish	*Macrognathus aral*	-	LC

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
41.	Barred spiny freshwater eel fish	*Macrognathus armatus*	-	LC

LC- Least Concern, NT- Not Threatened

Source: *Actual sightings, interactions with local people and Publication of ZSI, Kolkata*

4.7.6.6 Insect & Butterflies

Insects are the major part of the ecological system. Various kind of butterflies were observed in the study area. Insects as reported at site is presented in Table below.

Table 4-23: Insects and Butterflies reported in Study Area

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
1.	Not Available	Astychus pythias	-	-
2.	Common Banded Awl	Hasora chromus	-	-
3.	Common Grass Dart	Taractrocera maevius	-	-
4.	Indian Palm Bob	Saustus gremius	-	-
5.	Small Branded Swift	Pelopidas mathais	-	-
6.	Common Jay	Graphium doson	-	-
7.	Common Mormon	Papilio polytes	-	-
8.	Lime Butterfly	Papilio demoleus	-	-
9.	Common Rose	Pachliopta aristolochiae	-	-
10.	Common Lemmon Emigrant	Catopsilia pomona	-	-
11.	Mottled Emigrant	Catopsilia pyranthe	-	-
12.	Large Salmon Arab	Colotis fausta	-	-
13.	Common Grass Yellow	Eurema hecabe	-	-
14.	Small Grass Yellow	Eurema brigitta	-	-
15.	Spotless Grass Yellow	Eurema laeta	-	-
16.	Common Albatross	Appias albina	-	-
17.	Common Jezebel	Delias eucharis	-	-
18.	Psyche	Leptosia nina	-	-
19.	White Orange Tip	Ixias marianne	-	-
20.	Yellow Orange Tip	Ixias pyrene	-	-
21.	Pioneer White	Belenois aurota	-	-
22.	Common Leopard	Phalanta phalantha	-	-
23.	Plain Tiger	Danaus chrysippus	-	-
24.	Common Sailer	Neptis hylas	-	-
25.	Indian Common Crow	Euploea core	-	-
26.	Danaid Eggfly	Hypolimnas misippus	-	-
27.	Chocolate Pansy	Junonia iphita	-	-

S. No.	Common Name	Scientific Name	Wildlife Schedule	IUCN Category
28.	Yellow Pansy	Junonia hierta	-	-
29.	Blue Pansy	Junonia orithyia	-	-
30.	Peacock Pansy	Junonia almana	-	-
31.	Tiger/ Blue/ Blue Tiger / Brush-Footed Butterfly	Tirumala limniace	-	-
32.	Angled Castor	Ariadne	-	-
33.	Tawny/Common Coster	Acraea viole	-	-
34.	Common Palmfly	Elymnias hypermnestra	-	-
35.	Lesser Threewing	Ypthima inica	-	-
36.	Jewel Fourring	Ypthima avanta	-	-
37.	Dark-Brand Bushbrown	Mycalesis mineus	-	-
38.	Common Evening Brown	Melanitis leda	-	-
39.	Dark Evening Brown	Melanitis phedima	-	-
40.	Common Silverline	Spindasis vulcanus	-	-
41.	Common Pierrot	Castalius rosimon	-	-
42.	Rounded Pierrot	Tarucus extricates	-	-
43.	Gram Blue/Cupid	Euchrysops cnejus	-	-
44.	Pea Blue	Lampides boeticus	-	-
45.	Lesser Grass Blue	Zizina otis	-	-
46.	Pale Grass Blue	Pseudozizeeria maha	-	-
47.	Dark Grass Blue	Zizeeria karsandra	-	-
48.	Zebra Blue	Syntarucus plinius	-	-

LC- Least Concern, NT- Not Threatened

Source: *Actual sightings, interactions with local people and Publication of ZSI, Kolkata*

4.7.6.7 Findings Summary

The Site and Study areas near Bareta is predominantly dominated by agroecosystem on plains. No protected areas like National Park, Wildlife Sanctuary/ Reserve within the 10 km radius. The nearest ecologically notified area i.e. Bir Aishvan Wildlife Sanctuary is located at about 44km. As per the direct sighting records, indirect occurrence evidence records and records procured from secondary literature data there is a possibility of movement of twenty-nine mammalians, one hundred and twenty-five avian, twenty-three reptilians, six amphibians, forty-one fish and forty-eight butterfly species (Total 272 species belonging to five vertebrate classes and one order of butterflies in entire Mansa District, Punjab. Preliminary analysis indicates that about forty-two species of Special Concern in the above mentioned faunal checklist have been recorded from the entire Mansa District including the Site and Study areas.

Out of forty-two Species of Special Concern no threatened faunal species is a Resident species of the site and Study areas. It has also been observed at the time of inspection of the site that there was a

fairly good movement of faunal elements such as rodents, birds, lizards, insects, and butterflies in present vegetation in the Site area.

4.8 SOCIAL ENVIRONMENT

This section provides an understanding of the administrative setup of the district, the demographic profile of the villages/towns in the project area, the social groups present, the land use pattern in the area, the livelihood profile of the community, the common property resources, the social and physical infrastructure available in terms of the education and health infrastructure, the water supply for irrigation and drinking purposes, sanitation facilities and connectivity. The purpose of this section is to allow for an increased understanding of the key issues identified as well as identify areas of intervention in future scenarios.

4.8.1 Methodology

The key objective of the socio-economic study is to assess possible impact of the project on socio-economic life of the people in the neighborhood of the project.

A mixture of both quantitative and qualitative approach has been adopted in the current socio-economic study. The study has been conducted based on primary and secondary data. While primary data has been collected through a stratified sampling method of selected households located in the nearby village, the secondary data has been collected from the administrative records of the Government of Punjab, Census of India 2011, district statistical hand book, state and district portal.

The details regarding population composition, number of literates, workers, etc. have been collected from secondary sources and analyzed. Data on amenities available in the study area have been collected from secondary sources like District Annual Statistical Handbook, http://www.esopb.gov.in/static, Census of India 2011, and analyzed.

Two stage sampling design has been adopted to select the sampling units. The first stage units are census villages in the rural areas and towns/cities in urban areas. The ultimate stage units are households in the selected villages and towns/cities. Stratified Sampling Method has been adopted to select the sampling units. Estimation of various parameters has been made based on sample data and bottom top approach has been adopted.

On the basis of a preliminary reconnaissance survey, questionnaire was developed to make it suitable to fulfill the objectives of the study. The questionnaires contained both open ended and close ended questions.

The data collected during the above survey was analyzed to evaluate the prevailing socio-economic profile of the area. Based on that, impacts due to project operation on the community have been assessed and recommendations for improvement have been made. The impact from the solar power project will be very minimal and will be limited to maximum within project boundary. But the study area has been considered as 10 km radius of project boundary.

4.8.2 Baseline of the Study Area

4.8.2.1 State Profile: Punjab

Punjab is located in the northwestern part of India and has an area of 50,362 square km (19,445 m^2). It extends from the latitudes 29.30°N to 32.32°N and longitudes 73.55°E to 76.50°E and bounded on

the north by Jammu and Kashmir, on the northeast by Himachal Pradesh, on the south by Haryana and Rajasthan state and on the west by country of Pakistan. Punjab in its present form came into existence on November 1, 1966, when most of its predominantly Hindi-speaking areas were separated to form the new state of Haryana. The city of Chandigarh, within the Chandigarh union territory, is the joint capital of Punjab and Haryana. The word Punjab is a compound of two Persian words, panj ("five") and ab ("water"), thus signifying the land of five waters, or rivers (the Beas, Chenab, Jhelum, Ravi, and Sutlej).

The culture in Punjab is rich and diverse. The biggest community of Punjab comprises of Sikh and Jat. These people are extremely hard-working and are mostly into agriculture. They play a major role in the agricultural output of the state. Moreover, the fertile land of the state presents ample scope for agriculture. The people of Punjab are well-known for warmth and hospitality.

The population of Punjab as per Census 2011, is 2,77,43,338 of which male and female are 1,46,39,465 and 1,31,03,873 respectively. Salient features of Punjab State in comparison to District Mansa have been enriched in the Table below:

Table 4-24: Salient Features of Punjab State

S. No.	Particular	Unit	Details	District (Mansa)
1.	**GEOGRAPHICAL AREA**	**Sq. Km**	**50362**	**2171**
1.1	Rural Area	Sq. Km	48265 (96%)	-
1.2	Urban Area	Sq. Km	2097 (4%)	-
1.3	Area Under Forest	Sq. Km	3011 (6%)	27 (1.24%)
2.	**ADMINISTRATIVE SET UP**			
2.1	Divisions	Numbers	05	N/A
2.2	Districts	Numbers	22	1
2.3	Sub-divisions/ Tehsils	Numbers	82	3
2.4	Sub-Tehsils	Numbers	86	4
2.5	Blocks	Numbers	147	5
2.6	Census Towns-2011	Numbers	74	5
2.7	Inhabited Villages-Census 2011	Numbers	12581	238
2.8	Zila Parishads	Numbers	22	1
2.9	Municipal Corporation / Municipal Council / Nagar Panchyats	Numbers	165	5
3.	**POPULATION (CENSUS 2011)**			
3.1	Total Population	Lakh (1 Lakh=100000)	277.48	7.70
3.2	Male	Lakh	146.39 (52.8%)	4.09
3.3	Female	Lakh	131.04 (47.2%)	3.61
3.4	Gender Ratio	Female Per 1000 Male	895	883
3.5	Rural Population-2011	Lakh	173.44	6.06
3.6	Urban Population-2011	Lakh	103.99	1.64

S. No.	Particular	Unit	Details	District (Mansa)
3.7	Percentage of Rural Population to total Population	Percentage	62.52%	78.75
3.8	Population Density	Per Sq. Km	551	350
4.	**LITERACY RATE**			
4.1	Literacy (Total)	Percentage	75.80	61.63
4.2	Male	Percentage	80.40	67.31
4.3	Female	Percentage	70.70	55.68
4.4	Gender Gap in Literacy Rate	Percentage	9.70	11.63
5.	**AVERAGE MONTHLY PER CAPITA EXPENDITURE**			
5.1	Rural	INR	2345	-
5.2	Urban	INR	2794	-
6.	**PER CAPITA INCOME (AT CURRENT PRICES)**			
6.1	2013-14	INR	105145	-
6.2	2014-15	INR	114561	--
6.3	2015-16	INR	126063	-
7.	**PERCENTAGE OF POPULATION BELOW POVERTY LINE (2011-12)**			
7.1	Total	Percentage	8.26	-
7.2	Rural	Percentage	7.6	-
7.3	Urban	Percentage	8.26	-
8.	**AGRICULTURE (2014-15) P**			
8.1	Net Area Sown	000 Hectare	4135	-
8.2	Total Cropped Area	000 Hectare	7900	-
8.3	Cropping Intensity*	Percentage	191	-
9.	**MEDICAL AND PUBLIC HEALTH**			
9.1	Birth Rate (As on 01.09.2014)	Per thousand/Annum	15.7	-
9.2	Death Rate	Per thousand/Annum	6.7	-
9.3	Infant Mortality Rate (SRS 2012-13)	Per thousand/Annum	26	-
9.4	Hospitals (2015)	Numbers	98	3
9.5	Community Health Centers (CHCs) (2015)	Numbers	150	4
9.6	Dispensaries (2015)	Numbers	1440	40
9.7	Primary Health Centers (PHCs) 2015	Numbers	427	13
9.8	Ayurvedic and Unani Institutions (2015)	Numbers	529	13
9.9	Homeopathic Institutions (2015)	Numbers	111	2
9.10	Bed Installed in Medical Institutions (Allopathy) 2015	Numbers	23220	-

S. No.	Particular	Unit	Details	District (Mansa)
9.11	Population Served per Institutions, 2015	Numbers	13505	-
10.	**EDUCATION DATA AS ON 30.09.2014 (NUMBER OF INSTITUTION)**			
10.1	Universities	Numbers	14	0
10.2	Colleges	Numbers	252	8
10.3	High/Senior Secondary School	Numbers	8695	241
10.4	Middle School	Numbers	5448	113
10.5	Primary School	Numbers	14505	320
11.	**PUPIL-TEACHER RATIO IN SCHOOLS AS ON 30.09.2014**			
11.1	Primary Stage (Class I-V)	Numbers	29	-
11.2	Middle Stage (Class VI-VIII)	Numbers	22	-
11.3	High School Stage (IX-X)	Numbers	17	-
11.4	Senior Secondary Stage (XI-XII)	Numbers	32	-
12.	**FACTORIES COVERED UNDER ANNUAL SURVEY OF INDUSTRIES (ASI) 2013-14**			
12.1	Number of Factories	Numbers	12278	-
12.2	Fixed Capital	INR (in Lakh)	3935562	-
12.3	Number of Employees	Numbers	602818	-
12.4	Net Value Added	INR (in Lakh)	2406699	-

Source: http://www.esopb.gov.in/Static/PDF/Economic%20Survey%202015-16%20.pdf

4.8.2.2 District Profile: Mansa

Mansa District is located in the southern part of Punjab State and covers an area of 2,171 sq. km and lies between North latitude 29°32' to 30°12' and East longitude 75°10' to 75°46'. It is bounded by Sangrur district in the East, Bathinda Districts in the west, Barnala District in the North and Haryana State in the South. The district has total Population of 7,69,751 as per census 2011, with a population density of 350 persons/km^2 and the decennial growth of 11.2%. As per 2011 census, 78.75% population of Mansa districts lives in rural areas of villages. The total population of Mansa district living in rural areas is 6,06,147 out of which males and females are 322184 and 283963 respectively. In rural areas of Mansa district, sex ratio is 881 females per 1000 males.

This district is a newly created district of Punjab by reorienting parts of adjoining Bathinda District in 1992, and is divided into three Sub Divisions namely Mansa, Budhlada and Sardulgarh. There are five Blocks and 243 villages having 244 Gramm Panchyats.

Mansa is situated in the cotton belt of Punjab and therefore fondly called the "Area of white gold". Indeed, agriculture forms the backbone of the district economy. During the months of November and December a visitor to this part of Punjab shall be the proud witness to the pristine, milky white bloom of cotton, as nature blossoms in her full glory. The population is Punjabi-speaking and followed to the culture of the Malwa belt of Punjab. Industrially, the district is very deficient, yet some trade and industry is being carried out in Urban areas (Source: http://mansa.nic.in/html/about.html). Salient features of district Mansa has been presented in the Table below.

Table 4-25: Salient Features of Mansa District

S. No.	Particular	Unit	Details
1.	**ADMINISTRATIVE STRUCTURE OF THE DISTRICT**		
1	**Area**	**Sq. Km**	**2171**
1.1	Sub-division / Tehsil	Number	3
1.2	Sub-tehsil	Number	4
1.3	Block	Number	5
1.4	Towns	Number	5
1.5	Inhabited Villages	Number	238
2.	**POPULATION (CENSUS-2011)**		
2.1	Total	Number	769751
2.2	Male	Number	408732
2.3	Female	Number	361019
2.4	Sax Ratio (Number of Male / Thousand Female)	Number	883
2.5	Population Density (Per Sq. Km)	Number	350
3.	**LITERACY RATE (Census 2011)**		
3.1	Total	Percentage	61.83
3.2	Male	Percentage	67.31
3.3	Female	Percentage	55.68
3.4	Gender Gap in Literacy Rate	Percentage	11.63
4.	**MEDICAL AND HEALTH (2014)**		
4.1	Hospital	Number	3
4.2	Community Health Centers (CHCs)	Number	4
4.3	Primary Health Centers (PHCs)	Number	13
4.4	Dispensaries	Number	40
4.5	Ayurvedic Institutions	Number	12
4.6	Unani Institutions	Number	1
4.6	Homeopathic Institutions	Number	2
5.	**NUMBER OF EDUCATIONAL INSTITUTIONS (2013-14)**		
5.1	Primary School	Number	320
5.2	Middle School	Number	113
5.3	High and Senior Secondary School	Number	241
5.4	Technical Industrial / Polytechnic Institutions	Number	23
5.5	Colleges / Institutions	Number	8
6.	**Per Capita Income at Current Prices (in INR)**		
6.1	Current (2011-12)	INR	69645
6.2	Net District Domestic Product (2011-12)	INR (in Lakh)	580143

S. No.	Particular	Unit	Details
7.	**Agriculture**		
7.1	Total Cropped Area (2012-13)	Hectare	366
7.2	Cropping Intensity (2012-13)	Hectare	193

Source: www.esopb.gov.in

4.8.2.3 Project Influence Area

The proposed, 25 MW Solar Power Project site is located in Bareta, a small town, Tehsil Budhlada, District Mansa approximately 30 km to the SE from Mansa District Headquarter and 205 km NNW from National Capital, New Delhi. Nearest Railway Station is Bareta. The proposed project is covering 9 Census villages of Mansa district of Punjab state. The study area for the project has been considered 5 km peripheral from the project boundary. Further, to achieve an informative result the total area has been segregated into two different zones. Which is: -

Zone -1 : Core Zone

Zone -2 : 5 km. radius from Core Zone

On the basis of available census data, 2011 different aspects of socio economic condition of all villages in these two different zones have been analyzed and presented in section below.

4.8.3 Demographic Profile of the Study Area

4.8.3.1 Data Collection & Survey

There are 9 villages within the study area of core zone and buffer zone as explained above. Consultation and socio-economic survey was mainly conducted in 2 census villages (Bareta and Dayalpura) located close proximity and approachable distance from the site in order to assess the impact of the upcoming solar power project in district Mansa, Punjab. However, the secondary baseline data collection as per Census 2011 was collected from Census of India for all the villages within the study area as per the zones as described in the Table 4.26.

4.8.3.2 Concept & Definition of Terms Used

Quality of Life (QoL): Quality of Life refers to degree to which a person enjoys the important possibilities of his / her life. The 'Possibilities' result from the opportunities and limitations, each person has in his / her life and reflect the interaction of personal and environmental factors. Enjoyment has two components: the experience of satisfaction and the possession or achievement of some characteristic.

Household: A group of persons who normally live together and take their meals from a common kitchen are called a household. Persons living in a household may be related or unrelated or a mix of both. However, if a group of related or unrelated persons live in a house but do not take their meals from the common kitchen, then they are not part of a common household. Each such person is treated as a separate household. There may be one member households, two member households or multi-member households.

Sex Ratio: Sex ratio is the ratio of females to males in a given population. It is expressed as 'number of females per 1000 males'.

Literates: All persons aged 7 years and above who can both read and write with understanding in any language are taken as literate. It is not necessary for a person to have received any formal education or passed any minimum educational standard for being treated as literate. People who are blind but can read in Braille are also treated as literates.

Literacy Rate: Literacy rate of population is defined as the percentage of literates to the total population aged 7 years and above.

Work: Work is defined as participation in any economically productive activity with or without compensation, wages or profit. Such participation may be physical and/or mental in nature. Work involves not only actual work but also includes effective supervision and direction of work. The work may be part time or full time or unpCaid work in a farm, family enterprise or in any other economic activity.

Worker: All persons engaged in 'work' are defined as workers. Persons who are engaged in cultivation of land or milk production even solely for domestic consumption are also treated as workers.

Main Workers: Those workers who had worked for the major part of the reference period (i.e. 6 months or more in the case of a year) are termed as Main Workers.

Marginal Workers: Those workers who did not work for the major part of the reference period (i.e. less than 6 months) are termed as Marginal Workers.

Work Participation rate (WPR): The work participation rate is the ratio between the labor force and the overall size of their cohort (national population of the same age range). In the present study the work participation rate is defined as the percentage of total workers (main and marginal) to total population.

Below Poverty Line (BPL) family: As per Press Information Bureau, Govt. of India, 2011-12, Poverty Line Estimation for rural areas (as per Tendulkar Committee Report) is at INR 816 per capita per month and INR 1,000 per capita per month in urban areas. Thus, for a family of five, the all India poverty line in terms of consumption expenditure would amount to about INR 4,080 per month in rural areas and INR 5,000 per month in urban areas.

Pacca House: A pucca house is one, which has walls and roof made of the following material: (i) Wall material: Burnt bricks, stones (packed with lime or cement), cement concrete, timber, ekra etc. (ii) Roof Material: Tiles, GCI (Galvanised Corrugated Iron) sheets, asbestos cement sheet, RBC, (Reinforced Brick Concrete), RCC (Reinforced Cement Concrete) and timber etc.

Kutcha House: The walls and/or roof of which are made of material other than those mentioned above, such as unburnt bricks, bamboos, mud, grass, reeds, thatch, loosely packed stones, etc. are treated as kutcha house.

Semi-pucca House: A house that has fixed walls made up of pucca material but roof is made up of the material other than those used for pucca house.

Table 4-26: Demographic Profile of the Study Area

S. No.	Name of Villages	HH	Population			Literates			Main Workers			Marginal Workers			Non Workers		
			Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F
Zone I (Core Zone)																	
1.	Bareta (MCl)	3409	17432	9239	8193	11073	6281	4792	5443	4683	760	468	231	237	11521	4325	7196
Zone II (Buffer Zone 10 km. Radius)																	
2.	Bahadarpur (168)	1200	6146	3283	2863	3030	1769	1261	2120	1792	328	447	60	387	3579	1431	2148
3.	Dialpura (167)	513	2539	1374	1165	1101	668	433	831	763	68	191	27	164	1517	584	933
4.	Gobindpura (164)	321	1697	924	773	937	547	390	628	537	91	5	3	2	1064	384	680
5.	Jalwehra (162)	266	1397	744	653	699	397	302	482	465	17	0	0	0	915	279	636
6.	Khatriwala (169)	335	1702	865	837	830	455	375	467	451	16	8	5	3	1227	409	818
7.	Khudal Kalan (174)	457	2256	1210	1046	1114	667	447	912	651	261	228	48	180	1116	511	605
8.	Sanghreri (163)	184	1003	538	465	516	291	225	292	276	16	6	4	2	705	258	447
9.	Sirsiwala (165)	271	1408	723	685	719	406	313	339	323	16	40	37	3	1029	363	666
Total		3547	18148	9661	8487	8946	5200	3746	6071	5258	813	925	184	741	11152	4219	6933
Grand Total		**6956**	**35580**	**18900**	**16680**	**20019**	**11481**	**8538**	**11514**	**9941**	**1573**	**1393**	**415**	**978**	**22673**	**8544**	**14129**

Source: Census of India, 2011

4.8.4 Baseline Data of the Study Area

In the table below an attempt has been made to provide salient features of socio-economic features of the study area:

Table 4-27: Demography, Literacy and Occupational details of people living in Study Area

S. No.	Description	Number	% to total
1	Total Population - Gender wise	35,580	100
	Male	18,900	53.12
	Female	16,680	46.88
	Sex ratio (No. of females per 1000 males)	883	
2	Total Population (0-6 years) - Gender wise	3957	11.12
	Male	2161	54.61
	Female	1796	45.39
	Sex ratio (No. of females per 1000 males)	831	-
3	Total Population (Sector Wise)	35,580	100
	Rural	18,148	51.00
	Urban	17,432	49.00
4	Total no. of households	6,956	-
	Average House hold size	5.12	-
	Lowest Household size (Village: Khudal Kalan (174))	4.94	-
	Highest Household size (Village: Sanghreri (163))	5.45	-
5	Total SC & ST Population	12,425	34.92
	Total Population (SC)	12,425	34.92
	Total Population (ST)	0	0
6	Total Literates – Gender wise	20,019	63.30
	Male Literacy (with respect to the male population)	11,481	68.59
	Female Literacy (with respect to the female population)	8,538	57.36
	Literacy gap between male and female	-	11.22
7	Total Literates – Sector wise	20,019	63.30
	Rural (Number and % to total literates)	8,946	55.72
	Urban (Number and % to total literates)	11,073	71.12
9	Total Workers & Work Participation Rate	12,907	36.28
	Male (Number and % with respect to the male population)	10,356	54.79
	Female (Number and % with respect to the female population)	2,551	15.39
	Gender gap in workforce (in percentage)	-	39.50
10	Total Main Workers & percentage to total worker	11,514	89.21

S. No.	Description	Number	% to total
	Male (Number and % with respect to the male working population)	9,941	95.99
	Female (Number and % with respect to the female working population)	1,573	61.66
a)	Main Worker as Cultivator (Number and Percentage)	3,076	26.71
b)	Main Worker as Agricultural Labor (Number and Percentage)	2,249	19.53
c)	Main Worker as Household Industry Worker (Number and Percentage)	799	6.94
d)	Main Worker as Other workers (Number and Percentage)	5,390	46.81
11	Total Marginal Workers & percentage to total worker	1,393	10.79
	Male (Number and % with respect to the male working population)	415	4.01
	Female (Number and % with respect to the female working population)	978	38.34
a)	Marginal Worker as Cultivator (Number and Percentage)	176	12.63
b)	Marginal Worker as Agricultural Labor (Number and Percentage)	449	32.23
c)	Marginal Worker as Household Industry Worker (Number and Percentage)	155	11.13
d)	Marginal Worker as Other workers (Number and Percentage)	613	44.01
12	Number and Percentage of Marginal Worker (3-6 Months)	1255	90.09
13	Number and Percentage of Marginal Worker (0-3 Months)	138	9.91

Source: Census of India, 2011

4.8.5 Demographic Composition

4.8.5.1 Population

As per Census of India 2011, the total population of the study area is 35,580 in which 53.12% are males and 46.88% are females. An average gender ratio of the study area is approximately 883 females per 1000 males, which is very poor than national average of 943 females per 1000 males. Approximately half of the population of the study area comes under rural settlement, while half under semi-urban settlement. Approx. 11.12% of the total population belongs to 0-6 age group. The sex ratio of this age group is 831 female children per 1000 male children, which also much lower than the average sex ratio of the study area. The break-up of population data for the study area zone-wise is given in Table above.

4.8.5.2 Households and Household Size

The entire population of the study area has been grouped into 6,956 households and the average size of household is approximately 5.12 persons/ household. During site visit it was observed and noted that most of the houses of the study area are made of bricks and cement and of semi-pacca type with toilet facility.

Table 4-28: Zone-wise Break up of Population in Study Area

S. No.	Core/ Buffer Zone	House-holds	Household Size	Population				Population (06 years)			
				Total	M	F	Gender Ratio	Total	M	F	Gender Ratio
1	Core (Bareta)	3409	5.11	17432	9239	8193	887	1864	1019	845	829
2	Buffer	3547	5.12	18148	9661	8487	878	2093	1142	951	833
Total		6956	5.12	35580	18900	16680	883	3957	2161	1796	831

Source: Census of India, 2011

Gender Ratio of the study area with district, state and national average is compared and is shown in Figure 4.14.

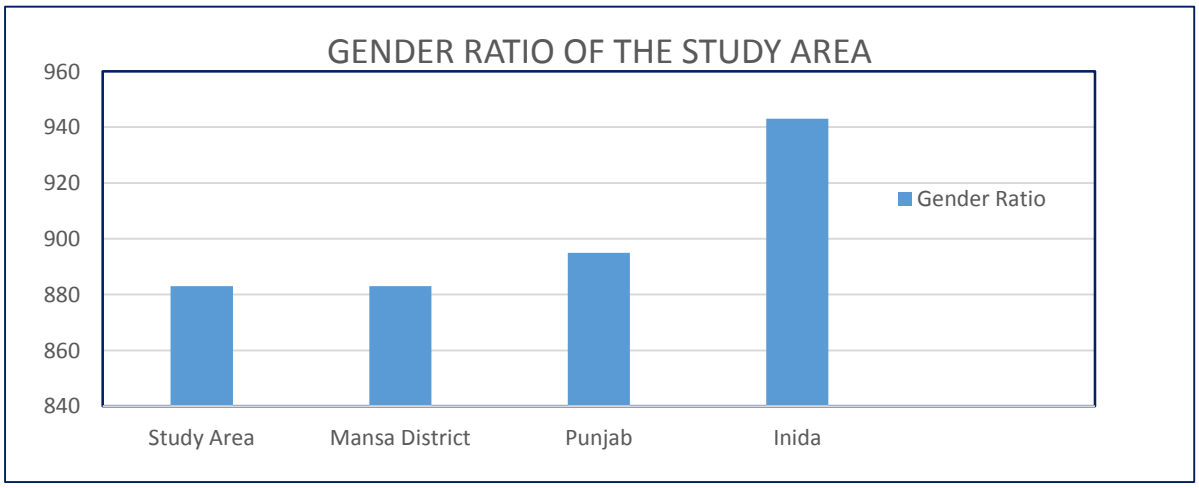


Figure 4-14: Gender ratio in the study area in reference to District, State and Nation

4.8.5.3 Social Stratification

With reference to the below Table, approx. 34.92% of the total population of the study area belongs to Schedule Castes and rest are general and other backward castes. There is no population of Schedule Tribes exist in the study area and even in the district of Mansa. Therefore, there is no any impact on indigenous people. The population of Scheduled Castes in core zone is 30.06% and in buffer zone is 39.59%. Most of the people of Bareta town believes in Hindu and Sikh religion (Hindu: 53.28%, Sikh: 44.95% as per Census 2011).

The break up distribution of scheduled caste and scheduled tribe population in the project area is shown in Table below.

Table 4-29: Zone-wise Distribution of SC and ST Population in Study Area

S. No.	Village	Schedule Caste Population				Schedule Tribe Population			
		Total	M	F	Percentage	Total	M	F	Percentage
Core Zone									
1.	Bareta	5240	2767	2473	30.06	0	0	0	0
Sub-Total		**5240**	**2767**	**2473**	**30.06**	**0**	**0**	**0**	**0**

S. No.	Village	Schedule Caste Population				Schedule Tribe Population			
		Total	M	F	Percentage	Total	M	F	Percentage
Buffer Zone									
2	Sub-Total	7185	3784	3401	39.59	0	0	0	0
Total		12425	6551	5874	**34.92**	**0**	**0**	**0**	**0**

Source: Census of India, 2011

Poverty Line in Core Zone of the Study Area: As per data collected from Municipal Panchyat office Bareta, there are 360 families are BPL cardholder in Bareta town which are 10.56% of Census 2011 family of Bareta.

4.8.5.4 Literacy and Literacy Rate

The average literacy rate of the study area is 63.31% (20019) in which male's literacy is 68.59% with respect to the male population as against 57.36% for females with respect to the female population, creating a gender gap of 11.22%. The average literacy rate of core zone is 71.13% while it is 55.72% in buffer zone of the study area. The break up distribution of literate population in the project area is shown in Table below.

Table 4-30: Zone-wise Distribution of Literacy in the Study area

S. No.	Zone	Number of Literates			Literacy Rate			
		Total	M	F	Total	M	F	Gender Gap
1	Core	11073	6281	4792	71.13	76.41	65.22	11.20
2	Buffer	8946	5200	3746	55.72	61.04	49.71	11.33
Total		**20019**	**11481**	**8538**	**63.31**	**68.59**	**57.36**	**11.22**

Source: Census of India, 2011

The literacy rate of the project area has been compared with the literacy rate of district, state and national level which shows that literacy rate of the study area is below than the literacy rate of the state and national level. But it is better than the literacy rate of district (Mansa District) level. Though overall literacy rate of Punjab state is better than the national level. Details of comparison are given in Figure below.

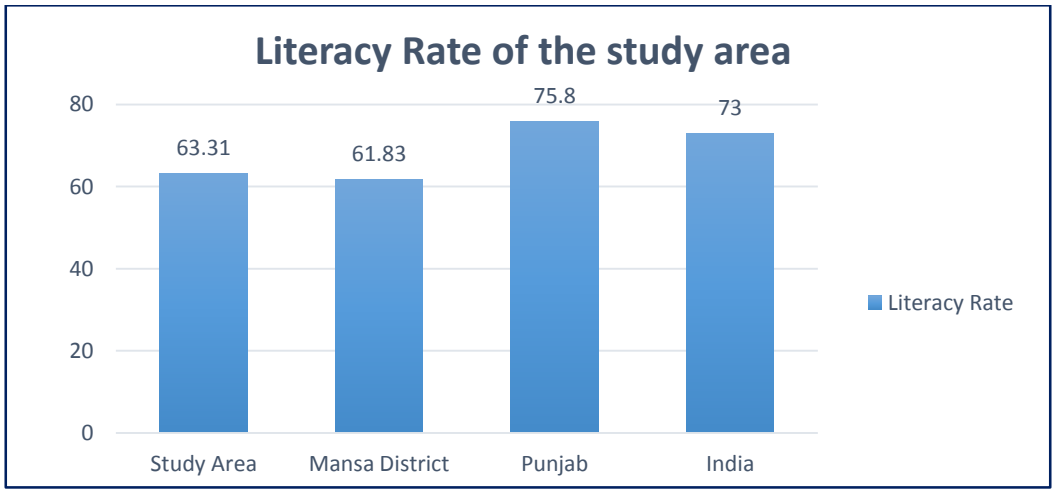


Figure 4-15: Literacy Rate in the study area when compared with district, state and national level

4.8.5.5 Workers and Work Participation Rate

The total number of workers in the study area is 12,907 and the WPR is 36.27% in which males are 54.79% with respect to the male population and females are 15.29% with respect to female population. Among the total workers 89.21% are main workers and the remaining 10.79% are marginal workers.

4.8.5.6 Categorization of Main Workers on the basis of Occupation

Following tables reflects that 46.81% of main worker are involved in other worker category followed by cultivators with 26.72%, agriculture labors with 19.53% and only 6.94% workers are involved in household industry. In core zone of the study area about 72.17% workers are involved in other types of working profession.

Table 4-31: Categorization of Main Workers on the basis of Occupation

S. No.	Zone	Types of Main Workers							
		Cultivators		Agricultural Labors		Household Industrial Workers		Other Workers	
		Nos.	%	Nos.	%	Nos.	%	Nos.	%
1	Core	439	8.06	309	5.68	767	14.09	3928	72.17
2	Buffer	2637	43.44	1940	31.96	32	0.53	1462	24.08
	Total	3076	26.72	2249	19.53	799	6.94	5390	46.81

Source: Census of India, 2011

4.8.5.7 Categorization of Marginal Workers on the basis of Occupation

Following tables reflects that 44.01% of marginal worker are involved in other workers category, followed by agricultural labors with 32.23%, cultivators with 12.63% and 11.23% are involved in household industry. In core zone of the study area 55.12% worker involved in other types of working profession.

Table 4-32: Categorization of Marginal Workers on the basis of Occupation

S. No.	Zone	Types of Marginal Workers							
		Cultivators		Agricultural Labors		Household Industrial Workers		Other Workers	
		Nos.	%	Nos.	%	Nos.	%	Nos.	%
1.	Core	24	5.12	118	25.21	68	14.53	258	55.12
2.	Buffer	152	16.43	331	35.78	87	9.41	355	38.38
Total		176	12.63	449	32.23	155	11.13	613	44.01

Source: Census of India, 2011

Considering the work culture of the study area, it appears that most of the workers in core zone (Bareta town) are involved in other types of profession while in buffer zone most of the workers are involved in cultivation and agricultural labors.

4.8.5.8 Culture and Religion

During consultation with local people of Bareta it was found out that in the study area numbers of religions exist in perfect harmony with each other. People of the study area speaks Punjabi and Hindi. The field survey and Census of India 2011 reveal that majority of the persons living in the villages and town of the study area are Hindus and Sikhs. As per Census of India 2011, approximately 53.28% population of Bareta town are Hindus while 44.95% are Sikhs and they play a vital role in making cultural and religious activities. The traditional attire of people is Kurta-pyjama with turban for men. Women prefer Patiala suits, ghagra as part of their traditional attire. However, the younger generation prefers trendy attire as per the fashion scenario. Bhangra, Jhumar and Giddha are the most popular folk dances of Punjab as well as of the study area. "Sarso ka saag" and "Makki di roti", Chole-bhature, lassi, naan etc. are among the famous dishes from the regional cuisine. Maghi, Lohri, Holi, Baisakhi, Teeyan, Diwali, Dussehra and Guru Nank Jayanti are the major festival celebrated in the Study Area.

4.8.5.9 Economy and Occupation

The economy of Punjab is largely dependent on Agriculture. Punjab is one of the most fertile regions in India. The region is ideal for wheat-growing. Punjab is called the "Granary of India" or "India's bread-basket". The state has been contributing about 50-60% of wheat and about 35-40% of rice produced by Government of India for food security of the country for last four decades.

The source of livelihood of the people of the study area are trade & business and agriculture. The people of Bareta are engaged in small and big trade and business, profession, services and few in daily wages labors while the people of the buffer zone of the study area are dependent on agriculture and cultivation. During consultation local people told that one can earn INR 35,000/ to INR 50,000/ per acre per annum through agriculture.

4.8.5.10Infrastructure Facilities

Roads: The site of the proposed solar power project is located adjacent to State Highway No. 10 (SH-10) that connect Bareta to Budhlada which are further well connected with NH-65 and NH-71. The internal roads/lanes of Bareta are in good conditions and interlinked with one another. Village road of the study area are also well connected with main road and in good condition.

Education: Considering the educational facilities in the study area, Govt. Primary School and Anganwadi Center are available in most of the villages of the study area. Bareta is enriched with various government and private educational institutions such as 2 numbers of Government Primary School, Govt. Girls Senior Secondary School, Govt. Boys Senior Secondary School, 3 Nos. of Private Senior Secondary School, Govt. Polytechnic Colleges and 3 nos. of Degree Colleges.

In addition, government facilitate Govt. Primary and Upper Primary School with scholarship, mid-day meal, free text-book and uniform to every student to encourage the students and improve the educational quality of the region and of Punjab. In spite of all these efforts the literacy rate (Census of India, 2011) of the study area is very poor and it is 63.31% in which males are 68.59% and females are 57.36% with 111.22% of gender gap.

Health: Bareta is endowed with a Government Civil Hospital with all basic infrastructure facility like ambulance, beds, maternity and nursing facility etc. In addition, in Bareta there are private Hospitals, Nursing Homes and Clinics available. During site visit, primary survey and consultation with local

people, it was found out that there are no chronic or epidemic disease has been reported in the study area except few cases of Cancer and Jaundice.

Drinking Water Facility: Hand-pumps and bore-well are the main source of water for drinking and other domestic use in the study area. In Bareta, water for drinking and domestic use are supplied through pipe line with the help of Bareta Municipal Panchyat. Good quality of ground water is available at 400-500 ft. However, RO system has also been installed in most of the houses.

Communication: The study area is well connected via mobile, telephone and internet. Government post office is available in Bareta and most of the village panchayat of the study area. Means of communications such as internet, telephone and television has made a vital role in changing the conservative thoughts of the people of the study area and brought awareness for development in both men and women.

Electricity Facility: The study area is good in terms of electricity supply. Generally, 20 hours' electricity is available in Bareta and most of the villages of the study area. Proposed 25 MW Solar power project may reduce demand-supply gap of the state. Thus in future, power cut will be reduced and people may utilize power in establishing household industry, irrigation etc. Thus proposed project will improve socio-economic status of the study area.

4.8.6 Conclusion

On the basis of interpretation made above, primary survey (interaction with stakeholders, FGD, community consultation and discussion with influential person of the study area) and secondary sources, the major outcomes specify the following observations and gap in the study area:

- No land of any ST, SC and BPL family has been taken on lease for the purpose of this project;
- Gender Ratio of the study area is very poor and it is approximately 883 females per thousand males. It is more poor and alarming in the children (831) below 6 years;
- Average literacy rate of the study area is approximately 63.31% whether as male literacy is 68.59% and female literacy rate is 57.36% with 11.22% of gender gap. The literacy rate of the study area is much below than the literacy rate of the district, the State and National level;
- Work Participation Rate of the study area is 36.28% in which males are 54.79% and females are 15.29%. There are 39.50% of gender gap between male and female in WPR;
- Social Status of women is very poor and they are completely depended and dominated by men;
- There is an urgent need to boost women empowerment programme in the study area;
- Bareta is a small town and livelihood of the people of the town is big and small trade & business, profession and government & private jobs while livelihood of the people of the buffer zone is cultivation and agriculture;
- Hand-pumps, bore-well and tap water are the main source of drinking water. Some hardness in ground water has been reported by local people;
- There is no population of Scheduled Tribes in the study area and even in Mansa district, therefore there is no any impact on indigenous people;
- Bareta is well endowed with educational and medical infrastructure; and
- There are no any chronic or epidemic disease has been reported in the study area except few cases of Cancer and Jaundice

5 ANTICIPATED ENVIRONMENT IMPACTS AND MITIGATION MEASURES

5.1 INTRODUCTION

The proposed project may have impact on the environment during construction and operation phases. This chapter describes the various environmental and social impacts identified and assessed for the construction and operation phases of the proposed Project. The identification of impacts has been done based on the review of available project information, discussions with the local community and representatives of the project proponents and other sector specific professionals.

During the construction phase, the impacts may be regarded as temporary or short-term; while long term impacts may be observed during the operation stage. The impact during operation phase are very limited and associated with transmission of electricity, washing of PV Modules, local transportation activities only. Spatially the impacts have been assessed over the study area of 10 km radius of the project site. The project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of power. It will certainly meet the ever increasing demand of power and to bridge the gap between demand and supply of power.

5.2 IMPACT APPRAISAL CRITERIA

The Criterion which has been employed to appraise impacts on various social and environmental components is as presented as **Table** below.

Table 5-1: Impact Appraisal Criteria

Criteria	Sub-Classification	Defining Limit	Remarks
Spread: refers to area of direct influence from the impact of a particular project activity.	Insignificant / Local spread	Impact is restricted within the foot prints of the Project boundary. For transmission line it will be within the right of way.	Except for ecology (which is defined as loss of vegetation only at site) or within the base of tower area
	Medium Spread	Impact is spread from up to 2 km from the boundary of the Project. Within 500m on either side of transmission line	Except for ecology (which is defined as loss of vegetation at site including large trees with limited disturbance to adjoining flora & fauna)
	High Spread	Impact is spread up to 2 km to 5 km from footprint boundary of the Project Beyond 500m on either side of transmission line	Except for ecology (which is defined as loss of vegetation at site and / or damage to adjoining flora and fauna).

Criteria	Sub-Classification	Defining Limit	Remarks
Duration: based on duration of impact and the time taken by an environmental component to recover back to current state	Insignificant / Short Duration	When impact is likely to be restricted for duration of less than 1 year;	The anticipated recovery of the effected environmental component within 2 years
	Medium Duration	When impact extends up to 3 years	With an anticipated recovery of the effected environmental component within 6 years
	Long Duration	When impact extends beyond 3 years	With anticipated recovery of prevailing condition to happen within 6 years or beyond or upon completion of the project life
Intensity: defines the magnitude of Impact	Insignificant intensity	When resulting in changes in the environmental baseline conditions is up to 10%	However, it shall be reconsidered where the baseline values are already high.
	Low intensity	When resulting in changes in the baseline conditions up to 20%	For ecology it refers to minimal changes in the existing ecology in terms of their reproductive capacity, survival or habitat change
	Moderate intensity	When resulting in changes in the baseline conditions for up to 30%	For ecology, it refers to changes that are expected to be recoverable
	High intensity	When change resulting in the baseline conditions beyond 30%	While for ecology, high intensity refers to changes that result in serious destruction to species destruction to species, productivity or their habitat

Criteria	Sub-Classification	Defining Limit	Remarks
Nature: refers to whether the effect is considered beneficial or adverse	Beneficial		Useful to Environment and Community
	Adverse		Harmful to Environment and Community

A significance assessment matrix was developed to assess the impacts based on the appraisal criteria developed above, which is as given in Table below.

Table 5-2: Impact Significance Criteria

Spread	Duration	Intensity	Overall Significance	
			Adverse	Beneficial
Local	Short	Low	Insignificant	Insignificant
Local	Short	Moderate	Minor	Minor
Local	Medium	Low		
Local	Medium	Moderate		
Medium	Short	Low		
Local	Long	Low		
Local	Short	High	Moderate	Moderate
Local	Medium	High		
Local	Long	Moderate		
Medium	Short	Moderate		
Medium	Medium	Low		
Medium	Medium	Moderate		
Medium	Long	Low		
Medium	Long	Moderate		
High	Short	Low		
High	Short	Moderate		
High	Medium	Low		
High	Medium	Moderate		
High	Long	Low		
Local	Long	High	Major	Major
Medium	Short	High		
Medium	Long	High		
High	Short	High		
High	Medium	High		
High	Long	Moderate		
High	Low	Low		
High	Low	High		

The Impacts for the proposed project are covered under the following subsections:

- Construction Phase
- Operational phase
- Decommissioning Phase

5.3 IMPACTS DURING CONSTRUCTION PHASE

The construction activity will comprise of following activities which will impact the environment and social aspects, as described in sections below:

- Site Preparation
- Labor Engagement
- Material Handling and Storage
- Concrete work, Erection and Installation Activities
- Construction Demobilization

Based on activities involved, an impact interaction matrix for construction phase was prepared for the project. The impact identification matrix is presented in Table below

Table 5-3: Impact Identification Matrix for Construction Phase

S. No.	Main Activities	Environmental and Social Components									
		Land	Ecology	Water Resources	Ambient Air Quality	Soil Resources	Ambient Noise Quality	Water Quality	Traffic/ Transport	Social/ Livelihood	Occupational Health and Safety
1	**Site Preparation**										
a	Leasing of Land										
b	Site Clearing Grading										
c	Vegetation clearance										
2	**Labor Engagement**										
a	Employment of workers										
b	Water requirement										
c	Power requirement										
d	Waste handling and disposal										
e	Sewage disposal										
3	**Material Handling and Storage**										
a	Transportation and Unloading of construction material										

S. No.	Main Activities	Environmental and Social Components									
		Land	Ecology	Water Resources	Ambient Air Quality	Soil Resources	Ambient Noise Quality	Water Quality	Traffic/ Transport	Social/ Livelihood	Occupational Health and Safety
b	Transportation of plant components										
c	Storage and Handling of plant components										
d	Storage and Handling of construction material, hazardous materials, etc.										
4	**Construction activities**										
a	Preparation/Mixing of construction material										
b	Supply of water, power, sanitation etc.										
c	Operation of construction machinery, foundation, access road, offices etc.										
d	Handling and Disposal of construction wastes										
e	Construction of new access roads and widening of existing roads										
5	**De-mobilisation of Construction Equipment**										
a	Dismantling of temporary support construction structures / equipment's										
b	Removal of construction machinery										

S. No.	Main Activities	Environmental and Social Components									
		Land	Ecology	Water Resources	Ambient Air Quality	Soil Resources	Ambient Noise Quality	Water Quality	Traffic/ Transport	Social/ Livelihood	Occupational Health and Safety
c	Transportation of Construction / Dismantled wastes										

Impacts associated with construction are discussed and mitigation measures are also suggested for different segment of environment in sections below.

5.3.1 Land Resource

5.3.1.1 Impacts

Project involves leasing of approximately 183 acres of agriculture land. Land use of the project site will get changed from agriculture to industrial land. This will boost the price of land in the region.

No access road will be required for the project as site is well accessible by SH-10. ROW of 18m shall be required for the transmission line. Land shall be acquired in the tune of 16 to 49 m^2 for erection of towers. The estimated distance between each tower varies from 70m to 260m based on the angle of tower.

5.3.1.2 Mitigation Measures

All the site suitability and selection criteria were followed while selecting the site. Efforts will be made to contained the construction activities within the project site, so that, no alteration of nearby land use is expected due to the project. Lease / Purchase agreement for tower area will have the provision of compensation for temporary restriction on farming / ploughing during erection activities. Area where work of transmission line is being carried out shall be cleared once the erection work is complete at site. It will be ensured by MAPPL that no erection waste is left over in the farming area after erection of transmission line.

5.3.1.3 Impact Significance

Impact on land use are minor and limited for the project site. The impact significance for Land use is tabulated below.

Table 5-4: Impact Significance on Land Use

Aspect	Scenario	Spread	Duration	Intensity	Overall
Land Resource	Without Mitigation	Local	Long	Low	Minor
	With Mitigation	Local	Long	Low	Minor

5.3.2 Impact on Soil Quality

5.3.2.1 Impacts

Site clearing and leveling activities for installation for PV Module and Other facilities involve excavation and compaction of the soil. The waste handling area and transportation of hazardous material may have an impact on the soil quality. Also the movement of vehicle and construction machineries will further lead to the compaction of soil. The excavated soil may risk for the Wind and Water induced soil erosion if didn't covered or compacted. The refilling of the excavated soil may alter the original layer of the soil formation.

The project site is agriculture land with some patches of waste scrub land. Primarily the site is devoid of any vegetation. Clearing activities will boost the soil erosion activities. The storage and use of hazardous material like Paints for PV Module structure, Oil for vehicles and machineries, lubricating oils for the structures, used oil from dg set or construction machineries can contaminate the nearby soil if doesn't handled safely.

5.3.2.2 Mitigation Measures

The project site is flat agriculture land, therefore, leveling activities shall be limited for the bare minimum extent. This will reduce the potential for compaction and disturbance to soil layers due to backfilling at site. The scale of construction being small will have limited heavy machineries at site and for limited duration, which will further diminish the potential for compaction. Movement of trucks and other vehicles will be maintained along dedicated paths to avoid disturbance to land and soil.

Regular water sprinkling will be carried out to settle down the excavated soil and protect from wind and water erosion.

All construction and hazardous material having potential to contaminate the site will be stored in separate designated areas. During painting of panels and switchyard structures, it will be ensured that the land beneath is covered with a sheet of impervious material in order to prevent contamination of soil.

5.3.2.3 Impact Significance

The impact on soil quality will be limited for shorter duration and contend within the project site. However, the mitigation measures will further reduce the impact upto insignificant level. The Impact significance as assessed for the project is tabulated below.

Table 5-5: Impact Significance for Soil Quality

Aspect	Scenario	Spread	Duration	Intensity	Overall
Soil Degradation due to construction activities	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Insignificant

5.3.3 Impact due to Waste Handling

5.3.3.1 Impacts

Site clearance, excavation, labor camp and installation of PV modules and associated facilities will produce different kinds of waste. The construction demobilisation which will entail removal of machinery, workers, campsite and other temporary structures will also result in generation of waste. The major waste generating areas are as follows.

- Construction Debris
- Domestic solid waste from labor camp
- Packaging material of the plant parts
- Waste oil from generator and other construction machinery
- Metal scraps, Paint containers, etc.

The debris generated due to construction activities may spread out in nearby areas with wind and run-off during rainy season. This may lead to the soil and water contamination.

Improper disposal of solid waste from the labor camps at site and lack of proper sanitation facility for labor can lead to unhygienic conditions and spread of diseases in the area. It can lead to discontent of local community and result in conflicts with the labor engaged at site.

Improper disposal of packaging materials, boxes, plastics and ropes can lead to littering in the construction site and surrounding areas. Hazardous wastes such as waste oil, lubricants, hydraulic oil etc. can cause contamination of soil and water bodies if adequate precautions for management and handling are not undertaken. Use of chemicals such as paints, curing chemicals can lead to contamination of soil.

5.3.3.2 Mitigation Measures

Construction debris will be utilised for levelling of the land and unused debris shall be disposed-off to nearest TSDF / waste disposal site. Excess topsoil will be given to nearby farmers for use in their fields. Efforts will be made to use the locally available labor for unskilled work purpose. Also considering the plant capacity and labor requirement, quantity of waste generation will be small and limited. Proper sanitation and sewage facility in terms of septic tank with soak pit shall be provided. Nearby municipality shall also be contacted for regular disposal of the labor camp waste.

Hazardous waste like paint empty tin, used oils will be stored in separate designated space and will be given to CPCB approved recyclers. Metals scrap will also be given to the approved recyclers.

5.3.3.3 Impact Significance

The overall impact due to solid waste are minor and can further be reduced to insignificant level after implementation of proper mitigation measure.

Table 5-6: Impact Significance due to Solid Waste Disposal

Aspect	Scenario	Spread	Duration	Intensity	Overall
Waste Disposal	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Insignificant

5.3.4 Impact on Water Quality and Resources

The water for the construction works shall be sourced from authorised tankers. Tankers normally draw the water from nearby Canals. These canals have fixed water allocation by the Govt. Policies. No use of groundwater is proposed for the construction phase of the Project.

The construction at site can alter the natural drainage pattern of the area at a micro level. There is potential of contamination of low lying areas and surface water quality due to sediment run-off from construction activities. Improper disposal of sewage and wastewater from labor camps and construction debris can contaminate the ground water resources in the area.

5.3.4.1 Mitigation Measures

Water for the labor camp will be sourced from bore-well or nearby villages, whereas, construction water requirement shall be met through authorized water tankers. Drinking water in the labor camps will be supplied through packaged water cans.

Septic tank with soak pit will be provided so that no contamination due to discharge of sewage may take place. The natural slope of the site will be maintained to the extent possible in order to avoid any change in the drainage pattern. Adequate arrangement for storm water management during construction period will be made to avoid sediment runoff from the site. Storm water flow will be directed to the existing channels with silt traps to avoid sedimentation of the channels or the receiving water body.

5.3.4.2 Significance of Impact

Overall the impact on water resources will be moderate without mitigation, whereas, it will minor with implementation of mitigation measures.

Table 5-7: Impact Significance for Water Resources

Aspect	Scenario	Spread	Duration	Intensity	Overall
Water Resources	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Local	Short	Moderate	Minor

5.3.5 Impact on Ecological Impact

5.3.5.1 Impacts

Removal of vegetation may result in loss of habitat for small mammals and birds. However, the ecological survey carried out at site established that the site is primarily agriculture land and does not support any significant ground vegetation. The project may however involve removal of few trees. Noise from construction and frequent movement of vehicles can also disturb the avifauna of the area. The impact on ecological environment is assessed to be minor for the project.

5.3.5.2 Mitigation Measures

The site is primarily agriculture land and devoid of any dense natural vegetation. Therefore, the loss of vegetation at site is considered to be limited. Efforts will also be made to retain some of the trees as presented at site. The noise generating activities shall be schedule during day time only. Movement of construction and transport vehicles will be restricted to dedicated paths to minimise any harm to small mammals within the site.

5.3.5.3 Impact Significance

The overall impact on ecological aspect during construction shall be moderate in nature and will further be reduced to minor level after putting all mitigation measures in place.

Table 5-8: Impact Significance on Ecological Aspects

Aspect	Scenario	Spread	Duration	Intensity	Overall
Ecology	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Local	Short	Moderate	Minor

5.3.6 Impact due Traffic and Transport

5.3.6.1 Impacts

The construction activities will require transportation of construction material PV modules and mounting structures components to the site. The additional traffic movement on the road due to project will increase accident related injuries in locals. Such impacts arise almost entirely during the construction period. Break down of vehicles and unplanned halt along the road can lead to traffic blockade and discomfort to community. Transportation of construction material in open trucks / tippers can also lead to dust generation along the route. Excess traffic on the road will create discomfort for locals due to increment in noise level and fugitive dust and gaseous pollution expected to exhaust from the vehicles.

5.3.6.2 Mitigation Measures

The increase in traffic due to the project is however going to be marginal as no village roads will be used. The traffic density on the State Highway is low and has adequate carrying capacity to accommodate the additional traffic due to the construction activities.

The traffic movement planned is kept significantly away from most of the villages. No movement is proposed on village roads. The drivers will be asked to maintain a minimum speed limit in the area to avoid accidents to people and livestock. The traffic movement in settlement areas shall be limited for day time only. Only PUC certified vehicle shall be deployed for the project to keep the air pollution under check. Tool Box training will be arranged for the driver to create awareness about road safety.

5.3.6.3 Impact Significance

Without mitigation measures, the impact shall be moderate overall. However, mitigation measures shall be implemented to keep it on minor level.

Table 5-9: Impact Significance due to Traffic and Transport

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact due to traffic	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor

5.3.7 Impact on Ambient Air Quality

5.3.7.1 Impacts

Construction activities shall lead to fugitive dust pollution from excavation, leveling, mixing of materials, transportation of the construction material, etc. Also the gaseous pollution is likely from

Vehicular Exhaust, Machineries Engines, DG Set Operation (In operation), etc. Increment in the number of vehicles shall also boost up the fugitive dust emission from road side bared soil.

5.3.7.2 Mitigation Measures

The scale of construction being small will require only a limited number of construction machinery and for limited duration, therefore emissions from heavy machinery are considered to be insignificant. Open burning of solid waste or packaging material will be strictly prohibited.

Regular water sprinkling is proposed to reduce fugitive dust emission from construction activities in identified dust prone areas. All machineries shall be properly maintained and will meet the pollution standards. Only PUC certified vehicle shall be deployed for the construction purpose. The construction material shall be transported in covered trucks and tipplers.

5.3.7.3 Impact Significance

Considering the size of the project, impact intensity on air quality part is minor and shall further be reduce to insignificant level by implementation of above discussed mitigation measures.

Table 5-10: Impact Significance on Air Quality

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Air Quality	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Insignificant

5.3.8 Impact on Noise Level

5.3.8.1 Impacts

Noise and vibration will be caused by the operation of earth moving and excavation equipment, concrete mixers and transportation of equipment, materials and people. Movement of traffic during night hours can also disturb the local community.

For an approximate estimation of dispersion of noise in the ambient air from the source location, a standard mathematical model for sound wave propagation is used. The sound pressure level generated by noise sources decreases with increasing distance from the source due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected due to atmospheric effect or its interaction with objects in the transmission path.

For hemispherical sound wave propagation through homogenous loss free medium, one can estimate noise levels at various locations, due to different sources using model based on following equation:

$$L_{P2} = L_{P1} - 20 \text{ Log } (r2/r1) - A_E - A_M$$

Where, Sound L_{P2} and L_{P1} are the Sound Pressure Levels (SPLs) at distances of r2 and r1 from the source.

A_E and A_M are attenuations due to Environmental conditions (E) and Machine correction (M)

About 90 dB(A) of noise will be generated from construction activity which will attenuate to less than 45dB(A) i.e. night time prescribed noise level at about 100m. The nearest habitation structure of

Bareta Settlement is located at a distance of over 500m and therefore the impact due to the noise will not be significant.

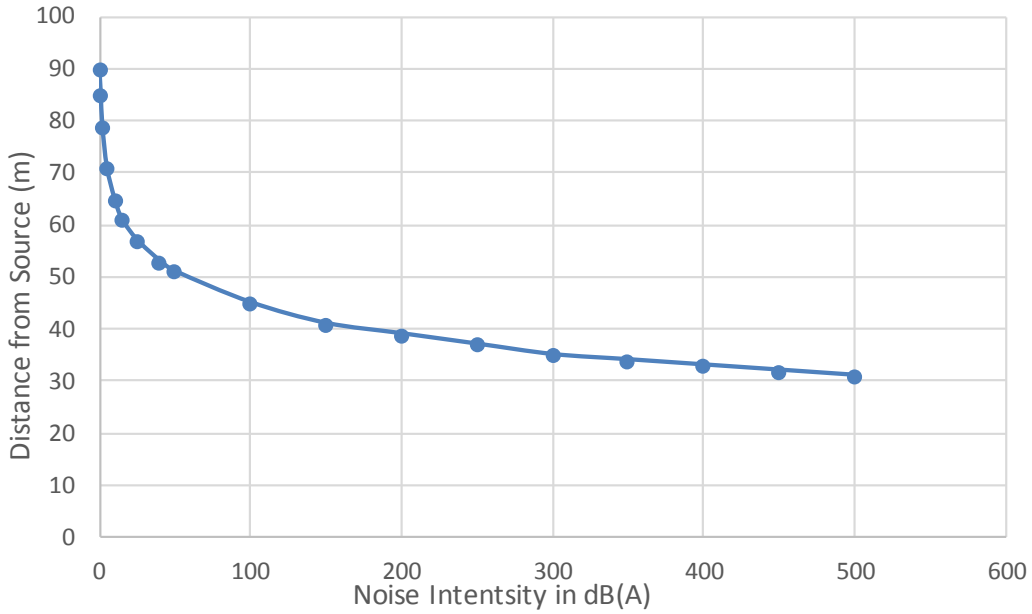


Figure 5-1: Noise Intensity in respect to Distance from Noise Source

5.3.8.2 Mitigation Measures

Considering the capacity and nature of the project, the use of construction machineries will be very limited. Most of noise generating activities like excavation, use of heavy earth moving machineries, etc. shall be limited for the construction phase.

Only limited construction activities shall be carried out during night-time. Temporary noise barriers shall be provided surrounding the high noise generating construction equipment. The personnel involved in high noise generating activities shall be provided with personal protective devices to minimize their exposure to high noise levels. Construction vehicles and machinery will be well maintained and confirming the CPCB noise standards.

5.3.8.3 Impact Significance

The impact due to construction activities on noise level shall be very minor as no sensitive receptor is located with 500m from the construction site. Significance of impact on noise level with and without mitigation is presented in table below.

Table 5-11: Impact Significance on Noise Level

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Nosie Level	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Insignificant

5.3.9 Health and Safety Hazards

5.3.9.1 Impacts

Loading and unloading operation of the construction material may cause an injury if not handled properly. During construction works, physical injury can result due to road accidents, construction accidents and other occupational hazards. Overexertion injuries and illness are potentially the most common health hazards associated with construction activities. Further there is potential for slips and fall on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction material, liquid spills and uncontrolled use of electrical cords and ropes on ground, which results in injuries and time loss during construction.

Hazards associated with fall of construction material or tools, as well as collapse of constructed slabs, walls and roofs can result in injury to head, eyes and extremities. Transportation and movement of vehicles are associated with road accidents and related hazards, which can lead to injuries and fatalities.

5.3.9.2 Mitigation Measures

Operation of loading–unloading equipment shall be undertaken under the guidance / supervision of trained professional. The contractor shall ensure that no person is engaged in driving or operating construction machineries unless he is sufficiently competent and reliable, possess the knowledge of risks involved in the operation and is medically examined periodically.

As per Section 23 of the Factories Act, 1948, as amended, young persons (below 18 years of age) must not be allowed to work at any dangerous machine unless they have been fully instructed about the dangers arising pertaining to the machine and the precautions to be observed, and have received sufficient training in work at the machine, or are under adequate supervision by a person who has a thorough knowledge and experience of the machine. No person shall be hired for project activity having age below 14 years.

Mytrah Energy has formulated a site Emergency Preparedness and Response Procedure, which shall also be followed for the subjected project. The On-Site emergency procedure provide details of the anticipated emergencies, the emergency organisation, facilities, emergency procedures and roles and responsibilities. Adequate training shall be provided to staff about raising awareness about use of Personal Protection Equipment (PPE) and emergency response measures. Job responsibility and shifting chart shall be prepared so that no person shall be over exhausted, which will ultimately lead to the accident or injuries. Safety sign shall also be marked at appropriate places. MEIL Standard Emergency Response and Preparedness Plan is given as **Annexure III**.

Excessive waste debris and liquid spills will be cleaned up regularly, while electrical cords and ropes will be placed along identified corridors marked for attention of everyone at site. Use of personal fall arrest system, such as full body harnesses as well as fall rescue procedures to deal with workers whose fall has been successfully arrested shall also been carried out.

It shall also ensure good housekeeping at the construction site to avoid slips and falls. PPEs such as safety glasses with side shields, face shields, hard hats and safety shoes shall be mandatory at construction site. Ear plugs shall be provided for workers placed at high noise areas.

5.3.9.3 Impact Significance

The project will have moderate impact on Health and Safety aspect during construction phase. However, this can be reduced to the insignificant level by successful implementation of mitigation measures.

Table 5-12: Impact Significance on Health and Safety Aspect

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Health and Safety Aspect	Without Mitigation	Local	Short	High	Moderate
	With Mitigation	Local	Short	Low	Insignificant

5.3.10 Impact on Social Aspect

The impacts on social aspect are discussed under following sections.

5.3.10.1Impact due to Land Leasing and Mitigation Measures

Impacts in this stage are mostly related to social aspects. Land for the project is being taken on 30 years lease agreement. The remuneration / lease rent will be paid on annual basis. INR 50,000 per acre has been agreed as lease rent with 5% escalation every year. The lease rent will be paid in the form of cheque in favor of land owner. As discussed with the locals, the agriculture activities yield to the crop of value INR 30,000 to 50,000 per acre per year as per current market rate. The lease rent as agreed primarily feels better opportunity in terms of livelihood of the land owners. Also the right of land will remain preserved with the land owners.

Grievance Redressed Mechanism as developed by Mytrah Energy shall be followed for this project too and communicated to community to express their concerns associated with the project.

5.3.10.2Access Issue and Job Opportunities

No access road is proposed for the project as site is well connected by SH-10. No structure found getting affected by the project. Also access block is observed due to the proposed development. The nearest settlement i.e. out-skirts of Bareta is at least 500m away from the proposed site. Job opportunity for the locals shall generate during construction phase.

5.3.10.3Labor Related Issues and Mitigation Measures

In the construction phase, skilled workers might be engaged in the project to perform technical work and they might come from outside the area. The project proponent will have to arrange for the accommodation of these workers. However, Bareta is a resourceful village / town and influx of EPC Engineers will not create any significant pressure on available resources.

The potential impacts that might arise in reference to labor related issues have been mentioned below,

- Once the construction activity for the project gets underway, there is a possibility that there will be an inflow of migrant workers from other parts of the country to this project area as labor force in the area is quite low. For unskilled work in the construction phase, the local population and its surrounding areas will be given first preference.

- The influx of migrant workers might put pressure on the existing resources like water supply, supply of fuel, provision of basic facilities, waste handling and sewage disposal of the project influenced population which might create frictions between them and the resident population of the area. However, chance of this scenario are rather low considering the project capacity and nature of work.
- With the inflow of migrant workers and their interaction with the local population, health issues among the local community might emerge. Health problems like STD's and HIV Aids might spread in the area because of this floating population. Regular medical camps will be conducted amongst the labors and the local population to make them aware about diseases like STD's and HIV Aids.

5.3.10.4Impact of Cultural, Archaeological and Historical Place

No such place was found getting affected by the proposed development.

5.3.10.5Impact Significance

Overall impact on the social aspect was found moderate in nature. However, will be made to keep it on minor level through implementation of mitigation measures.

Table 5-13: Impact Significance on Social Aspect

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Health and Safety Aspect	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor

5.4 OPERATION PHASE IMPACT

Being a renewable energy project, the operation phase impacts of the project are very low. The major issues of concern during operation of plant are Tabulated below:

Table 5-14: Impact Identification Matrix for Operation Phase

S. No.	Main Activities	Environmental and Social Components							
		Land and Visual Aesthetic	Waste Generation	Ecology	Water Resources and Quality	Soil Resources	Social / Livelihood	Occupational Health and Safety	Air Quality
1	Power Generation Process								
2	Maintenance Activities								
3	Corporate Social Activities								

The impacts are discussed in detailed under headings below.

5.4.1 Land and Visual Aesthetics

5.4.1.1 Impacts

Considering that the land will be used for some industrial activity and will result in generation of revenue, the change in land use is considered to be minor positive. Industrial activity will improve the aesthetic look of the project site.

5.4.1.2 Mitigation Measures

Efforts will be made to confined the industrial activities within the leased area.

5.4.1.3 Impact Significance

Overall minor impacts are expected due to proposed project.

Table 5-15: Impact Significance on Land use and Aesthetic Value

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Land Use and Aesthetic Value	Without Mitigation	Local	Long	Low	Minor
	With Mitigation	Local	Long	Low	Minor

5.4.2 Impact on Soil Quality

5.4.2.1 Impacts

Operation of solar photovoltaic panels for power generation will not have any direct impact on soil. However, the water as may use for washing activities may contaminate the soil if chemical is used for washing. The hazardous waste like used oil, hydraulic oils, etc. may contaminate the soil if not handled properly.

5.4.2.2 Mitigation

The water for cleaning purpose of solar PV modules to remove dust from it, is likely to get evaporate. Very small quantity of water is likely to be absorbed by the soil underneath of the module. The plant site will be provided with adequate drainage facility to drain-off wash wastewater. The water for cleaning purpose of solar PV modules to remove dust from it, is likely to get evaporate or absorbed by the vegetation and soil underneath the solar panels. All hazardous waste will be stored in a separate designated paved space.

5.4.2.3 Impact Significance

Impact on soil quality is moderate in nature and will further be reduced to minor after implementation of Management Plan.

Table 5-16: Impact Significance on Soil Characteristics

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Soil Characteristics	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

5.4.3 Waste Generation

5.4.3.1 Impacts

Industrial wastes are generated during routine operations (dielectric fluids, cleaning agents, and solvents). These wastes typically would be put in containers, characterized and labeled, possibly stored briefly, and transported by a licensed hauler to an appropriate permitted off-site disposal facility as a standard practice.

Once the plant is commissioned there will be limited waste generation, however repair and maintenance of underground cables and associated utilities will lead to generation of hazardous wastes such as used transformer oil. The defunct / damaged photo voltaic cells will also be generated and storage / disposal on unpaved ground can lead to contamination of soil.

5.4.3.2 Mitigation Measures

Separate designated area shall be earmarked for storage of hazardous waste. These waste shall be given to the CPCB / SPCB approved recyclers. Damaged / Defunct Solar modules shall be stored at site for next 25 years. MAPPL will also try to contact vendors who can recycle these defunct modules after technology development.

5.4.3.3 Impact Significance

The impact significance for the aspect considered to be minor and detailed out in Table below.

Table 5-17: Impact Significance due to Waste Generation

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact due to Waste Generation	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

5.4.4 Impact on Water Resource and Quality

5.4.4.1 Impacts

For operation phase, the water requirement will be for domestic as well for cleaning of modules. The operation phase water requirement of the project shall be in tune of 0.0627 m^3/MWh or say (500 m^3/month). Module cleaning needs to be carried out periodically (Per module 2 times in one month) to remove dust, bird droppings etc. The water requirements for the project will be met through groundwater or otherwise it will be taken through tankers by local vendors. In case of water extraction through bore well at project site, Mytrah will take permission from concern Government authority before dwelling any ground water. Compliance conditions as may have stipulated during permission shall be complied by MAPPL.

5.4.4.2 Mitigation Measures

As per 'Ground Water Information Booklet Mansa District, Punjab- Year 2013' prepared CGWB, Budhlada block comes under over exploited category. Bore-wells will be established after requisite permission from regulatory authority. Meters shall be installed at the bore-wells to monitor the abstraction of water. The plant site will be provided with adequate drainage facility to drain-off wash

wastewater and prevent any waterlogging at site or in the surroundings. Wastage of water during cleaning of panels shall be avoided.

Awareness campaign will be driven under project CSR activities for use of effective irrigation practices, scheduling of crops, change the crop pattern, awareness creation for effective use of water etc. as suggested by CGWB in above referenced Booklet.

5.4.4.3 Impact Significance

Impact on water resources are moderate in nature and need to take care by specific monitoring of water use. Impact even after mitigation measures will remain moderate as project region comes under the over exploited category.

Table 5-18: Impact Significance on Water Resource and Quality

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Water Resource and Quality	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Moderate	Moderate

5.4.5 Ecological Impact

5.4.5.1 Impacts

Glare / Reflection from solar modules may distract the avian fauna flying over the solar panel land. The impact to flora from the operation will be limited to the routine clearance of vegetation near the solar plant to avoid shadows and hindrance to sunlight on solar panels. No other impacts are seen on local ecological system due to the project.

5.4.5.2 Mitigation

Solar panels will absorb most of light falling on them which will be then converted to electricity. Thus there will be very less impact due to glare from the panels. The glare is reported to be similar to that of a small water body, which implies insignificant distraction for the avifauna. Clearing of vegetation will be limited to removal of undergrowth or shrubs at the plant site. It will have no significant impact on the flora of the area.

5.4.5.3 Impact Significance

Impact due to operation of proposed solar found minor in overall aspect.

Table 5-19: Impact Significance on Ecology

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Ecology	Without Mitigation	Local	Long	Low	Minor
	With Mitigation	Local	Long	Low	Minor

5.4.6 Impact on Air Quality / Climate Change

The project is based on the power generation through Solar PV Technology. The Solar PV technology is environment friendly in terms of GHGs emission. Levels of carbon dioxide (CO2) and other

greenhouse gases (GHG) in the atmosphere have increased dramatically in the past few decades. Solar energy is a renewable resource available with great potential to significantly reduce GHG emissions. The technology of electricity generation from Solar PV Plant is environment friendly as it does not use any fossil fuel. It thereby reduces the greenhouse gas emissions associated with fossil fuel based electricity generation system. The availability and reliability of solar power depend largely on current and future climate conditions, which may vary in the context of climate change.

The comparison of the GHGs emission caused by solar power plant with the GHGs emission that would have been caused by fossil fuel burned to make the same amount of electricity has been made. Thus the purpose of the project activity is to generate power from zero emissions Solar PV based power project and thereby reduce the emissions associated with the grid. ACM0002 Version 17.0 Methodology is followed to assess the Carbon Reduction Potential of the proposed project. The calculation of the total GHGs emission reduction as 40871 tCO_2e/year.

The proposed solar farm is based on Photovoltaic technology which generates electricity using solar energy from the sun through photo-electric effect, which depends upon solar flux of the area. It is defined by the Global Horizontal Irradiance (GHI) of the area, wherein shortwave radiations received by the surface at a high temperature get absorbed and individual electrons in bonds moves into a higher energy level. This absorption of energy does not cause any change in temperature of the area. It is also very well understood that there can be an increase in temperature, which will be confined only to the site.

As discussed under Section 3.10, rainfall is expected to decrease by 5% and temperature is likely to increase in the tune 4-5^{o}C in the project region. Solar cell output is usually rated at 25°C with output typically decreasing by about 0.5% for each temperature rise of 1°C. Therefore, a reduction of 2% in output of solar cells is expected due to climate change. Design has been done is such a manner that sufficient air flow is maintained to keep the modules cool and in turn to decrease the efficiency loss due to temperature rise.

5.4.6.1 Impact Significance

Climate change is a burning issue now a day. Project will help in reduction of GHG emission with the use of environment friendly technology of power generation. Though the significance level is minor due to capacity / size of the project but it would be a long term beneficial impact of the project.

Table 5-20: Impact Significance on Climate Change

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Climate Change	Without Mitigation	Local	Long	Low	Minor
	With Mitigation	Local	Long	Low	Minor

5.4.7 Health and Safety Risk

5.4.7.1 Impacts

Electromagnetic Fields (EMF) emanate from any wire carrying electricity. Possible effects associated with the electric and magnetic fields from transmission lines (or similar electrical sources) fall into two categories:

- Short-term effects that can be perceived and may represent a nuisance
- Possible long-term health effects

The issue of whether there are long-term health effects associated with exposure to fields from transmission lines and other sources has been investigated for several decades. There is little evidence that electric fields cause long-term health effects.

Table below gives the value of Electric and Magnetic Field intensities at various distance from the transmission line considering transmission line is erected on Steel / Iron towers.

Table 5-21: Magnetic field in µT at distance from Centreline

Scenario	Clearance	Maximum under line	10 m	25 m	50 m	100 m
Maximum	Clearance 5.5m phasing U load 1.4/1.4 kA	30.5	20.5	5.6	1.5	0.4
Typical	Clearance 8m phasing U load 0.13/0.13	1.9	1.4	0.5	0.1	0.04

All fields calculated at 1 m above ground level

Source: EMFs.info (Electric and magnetic fields and health)

Table 5-22: Magnetic field in V/m at distance from Centreline

Scenario	Clearance	Maximum under line	10 m	25 m	50 m	100 m
Maximum	Clearance 7m phasing U	1808	456	91	40	12
Typical	Clearance 10m phasing U	890	345	43	30	9

All fields calculated at 1 m above ground level

Source: EMFs.info (Electric and magnetic fields and health)

5.4.7.2 Mitigation

The lists of exposure limits for general public / occupational exposure to electric and magnetic fields published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) is as given in Tables below.

Table 5-23: ICNIRP exposure limits for general public exposure

Frequency	Electric Field (V/ m)	Magnetic Field (µT)
50 Hz	5,000	100

Frequency	Electric Field (V/ m)	Magnetic Field (µT)
60 Hz	4,150	83

Table 5-24: ICNIRP exposure limits for occupational exposure

Frequency	Electric Field (V/ m)	Magnetic Field (µT)
50 Hz	10,000	500
60 Hz	8,300	415

There are no specific standards or guidance on EMF in India however the Indian Electricity Act and Rules clearly stipulate the minimum clearances required. Hence the ICNIRP standards and guidelines have been considered. For the general public (up to 24 hours a day) an exposure level of 1,000mG or 100µT is suggested. The transmission line route has been suggested in such a manner that nearest receptor (residential structure likely to get 24-hours exposure) is beyond 30m from the transmission line. Therefore, from the comparison of above table it can be concluded that exposure level of electric field and magnetic field will always remain within the exposure limit of ICNIRP.

Workers handling electricity and related components will be provided with shock resistant gloves, shoes and other protective gears. Adequate training regarding health and safety will be provided to the workers. The switchyard building will be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire. Safety incidents will be recorded and monitored with an aim that numbers are never significant, and gradually reduce.

5.4.7.3 Impact Significance

Overall impact significance is moderate, which will further be reduced to the minor level after EMP implementation.

Table 5-25: Impact Significance on Health and Safety

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Health and Safety Aspect	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

5.4.8 Impact on Social Aspects

5.4.8.1 Impacts

Project is likely to have a positive impact on the local social system in terms of economy and area development project. Project will boost up local employment opportunities based on skill and education, increased taxation revenue, increased demand for materials and services through local contracting. These things will ultimately improve the revenue generation opportunities in the project region. Some financial support for infrastructure development will also be provided by the project developer in line with their CSR activities. The CSR plan for the project region shall be developed in line with MEIL's standard CSR Policy given as **Annexure IV**.

5.4.8.2 Mitigation

Community will be engaged on each aspect of CSR activities.

5.4.8.3 Impact Significance

The impact intensity will be low as most of the impact shall be limited for local area only.

Table 5-26: Impact Significance on Social Aspects

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact on Social Aspects	Without Mitigation	Local	Long	Low	Minor
	With Mitigation	Local	Long	Low	Minor

5.5 IMPACT DURING DECOMISSIONING

5.5.1 Impacts

Decommissioning of the project involves dismantling of the solar modules and trackers, and all associated electrical infrastructure and site buildings. Land will be hand over to its original owners after completion of the lease period. The impacts associated with decommissioning activities are:

- Improper disposal of demolition waste and obsolete machineries will lead to contamination of soil and discontent of community
- Demolition activity will lead to generation of dust which can be carried downwind to habitations
- Land may lost fertility potential during the year as no agriculture activity will take place during the year of O&M

5.5.2 Mitigation Measures

Dismantling activities will be taken care by experienced professionals under the guidance of plant EMS Head. All the dismantled infrastructures and debris shall be segregated and stored separately with cover facility to negotiate with contamination effects of such wastes.

The metal structure will be sold out to the approved recyclers, whereas, debris will be disposed-off as per their characteristics. The construction debris can be utilised for land filling in nearby low areas and debris having contamination potential shall be transported to nearby TSDF site. Solar Panels as utilised for the project even after 25 years will have the 70 – 80% power generation capacity. Due to technology improvement, after 25 years recycling or reutilisation of these panels are very much likely. In any of the case MAPPL will ensure compliance to Application Waste Management Legislative Framework.

Water sprinkling would be the regular practice to reduce the dust generation from the plant decommissioning activities. After decommissioning MAPPL will weed out the seeds of Leucaena *leucocephala* and Prosopis *Juliflora* to make the land fertile in few years.

5.5.3 Impact Significance

Decommissioning phase impact shall be limited to the site and minor in nature. However, impact will further be mitigated to the insignificant level.

Table 5-27: Impact Significance for Decommissioning

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impact of Decommissioning	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Insignificant

5.6 CUMMULATIVE IMPACT

MAPPL has signed a Power Purchase Agreement with Punjab State Power Corporation Ltd (PSPCL) for 50 MW Solar Project. The 50MW capacity is being developed at two sites, each having 25MW capacities at Bareta Village, Budhlada Tehsil, Manasa District (Subjected Project) and Bhakora Kalan Village, Lehragaga Tehsil, Sangrur District, Punjab (Second Project). The distance between the two projects is about 12km. No other industrial developmental activities were observed in vicinity of the project. The cumulative effect of both of the project is developed in sections below.

5.6.1 Impact on Land Use

Land at both of the places is being leased for the project purpose. This will lead to change in land use pattern of approx. 310 acres (Based on average of subjected project) of land. No forest or area of ecological importance is getting affected by the project. The remuneration / lease rent will be paid on annual basis. INR 50,000 per acre has been agreed as lease rent with 5% escalation every year. As discussed with the locals, the agriculture activities yield to the crop of value INR 30,000 to 50,000 per acre per year. The lease rent as agreed primarily feels better opportunity in terms of livelihood of the land owners. No further, impact on land use of the region is expected due to the projects.

5.6.2 Water Resource and Quality

The water requirement for cleaning of modules is an important aspect to be kept in view. The water requirement for operation phase of the project including cleaning of the whole plant is approximately 0.0627 m^3/MWh, depending on the option chosen. Module cleaning needs to be carried out periodically (Per module 2 times in one month) to remove dust, bird droppings etc. on the module and enhance the energy generation. Along with the module cleaning, for the construction of various structures (like IR, MCR Rooms, Pile Foundation etc.) in the plant, water is required. Water resource in the project are in over exploited region as per 'Ground Water Information Booklet Mansa District, Punjab- Year 2013' prepared CGWB. Therefore, water conservation measures are the must requirement for the project. Water conservation is to be practiced at the site. Natural Drainage system will be maintained at site to conserve this precious water in already over exploited region. Efforts will be made to keep the area unpaved upto maximum extent, so that, natural seepage and ground water recharging system will remain unaffected. Awareness campaign in the project area shall be driven by proponent under CSR activity for improvement in irrigation practices and change in cropping pattern as suggested by CGWB in above referenced report.

6 ANALYSIS OF ALTERNATIVES

6.1 INTRODUCTION

The proposed 25 MW Solar Power Project at Bareta, District Mansa (Punjab) was allocated as part of the 500MW capacity planned under Phase 3 of solar power projects being set up under the New and Renewable Sources of Energy (NRSE) Policy, 2012 of the State of Punjab. Development of solar power in the project area will not only be based on green energy and resources but also have the potential of not having emission issues as compared with power plants based on conventional energy. The other added benefits from such project are that it will add values to the local as well as national grid. Analysis of alternatives involves a thorough study of the possible future conditions in the project study area in response to a set of alternatives without the project or status quo condition. Alternative methods of power generation and comparison with the following one is discussed in this chapter.

6.2 ALTERNATIVE METHODS OF POWER GENERATION

Harnessing solar energy is an eco-friendly process, inexhaustible and processes a minimal environmental footprint. There are neither fuel requirements nor large quantities of water for operation of the plant. Solar energy scores over other forms of energy generation as it has a low gestation time. Table below elaborates upon the advantages and disadvantages of various power generation systems.

Greenhouse gas Emission: As per the estimation of International Atomic Energy (IAEA) the grams of carbon equivalent (including CO_2, CH_4, N_2O etc.) per kilowatt-hour of electricity (g Ceq/kWh) for Solar energy project are low and scores better when compared with other forms of conventional and non-conventional sources of energy. Table below highlights the advantages and disadvantages along with GHG emission that each technology possesses.

Considering various factor such as solar resources potential in the project districts; favorable environmental and social settings, low GHG emission in the project life cycle, land availability, governmental assistance, and local community's acceptance of solar energy project in the region, solar energy based power generation is the most suitable alternative in Punjab state.

Table 6-1: Advantage and Disadvantage of Conventional Technology

Mode	Disadvantage	Advantage
Thermal Power Plant	• High fossil fuel consumption • Large quantities of water requirement for cooling • High volume of emission from operation • Accumulation of fly ash (in case of coal powered installations) • GHG emission estimated as 960 gCeq/kWh	• Large scale production potential • Moderate gestation period • Relative inexpensive • Wider distribution potential
Nuclear Power	• Availability of fuel and power source • Hazard associated with radioactive material	• Capable of producing huge amounts of energy with little or no carbon

Mode	Disadvantage	Advantage
	• High cost of project • Long gestation period • Risk of fallout and melt down scenarios and its impacts on the local populace and environment. • GHG emission estimated as 66 gCeq/kWh	
Wind Power	• Overall land requirement is large • Site specific (associated to wind pattern) • Expensive installation • High Noise and Shadow Flicking Effect	• Pollution level are insignificant • Inexpensive power generation • Inexhaustible source • GHG emission as low as 10 gCeq/kWh
Solar Power	• Large land requirement • Site specific to solar installation • Concrete foundation on large area	• Pollution level are insignificant • Low-cost power generation • Inexhaustible source • GHG emission as low as 32 gCeq/kWh

Source: Nature Reports Climate Change
Published online: 24 September 2008 |doi:10.1038/climate.2008.99

Table 6-2: CO_2 Equivalent Emissions for full Energy Chain

Technology	Maximum Value	Minimum Value
Coal	1290	860
Oil	890	689
Gas	1234	460
Hydro	410	16
Nuclear	30	9
Wind	75	11
Solar PV	279	30
Biomass	116	37

Source: IAEA Bulletin

6.3 WATER REQUIREMENT

The interdependency between water and energy, sometimes called the water-energy nexus, is growing in importance as demand for both water and energy increases. Energy is required for water treatment and supply, while virtually all processes for energy production require significant amount of water. Many areas are already under water and energy constraints and yet water and energy are

both indispensable for modern economics. Moreover, the population is expected to grow, which will boost the water and energy demand substantially in the coming years.

Solar power project has been known to use almost insignificant water, in comparison to nuclear and coal based power projects. Solar plant requires small amount of water are used to clean photovoltaic panels.

6.4 CARBON OFFSETING

According to American Wind Energy Association (AWEA), water consumption (technology gallons/MWh) is as follows; Nuclear- 620; Coal- 490; Oil- 430; Wind- 1; Solar- 30.

6.5 ALTERNATIVE SITE LOCATION

Solar Power projects are non-polluting energy generation projects which are site specific and dependent on the availability of solar insolation. Shadow analysis and power potential assessment for the project was done by MAPPL, based on which potential areas are notified. The important meteorological parameter in the design of solar PV power plant are solar radiation, ambient temperature and wind speed which are represented in Table below. The average solar radiation, ambient temperature and wind speed of the study area is 4.91 kWh/m2/day, 24.7 0C and 0.8 m/s respectively which are generally suitable for the reasonably good energy generation.

Table 6-3: Metrological Data of the Site

S. No.	Month	Global Horizontal Irradiance on a Horizontal Plane (kWh/m2/day)	Ambient Temperature (0C)	Wind Speed (m/s)
1	Jan	3.22	12.8	0.69
2	Feb	4.34	16.5	0.88
3	Mar	5.33	22.4	1
4	Apr	6.1	28.6	1
5	May	6.36	32.9	1.1
6	Jun	6	32.4	1.1
7	Jul	5.48	31.8	0.9
8	Aug	5.45	30.6	0.8
9	Sep	5.16	28.7	0.68
10	Oct	4.59	25.8	0.5
11	Nov	3.77	19.4	0.4
12	Dec	3.08	14.7	0.49
Average		4.91	24.7	0.8

Source: Detailed Project Report, 25 MW Solar Power Project, Bareta

Further, before selecting the site MAPPL has assessed the site which are suitable for solar power plant and presented in the table below.

Table 6-4: Assessment of the Site

S. No.	Parameters of Assessment	Utility in Design and Construction	Characteristics of Site Assessed
1.	Access	Easy access to site or connectivity with main road or highways help in transportation of materials, man and machinery required during construction.	Site is easily accessible.
2.	Water Availability	For module cleaning purpose and for construction purpose water is required in large quantity. Availability of water (non-saline) on site in form of bore-well, pond, lake or river saves the time and cost of buying this water from outside.	Bore-well water is available for construction & maintenance purpose.
3.	Electrical Infrastructure	Availability of Grid sub-station at distance of not more than 10 km is considered to be good choice of land as it will allow minimum transmission losses and also saves transmission cost of project.	Sub-station Bareta is 5.5 km away from the site of the project.
4.	Climate	Site with moderate rainfall, solar irradiation in range between 4-6 kW/m2/day, wind speed not more than 45 m/s, low relative humidity is a good choice for setting a solar power plant	As per the PV System data, the solar irradiation available at the site are 4.91 kWh/m2 /day and the average wind speed is 0.8 m/s.
5.	Topography	Minimum undulation of land with minimum vegetation is good for Solar power plant. Site with gentle slopes provide natural drainage thus reducing water logging problem. It also serves as economic benefit as requirement of digging drains is minimized. It reduces construction time as well. Site under Zone 1-3 of Seismic zone is good for construction. Sand, gravel medium and hard clay type of soil is good for construction purpose.	Sandy soil is observed on the sites.

A checklist approach was followed and checklist as prepared for the Bareta Site is attached as **Annexure V**.

6.6 ALTERNATIVE TECHNOLOGY

In designing any power generation system that incorporates photovoltaic (PV) there is a basic requirement to accurately estimate the output from the proposed PV modules under operating conditions. A comparison of the characteristics of the most popular cell technologies are given in the Table below.

Table 6-5: Characteristics of Some PV Technology Classes

Technology	Crystalline Silicon	Amorphous Silicon	Cadmium Telluride	Copper Indium Gallium Di-Selenide
Percentage of global installed capacity	78%	22%	22%	22%
Current Commercial Efficiency	14-19%	11-12%	13-17%	7-16%
Temperature Co-efficient of Power (Typical)	-0.45%/°C	-0.21%/°C	-0.25%/°C	-0.36%/°C

Source: Detailed Project Report, 25 MW Solar Power Project, Bareta

Poly-crystalline Silicon Solar Modules: Poly-crystalline panels are made up from silicon offcuts, molded to form blocks and create a cell made up of several bits of pure crystal. Because the individual crystals are not necessarily all perfectly aligned together and there are losses at the joints between them, they are not quite as efficient. However, this mis-alignment can help in some circumstances, because the cells work better from light at all angles, in low light, etc. Due to random crystal arrangement the panels look a little bluer as they reflect some of the light. Conversion efficiency of the cell in large scale mass production is between 16% to 19%. Poly-crystalline modules are less expensive than mono crystalline. They have a better temperature coefficient. For reasons cited above, poly-crystalline modules are preferred for this project.

6.7 ALTERNATIVE PV MODULE MOUNTING SYSTEM

The Sun's intensity is at its maximum on a PV module when it is striking it perpendicularly—the incident angle is 0°. The mounting structure plays an important role in supporting and securing the module. It also deals with the module alignment with the sun at a particular angle at a certain time to maximize the solar power generation. Mainly there are two modes of installation:

- Fixed installation Technology; and
- Installation with Sun tracking Technology.

Fixed mounting systems keep the rows of modules at a fixed tilt angle while facing a fixed direction of orientation. The tilt angle is important for maximizing the energy incident on the collector plane. The tilt angle and orientation are generally optimized for each PV power plant according to location. This helps to maximize the total annual incident irradiation and total annual energy yield. Fixed tilt mounting systems are simpler, cheaper and have lower maintenance requirements than tracking systems.

Tracking systems follow the Sun as it moves across the sky. They are generally the only moving parts employed in a PV power plant. Single-axis or horizontal-axis trackers alter either the orientation or tilt angle. Depending on the site and characteristics of the solar irradiation, trackers may increase the annual energy yield by up to 25% for single-axis trackers. Dual-axis tracking systems alter both orientation and tilt angle and are able to track the Sun more precisely than single-axis systems. Depending on the site and characteristics of the solar irradiation, dual-axis trackers may increase the annual energy yield by up to 35%.

Solar tracking systems are utilized to continually orient photovoltaic panels to the sun and can help make best use of the investment in PV system. They are useful as the sun's position in the sky will alter gradually during a day and over the seasons throughout the year. Therefore, single axis solar tracking system has been selected for Bareta site.

6.8 WITH AND WITHOUT PROJECT SCENARIO

Keeping in view the site conditions and the scope of development of the area, 'with' or 'without' project scenarios have been compared as shown in Table 6.6. By looking at the table it can be concluded that 'with' project scenario with positive/ beneficial impacts will vastly improve the environment and enhance social and economic development of the region when compared to the 'without' project scenario, which will further deteriorate the present environmental setup and quality of life. Hence the 'with' project scenario with minor reversible impacts is an acceptable option than the 'without' project scenario.

Table 6-6: With and Without Project Scenario

Component	With Project Scenario	Without Project Scenario
Siting	The present project is of establishing a new solar power plant. Solar power is a green energy and requires adequate amount of solar heat/ energy for which siting is a pre-requisite. The site is well connected and is having good number of solar radiation days. With Project land owners will get rent @ INR 50,000 per acre per year with 5% increment every year.	Without the project this condition people will face power cut problem and also a huge power gap will be established in industry. Without the project, the project land would yield crop @ INR 35,000 to INR 50,000 per acre per year.
Power Generation	The proposed project would improve in power generation in the area through a green power within zero consumption of fossil fuel thereby minimizing the resource consumption.	Without project scenario, demand-supply gap will increase and people will face power cut in future.
Environmental Quality	Setting up of proposed solar power plant has very low environmental degradation.	Without the project, possibilities of setting up of thermal power plant in near future would have increased. The setting up of thermal power plant would have more environmental degradation than solar power plant.
Economic Development and Employment Opportunity	There will be increased power generation in the surrounding areas and this will minimize the gap between the demand and supply of power. Such activities would increase various economical activities including the various local based industries and agricultural activities (including water pumping etc.). This on other hand will reduce the dependence on DG set for pumping of water for agriculture	Without the project the dependence on DG set for power generation for carrying out small industrial and agricultural activities would further increase.

Component	With Project Scenario	Without Project Scenario
	activity by villagers and thereby would reduce the consumption of fossil fuel (e.g. diesel).	

7 INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

7.1 CONSULTATION

Public consultation and participation has been viewed as a continuous two ways process involving, promoting of public understanding of the processes and mechanisms through which developmental problems and needs are investigated and solved. The public consultation, as an integral part of environmental and social assessment process throughout the project preparation stage not only to minimizes the risks and unwanted hurdle against the project implementation but also abridges the gap between the community and the project formulators which leads to successful and timely completion of the project and making the project people friendly.

Therefore, keeping in mind the above objective public consultation with the people of different section of the society, i.e., local administrative officials, some related social agencies, business groups, community representatives, village heads, Panchayat members and respectable and influential persons of the project area were made. Moreover, potential vulnerable people were also consulted with the aim to make people aware and minimize adverse impacts of the solar project. The option of alternative design was also discussed to achieve accelerate the implementation of proposed solar project with people's involvement.

As per the Safeguard Policy Statement (SPS) of ADB, Public Consultation and participation plan needs to be included in the EIA/ESIA Report for all stages of the project (project design, construction and operations phase) for categories "A" and "B". Also, a documentation of meaningful consultation with affected local communities especially project affected persons needs to be carried out.

7.2 OBJECTIVES

Following are the main objectives of the consultation:

- Promote public awareness and improve understanding of the local people about the proposed project;
- Assessment of possible requirement of improvements;
- Solicit the views of affected communities/individuals on environmental and social problems;
- Improve environmental and social soundness;
- To settle problems with mutual consent; and
- Create accountability and sense of local ownership during project implementation.

7.3 CONSULTATION DURING PROJECT PRE-CONSTRUCTION STAGE BY ESIA TEAM

Within the study area a total 3 consultation programs (Focus Group Discussion, Community based) have been finalized after informal discussion with the officials of MAPPL, village sarpanch and local community including questionnaire for the same. The details of consultation location, dates of consultation are shown in Table below.

Table 7-1: Details of Public Consultation

S. No	Location of consultation	Community being consulted	Dates of Consultation	Target group
1	Project Site office	Project Developer	Date: 04/05/2016 (02.00 PM to 04.00 PM)	Project developer and local Villagers/land lessee
2.	Municipal Panchyat Office Bareta	Local people of Bareta	Date: 05/05/2016 (12.30 PM to 02.00 PM)	Panchayat Members, land lessee and Respectable and Influential Person of the town
3.	At village Sarpanch House and near Gurudwara at village Dialpura	Villagers, School teachers and Anganvadi workers of the village	Date: 06/05/2016 (01.00 PM to 03.00 PM)	Village Sarpanch, land lessee, Villagers, School Teachers, Women, Influential person of the village

Note: Attendance Sheet of the participants of Bareta and Dialpura has been enclosed as **Annexure VI**

7.4 CONSULTATION PROCESS

The process of stakeholder consultation included:

- Identification of the relevant stakeholders including all those individuals, groups and organizations potentially affected by or interested in the project;
- Imparting information about the project and its potential impacts on their lives in local and simple language;
- During the consultation process the project plan was clearly explained;
- Recording of their concerns and aspirations through survey and discussions;
- Responding to their queries in a neutral manner.

In the primary survey a list of open-ended questionnaire is used in both the focus group discussions and the individual interviews which is annexed as **Annexure VII**. A three-person survey team carried out the discussions and the interviews. The list of persons involved in the public consultation is limited to those who were willing to allow their name to be added in the document. Attendance Sheet of the participants has been enclosed as **Annexure VI**. Project proponent, land sellers, village Sarpanch and panchayat members, members of the town Bareta and village Dayalpura, government officials of revenue and rural development department, local labors, contractors were our stakeholders to whom we consulted.

7.5 PROJECT DISCLOSURE: AWARENESS ANOUT THE PROJECT

A focused group discussion and public consultations were conducted in Bareta and Dialpura village. All the people expressed their full support for solar project as they see that there is an opportunity of employment and power generation. They do not have any problem due to proposed projects and they are already aware with the projects. In the consultation approximately 15-20 people at each location were participated. Consultant team has also consulted/discussed informally with youths, women and daily wages workers in and around the project site. At the very beginning of the public consultation/discussions the participants were introduced about the details of a solar power plant. It

was also explained to them that solar power is an environment friendly system which reduces the environmental impacts of combustion of fossil fuel based power generation, such as impacts from greenhouse gases and other air pollution emissions. It was also explained to that unlike fossil fuel power generating facilities, solar facilities have no air emissions of air pollutants such as Sulphur dioxide, Nitrogen oxides, Carbon monoxide, Volatile Organic Compounds, and the greenhouse gas carbon dioxide during operations.

7.6 CONSULTATION WITH DIFFERENT GROUP OF PERSONS

Focus group discussions were held with the randomly selected villagers and land owners. These groups encompass a wide age range, as well as both genders, and people from the entire communal spectrum. The FGD included people who had given their land for the proposed project.

Natural group discussions were also conducted, where ever possible. Natural group discussions are interviews conducted with 'naturally' occurring groups. The method has the advantage of being interviewed at a time and place of their convenience, and is suitable from the point of view of the interviewee. The result is honest and open discussion in a more relaxed and informal manner.

7.6.1 Consultation with The Site Staffs

During the study period, ESIA team consulted with MAPPL staff at project site to understand about the project and other environmental and social features around the project site.

Figure 7-1: Consultation with MAPPL Officials and Site Inspection at Project Site Bareta

7.6.2 Consultation with Project Affected Families

The ESIA team has consulted with 12 project affected families (lessee) and discussed about their socio-economic conditions. The team talked their willingness of leasing the land, discussed about their land holding types, total land they own, land left after leasing, their source of income, total income by agriculture and others sources, their expenditure, household size, literacy, socio-economic status of women etc. Details of the above information has been annexed as **Annexure VIII**.

7.6.3 Consultation with the Local Labors

Daily wage labors, mostly in and around Bareta and project site have been observed during site visit and tried to consult them. Consultation with the labors highlights that as the proposed Solar Power Project supported their employment during construction period and helped them tackle the seasonal unemployment in the area so they are very positive and glad about the project.

Consultation with Daily Wages Labors at Bareta

Consultation with Lessee at Bareta

Consultation with Local Villagers at Dialpura Village

Consultation with Women Group at Dialpura Village

Figure 7-2: Consultation and Group Discussion with People at Bareta and Dialpura Town

7.6.4 Consultation with Women

Women in the study area consistently lag behind the men in terms of gender gap, involvement in economic activities, access to education, health care, jobs etc. Unless these basic measures are taken to improve it will be difficult for the region, state and India to prosper as a nation.

Keeping these basic things in mind, we have also consulted with women groups and asked them about their education, employment opportunity, degrading gender ratio, health and position in the society. In addition to do all their household works, their involvement in economic activities are limited to agricultural workers. They are generally less educated and have limited opportunity of employment but they are aware about their rights. Work participation rate of women of study area is 15.85%, sex ratio is 890 and literacy rate is 52.91%.

7.6.5 Consultation with Youth of the Study area

We have also consulted with youth of the study area and tried to know their opinion about the project. We discussed with developmental issues and employment opportunity in the region. They are very hopeful with the project in the region. They are much conscious with their education and are seeking

employment opportunity in metropolitan cities like Delhi, Chandigarh, Ludhiana, Amritsar, Mumbai, Hyderabad. They are much ambitious.

7.7 ISSUES / CONCERNS / CONCERNS RAISED / ADDRESSED DURING CONSULTATION

Following issues have been discussed.

7.7.1 Awareness About the Project

All the respondents, community of Bareta and Dialpura were aware with the proposed solar power project. All the people expressed their full support for solar project and they do not have any problem due to proposed projects.

7.7.2 Occupation and Livelihood

Economy of Punjab state is dependent on agriculture. The main occupation of the people of Bareta is trade & business, profession, government and private jobs while in buffer zone of the project is Agriculture. During consultation it was found out that average land holding size of the farmer of the study area is 3 to 80 acre per family and with agriculture they may earn INR 35,000 to 50,000 per acre per year. Wheat, cotton, paddy, pulses are the main crops that grown in the region. In addition, the people of down trodden, uneducated and belonging to BPL family earn their livelihood as agricultural labors.

7.7.3 Health

There is no any epidemic or chronic disease have been reported in the study area during consultation with local people of Bareta and Dayalpur except general fever, cough, cold and few cases of Cancer and Jaundice. People of the study area are well aware with HIV / AIDS / STP. Government Civil Hospital and private Nursing Homes, Hospitals and Clinic are available in Bareta town.

7.7.4 Education

In spite of government infrastructure facility and support for mid-day meal, free text books, scholarship and uniform to every student at Primary and Upper Primary level, the literacy rate of the study area is poor. Although, there is support for girl child education, but it is only up to junior level. Average literacy rate of the study area is 58.48% while literacy rate of males is 63.48% and females is 52.92% with 10.56% of gender gap. During consultation local people revealed their concern that they are very conscious about the education of their male and female children without any discrimination.

7.7.5 Use of Land Being Procured

The land identified for the proposed project are agricultural with patches of barren and scrape land. Identified land has been procured on lease for 30 years and has been negotiated @ INR 50,000 per acre per year with 5% of increment every year. It was told by lessee that current yielding of land is INR 35,000 to 50,000 per acre per year.

7.7.6 Rates offered for the Land

The land owners agreed with the fact that rate being offered by the project proponent is better than what they have been yielding from agriculture. The land owners have leased their land as per their

own choice and willingness. Land holding size of the lessee is 3-80 acre, therefore no family rendered landless by procurement of land as all of the land owners have more land besides it.

7.7.7 Employment Opportunity

Local people are also concern about employment opportunity through proposed solar power project. MAPPL assured that they will prefer local people for unskilled labor during project construction period on the basis of their skill and education. During project operation period employment opportunity will be limited to security staff only.

The outcome of the public consultation with the villagers is given in Table below.

Table 7-2: Outcome of Public Consultation

S. No.	Concerns & Expectations	Addressal of Issues/ Concerns by MAPPL
1.	Capacity and Technology adopted for the proposed project	A brief introduction about the proposed project has been given to local community by Consultant team and MAPPL. It has been told that it is a Poly-Crystalline silicon technology based 25 MW Solar Power Plant proposed at Bareta town.
2.	Requirement of land and process of land procurement	Approximately 183 acers of land have been procured on lease basis for 30 years to establish the project. The lease deed has been done on the basis of direct negotiation between lessor and lessee.
3.	Will the upcoming solar power plant create employment opportunities for the local people?	During construction period, the proposed project will provide an employment opportunity to semi-skilled and unskilled worker. The priority of employment will be provided to local villagers/residents on the basis of their skill and qualification.
4.	Will there be any influx of people due to upcoming solar power plant? Will it disrupt public services?	The chances of influx of people from outer area for this project are limited to the plant persons which are very nominal and will be accommodated within the project site itself. This will not as such disturb the public services.
5.	Will the proposed solar power plant disturb existing land uses?	The land use pattern of the identified land will be changed from agricultural to industrial land.
6.	Will the solar power plant project pose a risk to human health and the environment?	No. It is considered safe to human health and the environment. It does not present any risks to public health and the environment.
7.	Will the power plant will provide regular electricity to the villagers	Electricity will be supplied to grid, thus reduce the power deficit of the state and help in improving the power supply in the area.
8.	What will the benefits be of the project to local people?	The proposed project will reduce demand supply gap of electricity to the state as well as to local region. It will provide employment opportunity to local community during construction period. Monetary gains, education, health, sanitation, water

S. No.	Concerns & Expectations	Addressal of Issues/ Concerns by MAPPL
		conservation, plantation and improvement in general environment through CSR/community development plan will lead to positive growth to local community.

Thus on the basis of above consultation / group discussion with local community / villagers / village sarpanch / village panchayat members / influential person of the region / government officials and various stake holders, we may conclude that proposed project will prove beneficial not only to local region but also up to state and national level for a long term. There is a big support of local community in favor of the project. They are seeing their development through proposed project

8 GRIEVANCE REDRESSAL MECHANISM

8.1 INTRODUCTION

This Grievance Redressal Framework (GRM) has been developed by Mytrah for managing grievances related to environmental and social performance arising from its operations in Solar / Wind Projects. The Corporate level Mytrah's Grievance Redressal Framework shall also be applicable for MAPPL.

This GRM shall serve as one of the component of MAPPL's Environmental and Social Management for managing overall performance of its projects as well as providing more accountability to its stakeholders. The GRM is based on four guiding principles of the company which include:

- Transparency
- Fairness
- Respect
- Accountability

8.2 TYPES OF GRIEVANCES

If any internal or external stakeholder believes that the company's business practices or activities are having an adverse impact on their quality of life, livelihood or environment, which they want the appropriate management to address, such a concern can be classified as a complaint or grievances. From the purpose of classifying the various kinds of grievances that can arise, they are mostly categorized under two headings.

8.2.1 Internal Grievances

Employee Grievance- Separate procedure in place as part of the Human Resources (HR) of MAPPL. These include the employees hired specifically for the site.

8.2.2 External Grievances

Contractor and Labor related Grievances- Directly / indirectly controlled by MAPPL

Community Grievances including those on land and resettlement issues, project activities, CSR intervention, employee / worker-community conflicts, and other project related issues (Directly/Indirectly controlled by MAPPL)

8.2.2.1 Internal Grievances- Employees Grievance

The likely grievances of direct employees of MAPPL may include but not limited to:

- Complaints pertaining to amount of wage, salary, other remuneration or benefits, as per company's centralized HR Policy
- Timely disbursement of remuneration;
- Working condition, health and safety of the employees;
- Unethical behavior between senior and subordinate employees;
- Discrimination on the basis of caste, creed, language, religion etc.;
- Gender discrimination; and
- Workplace harassment

8.2.2.2 External Grievances

External grievances are those grievances received from the external stakeholders such as labor and workforce, contractors, communities, local administrative setup, community groups / NGOs, and media groups.

Contractors and Labor Related Grievance

The workers include the local and interstate migrant workers are likely to have the grievance related to the following issues:

- Risk to health and safety of the labors or workers hired by the Contractors;
- Working condition of the labor;
- Wage discrimination among the labor;
- Timing of the payments;
- Adequate facilities in the labor camps (during construction stages) including water supply and sanitation;
- PF, ESIC, Workmen's compensation, adequate health facility related issues;
- Unjustified deduction from the wages;
- Minimum wage rates for the labor;
- Extended working hours;
- Prevention and protection of child labor from hazardous work condition;
- Issue of forced labor;
- Gender discrimination.

Note: MAPPL has limited control on labor & workforce deputed through contractor/subcontractor as per business model. However, as a principle employee, MAPPL shall monitor the overall process as & when required as a part of its own Environmental & Social Management system

8.2.2.3 Community Grievance

The surrounding community of the project is considered as important stakeholder by the Project. The possible grievances of the community could be:

- Land and compensation related issues
- Damage to, crops, infrastructure;
- Eligibility issues and payment of compensation;
- Improper/ inadequate valuation of the compensation;
- Compensation and employment entitlement against losses;
- Delay in the payment of the compensation;
- Livelihood restoration issues and associated benefits;
- Adverse impacts on community, common property resources (CPR);

Community development, employment and other issues

- Risks to community, health & safety (e.g. traffic);
- Accidents (e.g. involving livestock);
- Unethical Behavior by MAPPL personnel or its sub-contractors;

- Noise/dust/air emissions or any other impact on environment caused by project or sub-contractors;
- Demand for development interventions in the community;
- Issues owing to behavior of the security personnel and general attitude of the local community;
- Issues related to cultural conflicts or opportunity conflict owing to presence of migrant workers in the community or in the nearby areas;
- Any attempts to conceal the above

Note: MAPPL has limited control in case of Trunkey contract for the project /OEM. However, as a principle employee, MAPPL shall monitor the overall process as & when required as a part of its own Environmental & Social Management system.

ESMS will be the part of Contract Conditions between EPC / O&M Contractor and MAPPL. Contractor will abide by policies and procedures of MAPPL.

8.3 REDRESSAL PROCESS

The redressal process has been developed for both internal as well as external grievances. The process flow diagram for grievances are shown in Figures below and process are described in subsequent sections.

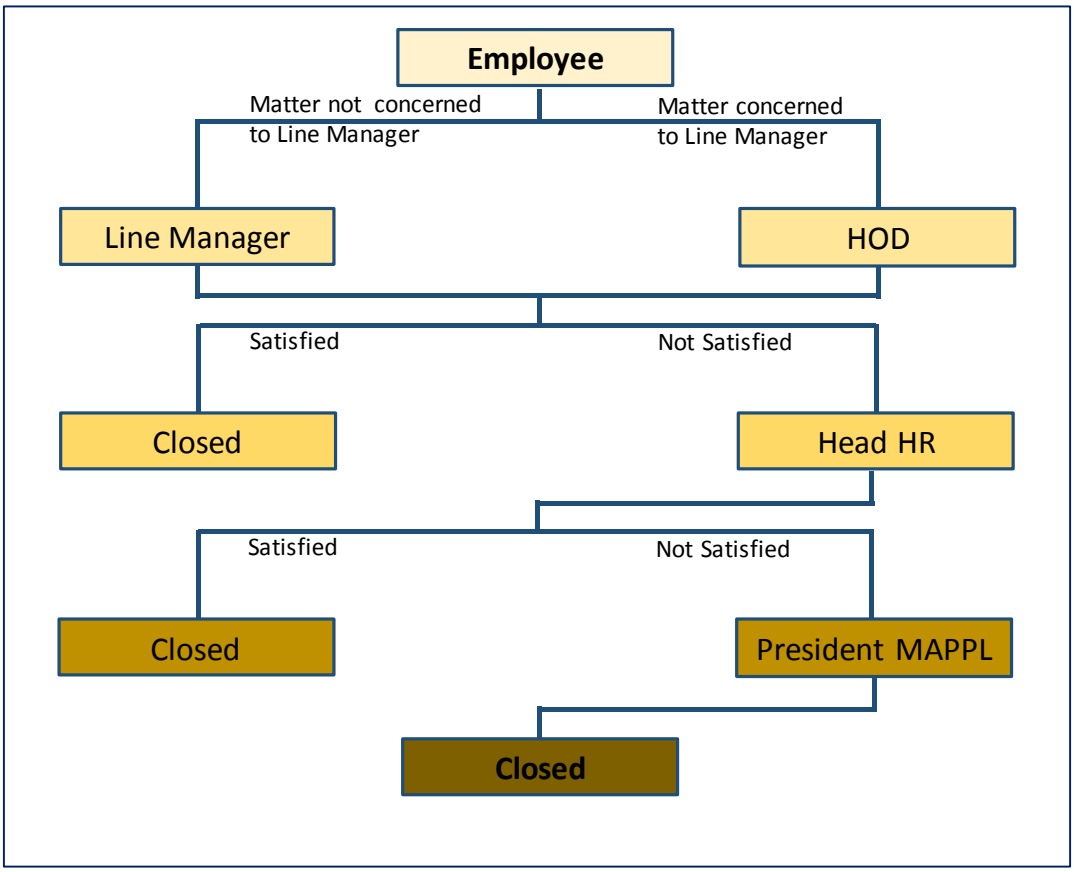


Figure 8-1: Grievance Redressal Mechanism for Internal Grievances

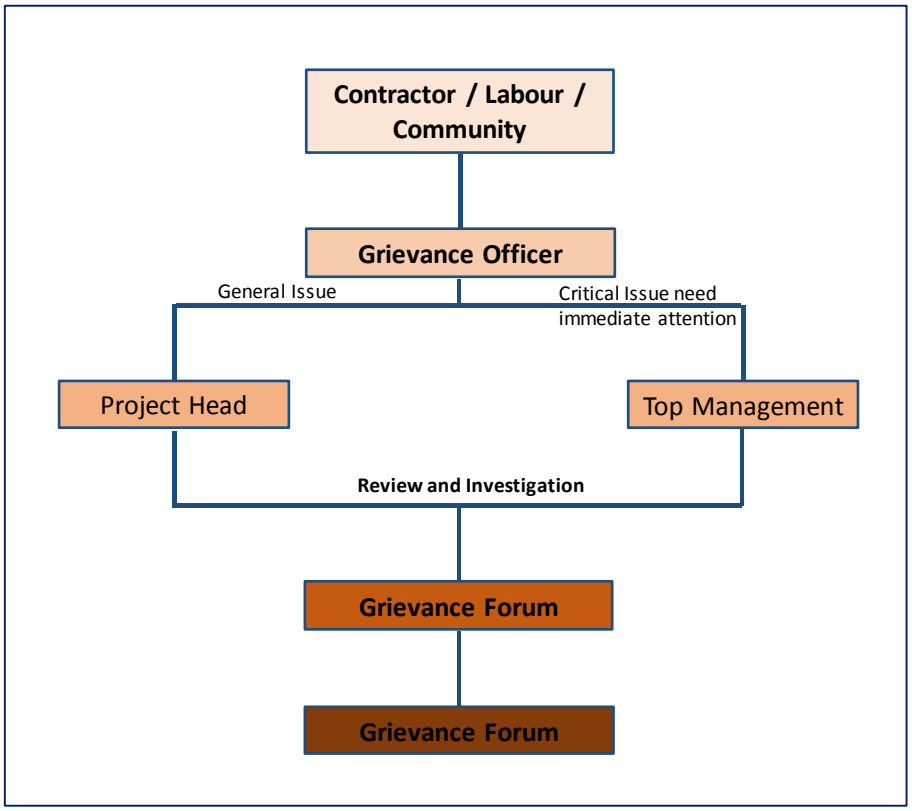


Figure 8-2: Grievance Redressal Mechanism for External Grievances

8.3.1 Redressal Process for Internal / Employee Grievances

MAPPL as part of its Human Resources system has developed grievance addressing policy with detailed scope and coverage considering registration and addressal of internal grievances raised by the employees, which display Grievance procedures transparently in its SAP Net Weaver Portal with following objectives:

- Grievances of the employees in the shortest possible time
- At the lowest possible management level
- With appellate stages so that it is fair, transparent and reasonable

The grievance policy is intended as the tool by which a member of staff may formally have a grievance, regarding any condition of their employment, which he/ she wants to be heard by the management of the Company.

The following stages outline the existing grievance redressal process established by MAPPL with stipulated time period to resolve the issues for its employees:

8.3.1.1 Stage 1: First level of grievance addressal

The aggrieved employee may take up the grievance in writing with his/her reporting officer. If the matter itself concerns the employee's line manager or program manager, then the grievance should be escalated to the Head of the Department.

8.3.1.2 Stage 2: Second level of grievance addressal

In case employee is not satisfied with the decision communicated to him/her at Stage-I, or if she/he fails to receive the reply within stipulated period, he/she may submit the grievance in the prescribed form to Head- HR

8.3.1.3 Stage 3: Third level of grievance addressal

If the employee remains aggrieved and not satisfied with the decision of the Head-HR, will have an option to appeal to the President.

8.3.2 Redressal Process for External Grievances

MAPPL has limited on External Grievances due to its Business model. Mainly deputed Pretty contractor will be responsible for grievances redressal system as they are responsible from land purchasing to Plant erection and OEM. In those cases, as a principle employee, MAPPL shall monitor the overall process as & when required as a part of its own Environmental & Social Management system. However, in case of self-developed project and OEM, MAPPL will implement a robust Grievance Redressal & Management system with a defined process.

8.3.2.1 Step 1: Publicizing Grievance Management Procedures

For any project, MAPPL / deputed Contractor is required to ensure suitable public disclosure of its grievance handling and redressal process to its external stakeholders such as the community or the local administration. The company will establish a grievance body at the plant site comprising of designated personnel and disclosure of such a body to be displayed at suitable location in the plant premises so that any member of the community can easily access such information.

Looking at the scale of the project and the duration of the construction stage wherein maximum numbers of contract workers, migrant workers or workers from the local community are supposed to be working at the site for a duration ranging from six months to nine months tentatively, the Grievance Redressal Mechanism for the community can simultaneously be used for the workers. The process of disclosure of information and the GRM process itself will be disclosed to the workers considering the duration i.e. six months to nine Months. Should the contractors have their own GRM, MAPPL will ensure that it is functioning effectively and even review the grievance records as and when required.

For the grievance mechanism to be in line with the cultural and socio- economic characteristics, based on its understanding of the ground situation in the project area, the company / deputed contractor will strive to provide the following information to the stakeholders (primarily community) from time to time with suitable communication media, at least some of the following:

- Project-level mechanisms capable of delivering outputs against grievances and benefits complainants can receive from using the company grievance mechanism, as opposed to other resolution mechanisms;
- Information on who can raise complaints (affected communities);
- Where, when, and how community members can file complaints;
- Company personnel responsible for receiving and responding to complaints, and
- Type of response complainants can expect from the company/contractor, including proposed timing of response, based on the gravity;

Designated personnel shall be responsible for publicizing the procedure through appropriate methods.

8.3.2.2 Step 2: Receiving and Keeping Track of Grievances

This receipt and tracking of grievances primarily involves the following stages:

- Collecting and recording grievances;
- Registering them in a suitable manner; and
- Tracking them to reflect their status

Designated personnel from the grievance body with collection of grievances writes down complaints at group or individual meetings, during field visits, or at designated locations. These grievances are to include:

- Complaints received through third parties such as Sarpanch, community persons, contractors, contract workers, etc.;
- Complaints received by project staff directly/indirectly involved in handling grievances;
- Tracking of grievances can be undertaken with keeping of records in the registrar

Designated grievance personnel of respective sites will be responsible to intimate the Grievance status at regular interval to appropriate authority e.g. Project Head, OEM Head, HR&FMS-Head and EHS Head so that it will be reflected in appropriate forum like ESMS committee. The designated Grievance personnel may also do a case to case grievance status reporting to the Top management in case of critical grievances or grievances that may require immediate attention of the Top management or ESMS committee.

8.3.2.3 Step 3: Reviewing and Investigating Grievances

The designated personnel from the grievance body responsible for grievance handling will organize the process to validate the complaint's legitimacy and arrange for investigation of details as per the applicability. All grievances shall undergo some degree of review and investigation, depending on the type of grievance and clarity of circumstances.

MAPPL will communicate clearly to all concerns about the role, responsibilities, and limitations of a company grievance mechanism and the limitations of the same in handling grievances, if any to ensure transparent dealing of any grievance.

8.3.2.4 Step 4: Developing Resolution Options and Preparing a Response

Rationale for Grievance Closure

- The requirements / need specified in the form of grievance by the aggrieved have been effectively addressed to the satisfaction of the complainant;
- Applicable Grievance to be duly addressed and closed by MAPPL in stipulated time based on the merit

Process of the Grievance Redressal

- The person having grievance will come on the scheduled time and lodge the complaint in person or through other recognized person/forum identified by the company

- The grievance will be processed and concerned person will be informed through a suitable communication by person or through company recognized person/forum within mutually agreed stipulated period
- On hearing from the designated grievance personnel they have to come for further processing to the grievance redressal, if required.

8.3.2.5 Step 5: Monitoring, Reporting, and Evaluating a Grievance Mechanism

Monitoring and reporting can be tools for measuring the effectiveness of the grievance mechanism and the efficient use of resources, and for determining broad trends and recurring problems so they can be resolved proactively before they become points of contention. Monitoring helps identify common or recurrent claims that may require structural solutions or a policy change, and it enables the company to capture any lessons learned in addressing grievances. Periodic review of internal and external grievances has to be carried out at the appropriate forum of MAPPL like ESMS committee meetings.

Monitoring Indicators

Grievance records will provide the background information for regular monitoring, both informal and formal.

8.3.2.6 Step 6: Reporting and Recording

Based on all grievances received, registered, documented and tracked through database reports shall be prepared for reporting to the appropriate Forum. This shall assist in tracking overall trends and patterns in concerns allowing emerging issues to be flagged and understood at an early stage. Monitoring and reporting also create a base level of information that can be used by the company to report back to communities as per the applicability and requirement.

8.4 DISCLOSURE OF GRM

The disclosure for GRM will be done with the appropriate community, employees and stakeholders to fulfil the specific purpose based on the requirement through suitable communication.

8.5 PERSONNEL: ROLES AND RESPONSIBILITIES

8.5.1 Corporate Level

At the corporate level, handling of grievances is required to be directly handled by the HR&FMS department under the responsibility of the designated officer, declared in the SAP Net Weaver Portal for resolution of internal grievances.

8.5.2 Project & O&M Level

A grievance Body, leaded by designated Grievance officer is proposed for effective implementation of GRM and coordinating day to day functions. The grievance Body would be reporting back to the appropriate authority including functional areas such as HR, Project, O&M, BD/Land, CSR, EHS etc. as per requirement. The mandate of this cell would be managed as part of the ESMS forum.

8.6 FINANCIAL

MAPPL will ensure appropriate budget allocation to deal with grievance tracking and handling with consent of appropriate authority.

8.7 TRAINING

Awareness shall be provided in the company's policy and practices for both employee and appropriate stakeholder grievance mechanisms, relevant to their exposure and responsibilities.

9 ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

9.1 INTRODUCTION

ADB Environmental Safeguards requires the project proponent to prepare an environmental management plan which addresses the identified potential impacts and risks. The importance of managing social and environmental performance throughout the life of a project is also highlighted by the IFC Performance Standard-1.

An effective environmental management system is a dynamic, continuous process initiated by management and involving communication between the project proponent, the workers, and the local communities directly affected by the project. The EMP includes proposed mitigation measures, environmental monitoring and reporting requirements, training measures, implementation schedule and cost estimates.

MAPPL is committed to execute all construction and operation related activities for the proposed Solar PV Project as per the best established environmental, health and safety (**Annexure IX- MEIL 'EHS Policy'**) standards and also it will be aligned with upcoming project to be implemented at asset level. Mitigation measures are proposed for impacts which are identified and quantified. Some residual impact will however persist after the all mitigation measures are employed, the Environmental and Social Management Plan intends to delineate monitoring and management measures to minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures during construction and operational phase.

9.2 REGULATORY AGENCIES

The authorities / agencies to be coordinated for ESMP implementation include the following:

- District Administration of Mansa District;
- District Forest Department, Mansa;
- Punjab State Pollution Control Board;
- Punjab State Electricity Board;
- Central Electricity Authority;
- Factory Inspectorate, etc.

9.3 ENVIRONMENT & SOCIAL MANAGEMENT SYSTEM (ESMS)

An Environment & Social Management System (ESMS) is already available (MEIL) to assist MAPPL in developing a comprehensive mechanism at the asset level to lay down a rationalized procedure for assessing and managing social, environmental, health and safety issues at all stages of their activities. The corporate MEIL ESMS will guide the implementation at the project level compliance to the standards as committed by MAPPL. The Environment and Social Management Plan (ESMP) provided in the subsequent sections will be operationalized within the framework of the management system.

9.3.1 Organization, Roles and Responsibilities

The organogram of the both the MAPPL's Punjab Solar Project shall be headed by one Cluster Project Manager. Head EHS reporting to Head Projects will look after the compliance of the ESMMP at both of the site. The proposed organizational structure to implement the ESMP is as follows.

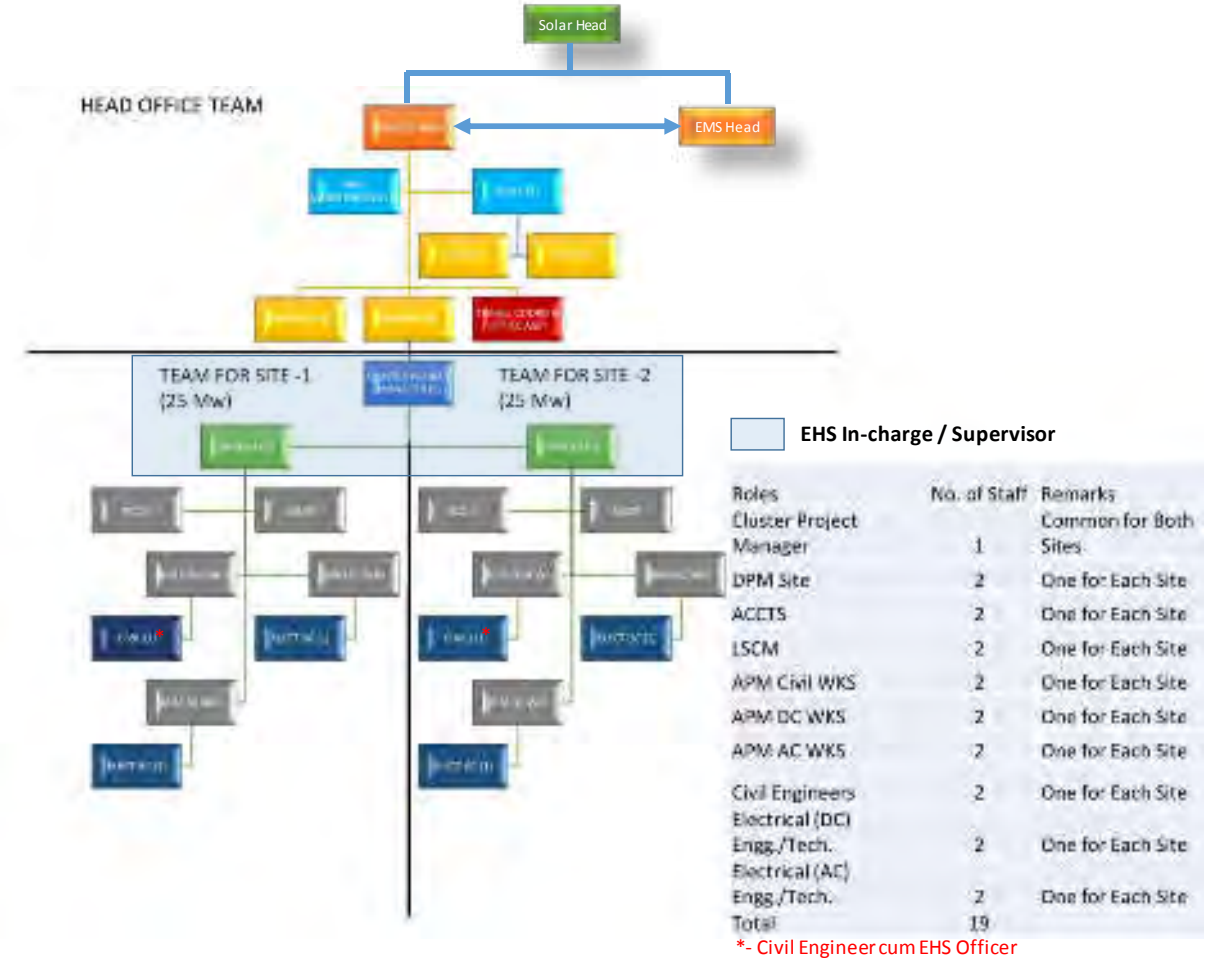


Figure 9-1: Organizational Structure for ESMS Implementation

The usual activities of the EHS manager and his team will be as following:

- Ensuring availability resources and appropriate institutional arrangements for implementation of ESMP;
- Compliance of legislative requirements and ADB safeguards;
- Carryout audits, and inspection of all the project activities through site engineer;
- Preparation of necessary documents and record keeping system through site engineer;
- Review and updating of ESMP for effective its implementation.

9.3.2 Contractors Management

Prior to assigning any contract, MAPPL will pre-qualify each contractor according to commercial, technical, quality assurance and its past performance on EHS standards so as to satisfy MAPPL's requirements.

MAPPL will ensure that the job specific training and EHS Induction Training needs are identified based on the specific requirements of ESMP and existing capacity of site and project personnel (including the Contractors and Sub-contractors) to undertake the required actions and monitoring activities.

General environmental awareness will be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project

activities. This will help in minimizing adverse environmental impacts, compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment will be imparted to the contractors and sub-contractors prior to the commencement of the project.

An environmental and social management training programme will be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training programme will ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities;
- Requirements of the specific Action Plans;
- Understanding of the sensitive environmental and social features within and surrounding the project areas; and
- Aware of the potential risks from the project activities; etc.

A basic occupational training program and specialty courses should be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments.

Training should be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards. Workers with rescue and first-aid duties should receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their coworkers.

Through appropriate contract specifications and monitoring, the employer should ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin. Turnkey Contractor shall ensure that the sub-contractors provide the basic facilities and infrastructure to their worker as per Contract Labor regulation and abolition act 1970 Chapter V-Health and Welfare of Contract Labor.

- Principal employer shall have labor registration certificates for 500 people working at site and shall issue form V to the principal contractor
- Principal Contractor shall have the labor license for the number of labors as mentioned in the labor registration certificate of principal employer.
- All Main, Sub and Sub Sub-contractor employing more than 20 needs to have labor License
- All the contractors irrespective of no. of employee needs to have PF, ESI registration and monthly compliance and other labor law related matter. The necessary list of compliance and documentation are attached.
- Every sub-contractor shall be responsible for payment of minimum wages ax per prevailing rule to each worker employed by him as contract labor and such wages shall be paid before the expiry of such period as may be prescribed.
- Labor camps to be set up for construction workers outside the plant boundary.
- Sub-Contractor has to sign leasing / rental agreement with respective land owners and submit the copy of the contract agreement to the main contractor for records.
- Rest Rooms (Urinals / Latrines) sufficiently ventilated, lighted with water facility for male and female shall be provided separately.
- Proper drainage / soak pit arrangement shall be made.

- Washing facilities
- Storm water drain as per approved design of the project shall be provided at site.
- Water shall be arranged through tanker and storing arrangements shall be made if bore well is not available.
- Adequate drinking water shall be arranged.
- Canteen facilities wherein contract labor numbering one hundred or more is ordinarily employed by a contractor.
- Temporary sheds to be arranged for labours to take food during working hours at different locations inside the site.
- First aid box with prescribed contents to be made available at distinguished places.
- Tie up with nearby hospitals having ambulance facility and anti-venom injections should be made by Principal Contractor and site Safety officer shall be responsible to organize as when needed.
- Safety Induction Training to be imparted for all the workers
- Attendance register (IN/OUT) for all main contractor and sub-contractor's employees / workers shall be maintained at Security Post.
- There is no hot work involved in setting up of solar power plant and it comes under C class fire hazard, required fire extinguishers shall be maintained at the work place.
- Personal Protective equipment (PPE) shall be made available and mandatory to use at site.

9.3.3 ESMP Review and Amendments

The ESMP provided with this report is an environment management tool which needs to be reviewed periodically to address changes in the organization, process or regulatory requirements.

9.3.4 Inspection, Monitoring & Audit

In order to implement the ESMP effectively, the on-site team will develop a time-bound and action oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the identified environmental and social impacts. ESMP compliance will be monitored on a half-yearly and all outcomes would need to be audited in accordance with existing EHS commitments as per **Annexure IX**. Environment and Social Action Plan will be in line with Mytrah's Integrated ISO Manual. The action plan will also be aligned with integrated ESMS as being developed to have a common approach for all the projects.

The monitoring process will cover all stakeholders including contractors, labors, suppliers and the local community impacted by the project activities and associated facilities. Inspection and monitoring of the environmental and social impacts of construction and operation phase activities will increase the effectiveness of suggested mitigations. Through the process of inspection, audit, and monitoring MAPPL will ensure that all the contractors comply with the requirements of conditions for all applicable permits including suggested action plans. The inspections and audits will be done by MAPPL's trained team. EHS Team of HQ will carried-out Inspection and Audit Task during initial stage, however, HQ Team will develop the plant site person to carry out audit and Inspection on regular basis. The entire process of inspections and audits will be documented. The inspection and audit findings will be implemented by the contractors in their respective areas.

9.3.5 Reporting and Review

MAPPL will develop and implement a programme of reporting through all stages of the project - construction and commissioning, operation and decommissioning. Contractors will be required to fully comply with the reporting requirements in terms of timely report submission with acceptable level of details. Reporting will be done in form of environmental, health, safety and social check list, incident record register, environmental, health, safety and social performance reports (quarterly basis).

9.3.6 External Reporting and Communication

All complaints and enquiries are to be appropriately dealt with and records be maintained in Complaint / Enquiry Register by EHS Officers or other delegated staff. MAPPL shall also submit annual monitoring reports to financial institutions on the progress of implementation of the ESMP. MAPPL shall undertake annual inspections in order to verify compliance with the ESMP and progress towards the expected outcomes. Necessary corrective actions shall be identified based on the verifications and a corrective action plan shall be formulated. MAPPL shall ensure effective implementation of these corrective actions and submit periodic monitoring reports to ADB. MAPPL shall also provide ADB with an annual report on its compliance with ADB's social protection requirements.

9.3.7 Internal Reporting and Communication

Inspection and audit observations along with their improvement program are to be regularly reported to the senior management for their consideration. The same are also to be communicated within the staff working on the project. To maintain open communication between the staff and management on EHS&S issues the following shall be used:

- Team Briefings,
- On-site work group meetings;
- Work Specific Instructions; and
- Meeting with stakeholders.

9.3.8 Documentation and Record Keeping

Documentation and record keeping system will be established by MAPPL through turnkey contractor to ensure updating and recording of requirements specified in ESMP. Responsibilities have to be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained and that document control is ensured through access by and distribution to identified personnel in form of the following:

- Documented Environment management system;
- Legal Register;
- Operation control procedures;
- Work instructions;
- Incident reports;
- Emergency preparedness and response procedures;
- Training records;
- Monitoring reports;
- Auditing reports; and

- Complaints register and issues attended/closed.

9.3.9 Proposed Environment and Social Management Plan

An Environment and Social Management Plan has been developed following the delineation of impacts and mitigation measures. These measures will be adopted by the project proponent and imposed as conditions of contract of the sub-contractor employed for respective phases of this solar power project. The mitigation measures suggested during operation will be made part of the regular maintenance and monitoring schedule. Environment and Social Management & Monitoring Plan as developed for the proposed project is Tabulated at next page.

9.3.10 Feedback Mechanism

The key indicators from various monitoring will be helpful in refining the mitigation measures suggested and also for introduction of new measures as required. The key indicators on the status of project during the various stages of the project are:

9.3.10.1Construction

Grievance redressal shall be the key indicator to assess community concerns, concerns of women and behavioral issues of workers. The EHS supervisor will assess the basic behavior of workers at site towards local community, women and other workers. The inputs from EHS supervisor will determine the need for extent and frequency of briefing and training on local customs, respect for women and code of conduct to be imparted to the workers. The liaison officer will continuously interact with the community and land aggregators to address the key concerns.

Incident reporting mechanism shall be a key indicator for the Health and Safety aspects of the site. The safety Officer (EHS Officer) shall either directly or through EHS In-charge will verify the capability of the contractors / sub-contractors to implement the EHS requirement. The need for training and scope for improvement shall be charted internally and implemented. MAPPL shall focus on incident reduction and follow up measures.

Internal Audits of the site shall be carried out on periodic basis. Internal Audit on bi-annually basis shall be undertaken after the construction work is fully initiated. The Audit reports and the corrective actions submitted shall be implemented in a time bound manner by MAPPL under the guidance of the corporate EHS head.

Debris removal of site: Restoration of site post construction is a key indicator for the lenders and MAPPL to assess the commitment to environment. Removal of debris and vegetation in open or unutilized areas shall be undertaken in a time bound manner.

9.3.10.2Operation

Grievance Redressal will remain a key indicator for community concerns and to understand the effectiveness of CSR programs planned/implemented. It will also provide an assessment of behavior of security staff with the local community, especially women.

Table 9-1: Environment and Social Management & Monitoring Plan

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
Construction Phase				
Land Resources				
• Land use Change • Aesthetic Change • Contamination	• Setting-up of the proposed project will increase aesthetic look of the area • Land is being leased and shall return back to owners after lease period • Hazardous material / waste shall be stored in a separate designated space	• Workers handling hazardous material to be briefed about the need to prevent contamination • Inspection / Monitoring to contain the construction activities within the site boundary only	• To be implemented with EPC contractor	Normal Practice for complete implementation stage
Soil Characteristics				
• Erosion and compaction • Contamination	• Loose soil to be protected from wind and runoff by covering / watering / other means of covering • Unutilized / Open area to be suitably re-vegetated at the earliest • Use of existing track for transport of man and material to the extent possible	• MAPPL representative to make observations as and when on storage and handling of construction material • Drivers to be instructed about use of dedicated tracks within the site Workers to be trained on handling and storage of fuel and hazardous waste by contractor • Workers handling painting activity to be briefed about the need to prevent contamination	• To be implemented with EPC contractor Site supervisor / Engineer to make observations and convey it to the contractors and Project Head. • Deputed EHS / site engineer of MAPPL will monitor the implementation of	Normal Practice for complete implementation stage

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
	• All construction material to be kept within the footprint of the area leased • Painting of panels, switchyard structures to be undertaken after covering the land beneath with a sheet of impervious material as per the requirement. • Re-fueling of machinery at site to be undertaken over paved / suitable surface • In case of any accidental spill the soil to be cut and stored securely for disposal with hazardous waste	• Inspection / Monitoring to contain the construction activities within the site boundary only • Soil monitoring for Heavy Metals and Physical Properties once during construction phase	ESMMP and report to MAPPL on monthly basis.	
Waste Disposal				
• Accumulation of construction waste • Unhygienic condition for labors • Hazardous waste from machinery, generators etc. (lube oil, hydraulic oil, waste oil etc.)	• Construction debris will be utilised for levelling of the land and unused debris shall be disposed-off to nearest TSDF / waste disposal site. • Proper sanitation and sewage facility in terms of septic tank with soak pit shall be provided.	• MAPPL will brief the specific needs as per Host Country's requirement for further execution, as and when required. • Workers to be instructed to maintain neat, clean & hygiene at the use of facilities	• Contractors will be abided with Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 and amendments thereof	• To be incorporated as part of project budget, no additional cost is envisaged. • During Construction phase

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
• Soil and land contamination due to accidental leakage • Run off into rainwater channels	• Nearby municipality shall also be contacted for regular disposal of the labor camp waste. • Other wastes like wood packaging material, metal, jute, etc. will be sold to scrap dealers/ buyers. • Random stocking of raw material, storage of debris, piling of loose soil etc. to be strictly controlled. • Portable toilets / suitable arrangements with septic tank-soak pit arrangement to be provided for workers • Hazardous waste (like used oil, paint tins, defected panels, etc.) shall be stored at designated place and only be sold to CPCB authorized vendors.	• Contractors will be briefed about the need for proper storage and disposal of construction waste • Inspection and Audit at every 3 months interval for waste management practices • Soil monitoring for Heavy Metals and Physical Properties once during construction phase	• Site Engineer to make observations and convey it to the contractors. • Monthly report of EHS supervisor to include the compliance and observations if any.	
Water Resource and Quality				
• Run off into rainwater channels and	• Water for construction and consumption to be arranged by the suitable local contractors	• Daily consumption of water to be recorded.	• Conditions will be the part of contract with the EPC contractor	• Water quality monitoring cost– INR 12,000 per sample

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
ultimately into nearby surface water body • Change in micro level drainage pattern • Wastage of water and sewage discharge from labor camp	through authorized tanker water suppliers. • Adequate arrangement for storm water management in identified area during construction period to be made to avoid sediment run off from the site. • Storm water flow during monsoons to be directed to the existing suitable channels. • Leaks and losses to be checked frequently to ensure optimum uses. • Septic tank with soak pits will be provided at site to facilitate the sewage generated.	• Storm water arrangements to be monitored for clogging as and when required • Water quality monitoring will be conducted if any mishap observed once during construction phase • Performance parameters are EC, TSS, TDS, Oil & Grease, Total Coliforms, BOD, etc. • Workers to be instructed about optimal use of water	• Site Engineer to make observations and convey it to the contractors • Report of Site Engineer / EHS site engineer to be sent to EHS head	• During Construction phase
Ecology				
• Clearing of vegetation • Cutting of trees • Disturbance to avifauna, small mammals	• Tree cutting to be limited to those directly affecting solar panel exposure • Workforce to be instructed to avoid any other activity likely to affect the local flora & fauna	• Visual damage loss inspection by Site Engineer • Construction contractor to instruct and inform workers about need to refrain from activities that may adversely affect the ecology	• Site supervisor / Engineer will take care of this aspect • Will be the part of EPC Contract	• Precautions need to be taken care for full construction phase

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
	• Movement of construction and transport vehicles will be restricted to dedicated paths to minimise any harm to small mammals	• Visible damage loss inspection in site nearby areas once during construction phase		
Traffic and Transport				
• Movement of additional vehicles leading to congestion and accidents • Break-down and Improper halt of vehicles • Discomfort due to air and noise pollution due to raw materials transportation • Damage to road and related structure from heavy vehicles	• Vehicle movement and parking within the project premises shall be managed properly to avoid accidents • Routes for use by construction traffic to be planned to minimize impact on adjoining activities. • Dedicated path within the site for exclusive entry and exit of the construction vehicles to be provided. • Only PUC certified vehicle will be deployed • Construction material will be transported in covered trucks • Transportation to be undertaken along pre-identified paths.	• No village road shall be utilized for the project. If any such condition arises proper NoC from Panchayat shall be taken. • Necessary training to the driver of construction vehicles for speed restrictions • Drivers to be assessed for their knowledge on traffic rules before engagement. • During the construction phase number of vehicles as well as any incidents and accidents need to be reported and their outcomes will be monitored.	• Site supervisor/ Engineer will provide the training • To be mentioned in the contract with the construction contractor	• Per Training Cost- INR 25,000/- • Regular maintenance of vehicle and up keep of roads shall be included in O&M budget • For all construction related activities during construction and operation phases.

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
	• High noise generating activities to be restricted to day time (07:00 to 22:00 hours) with proper mitigation measures.			
Air Quality				
• Fugitive dust • Emissions from diesel engines / vehicles	• Regular water sprinkling while undertaking dust generation activities • Work shall be avoided during high wind speed time • Construction material shall be covered to prevent any fugitive dust from these areas • Regular maintenance of construction machineries • Deployment of only PUC certified vehicles • Flyable Construction material will be transported in covered trucks only • Vehicle speed to be restricted to 30km/hour at site to minimize potential for dust emission in the surroundings	• Awareness will be developed among the site workers for fugitive dust management • Air Quality monitoring specifically for particulate matter in nearby settlement areas once during construction for Compliance to NAAQ Standards	• Site supervisor / Engineer will regularly coordinate and super-wise the work • Monitoring agency will take out the monitoring work • To be incorporated in the contract with contractor	• Water tankers would cost INR 1200-1600 per tanker (15,000-20,000 liters) • Throughout construction phase
Noise and Vibration				

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
• Disturbance to habitations • Disturbance to fauna • Occupational Hazard	• Only well maintained equipment (Compliant to CPCB noise standards) will be operated on site • DG sets shall be used for emergency power / backup • Temporary noise barriers shall be provided surrounding the high noise generating construction machineries • Scheduling of the construction activities • Loud, sudden noise emissions to be avoided wherever possible. • Personal protective devices for site workers working near high noise equipment	• Arrangements / facilities for noise reduction to be monitored as and when required • Schedule of activities to be discussed and finalized between site manager and the contractor • Noise monitoring in nearby settlement areas once during construction period to ensure compliance with Noise Rules	• Site Engineer will take care of the compliance of ESMMP • Third party monitoring agency to be engaged for Noise Monitoring • External training on use of PPE will be the responsibility of EPC Contractor	• Throughout construction phase
Cultural				
• Cultural differences amongst workers	• To the extent possible sourcing of construction labor to be done from local region by contractor for unskilled activities	• Workers to be briefed about need for cooperation and harmony with the community	• EPC Contractor	Normal Practice
Health and Safety				

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
• Working at height • Operation of heavy machinery • Accidents leading to injuries fatalities • Occupational health hazards	• Operation of loading–unloading equipment shall be undertaken under the guidance / supervision of trained professional • Sufficiently competent person will be engaged in driving or operating construction machineries • Ensure effective work permit system for hot-work, electrical work, working at height, working in confined space etc. • Ensure personal protective equipment for all personnel present at site are made available • Arrangement for fire control measures • Display of Emergency phone numbers at site. • Ensure good house-keeping at the construction site to avoid slips and falls.	• Proper training of the workers regarding health and safety procedures • Workers to be trained through sub-contractors regarding use of Personal protection equipment and its importance. • Operation of Cranes shall normally be limited for transmission line as per requirement. Crane will be operated as per contractor's Crane Safety Plan.	• Site Manager / Engineer will ensure compliance of safety guidelines • Safety Officer of contractor will be responsible for implementation of safety guidelines • To form part of the contractor's contract	• Training of workers will be mostly given by internal resources. INR-25,000/- has been kept for each training • Throughout Construction phase
Social				

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
• Expectations for infrastructure development benefits	• MAPPL's officials will communicate and discuss with the community in a transparent manner on a regular basis and demonstrate their concerns. • Consultation with women's groups will also be held during construction and operation phases to listen to their issues and concerns regarding labor, health and safety etc. as well as to solicit their ideas on various community initiatives.	• MAPPL shall hold regular consultations with appropriate stakeholders. • All concerns must be addressed through systematic process.	• MAPPL Site Engineer	Normal Practice
• Local Employment	• Assess the exact number of workers to be required at each stage through contractor / own resource in the construction period. • Ensure priority is given to local people for short term / long term employment opportunities, based on required skill and education level.	• Explore possibilities of training and capacity building to enable the community to be able to secure the available jobs and contracts, as per the applicability and requirement of the business. • MAPPL will explore possibility to engage women in appropriate work as per the applicability during construction phase.	• EPC contractor in discussion with MAPPL will assess potential for engagement of local community and for women.	Normal Practice
• Demands for materials	• Ensure local contracting and vendor opportunities aligned		• MAPPL / Contractor	Normal Practice

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
	with the scope and demand as far as possible			
• Livelihood loss due to leasing of land	• Lease price is slightly higher in comparison to the crop rate of the area • 5% escalation rate is considered for lease rent • Lease will be credited annually to have a regular income	• Regular crediting of lease rent	• Deputed Executive	Normal Practice
• Influx of migrant labor • Excess load on existing resources • Spread of communicable disease	• Local labor shall be preferred for unskilled work • Awareness camp for communicable disease understanding • Medical camp as part of CSR activities	• Awareness training for applicable regulatory regulations	• MAPPL's Site In-charge through EPC Contractor	INR 25,000/- Per training camp INR 1,50,000/- Per Medical Camp
Operation Phase				
Waste Generation				
• Used Oil • Dielectric fluids, cleaning agents, and solvents • Defunct / damaged photo voltaic cells	• Earmarking of designated areas for storage of waste separately • Waste shall be given to approved recylcers in a systematic approach	• Training and briefing of the staff involved in waste management • Soil sampling and analysis on annual basis near to hazardous waste storage areas	• Plant manager and Safety Engineer	• Normal Process • Training budget of INR 25,000/- Annum

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
Ecological Impact				
• Distraction due to Glare / Visual intrusion • Routine clearance of vegetation	• Clearing shall be limited for affected area only	-	• Plant EHS or Safety Officer	-
Water Resources				
• Ground water extraction • Water Logging • Water Discharge	• Avoidance of water wastage to the maximum extent • Proper storm water facility	• Extraction after requisite permission • Water table data collection from nearby wells to have a check on Water table in Study area on annual basis • Regular check on water use quantity • Awareness campaign for effective use of water	• Plant EHS or Safety Officer	-
Soil Quality Degradation				
• Accidental spillage of oils	• Storage of hazardous materials or waste in separate designated areas • Adequate drainage facility to drain out the wash waste water	• Regular upkeep and record management of hazardous materials • Soil sampling and analysis on annual basis near to hazardous waste storage areas	• Plant EHS or Safety Officer	-
Health and Safety				

Impact Identified	Suggested Mitigation	Monitoring / Training, Parameters and Frequency	Management Responsibility	Cost Estimate and Timeline
• Electromagnetic field • Accidents leading to Injury / fatality • Fire Risk	• Workers handling electricity and related components will be provided with shock resistant gloves and shoes • Fire extinguisher in accident prone areas	• Health and safety awareness training on regular interval • Safety incidents will be recorded and monitored with an aim that numbers are never significant, and gradually reduce.	• Plant EHS or Safety Officer	-
Social Aspects				
• Local Economy • Upgradation of infrastructure	• Boost of the local economy though local contracting up to the maximum extent • Infrastructure upgradation as part of CSR	-	• Environment and Social Team	Continuous improvement
Decommissioning Phase				
• Impacts due to disposal of panels, • Contamination of soil, • Generation of wastes and associated health and safety risks • Fertility loss of the Land and Soil	• Dismantling activities will be taken care by experienced professionals • All the dismantled infrastructures and debris shall be segregated and stored separately • Seeding of Leucaena leucocephala and Prosopis Juliflora to make the land fertile in few years.	-	• Plant EHS or Safety Officer	-

10 CONCLUSION AND RECOMMNEDATION

The ESIA has assessed the overall impacts on Environmental and Social components as a result of construction and operation of proposed 25MW Solar PV Power Project at Bareta Village of Punjab State. Most of the impacts due to project is minimal, site specific and reversible in nature. Impact associated with land leasing and water use for washing will be mitigated through proper implementation of the management plan. The proposed Environmental and Social Management Plan describes implementation mechanism for recommended mitigation measures together with monitoring to verify overall project performance. Mitigation measures for potential impacts on physical, social and biological aspects of the environment have been specified through:

- Adequate arrangements for construction safety, stakeholder engagement and grievance redress mechanism;
- Stringent adherence to Health and Safety requirements; and
- Obtaining requisite permits for the proposed project.

Based on the ESIA study, as per ADB's Environment Categorization of Projects the proposed Solar PV power project can be classified as a Category B for Environment as the project will have adverse environmental impacts that are less in number, generally site specific and readily addressed through mitigation measures. In addition, the project is also classified as Category C for Involuntary Resettlement and Indigenous People as no involuntary resettlement and indigenous people are anticipated to be affected by the project activities. In reference to IFCs categorization of projects the proposed project can be categorized as Category B, which specifies that the project can cause potential and limited adverse social or environmental impacts which are generally site-specific, largely reversible and readily addressed through mitigation measures.

The rationale for categorization being:

- Overall the project being a Solar PV Power Project is a green project and does not have significant adverse impacts associated with the construction or operation activities;
- The land required for the project is taken on lease basis and the project does not involve any physical / economic displacement, ownership rights of the land owners will remain preserved;
- There are no indigenous communities being affected in the project area;
- The project does not involve diversion of any forest land. Therefore, ensuring minimal impact on ecology during the construction and operation phase of the project

The project will throw opportunities to local people for both direct and indirect employment. The project will provide impetus to industrialization of the area. Ribbon development will increase the economy and revenue potential of the region. It is expected that project development will also be helpful in development of surrounding and State & Country at large.

Annexure I

Final Document
on
Revised
Classification
of
Industrial Sectors
Under

Red, Orange, Green and White Categories

(February 29, 2016)

Central Pollution Control Board

Delhi

Executive Summary

Categorization of Industrial Sectors under Red, Orange, Green and White Category

The Ministry of Environment, Forest and Climate Change (MoEFCC) had brought out notifications in 1989, with the purpose of prohibition/ restriction of operations of certain industries to protect ecologically sensitive Doon Valley. The notification introduced the concept of categorization of industries as " Red", "Orange "and "Green" with the purpose of facilitating decisions related to location of these industries. Subsequently, the application of this concept was extended in other parts of the country not only for the purpose of location of industries, but also for the purpose of Consent management and formulation of norms related to surveillance / inspection of industries.

The concept of categorization of industries continued to evolve and as different State Pollution Control Boards interpreted it differently, a need arose to bring about necessary uniformity in its application across the country. In order to harmonize the 'Criteria of categorization', Directions were issued by CPCB under Section 18(1)(b) of the Water (Prevention & Control of Pollution) , Act, 1974 to all SPCBs/PCCs to maintain uniformity in categorization of industries as red, green and orange as per list finalized by CPCB, which identified 85 types of industrial sectors as 'Red', 73 industrial sectors as 'Orange' and 86 sectors as 'Green'.

The process of categorization thus far was primarily based on the size of the industries and consumption of resources. The pollution due to discharge of emissions & effluents and its likely impact on health was not considered as primary criteria. There was demand from the SPCBs / PCCs and industrial associations for categorization of the industrial sectors in a more transparent manner. Accordingly, the issue was discussed thoroughly during the national level conference of the Environment Ministers of the States, held in New Delhi during April 06-07, 2015 and a 'Working Group' comprising of the members from CPCB, APPCB, TNPCB, WBPCB, PPCB, MPPCB and Maharashtra PCB is constituted to revisit the criteria of categorization of industries and recommend measures for making the system transparent and rational.

The Working Group has developed the criteria of categorization of industrial sectors based on the Pollution Index which is a function of the emissions (air pollutants), effluents (water pollutants), hazardous wastes generated and consumption of resources. For this purpose the references are taken from the the Water (Prevention and Control of Pollution) Cess (Amendment) Act, 2003, Standards so far prescribed for various pollutants under Environment (Protection) Act , 1986 and Doon Valley Notification, 1989 issued by MoEFCC. The Pollution Index PI of any industrial sector is a number from 0 to 100 and the increasing value of PI denotes the increasing degree of pollution load from the industrial sector. Based on the series of brain storming sessions among CPCB, SPCBs and MoEFCC , the following criteria on 'Range of Pollution Index 'for the purpose of categorization of industrial sectors is finalized.

- Industrial Sectors having Pollution Index score of 60 and above – Red category
- Industrial Sectors having Pollution Index score of 41 to 59 –Orange category
- Industrial Sectors having Pollution Index score of 21 to 40 –Green category
- Industrial Sectors having Pollution Index score incl.&upto 20 -White category

The newly introduced White category of industries pertains to those industrial sectors which are practically non-polluting such as Biscuit trays etc. from rolled PVC sheet (using automatic vacuum forming machines), Cotton and woolen hosiers making (Dry process only without any dying/washing operation), Electric lamp (bulb) and CFL manufacturing by assembling only, Scientific and mathematical instrument manufacturing, Solar power generation through photovoltaic cell, wind power and mini hydel power (less than 25 MW).

The salient features of the 'Re-categorization' Exercise are as follows :

- Due importance has been given to relative pollution potential of the industrial sectors based on scientific criteria . Further, wherever possible, splitting of the industrial sectors is also considered based on the use of raw materials, manufacturing process adopted and in-turn pollutants expected to be generated.
- The Red category of industrial sectors would be 60.
- The Orange category of industrial sectors would be 83.
- The Green category of industrial sectors would be 63.
- Newly introduced White category contains 36 industrial sectors which are practically non-polluting.
- There shall be no necessity of obtaining the Consent to Operate'' for White category of industries. An intimation to concerned SPCB / PCC shall suffice.
- No Red category of industries shall normally be permitted in the ecologically fragile area / protected area.

The purpose of categorization is to ensure that the industry is established in a manner which is consistent with the environmental objectives. The new criteria will prompt industrial sectors willing to adopt cleaner technologies, ultimately resulting in generation of fewer pollutants. Another feature of the new categorization system lies in facilitating self-assessment by industries as the subjectivity of earlier assessment has been eliminated. This 'Re-categorization' is a part of the efforts, policies and objective of present government to create a clean & transparent working environment in the country and promote the Ease of Doing Business.

Other similar efforts include installation of Continuous Online Emissions/ Effluent Monitoring Systems in the polluting industries, Revisiting of the CEPI (Comprehensive Environment Pollution Index) concept for assessment of polluted industrial clusters, Revision of existing industrial Emission/Effluent discharge standards, initiation of special drive on pollution control activities in Ganga River basin and many more in coming future.

Revised Criteria of Categorization of Industries

"Securing industrial pollution control in accordance with the Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981 by linking with categorization of industries, consent management and vigilance – 'In context of Red, Orange, Green and White categories of industries"

A: Genesis of Categorization:

- The Ministry of Environment, Forest and Climate Change (MoEFCC) had brought out notifications, which inter-alia refers to Prohibition/ Restriction on operation of industries to protect ecologically sensitive areas or areas of specific importance. This has for the first time brought the concept of categorization of industries to" Red", "Orange "and "Green" and restrict their operation in certain areas of importance. Therefore, it is at-once interpreted that Red, Orange and Green categorization is linked with location specific needs.
- The notification of MoEF was first brought on 2nd February,1989 in case of "Restriction on location of industries, mining operations and other developmental activities in Doon Valley in "Uttarakhand" and thereafter another notification on 24th February 1999 regarding restriction on the setting up of industries in Dahanu Taluka in Maharashtra. The categorization had been made mainly on the basis of size of the industries, man power and consumption of resources.
- However, in other parts of the country, there have been variations in context to the classification of industries under Red, Orange and Green categories. SPCBs / PCCs were following their own criteria in different States thereby creating confusion.
- In order to harmonize the 'Criteria of categorization', a 'Working Group' was formed as per resolution passed during the 57th Conference of the Chairmen & Member Secretaries of CPCB and SPCBs. Based on the recommendations of the Working Group, Directions dated 4/6/2012 under Section 18(1)(b) of the Water

(Prevention & Control of Pollution) , Act, 1974 were issued to all SPCBs/PCCs with the effects to maintain uniformity in categorization of industries as red, green and orange as per list finalized by the Working Group. This indicative list included 85 types of industrial sectors as 'Red', 73 industrial sectors as 'Orange' and 86 sectors as 'Green'. However, these identified categories have not been assigned with scores as per existing criteria/ or any new criteria

B: Categorization criteria used by SPCBs/PCCs:

SPCBs and PCCs use the criteria of Red, Orange and Green categories for consent management and vigilance purposes for carrying out inspections to verify compliance to the stipulated standards. However the above categorization do not emphasize on sector-specific plan for control of pollution in accordance with priority based on pollution index.

C: Gap in the process:

1. The categorization has been made mainly on the basis of size of the industries and consumption of resources. The pollution due to discharge of emissions & effluents and its impact on health was not considered as primary criteria.
2. Categorization was on random basis, no scoring system was adopted.

D: Resolutions made during National Level Conferences

The issue was discussed thoroughly during the following national level conferences held in New Delhi:

- Conference of the Environment Ministers of Central Government and State Governments during April 06-07, 2015
- 59th Conference of Chairmen & Member Secretaries of Pollution Control Boards / Pollution Control Committees held on April 08, 2015

Accordingly following resolutions were made during the Conferences:

1. *A 'Working Group' comprising of the members from CPCB, APPCB, TNPCB, WBPCB, PPCB, MPPCB and Maharashtra PCB is constituted.*
2. *This WG shall revisit the categorization of industries that is based on pollution index criteria & environmental issues such as generation of emission, effluent and hazardous wastes.*
3. *The categorization will be done on the basis of composite score (0-100 marks) of Pollution Index given in accordance with the following weightage.*

Air Pollution Score based on parameters namely PM, CO, NOx, SOx, HMs , Benzene, Ammonia and other toxic parameters relevant to the industry.	*40 Marks*
Water Pollution Score based on parameters namely pH, TSS, NH_3-N, BOD, Phenol and other toxic pollutants relevant to the industry.	*40 Marks*
Hazardous wastes (land fillable, incinerable, recyclable) as generated by the industry.	*20 Marks*
Note : • *Parameters to be decided on the basis of the nature of the wastes generating from the industrial sector.* • *Industries having only either water pollution or air pollution, the score will be normalized wrt 100.*	

4. *Based on the score of the Pollution Index, following categorization be made :*
    - *Type of industries, if scores 60 and above be categorized as Red*
    - *Type of industries, if scores from 30 to 59 be categorized as Orange*
    - *Type of industries, if scores from 15 to 29 be categorized as Green*
    - *Type of industries, if less than 15 be categorized as White or non-polluting industry.*
5. *SPCBs/PCCs may issue consent to the industries*
    - *Red category of industries for 5 years.*
    - *Orange category of industries for 10 years.*
    - *Green category of industries for 15 years.*
    - *No necessity of consent for non-polluting industries.*
6. *No red categories of industries will be permitted to establish in eco-sensitive areas and protected areas.*

E: Follow-up Actions made on the Resolutions :-

- Accordingly, a Committee comprising the Chairmen of CPCB, APPCB, TNPCB, MPPCB, MPCB, PPCB, WBPCB and MS, CPCB was constituted vide CPCB OM dated

23.04.2015 to review & classify industrial sectors into different categories based on criteria of respective pollution potential.

- The categorization is made on the basis of following:
    - Quality of emissions (air pollutants) generated
    - Quality of effluents (water pollutants) generated
    - Types of hazardous wastes generated
    - Consumption of resources

- Reference is taken from the following :
    - The Water (Prevention and Control of Pollution) Cess Act, 1977
    - Standards so far prescribed for various pollutants under the Environment (Protection) Act , 1986
    - Doon Valley Notification, 1989 issued by MoEF.

F : Scoring Methodology :

The details on the scoring methodology in respect of the aforesaid 3 components is presented in the following tables F-1 to F-4 .

Table F-1 : Water Pollution Scoring Methodology

Sl. No.	Activity / Types of Discharges	Score
Part A : Score W1 : Score based on types of expected criteria water-pollutants present in industrial processes waste waters. **Maximum of the following seven categories is to be taken.**		
W11	Waste-water which is polluted and the pollutants are - • not easily biodegradable (very high strength waste waters having BOD > 5000 mg/l); or • toxic; or • both toxic and not easily biodegradable. (Presence of criteria water pollutants having prescribed standard limits up-to 10 mg/l or having BOD > 5000 mg/l). For details appendix 1 may be referred)	30
W12	Non-toxic high strength polluted waste-water having BOD in the range of 1000-5000 mg/l and the pollutants are biodegradable. (Presence of criteria water pollutants having prescribed standard limits from 11 mg/l to 250 mg/l and having BOD strength in the range of 1000-5000 mg/l) . For details appendix 1 may be referred)	25
W13	Non toxic- polluted waste-water having BOD below 1000 mg/l and the pollutants are easily biodegradable. (Presence of criteria water pollutants having prescribed standard limits from 11mg/l to 250 mg/l and having BOD strength below 1000 mg/l) . For details appendix 1 may be referred)	20
W14	Waste-water generated from the chemical processes and which is polluted due to presence of high TDS (total dissolved solids) of inorganic nature. (Presence of criteria water pollutants having prescribed standard limits more than 250 mg/l. For details appendix 1 may be referred)	15
W15	Waste-water generated from the physical unit operations / processes and which is polluted due to presence of TDS (total dissolved solids) of inorganic nature and of natural origin like fresh-water RO rejects, boiler blow-downs, brine solution rejects etc. (Presence of criteria water pollutants having prescribed standard limits more than 250 mg/l. For details appendix 1 may be referred)	12
W16	Non-toxic polluted waste-water from those units which are: • Having the overall waste-water generation less than 10 KLD and • The pollutants are easily bio-degradable having BOD below 200 mg/l which can be easily treated in a single stage ASP (activated	12

	sludge process) based Effluent Treatment Plant. Note : This is a special category and is applicable to only those units having over-all liquid waste generation less than 10 KLD with low strength organic load.	
W17	Waste-water from cooling towers and cooling-re-circulation processes	10
Part B : Score W2 : Score based on huge discharges of any kind (Penalty Clause)		
W2	Industry having overall liquid waste generation of 100 KLD or more including industrial & domestic waste-water.	10
Overall Water Pollution Score W = W1+W2		

Appendix 1

- **Water Pollutants covered under Group W11:**

  - ✓ Free available Chlorine , Total residual chlorine, Fluoride (as F), Sulphide (as S), Free Ammonical Nitrogen, Dissolved phosphates (as P), Free ammonia (as NH3), Nitrate Nitrogen, Mercury (As Hg), Selenium (as Se), Hexa-valent chromium (as Cr + 6), Lead (as Pb), Tin , Vanadium (as V), Cadmium (as Cd), Manganese (as Mn), Total chromium (as Cr), Copper (as Cu), Iron (as Fe), Nickel (as Ni), Zinc (as Zn), Benzene, Arsenic (as As), Benzo-a-pyrene, Cyanide (as CN), Phenolic compounds (as C_6H_5OH) , Adsorbable Organic Halogens (AOX), Boron and /or
  - ✓ BOD strength of waste water > 5000 mg/l

- **Water Pollutants covered under Group W12:**

  - ✓ Sodium Absorption Ratio (SAR) , Biochemical oxygen demand (3 days at 27^{o}C), Total Kjeldahl nitrogen (TKN), Ammonical nitrogen (as N), Suspended solids, Total nitrogen (as N), Chemical oxygen demand, Oils & grease and
  - ✓ BOD strength of waste water is in the range of 1000-5000 mg/l

- **Water Pollutants covered under Group W13:**

  - ✓ Sodium Absorption Ratio (SAR), Biochemical oxygen demand (3 days at 27^{o}C), Total Kjeldahl nitrogen (TKN), Ammonical nitrogen (as N), Suspended solids, Total nitrogen (as N), Chemical oxygen demand and
  - ✓ BOD strength of waste water is below 1000 mg/l

- **Water Pollutants covered under Group W14 and W15:**

  Chlorides as Cl, Colour , Total dissolved solids (TDS - Inorganic)

- **Water Pollutants covered under Group W16**

  - ✓ BOD strength of waste water is below 200 mg/l and overall discharge is less than 10 KLD.

Table F-2 : Air Pollution Score

Sl. No.	Air Pollutants Group	'Range of Prescribed Standard ' of criteria pollutants	Marks
Part 1 : Score A1 = Score based on types of expected criteria Air Pollutants present in the emissions . Maximum of the following seven categories is to be taken. For details appendix 2 may be referred.			
1	Group A1A	Presence of criteria air pollutants having prescribed standard limits up-to 2 mg/Nm3	30
2	Group A1B	Presence of criteria air pollutants having prescribed standard from 3 to10 mg/Nm3	25
3	Group A1C	Presence of criteria air pollutants having prescribed standard from 11 to 50 mg/Nm3	20
4	Group A1D	Presence of criteria air pollutants having prescribed standard from 51 to 250 mg/Nm3	15
5	Group A1E	Presence of criteria air pollutants having prescribed standard from 251mg/Nm3 & above.	10
6	Group A1F	• Generation of fugitive emissions of Particulate Matters which are: o Not generated as a result of combustion of any kind of fossil-fuel. o Generated due to handling / processing of materials without involving the use of any kind of chemicals. o Which can be easily contained /controlled with simple conventional methods	10
7	Group A1G	• Generation of Odours which are : o Generated due to application of binding gums / cements /adhesives /enamels o Which can be easily contained /controlled with simple conventional methods	10
Part 2 : Score A2 = Score based on consumption of fuels and technologies required for air pollution control :			
6	Group A2F1	• All such industries in which the daily consumption of coal/fuel is more than 24 MT/day and the particular (Particulate/gaseous/process) emissions from which can be controlled only with high level equipments / technology like ESPs, Bag House Filters, High Efficiency chemical wet scrubbers etc.	10
7	Group A2F2	• All such industries in which the daily consumption of coal/fuel is from 12 MT/day to 24 MT/day and the particular (Particulate/gaseous/process) emissions from which can be controlled with suitable proven technology.	5
Overall Air Pollution Score –A = A1 + A2			

Appendix 2

- **<u>Air pollutants covered under Group A1A:</u>**

  Cd+Th, Dioxins & Furans, Mercury, Asbestos

- **<u>Air Pollutants covered under Group A1B:</u>**

  HF, Nickel+ Vanadium, HBr, Manganese, Lead, H_2S, P_2O_5 as H_3PO_4

- **<u>Air Pollutants covered under Group A1C:</u>**

  Chlorine, Pesticide compounds, CH_3Cl, TOC, Total Fluoride, Hydrocarbons, NH_3, HCL vapour & Mist, H_2SO_4 Mist, SO_2

- **<u>Air Pollutants covered under Group A1D:</u>**

  CO, PM, CO, NOx

- **<u>Air Pollutants covered under Group A1E:</u>**

  NOx with liquid-fuel, SO_2 with liquid-fuel

Table F-3: Hazardous Waste Generation Score

Sl.No.	**Types of Hazardous Waste Generated as** per Schedule 1 / Schedule 2 of Hazardous Waste (Management, Handling & Trans-boundary Movement) Rules , 2008 . **Maximum of the following four categories is to be taken**	**Score**
HW1	• Land disposable HW which require special care & treatment for stabilization before disposal.	20
HW2	• Incinerable HW	15
HW3	• Land disposable HW which doesn't require treatment & stabilization before disposal. • High volume low effect wastes such as fly-ash, phspho-gypsum, red-mud, slags from pyro-metallurgical operations, mine tailings and ore beneficiation rejects)	10
HW4	• Recyclable HW, which are easily recyclable with proven technologies.	10

Table F-4 : Calculation Sheet

Industrial Sector - .....

1. Water Pollution Score (W)			
Scores	Waste Water Category	Value	
Score on W1			
Score on W2			
Water Pollution Score = W1+W2			
2. Air Pollution Score (A)			
Scores	Air Pollutant Category	Value	
Score on A1			
Score on A2	-	-	
Air Pollution Score = A1+A2			
3. Hazardous Waste Score (HW)			
Score	HW Category	Value	
HW			
Grand Total = W + A + HW			

Note :

1. Any of the industrial sector having only either air pollution (A) or water pollution (W) , the score will be normalized to 100 as per the following formula –

   Normalized Score = {100 x W (or A)} / 40

2. Any of the industrial sector having air pollution (A) and water pollution (W) both but no hazardous waste generation (H) , the joint score of air & water pollution will be normalized to 100 as per the following formula –

   Normalized Score = {100 x (W+A)} / 80

3. Any of the industrial sector having air pollution (A) & hazardous waste generation (H) but no water pollution (W), the joint score of air pollution & hazardous waste generation will be normalized to 100 as per the following formula –

   Normalized Score = {100 x (A+H)} / 60

4. Any of the industrial sector having water pollution (W) and hazardous waste generation (H) but no air pollution (A), the joint score of water pollution & hazardous waste generation will be normalized to 100 as per the following formula –

   Normalized Score = {100 x (W+H)} / 60

G : Developments :

i. The existing Red (85 sectors) , Orange (73 sectors) and Green (86 sectors) i.e a total of 244 industrial sectors have been assessed as per the proposed formula by the Working Group. For this purpose, concerned Engineers / Scientists from the Member SPCBs were also involved & consulted during May 28-29, 2015.

ii. After careful examination and consideration of the suggestions of concerned stake-holders the "Draft Document on Revised Concept of Categorization of Industrial Sectors " was prepared by the Committee and circulated to all the SPCBs, PCCs and concerned Ministries for their information & comments. The ' Draft Document ' was uploaded on the website of CPCB also for information & comments of one & all.

iii. The matter was discussed during the 170th Board Meeting also and issues raised by the Board Members pertaining to some of the industrial sectors were clarified.

iv. Responses were received from various concerned Ministries, SPCBs, Industrial Associations including individuals.

v. Based on the above, final meeting was convened by the Secretary , MoEFCC with CPCB and senior officers of MoEFCC on January 06, 2016 to resolve the issues appropriately and finalize the 'Re-categorization'. Accordingly , following modifications in the 'Range of Pollution Index 'for the purpose of categorization of industrial sectors were suggested :

- Industrial Sectors having Pollution Index score of 60 and above – Red category
- Industrial Sectors having Pollution Index score of 41 to 59 –Orange category
- Industrial Sectors having Pollution Index score of 21 to 40 –Green category
- Industrial Sectors having Pollution Index score incl.& upto 20 –White category

vi. Based on the final criteria as described in v above , the final categorization is as follows :

Category of Industrial Sector	Existing Categorization	Proposed (New) categorization
Red	85	60
Orange	73	83
Green	86	63
White	---	36
Total	244	242

vii. In the proposed categorization, some of the industrial sectors have been either deleted due to duplication or merged with similar type of sectors on account of same

characteristics of pollution generation. In a similar way, some of the industrial sectors are split into more sectors on account of variation in the raw materials / manufacturing process. As a result final totals of the existing and proposed categorization are different.

viii. The industrial sector which doesn't fall under any of the above four categories (Red, Orange, Green and White) , decision with regard to its categorization will be taken at the level of concerned SPCB/PCC by a committee headed by the Member Secretary , SPCB/PCC and comprising of two senior cadre Engineers / Scientists of the SPCB / PCC in accordance with the scoring-criteria specified in this document.

ix. The summary is presented in the following Table G-1 and final lists of Red, Orange, Green and White categories of industries are presented in Tables G-2, G-3, G-4 and G-5 respectively, which are self explanatory.

Table G-1: Final Summary Table Red , Orange, Green and White Categories of Industries (16-01-16)

Sl No.	Original Categorization	Initial Nos.	Addition by Splitting into further classes	Deletion/ Shifting to foot-note due to vague term / Merger / other reasons	Re-categorization to Red	Re-categorization to Orange	Re-categorization to Green	Re-categorization to White	Check
		1	2	3	4	5	6	7	(1+2) = (3 to 7)
1	Red	85	11	7	60	26	3	Nil	96=96
2	Orange	73	2	3	Nil	51	19	2	75=75
3	Green	86	Nil	3+2=5	Nil	6	41	34	86=86
Final Categorization		244	13	15	**60 (Red)**	**83 (Orange)**	**63 (Green)**	**36 (White)**	**257 =257** (Total categories including in foot-note)

Table G-2 : Final List of Red Category of Industrial Sectors

Sl No.	Orgnl Sl.No	Industry Sector	W1	W2	W	A1	A2	A	H	W+A+H	Revised Category	REMARKS
1.	38	Isolated storage of hazardous chemicals (as per schedule of manufacturing, storage of hazardous chemicals rules ,1989 as amended)									R-R	As per provisions of Rules, to be kept under Red category especially for safety purposes.
2.	4	Automobile Manufacturing (integrated facilities)	30	-	30	20	-	20	10	60	**R-R**	i. Such types of plants are having either one or combinations of polluting activities viz. washing, metal surface finishing operations, pickling, plating, electro-plating , phosphating, painting , heat treatment etc. ii. Some of such plants may outsource some /all of the polluting activities. In such cases, after thorough inspection of such units by concerned SPCB, re-categorization of the industry shall be made accordingly.
3.	34	Industries engaged in recycling / reprocessing/ recovery/reuse of Hazardous Waste under schedule iv of HW(M, H& TBM) rules, 2008 - Items namely - Spent cleared metal catalyst containing copper,, Spent cleared metal catalyst containing zinc,,	30	-	30	20	-	20	10	60	**R-R**	All the three types of pollutants are expected.
4.	44	Manufacturing of lubricating oils ,grease and petroleum based products	20	-	20	20	-	20	20	60	**R-R**	Generates all sorts of pollution.
5.	66 E	DG Set of capacity > 5 MVA	-	-	-	20	5	25	-	62.5	**R-R**	i. Mainly air polluting. ii. DG sets consume the diesel @ 0.21 litres/hr/KVA at full load. iii. Average running is taken @ 12 hrs / day although many of the DG sets run for more than this period.
6.	31	Industrial carbon including electrodes and graphite blocks, activated carbon, carbon black	10	-	-	20	5	25	10	62.5	**R-R**	Mainly air polluting. Air pollution score is normalized to 100.

7.	39	Lead acid battery manufacturing(excluding assembling and charging of lead-acid battery in micro scale)	10	-	10	25	-	25	10	62.5	**R-R**	i. Mainly air polluting. Air pollution scores are normalized to 100. ii. Lead Acid Battery manufacturing consists of various stages which broadly involve (after producing or receiving lead oxide): Paste Mixing , Grid Casting , Grid Pasting & Curing , Hydro-setting, parting & enveloping , Stacking, grouping & inter-cell welding , Formation. iii. Exposure of workmen to lead during all or any of the processes outlined above exceeds the prescribed standards if appropriate equipment in this respect is not installed at any Battery Manufacturing Unit. iv. All of the above processes, some more than others, involve release of lead particles or fumes into the environment. Pollution from the above processes can be grouped into two possible types, viz: (a) Lead Oxide becomes airborne and there is Particulate Pollution (b) Fumes are generated and there is Gaseous Pollution
8.	62	Phosphate rock processing plant	30	-	30	20	-	20	-	62.5	**R-R**	i. The separation of phosphate rock from impurities and non-phosphate materials for use in fertilizer manufacture consists of beneficiation, drying or calcining at some operations, and grinding. Phosphate rock from the mines is first sent to beneficiation units to separate sand and day and to remove impurities. Steps used in beneficiation depend on the type of rock. ii. The water & air pollution scores are normalized to 100.

9.	66	Power generation plant [except Wind and Solar renewable power plants of all capacities and Mini Hydel power plant of capacity <25MW]	10	-	10	15	10	25		62.5	**R-R**	1. Mainly air polluting. It uses a mixture of biomass (agro based) and coal (< 10 %) as a fuel. Almost, round the year operation. 2 . In case of DG sets of 5 MVA & more and emissions of SO2 will take place due to use of liquid fuel. Air pollution score will be =20 + 10 = 30, Normalized score will be 75. 3. In case of 'Waste to Energy Plants' , water will be used for cooling and air score will be - 30+10 = 40.
10.	34	Industries engaged in recycling / reprocessing/ recovery/reuse of Hazardous Waste under schedule iv of HW(M, H& TBM) rules, 2008 - Items namely - Spent catalyst containing nickel, cadmium, Zinc, copper, arsenic, vanadium and cobalt,	30	-	30	25	-	25	10	65	**R-R**	All the three types of pollutants are expected.
11.	67	Processes involving chlorinated hydrocarbons	30	-	30	20	-	20	15	65	**R-R**	Chlorinated hydrocarbons are used in the manufacture of insecticides, pesticides and organo chloro pesticides. Effluents & emissions are toxic in nature.
12.	74	Sugar (excluding Khandsari)	20	10	30	15	10	25	10	65	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Sugar mills generate all sorts of pollution problems.
13.	22	Fibre glass production and processing (excluding moulding)	-	-	-	20	-	20	20	67	**R-R**	i. The use of styrene in most methods of fiberglass production causes hazardous air pollution that is harmful to breathe at excessive levels. ii. It is mainly air polluting & HW generating industry. The air pollution & HW scores are normalized to 100. iii. In case of lead containing glass, the score of A1 will be 25 and final normalized score will be 75 and shall be categorized as Red.
14.	23	Fire crackers manufacturing and bulk storage facilities	-	-	-	20	-	20	20	67	**R-R**	i. This is the normalized score based on air pollution & HW generation. ii. Various hazardous chemicals are used in the manufacturing process. iii. These chemicals are namely Potassium Nitrate , Potassium per-chlorate, Barium Nitrate, Aluminium compounds, Copper Chloride etc.

												iv. These chemicals are highly hazardous and cause serious diseases among the workers. especially ability of blood to carry oxygen leading to headaches, methemoglobinemia and kidney problems , skin problems, thyroid metal fume etc.
15.	34	Industries engaged in recycling / reprocessing/ recovery/reuse of Hazardous Waste under schedule iv of HW(M, H& TBM) rules, 2008 - Items namely - Dismantlers Recycling Plants -- Components of waste electrical and electronic assembles comprising accumulators and other batteries included on list A, mercury-switches, activated glass cullets from cathode-ray tubes and other activated glass and PCB-capacitors, or any other component contaminated with Schedule 2 constituents (e.g. cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they exhibit hazard characteristics indicated in part C of this Schedule.	-	-	-	30	0	30	10	67	R-R	Mainly air polluting and hazardous waste generating. Air & HW pollution scores are jointly normalized to 100.
16.	47	Milk processes and dairy products(integrated project)	20	10	30	20	5	25	-	68.75	**R-R**	i. Water as well as air polluting due to use of boilers. ii. Water & air pollution scores are normalized to 100.
17.	63	Phosphorous and its compounds	30	-	30	25	-	25	-	68.75	**R-R**	Water pollution & air pollution containing compounds of phosphorous are expected
18.	61	Pulp & Paper (waste paper based without bleaching process to manufacture Kraft paper)	20	10	30	15	10	25	0	68.75	**R-R**	Mainly water & air polluting . Water & air pollution scores are normalized to 100.
19.	13	Coke making , liquefaction, coal tar distillation or fuel gas making	30	-	30	20	-	20	20	70	**R-R**	It is a kind of petrochemical industry.

20.	41	Manufacturing of explosives, detonators, fuses including management and handling activities	30	-	30	20	-	20	20	70	**R-R**	i. Explosives manufacture and use contribute some measure of hazardous waste to the environment. ii. Nitroglycerin produces several toxic byproducts such as acids, caustics, and oils contaminated with heavy metals. These must be disposed of properly by neutralization or stabilization and transported to a hazardous waste landfill. iii. The use of explosives creates large amounts of dust and particulate from the explosion, and, in some cases, releases asbestos, **lead,** and other hazardous materials into the atmosphere.
21.	45	Manufacturing of paints varnishes, pigments and intermediate (excluding blending/mixing)	30	-	30	25	-	25	15	70	**R-R**	i. The process may cause considerable emissions of volatile organic compounds (VOC). VOC contribute to the creation of ozone in the lower layers of the atmosphere (photochemical air pollution) and can present danger to health. ii. Dust and odour may also be a problem. iii. Washing of vessels will contribute waste-waters. iv. Large quantity of HWs are also produced.
22.	56	Organic Chemicals manufacturing	30	-	30	20	-	50	20	70	**R-R**	Such types of industrial sectors generate all sorts of pollution.
23.	1	Airports and Commercial Air Strips	20	10	30	-	-	-	10	75	**R-R**	i. The Airports are generating mainly the waste-waters. ii. This is the water pollution normalized score for airports having discharge more than 100 KLD. iii. The airports / strips having discharge less than 100 KLD will have score of 50 and hence orange category. iv. If the score is normalized wrt water + HW both, then all the airports will come under Orange category (score - 58.33).
24.	3	Asbestos and asbestos based industries	-	-	-	30	-	30	10	75	**R-R**	i. This is mainly air polluting industry. ii. Final score is based on air pollution score only. iii. Asbestos is carcinogenic and banned in many countries.
25.	5	Basic chemicals and electro chemicals and its derivatives including manufacturing of acid	30	-	30	-	-	-	10	75	**R-R**	i. Standards prescribed for Inorganic Chemicals are adopted. ii. It is mainly water polluting industry having effluents which are toxic and not easily biodegradable.

												iii. Water pollution score normalized to 100 is undertaken. iv. The earlier Red category industrial sector namely "Hydrocyanic acid and its derivatives " is also merged under this industrial sector.
26.	7	Cement	-	-	-	20	10	30	-	75	**R-R**	This is mainly air polluting industry & hence normalized air pollution score.
27.	9	Chlorates, per-chlorates & peroxides	30	-	30	-	-	-	-	75	**R-R**	i. It is mainly water polluting industry having effluents which are toxic and not easily biodegradable. ii. Water pollution score normalized to 100 is undertaken.
28.	10	Chlorine, fluorine, bromine, iodine and their compounds	30	-	30	-	-	-	-	75	**R-R**	i. It is mainly water polluting industry having effluents which are toxic and not easily biodegradable. ii. Water pollution score normalized to 100 is undertaken.
29.	16	Dyes and Dye- Intermediates	30	-	30	20	5	25	20	75	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Such types of industrial sectors generate all sorts of pollution.
30.	26	Health-care Establishment (as defined in BMW Rules)	20	10	30	-	-	-	-	75	**R-R**	i. Mainly water polluting. ii. The water pollution score is normalized to 100 & valid for Hospitals having total waste-water generation > 100 KLD. iii. The hospitals with incinerator will be categorized as Red irrespective of the quantity of the waste-water generation. iv. The hospitals having total waste-water generation less than 100 KLD and without incinerator, the normalized water pollution score will be 50 and will be categorized as Orange category.
31.	29	Hotels having overall waste-water generation @ 100 KLD and more.	20	10	30	15	-	15	-	75	**R-R**	i. Mainly water polluting. Small boiler may be installed. ii. The water pollution score is normalized to 100 & valid for Hotels having waste-water generation > 100 KLD. iii. The hotels having more than 20 rooms and waste-water generation less than 100 KLD and having a coal / oil fired boiler , the pollution score will be 35/40 & are categorized as Orange. iv. The hotels having more than 20 rooms and waste-water generation less than 10 KLD and

												having no-boiler & no hazardous waste generation, the pollution score will be 20 & are categorized as Green.
32.	34	Industries engaged in recycling / reprocessing/ recovery/reuse of Hazardous Waste under schedule iv of HW(M, H& TBM) rules, 2008 - Items namely - Lead acid battery plates and other lead scrap/ashes/residues not covered under Batteries (Management and Handling) Rules, 2001. [* Battery scrap, namely: Lead battery plates covered by ISRI, Code word "Rails" Battery lugs covered by ISRI, Code word "Rakes". Scrap drained/dry while intact, lead batteries covered by ISRI, Code word "rains".	30	-	30	25	--	25	20	75	**R-R**	All the three types of pollutants are generated.
33.	34	Industries engaged in recycling / reprocessing/ recovery/reuse of Hazardous Waste under schedule iv of HW(M, H& TBM) rules, 2008 - Items namely - Integrated Recycling Plants -- Components of waste electrical and electronic assembles comprising accumulators and other batteries included on list A, mercury-switches, activated glass cullets from cathode-ray tubes and other activated glass and PCB-capacitors, or any other component contaminated with Schedule 2 constituents (e.g. cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they exhibit hazard characteristics indicated in part C of this Schedule.	30	-	30	25	-	25	20	75	**R-R**	All the three types of pollutants are expected.
34.	43	Manufacturing of glue and gelatin	30	10	40	20	-	20	-	75	**R-R**	Highly water polluting & obnoxious air polluting.
35.	49	Mining and ore beneficiation	30	10	40	15	5	20	-	75	**R-R**	Both air and water polluting. Score is normalized with air & water pollution.

36.	52	Nuclear power plant	10	-	10	30	-	30	15	75	**R-R**	i. Mainly air polluting due to incinerator. Others - cooling water. ii. Air pollution score is normalized to 100.
37.	58	Pesticides (technical) (excluding formulation)	30	-	30	25	-	25	20	75	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Such types of industrial sectors generate all sorts of pollution.
38.	64	Photographic film and its chemicals	30	-	30	-	-	-	-	75	**R-R**	i. Silver salts and other chemicals are used in preparation. Slight quantity of effluents is generated. ii. Water pollution scores are normalized to 100.
39.	68	Railway locomotive work shop/Integrated road transport workshop/Authorized service centers	20	10	30	-	-	-	10	75	**R-R**	i. Mainly water polluting industry . Water is used in the washing of locomotives, road transport vehicles during servicing. ii. This score is valid for those Centers having discharge more than 100 KLD. iii. Service Centers having waste-water generation < 100 KLD, the normalized score will be =(100*20)/40= 50.
40.	84	Yarn / Textile processing involving any effluent/emission generating processes including bleaching, dyeing, printing and colouring	30	10	40	15	-	15	20	75	**R-R**	In this sector all sorts of pollution are generated.
41.	8	Chlor Alkali	30	10	40	20	10	30	10	80	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Chlor-alkali units are having different section like NaOH, Cl2, SBP etc which are having toxic effluents. Additionally , fuel consumption is also on higher-side.
42.	70	Ship Breaking Industries	30	-	30	30	-	30	20	80	**R-R**	i. The ship-breaking industry creates numerous hazards for the coastal and marine environment. ii. Ship-breaking releases a large number of dangerous pollutants, including toxic waste, oil, poly-chlorinated biphenyls, and heavy metals, into the waters and sea bed. iii. While most of the oil is removed before a ship is scrapped, sand used to mop up the remaining oil is thrown into the sea. High concentrations of oil and grease are then found in the coastal waters, choking marine life.

												iv. Solid waste strewn on the shore, 45 tonnes on any given day according to a study by the Central Pollution Control Board, also finds its way into the sea. v. Adding to the stress on coastal waters, the organic load from the thousands of workers living in cramped conditions with little or no sanitary facilities results in unacceptably high levels of BOD.
43.	53	Oil and gas extraction including CBM (offshore & on-shore extraction through drilling wells)	30	-	30	-	-	-	20	83	**R-R**	i. Mainly water polluting & hazardous waste generating. ii. The water pollution & HW generation scores are normalized to 100.
44.	36	Industry or process involving metal surface treatment or process such as pickling/ electroplating/paint stripping/ heat treatment using cyanide bath/ phosphating or finishing and anodizing / enamellings/ galvanizing	30	-	30	-	-	-	20	83	**R-R**	Mainly water polluting & toxic hazardous waste generating industry. Scores are normalized to 100.
45.	80	Tanneries	30	-	30	-	-	-	20	83	**R-R**	Mainly water polluting & hazardous waste generating industry. Scores are normalized to 100.
46.	65	Ports and harbour, jetties and dredging operations	30	10	40	15	10	25	20	85	**R-R**	This category contain all sorts of pollution.
47.	77	Synthetic fibers including rayon ,tyre cord, polyester filament yarn	30	10	40	25	10	35	10	85	**R-R**	This sector generates all sorts of pollution problems.
48.	81	Thermal Power Plants	30	10	40	20	10	30	15	85	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. TPP generate all sorts of pollution problems.
49.	71	Slaughter house (as per notification S.O.270(E)dated 26.03.2001)and meat processing industries, bone mill, processing of animal horn, hoofs and other body parts	25	10	35	-	-	-	-	87.5	**R-R**	Mainly water polluting and obnoxious odour generating industry. The water pollution score is normalized to 100
50.	2	Aluminium Smelter	30	10	40	20	10	30	20	90	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. This sector is generating all sorts of pollution i.e. air, water and HW.
51.	12	Copper Smelter	30	10	40	20	10	30	20	90	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Integrated Copper Smelters contain all sorts of

													pollution.
52.	20	Fertilizer (basic) (excluding formulation)	30	10	40	20	10	30	20	90	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Generates all sorts of pollution.
53.	37	Iron & Steel (involving processing from ore/ integrated steel plants) and or Sponge Iron units	30	10	40	20	10	30	20	90	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Such types of industrial sectors generate all sorts of pollution.
54.	61	Pulp & Paper (waste paper based units with bleaching process to manufacture writing & printing paper)	25	10	35	25	10	35	20	90	**R-R**	Waste paper based Pulp & Paper mills with bleaching process generate all sorts of pollution.
55.	85	Zinc Smelter	30	10	40	20	10	30	20	90	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Integrated Zinc smelter generates all sorts of pollution problems.
56.	55	Oil Refinery (mineral Oil or Petro Refineries)	30	10	40	25	10	35	20	95	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Such types of industrial sectors generate all sorts of pollution.
57.	59	Petrochemicals Manufacturing (including processing of Emulsions of oil and water)	30	10	40	25	10	35	20	95	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Such types of industrial sectors generate all sorts of pollution. iii. The earlier red category industrial sector namely "Processing of Emulsions of Oil & Water " is merged with this industrial sector.
58.	60	Pharmaceuticals	30	10	40	30	5	35	20	95	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Such types of industrial sectors generate all sorts of pollution.
59.	61	Pulp & Paper (Large-Agro + wood) , Small Pulp & Paper (agro based-wheat straw/rice husk)	30	10	40	25	10	35	20	95	**R-R**	i. This industrial sector is the one among the '17 categories of Highly Polluting Industries'. ii. Large /Small Agro based Pulp & Paper mills contribute all sorts of pollution problems.
60.	15	Distillery (molasses / grain / yeast based)	30	10	40	-	-	-	-	100	**R-R**	Mainly water polluting industry. Final score is the normalized water pollution score.

Note :

i. *Under the column Revised Category, the full forms of the abbreviations are as follows :*
   a. *R-R means original category was Red and revised category is also Red*
   b. *R-O means original category was Red and revised category is Orange*
   c. *O-O means original category was Orange and revised category is also Orange*
   d. *O-G means original category was Orange and revised category is Green*
   e. *O-W means original category was Orange and revised category is White*
   f. *G-O means original category was Green and revised category is Orange*
   g. *G-G means original category was Green and revised category is also Green*
   h. *G-W means original category was Green and revised category is White*

ii. *There are specific remarks in respect of some of the industrial sectors. These sectors are either merged with other relevant sectors or deleted due to duplication. The overall details are as follows :*

Sl No.	Original Sl No.	Industry Sector	Original Category	Remarks
1	14	Common treatment and disposal facilities(CETP, TSDF, E-waste recycling, CBMWTF, effluent conveyance project, incinerator, solvent/acid recovery plant, MSW sanitary land fill site)	R	i. All such facilities are classified as Red but special category projects as these are parts of pollution control facilities. ii. In case of CETP , the categorization will depend upon the category of member industries being served.
2	18	Processing of Emulsions of Oil & Water		It is a part of Petrochemical industries. Transferred and merged with the industrial sector namely 'Petrochemicals' at Sl. No. 54.
3	27	Heavy engineering including ship building (with investment on Plant & Machineries more than Rs 10 crores)	R	Most of the pollution generating processes / operations under this category are similar to the industry category namely "Automobile Manufacturing (integrated facilities)" at Sl . No. 1 and may be referred accordingly.
4	30	Hydrocyanic acid and its derivatives	R	Have been merged with the red category industrial sector namely " Basic chemicals and electro chemicals and its derivatives including manufacturing of acid " at Sl. No. 24
5	32	Industrial estates/ parks / complexes/ areas/ export processing zones/ SEZs/ Biotech parks/ leather complex	R	The classification will depend upon the category(ies) of the industries operating / proposed to be permitted in the area. In this context, guidelines prescribed in EIA Notification, 2006 shall be followed.
6	33	Industrial inorganic gases namely- a) Chemical gas- Acetylene, hydrogen, chlorine, fluorine, ammonia, sulphur dioxide, ethylene, hydrogen-sulphide, phosphine b) Hydrocarbon gases- Methane , ethane, propane	R	These gases are generally secondary products and produced alongwith other main products. To be classified as per the main parent plant.
7	69	Reprocessing of used oils & waste oils	R	i. The industry generates mainly the air pollution and oil bearing hazardous wastes. The normalized (air pollution & HW generation score is 58.33. ii. To be deleted as already covered under HW Recyclers / Re-processors (Used oils / Waste Oils) under Orange Category

Table G-3 : Final List of Orange Category of Industrial Sectors

Final Sl. No.	Orgnl S.No	**Industry Sector**	W1	W2	W	A1	A2	A	H	W+A+H	Revised category	Remarks
1.	20	Dismantling of rolling stocks (wagons/ coaches)	--	--	--	15	--	15	10	41.67	O-O	Emissions of dust and generation of waste oils take place during dismantling. Air pollution & HW generation scores (15+10=25) are normalized to 100.
2.	5	Bakery and confectionery units with production capacity > 1 TPD. (With ovens / furnaces)	20	--	20	15	--	15	--	43.75	O-O	
3.	10	Chanachur and ladoo from puffed and beaten rice(muri and shira) using husk fired oven	20	--	20	15	--	15	--	43.75	O-O	Normal water and air polluting.
4.	23	Coated electrode manufacturing	15	0	15	20	0	20	0	43.75	**G-O**	Preparation of core wire / rod, preparation of dry mix, preparation of wet mix, application of coating by extrusion, baking of coated electrodes
5.	24	Compact disc computer floppy and cassette manufacturing / Reel manufacturing	15	0	15	20	0	20	0	43.75	**G-O**	Generates waste-water and process emissions.
6.	24	Flakes from rejected PET bottle	20	-	20	15	-	15	-	43.75	R-O	Normal water & air pollutions are generated.
7.	30	Food and food processing including fruits and vegetable processing	20	--	20	15	--	15	--	43.75	O-O	Normal water and air polluting.
8.	40	Jute processing without dyeing	20	--	20	15	--	15	--	43.75	O-O	CPCB has notified standards for this category. Both air and water pollutions are generated.
9.	56	Manufacturing of silica gel	15	0	15	20	0	20	0	43.75	**G-O**	Waste-waters containing TDS and emissions of H_2SO_4 are generated.

10.	45	Manufacturing of tooth powder, toothpaste, talcum powder and other cosmetic items	20	--	20	15	--	15	--	43.75	O-O	Both air and water pollution are generated.
11.	55	Printing or etching of glass sheet using hydrofluoric acid	15	--	15	20	--	20	--	43.75	O-O	Both air and water pollution are generated.
12.	65	Silk screen printing, sari printing by wooden blocks	20	--	20	15	--	15	--	43.75	O-O	Wash-water and PM emissions from boilers .
13.	76	Synthetic detergents and soaps(excluding formulation)	20	-	20	15	-	15	-	43.75	R-O	i. This is the score for units having generation of waste-waters less than 100 KLD. ii. The units having waste-water generation more than 100 KLD will become mainly water polluting and accordingly normalized water pollution score will be 75 and be categorized as Red.
14.	71	Thermometer manufacturing	15	--	15	20	--	20	--	43.75	O-O	Process - making glass bulb, forming reservoir in the glass tube for fluid, inserting fluid, scale marking. Use of fuel to heat the glass tubes and hydrofluoric acid to seal the scaling. Small quantities of spent acids are generated.
15.	14	Cotton spinning and weaving (medium and large scale)	--	--	--	15	--	37.5	10	47.5	O-O	Mainly air polluting industry. Sources of air pollution (PM) are the fine particles of cotton from spinning process. Air pollution score is normalized to 100.
16.	1	Almirah, Grill Manufacturing (Dry Mechanical Process)	--	--	--	20	--	20	--	50	O-O	Air pollution due to spray painting (emissions of VOCs). Units without painting operations shall be categorized as White.

17.	2	Aluminium & copper extraction from scrap using oil fired furnace (dry process only)	--	--	--	20	--	20	10	50	O-O	i. Normalized Air pollution score. ii. Significant air pollution due to melting (emissions of SO2, PM).
18.	3	Automobile servicing, repairing and painting (excluding only fuel dispensing)	20	--	20	20	--	20	10	50	O-O	Normal water & air polluting and recyclable waste oil generating. If the waste water generation is more than 100 KLD, it will become mainly water polluting and Red category unit.
19.	4	Ayurvedic and homeopathic medicine	20	--	20	15	--	15	15	50	O-O	
20.	7	Brickfields (excluding fly ash brick manufacturing using lime process)	--	--	--	20	--	20	--	50	O-O	Significantly air polluting.
21.	8	Building and construction project more than 20,000 sq. m built up area	20	--	20	20	--	20	--	50	O-O	1. In the pre-construction stage , it is mainly air polluting due to generation of dust (PM) emissions. 2. After construction, it is mainly water polluting. If the discharge is more than 100 KLD, it will be having the normalized score of 75 and be categorized as Red.
22.	6	Ceramics and Refractories	-	-	-	20	-	20	-	50	R-O	i. Mainly air polluting industry. ii. This score is for the units having coal consumption < than 12 MT/day. iii. For the units having coal consumption > 12 MT /day, the normalized air pollution score will be 62.5 and shall be categorized as Red.

23.	11	Coal washeries	15	10	25	15	-	15	-	50	R-O	i. Wet washeries are mainly water polluting industry generating effluents which are having inorganic SS & TDS. Additionally, air pollution due to PM emissions is also generated. ii. Water & air pollution scores are jointly normalized to 100.
24.	16	Dairy and dairy products (small scale)	20	--	20	20	--	20	--	50	O-O	Water and air polluting both.
25.	18	DG set of capacity >1MVA but < 5MVA	--	--	--	20	--	20	--	50	O-O	Mainly air polluting . air pollution score is normalized to 100.
26.	17	Dry coal processing, mineral processing, industries involving ore sintering, pelletisating, grinding & pulverization	-	-	-	20	-	20	-	50	R-O	Mainly air polluting industry. Final score is the normalized air pollution score.
27.	19	Fermentation industry including manufacture of yeast, beer, distillation of alcohol (Extra Neutral Alcohol)	20	-	20	-	-	-	-	50	R-O	i. Mainly water polluting industry. This is the normalized water pollution score for units having discharge < 100 KLD. ii. For the units having discharge > 100 KLD, the normalized water pollution score will be 75 and shall be accordingly categorized as Red.
28.	21	Ferrous and Non- ferrous metal extraction involving different furnaces through melting, refining, re-processing, casting and alloy-making	-	-	-	15	5	20	10	50	R-O	i. Mainly air polluting. ii. This score is applicable to secondary production of ferrous & non-ferrous metals (excluding lead) up-to 1 MT/hour production.

												iii. For lead, the normalized air pollution score will be = (100*25)/40= 62.5 and is categorized as Red. iv. For Induction Furnace clubbed with AOD furnace – separate calculation shall be made based on the capacity of the furnaces. In such industries, the molten metal from induction furnace is transferred to AOD furnace where other metals like manganese and nickel are added to get the metal of desired constituents. The lime and silicon are also added for reduction of the metal oxides to the base metal. the normalized air pollution score will be = (100*25)/40= 62.5 and is categorized as Red.
29.	26	Fertilizer (granulation / formulation / blending only)	--	--	--	20	--	20	--	50	O-O	Air polluting.
30.	27	Fish feed, poultry feed and cattle feed	--	--	--	20	--	20	--	50	O-O	Obnoxious odour , H2S etc. AP score is normalized to 100
31.	28	Fish processing and packing (excluding chilling of fishes)	20	--	20	--	--	--	--	50	O-O	Mainly water polluting. WP score is normalized to 100.

32.	31	Forging of ferrous and non- ferrous metals (using oil and gas fired furnaces)	--	--	--	20	--	20	--	50	O-O	Heating furnace. Mainly air polluting.
33.	32	Formulation/pelletization of camphor tablets, naphthalene balls from camphor/ naphthalene powders.	--	--	--	20	--	20	--	50	O-O	Mainly air polluting. Emissions of Benzene, HC are expected.
34.	33	Glass ceramics, earthen potteries and tile manufacturing using oil and gas fired kilns, coating on glasses using cerium fluorides and magnesium fluoride etc.	--	--	--	20	--	20	--	50	O-O	Mainly air polluting. Emissions of SO2 are expected.
35.	35	Gravure printing, digital printing on flex, vinyl	20	--	20	20	--	20	10	50	O-O	Waste waters , emissions of VOCs
36.	36	Heat treatment using oil fired furnace (without cyaniding)	--	--	--	20	--	20	--	50	O-O	Mainly air polluting and noise generating. AP Score is normalized to 100.
37.	28	Hot mix plants	-	-	-	20	-	20	-	50	R-O	Mainly air polluting. Air pollution scores are normalized to 100.
38.	37	Hotels (< 3 star) or hotels having > 20 rooms and less than 100 rooms.	20	--	20	20	--	20	--	50	O-O	Mainly water polluting. WP score is normalized to 100.
39.	38	Ice cream	20	--	20	20	--	20	--	50	O-O	Wash-water and boilers / oven for pasteurization.
40.	34	Industries engaged in recycling / reprocessing/ recovery/reuse of Hazardous Waste under schedule iv of HW(M, H& TBM) rules, 2008 - Items namely - Paint and ink Sludge/residues	-	-	-	20	0	20	0	50	R-O	Mainly air polluting. Air pollution score is normalized to 100
41.	34	Industries engaged in recycling / reprocessing/ recovery/reuse of Hazardous Waste under schedule iv of HW(M, H& TBM) rules, 2008 - Items namely - Brass Dross ,, Copper Dross,, Copper Oxide Mill Scale,, Copper Reverts, Cake & Residues,, Waste Copper and copper alloys in	10	-	10	20	-	20	10	50	R-O	Mainly air polluting.

		dispersible form,, Slags from copper processing for further processing or refining „ Insulated Copper Wire,, Scrap/copper with PVC sheathing including ISRI-code material namely "Druid" „ Jelly filled Copper cables „ Zinc Dross-Hot dip Galvanizers SLAB,, Zinc Dross-Bottom Dross,, Zinc ash/Skimming arising from galvanizing and die casting operations,, Zinc ash/Skimming/other zinc bearing wastes arising from smelting and refining,, Zinc ash and residues including zinc alloy residues in dispersible from ,,										
42.	35	Industry or processes involving foundry operations	-	-	-	20	-	20	-	50	R-O	i. This score is valid for the foundries having capacity < 5 MT/hr as such units require the coal/coke @ < 500 kg/hr. ii. The units having capacity of 5 MT/hr and more, the coal/coke consumption will be more than 500 kg/hr and the normalized score will be 62.5 and classified accordingly as Red.
43.	40	Lime manufacturing (using lime kiln)	-	-	-	20	-	20	-	50	R-O	Mainly air polluting
44.	41	Liquid floor cleaner, black phenyl, liquid soap, glycerol mono-stearate manufacturing	20	--	20	20	--	20	--	50	O-O	Both air and water pollution are generated.

45.	42	Manufacturing of glass	10	-	-	20	-	20	-	50	R-O	i. Mainly air polluting (melting at 1500ºC and refining . ii. In case of lead glass , the score of A1 will be 25 and accordingly the normalized scores will be 62.5 i.e. Red .
46.	43	Manufacturing of iodized salt from crude/ raw salt	12	--	12	20	--	20	--	50	O-O	Boiling in Evaporators (multiple effect evaporators), centrifuging, iodization with KIO3 mixing . Mainly air polluting. Air pollution score is normalized to 100.
47.	42	Manufacturing of mirror from sheet glass	--	--	--	20	--	20	--	50	O-O	Evaporator & furnace for heating the metal to be applied as reflector on mirror. Mainly air polluting.
48.	44	Manufacturing of mosquito repellent coil	--	--	--	20	--	20	--	50	O-O	Mainly air polluting. Toxic fumes are expected.
49.	46	Manufacturing of Starch/Sago	25	-	25	15	-	15	-	50	R-O	i. Water and air polluting industry. Boiler is used for steam generation. ii. Water & air pollution scores are normalized to 100
50.	46	Mechanized laundry using oil fired boiler	20	--	20	20	--	20	--	50	O-O	Both air and water pollution are generated.
51.	47	Modular wooden furniture from particle board, MDF< swan timber etc, Ceiling tiles/ partition board from saw dust, wood chips etc., and other agricultural waste using synthetic adhesive resin, wooden box making (With boiler)	--	--	--	20	--	20	--	50	O-O	1. Mainly air polluting. Boiler as well as VOCs from use of adhesives. 2. Without boiler, it will be a Green category industry.
52.	50	New highway construction project	-	-	-	20	-	20	-	50	R-O	Mainly air polluting project.

53.	51	Non-alcoholic beverages(soft drink) & bottling of alcohol/non alcoholic products	20	-	20	15	5	20	-	50	R-O	i. Both air and water polluting. Score is normalized with air & water pollution. This score is valid for industries having waste-water generation < 100 KLD. ii. For the units having waste-water generation > 100 KLD the , normalized score would be 62.5 and categorized as Red.
54.	49	Paint blending and mixing (Ball mill)	20	--	20	20	--	20	10	50	O-O	Both air and water pollution are generated.
55.	62	Paints and varnishes (mixing and blending)	20	0	0	20	0	20	0	50	**G-O**	Waste-waters as well as fumes of VOCs due to solvents, pigments, varnishes.
56.	51	Ply-board manufacturing(including Veneer and laminate) with oil fired boiler/ thermic fluid heater(without resin plant)	0	--	0	20	--	20	--	50	O-O	Mainly air polluting because of use of boiler. AP score is normalized to 100
57.	52	Potable alcohol (IMFL) by blending, bottling of alcohol products	20	--	20	--	--	--	--	50	O-O	Mainly water polluting. WP score is normalized to 100.
58.	54	Printing ink manufacturing	20	--	20	20	--	20	--	50	O-O	1. Pigments, binders and solvents are used. 2. Boiler is also used. 3. Emissions of VOCs take place.
59.	70	Printing press	20	0	20	20	0	20	0	50	**G-O**	Colored waste-waters containing dyes and VOC emissions are generated.
60.	59	Reprocessing of waste plastic including PVC	20	--	20	20	--	20	--	50	O-O	Large quantities of wash-water and fugitive emissions are generated.
61.	61	Rolling mill (oil or coal fired) and cold rolling mill	10	--	10	20	--	20	--	50	O-O	Mainly air polluting. Air pollution score is normalized to 100. Others - cooling water and recyclable waste oils etc. are generated.
62.	67	Spray painting, paint baking, paint shipping	--	--	--	20	--	20	10	50	O-O	Mainly air polluting. Emissions of VOCs and HC are generated.

63.	72	Steel and steel products using various furnaces like blast furnace /open hearth furnace/induction furnace/arc furnace/submerged arc furnace /basic oxygen furnace /hot rolling reheated furnace	10	-	10	20	-	20	10	50	R-O	i. Mainly air polluting. In the emissions, oxides of manganese, nickel etc. are also present. ii. Air pollution score is normalized to 100.
64.	73	Stone crushers	-	-	-	20	-	20	-	50	R-O	Mainly air polluting. Air pollution score is normalized to 100.
65.	75	Surgical and medical products including prophylactics and latex	20	-	20	20	-	20	-	50	R-O	Both air as well as water polluting. Air and water pollution scores are normalized to 100.
66.	85	Tephlon based products	0	0	0	20	0	20	0	50	**G-O**	Due to spraying applications, emissions (HC) are generated
67.	70	Thermocol manufacturing (with boiler)	--	--	--	20	--	20	--	50	O-O	Polystyrene is heated. Mainly air polluting with boiler.
68.	82	Tobacco products including cigarettes and tobacco/opium processes	20	-	20	20	-	20	-	50	R-O	Such industries generate both air as well as water pollution. These scores are normalized to 100.
69.	72	Transformer repairing/ manufacturing (dry process only)	--	--	--	20	--	20	10	50	O-O	Mainly air polluting because of ovens, shot-blasting etc.
70.	73	Tyres and tubes vulcanization/ hot retreating	10	--	10	20	--	20	--	50	O-O	Mainly air polluting . Emissions of PM, VOCs and obnoxious odour are generated.
71.	83	Vegetable oil manufacturing including solvent extraction and refinery /hydrogenated oils	20	-	20	15	5	20	10	50	R-O	i. All sorts of pollution are generated. ii. This score is valid for plants having waste-water generation < 100 KLD. iii. If the waste-water generation is more than 100 KLD, the unit shall be classified as Red.
72.	74	Wire drawing and wire netting	20	--	20	--	--	--	--	50	O-O	Mainly water polluting. WP score is normalized to 100.

73.	21	Dry cell battery (excluding manufacturing of electrodes) and assembling & charging of acid lead battery on micro scale	30	--	30	15	--	15	10	55	O-O	Water and air polluting both.
74.	50	Pharmaceutical formulation and for R & D purpose (For sustained release/ extended release of drugs only and not for commercial purpose)	20	--	20	20	--	20	15	55	O-O	i. All sorts of pollution are generated. ii. R&D activities are to be shifted to Red category.
75.	78	Synthetic resins	20	-	20	20	-	20	15	55	R-O	All sorts of pollution are generated.
76.	79	Synthetic rubber excluding molding	20	-	20	20	-	20	15	55	R-O	i. Most synthetic rubber is created from two materials, styrene and butadiene. Both are currently obtained from petroleum. ii. Process is similar to a part of Petrochemical plants.
77.	9	Cashew nut processing	25	--	25	20	--	20	--	56	O-O	Normal water and air polluting.
78.	12	Coffee seed processing	25	--	25	20	--	20	--	56	O-O	Normal water & air polluting industry.
79.	57	Parboiled Rice Mills	25	-	25	20	-	20	-	56	R-O	i. Rice Mills are generating both air and water pollution. Waste-waters are having high strength in respect of BOD. ii. This is the normalized air & water pollution score for units having waste-water generation < 100 KLD and fuel consumption less than 12 MTD. iii. For units having waste-water generation > 100 KLD or fuel consumption > 12 MTD or both , the unit shall be classified as Red.

80.	29	Foam manufacturing	--	--	--	20	--	20	15	58	O-O	i. Raw material is polyurethane, latex etc. ii. Emissions of VOCs and HAPs. CH3Cl2 and similar compounds as blowing agents. iii. Outdated raw materials and spoiled slots are discarded as HW.
81.	34	Industries engaged in recycling / reprocessing/ recovery/reuse of Hazardous Waste under schedule iv of HW(M, H& TBM) rules, 2008 - Items namely - Used Oil – As per specifications prescribed from time to time.	10	0	10	20	0	20	15	58.33	R-O	Mainly air polluting and hazardous waste generating industry. Air pollution & HW scores are normalized to 100
82.	34	Industries engaged in recycling / reprocessing/ recovery/reuse of Hazardous Waste under schedule iv of HW(M, H& TBM) rules, 2008 - Items namely - Waste Oil ---As per specifications prescribed from time to time.	-	-	-	20	0	20	15	58.33	R-O	Mainly air polluting and hazardous waste generating industry. Air pollution & HW scores are normalized to 100.
83.	56	Producer gas plant using conventional up drift coal gasification (linked to rolling mills glass and ceramic industry refectories for dedicated fuel supply)	--	--	--	20	--	20	15	58.33	O-O	Mainly air polluting & tar (HW) generating. SO2, CO, NOx are generated. Tar is the by-product and utilized by other industries in co-processing.

Note :

i. Under the column Revised Category, the full forms of the abbreviations are as follows :

a. R-R means original category was Red and revised category is also Red

b. R-O means original category was Red and revised category is Orange

c. O-O means original category was Orange and revised category is also Orange

d. O-G means original category was Orange and revised category is Green

e. O-W means original category was Orange and revised category is White

f. G-O means original category was Green and revised category is Orange

g. G-G means original category was Green and revised category is also Green

h. G-W means original category was Green and revised category is White

ii. There are specific remarks in respect of some of the industrial sectors. These sectors are either merged with other relevant sectors or deleted due to duplication / vague category. The overall details are as follows:

Sl No.	*Original Sl No.*	*Industry Sector*	*Original Category*	*Remarks*
1	*24*	*Excavation of sand from the river bed (excluding manual excavation)*	*O*	*Since such types of activities cause ecological disturbances, the instructions issued by the government from time to time be followed. To be categorized by MoEF&CC.*
2	*39*	*Infrastructure Development Project*	*O*	*Vast variety of such projects come under such category. This is to be decided by the concerned SPCB in line of EIA Notification , 2006.*
3	*53*	*Power press*	*O*	*Very vague term hence deleted. Such types of general engineering units have already been covered.*

Table G-4 : Final List of Green Category of Industrial Sectors

Sl. No.	Orgnl Sl. No.	**Industry Sector**	W1	W2	W	A1	A2	A	H	W+A+H	Revised Category	Remarks
1.	2	Aluminium utensils from aluminium circles by pressing only (dry mechanical operation)	--	--	--	10	--	10	--	25	**G-G**	Minor air pollution due to some fugitive PM emissions from buffing operations.
2.	6	Ayurvedic and homeopathic medicines (without boiler)	10	--	10	--	--	--	--	25	**G-G**	Small quantities of waste-waters are generated from washing operations.
3.	8	Bakery /confectionery /sweets products (with production capacity <1tpd (with gas or electrical oven)	10	--	10	--	--	--	--	25	**G-G**	Small quantities of waste-waters are generated from washing operations.
4.	6	Bi-axially oriented PP film along with metalizing operations	10	--	10	--	--	--	--	25	**O-G**	Mainly extrusion process involving Cooling water recirculation
5.	10	Biomass briquettes (sun drying) without using toxic hazardous wastes	--	--	--	10	--	10	--	25	**G-G**	Minor air pollution due to some fugitive PM emissions from pulverization / mixing operations.
6.	13	Blending of melamine resins & different powder, additives by physical mixing	--	--	--	10	--	10	--	25	**G-G**	Minor air pollution due to some fugitive PM emissions from pulverization / mixing operations.
7.	15	Brass and bell metal utensils manufacturing from circles(dry mechanical operation without re-rolling facility)	--	--	--	10	--	10	--	25	**G-G**	Minor air pollution due to some fugitive PM emissions from buffing operations.
8.	16	Candy	10	--	10	10	--	10	--	25	**G-G**	Small quantities of waste-water and minor

												PM emissions are generated.
9.	17	Cardboard or corrugated box and paper products (excluding paper or pulp manufacturing and without using boilers)	--	--	--	10	--	10	--	25	**G-G**	This score is valid with Small gas / electricity operated oven / furnace for making glue.
10.	18	Carpentry & wooden furniture manufacturing (excluding saw mill) with the help of electrical (motorized) machines such as electrical wood planner, steel saw cutting circular blade, etc.	--	--	--	10	--	10	--	25	**G-G**	Minor air pollution due to some fugitive PM emissions from cutting operations.
11.	19	Cement products (without using asbestos / boiler / steam curing) like pipe ,pillar, jafri, well ring, block/tiles etc.(should be done in closed covered shed to control fugitive emissions)	--	--	--	10	--	10	--	25	**G-G**	Minor air pollution due to some fugitive PM emissions from mixing operations.
12.	20	Ceramic colour manufacturing by mixing & blending only (not using boiler and wastewater recycling process)	--	--	--	10	--	10	--	25	**G-G**	Minor air pollution due to some fugitive PM emissions.
13.	11	Chilling plant, cold storage and ice making	10	--	10	--	--	--	--	25	**O-G**	Cooling water recirculation only.
14.	13	Coke briquetting (sun drying)	--	--	--	10	--	10	--	25	**O-G**	Mainly air polluting industry. Sources of air pollution (PM) are pulverizes and mixers. Air pollution score is normalized to 100.
15.	28	Cotton spinning and weaving (small scale)	--	--	--	10	--	10	--	25	**G-G**	Minor PM emissions from spinning process.
16.	17	Dal Mills	--	--	--	10	--	10	--	25	**O-G**	Some fugitive emissions of PM.

17.	29	Decoration of ceramic cups and plates by electric furnace	--	--	--	10	--	10	--	25	**G-G**	Fumes of enamels. Minor air pollution.
18.	19	Digital printing on PVC clothes	--	--	--	10	--	10	--	25	**O-G**	Minor emissions / odour generations are expected.
19.	25	Facility of handling, storage and transportation of food grains in bulk	--	--	--	10	--	10	--	25	**O-G**	Some fugitive emissions of PM during handling of grains.
20.	36	Flour mills (dry process)	--	--	--	10	--	10	--	25	**G-G**	Fugitive dust emissions.
21.	41	Glass , ceramic, earthen potteries, tile and tile manufacturing using electrical kiln or not involving fossil fuel kiln	--	--	--	10	--	10	--	25	**G-G**	Minor fugitive emissions only.
22.	34	Glue from starch (physical mixing) with gas / electrically operated oven /boiler.	--	--	--	10	--	10	--	25	**O-G**	Some fugitive emissions of PM during mixing of raw materials.
23.	42	Gold and silver smithy (purification with acid smelting operation and sulphuric acid polishing operation) (using less or equal to 1 litre of sulphuric acid/ nitric acid per month)	--	--	--	10	--	10	--	25	**G-G**	Minor fumes from cleaning process.
24.	36	Heat treatment with any of the new technology like ultrasound probe , induction hardening , ionization beam, gas carburizing etc.	10	--	10	10	--	10	--	25	**O-G**	• Cooling waters and minor heat fumes. • Finalization of categorization subject to field verification.
25.	46	Insulation and other coated papers (excluding paper or pipe manufacturing)	--	--	--	10	--	10	--	25	**G-G**	Minor fumes due to application of poly-urethane
26.	49	Leather foot wear and leather products (excluding tanning and hide processing except cottage scale)	--	--	--	10	--	10	--	25	**G-G**	Minor fumes due to use of adhesives / gums.

27.	50	Lubricating oil, greases or petroleum based products (only blending at normal temperature)	--	--	--	10	--	10	--	25	**G-G**	Minor fumes at the time of transfers from one container to other.
28.	54	Manufacturing of pasted veneers using gas fired boiler or thermic fluid heater and by sun drying	--	--	--	10	--	10	--	25	**G-G**	1. Minor fumes due to application of gums / adhesives / pastes etc. 2. This score is valid only for gas fired boiler.3. The units having coal fired boilers shall be categorized as Orange.
29.	59	Oil mill Ghani and extraction (no hydrogenation / refining)	10	--	10	--	--	--	--	25	**G-G**	Small quantities of floor washings & equipments washings are generated.
30.	48	Packing materials manufacturing from non asbestos fibre, vegetable fibre yarn	--	--	--	10	--	10	--	25	**O-G**	Some fugitive emissions of PM are expected.
31.	65	Phenyl/toilet cleaner formulation and bottling	--	--	--	10	--	10	--	25	**G-G**	Minor fumes of VOCs in the work zone
32.	67	Polythene and plastic processed products manufacturing (virgin plastic)	10	--	10	10	--	10	--	25	**G-G**	Cooling water & emissions due to mixing of raw materials.
33.	68	Poultry, Hatchery and Piggery	--	--	--	10	--	10	--	25	**G-G**	Obnoxious odour containing H_2S, CH_4 etc. and fugitive PM emissions
34.	69	Power looms (without dye and bleaching)	--	--	--	10	--	10	--	25	**G-G**	Minor emissions of PM.
35.	71	Puffed rice (muri) (using gas or electrical heating system)	--	--	--	10	--	10	--	25	**G-G**	Minor emissions of PM.
36.	57	Pulverization of bamboo and scrap wood	--	--	--	10	--	10	--	25	**O-G**	Some fugitive emissions of PM are expected.
37.	72	Ready mix cement concrete	--	--	--	10	--	10	--	25	**G-G**	PM emissions.
38.	73	Reprocessing of waste cotton	--	--	--	10	--	10	--	25	**G-G**	PM emissions.
39.	60	Rice mill (Rice hullers only)	--	--	--	10	--	10	--	25	**O-G**	PM emissions are generated. Mainly air

												polluting. AP score is normalized to 100
40.	62	Rolling mill (gas fired) and cold rolling mill	10	--	10	10	--	10	--	25	**O-G**	Mainly air polluting. AP score is normalized to 100
41.	75	Rubber goods industry (with gas operated baby boiler)	--	--	--	10	--	10	--	25	**G-G**	Some PM emissions and obnoxious odour.
42.	63	Saw mills	--	--	--	10	--	10	--	25	**O-G**	Mainly air polluting. PM and noise are generated.
43.	77	Soap manufacturing (hand made without steam boiling / boiler)	10	--	10	--	--	--	--	25	**G-G**	Small quantities of waste-water are generated.
44.	80	Spice grinding (upto-20 HP motor)	--	--	--	10	--	10	--	25	**G-G**	Small quantities of fugitive emissions of raw materials.
45.	66	Spice grinding (>20 hp motor)	--	--	--	10	--	10	--	25	**O-G**	Mainly air polluting. Fugitive emissions of PM.
46.	81	Steel furniture without spray painting	--	--	--	10	--	10	--	25	**G-G**	Obnoxious gases from welding as well as noise pollution.
47.	82	Steeping and processing of grains	10	--	10	--	--	--	--	25	**G-G**	Washing waters are generated.
48.	86	Tyres and tube retreating (without boilers)	--	--	--	10	--	10	--	25	**G-G**	Due to applications of binding gum / adhesives / cement, some obnoxious fumes may generate.
49.	22	Chilling plant and ice making without using ammonia	12	--	12	--	--	--	--	30	**G-G**	Cooling water and brine water circuits. Spillages / blow down may take place
50.	26	CO2 recovery	12	--	12	--	--	--	--	30	**G-G**	Normal water pollution from scrubbing action
51.	32	Distilled water (without boiler) with electricity as source of heat	12	--	12	--	--	--	--	30	**G-G**	TDS as distillation residues

52.	45	Hotels (up to 20 rooms and without boilers)	12	--	12	--	--	--	--	30	**G-G**	This score is valid for hotels having overall waste-water generation less than 10 KLD.
53.	53	Manufacturing of optical lenses (using electrical furnace)	12	--	12	--	--	--	--	30	**G-G**	Small quantities of waste-waters containing TDS, SS are generated.
54.	58	Mineralized water	12	--	12	--	--	--	--	30	**G-G**	RO Rejects.
55.	68	Tamarind powder manufacturing	12	--	12	15	--	15	--	33.75	O-G	• Dried tamarind fruits - cleaned and after soaking them in water they are boiled in steam jacketed kettle for about 40-45 minutes. Then pulp is extracted in pulper and dried in drum type drier and on cooling, the final product is packed. • Generates small quantities of waste waters and air emissions. Joint score is normalized to 100.
56.	15	Cutting, sizing and polishing of marble stone	15	--	15	--	--	--	--	37.5	O-G	Mainly water polluting . Water pollution score is normalized to 100.
57.	22	Emery powder (fine dust of sand) manufacturing	--	--	--	15	--	15	--	37.5	O-G	Air polluting. PM emissions take place during various stages of grindings of naturally occurring minerals.
58.	25	Flyash export, transport & disposal facilities	-	-	-	15	-	15	-	37.5	R-G	• This is mainly air polluting activity. • This is the normalized score based on air pollution.
59.	48	Mineral stack yard / Railway sidings	15	-	15	15	-	15	-	37.5	R-G	• Mainly air pollution due to loading, unloading, storage and transportation of the minerals.

												• Waste-water generation mainly during rains only.
60.	54	Oil and gas transportation pipeline	-	-	-	10	5	15	-	37.5	R-G	• Contains small gas based power plants up-to 5 MWs. • Air pollution score is normalized to 100. • In case , if these power plants are bigger / liquid fuel / oil based, scores will be calculated accordingly.
61.	64	Seasoning of wood in steam heated chamber	--	--	--	15	--	15	--	37.5	O-G	Air pollution due to use boiler for supply of steam. Air pollution score is normalized to 100.
62.	84	Synthetic detergent formulation	--	--	--	15	--	15	--	37.5	**G-G**	• This score is valid for the industries which are not manufacturing LABSA. It is procured from outside. • Small quantities of emissions are generated from mini boiler. • Air pollution score is normalized to 100.
63.	69	Tea processing (with boiler)	--	--	--	15	--	15	--	37.5	O-G	With boiler, it is an orange category industry. Without boiler, it will be green category industry.

Note :

i. *Under the column Revised Category, the full forms of the abbreviations are as follows :*
   a. *R-R means original category was Red and revised category is also Red*
   b. *R-O means original category was Red and revised category is Orange*
   c. *O-O means original category was Orange and revised category is also Orange*
   d. *O-G means original category was Orange and revised category is Green*
   e. *O-W means original category was Orange and revised category is White*
   f. *G-O means original category was Green and revised category is Orange*
   g. *G-G means original category was Green and revised category is also Green*
   h. *G-W means original category was Green and revised category is White*

ii. *There are specific remarks in respect of some of the industrial sectors. These sectors are either merged with other relevant sectors or deleted due to duplication. The overall details are as follows :*

Sl No.	Original Sl No.	Industry Sector	Original Category	Remarks
1	47	Jobbing and Machining	G	Vague category to be deleted, as such activities have already been covered in other categories.
2	66	Reel manufacturing	G	Already covered in other categories. Hence, deleted
3	1	Assembling of acid lead batteries (up to 10 batteries per day excluding lead plate casting)	G	Already covered in Orange category. Hence, deleted
4	5	Automobile fuel outlets (only dispensing)	G	Minor air pollution due to some fugitive emissions during fuel filling operations. May be exempted from the purview of Consent management.
5	30	Diesel generator sets (15 KVA to 1 MVA)	G	• Normal operation – 12 hrs a day. • Consumption of diesel = 1680 litres for 1 MVA DG set at full load @ 0.21 litres / KVA / hr. • Stand-alone DG Sets having total capacity 1 MVA or less and equipped with acoustic enclosures alongwith adequate stack height may be exempted from the purview of Consent management. Higher capacity DG sets have already been covered under Red / Orange categories .

Table G-5: Final List of White Category of Industries

Sl. No.	Orgnl Sl. No.	**Industry Sector**	W1	W2	W	A1	A2	A	H	W+A+H	Revised Category
1.	3	Assembly of air coolers /conditioners ,repairing and servicing	--	--	--	--	--	--	--	--	**G-W**
2.	4	Assembly of bicycles ,baby carriages and other small non motorizing vehicles	--	--	--	--	--	--	--	--	**G-W**
3.	7	Bailing (hydraulic press)of waste papers	--	--	--	--	--	--	--	--	**G-W**
4.	9	Bio fertilizer and bio-pesticides without using inorganic chemicals	--	--	--	--	--	--	--	--	**G-W**
5.	11	Biscuits trays etc from rolled PVC sheet (using automatic vacuum forming machines)	--	--	--	--	--	--	--	--	**G-W**
6.	12	Blending and packing of tea	--	--	--	--	--	--	--	--	**G-W**
7.	14	Block making of printing without foundry (excluding wooden block making)	--	--	--	--	--	--	--	--	**G-W**
8.	21	Chalk making from plaster of Paris (only casting without boilers etc. (sun drying / electrical oven)	--	--	--	--	--	--	--	--	**G-W**
9.	25	Compressed oxygen gas from crude liquid oxygen (without use of any solvents and by maintaining pressure & temperature only for separation of other gases)	--	--	--	--	--	--	--	--	**G-W**
10.	27	Cotton and woolen hosiers making (Dry process only without any dying / washing operation)	--	--	--	--	--	--	--	--	**G-W**
11.	31	Diesel pump repairing and servicing (complete mechanical dry process)	--	--	--	--	--	--	--	--	**G-W**
12.	33	Electric lamp (bulb) and CFL manufacturing by assembling only	--	--	--	--	--	--	--	--	**G-W**

13.	34	Electrical and electronic item assembling (completely dry process)	--	--	--	--	--	--	--	--	**G-W**
14.	23	Engineering and fabrication units (dry process without any heat treatment / metal surface finishing operations / painting)	--	--	--	--	--	--	--	--	**O-W**
15.	35	Flavoured betel nuts production/ grinding (completely dry mechanical operations)	--	--	--	--	--	--	--	--	**G-W**
16.	37	Fly ash bricks/ block manufacturing	--	--	--	--	--	--	--	--	**G-W**
17.	38	Fountain pen manufacturing by assembling only	--	--	--	--	--	--	--	--	**G-W**
18.	39	Glass ampules and vials making from glass tubes	--	--	--	--	--	--	--	--	**G-W**
19.	40	Glass putty and sealant (by mixing with machine only)	--	--	--	--	--	--	--	--	**G-W**
20.	43	Ground nut decorticating	--	--	--	--	--	--	--	--	**G-W**
21.	44	Handloom/ carpet weaving (without dying and bleaching operation)	--	--	--	--	--	--	--	--	**G-W**
22.	48	Leather cutting and stitching (more than 10 machine and using motor)	--	--	--	--	--	--	--	--	**G-W**
23.	51	Manufacturing of coir items from coconut husks	--	--	--	--	--	--	--	--	**G-W**
24.	52	Manufacturing of metal caps containers etc	--	--	--	--	--	--	--	--	**G-W**
25.	55	Manufacturing of shoe brush and wire brush	--	--	--	--	--	--	--	--	**G-W**
26.	57	Medical oxygen	--	--	--	--	--	--	--	--	**G-W**
27.	60	Organic and inorganic nutrients (by physical mixing)	--	--	--	--	--	--	--	--	**G-W**
28.	61	Organic manure (manual mixing)	--	--	--	--	--	--	--	--	**G-W**
29.	63	Packing of powdered milk	--	--	--	--	--	--	--	--	**G-W**
30.	64	Paper pins and u clips	--	--	--	--	--	--	--	--	**G-W**
31.	58	Repairing of electric motors and generators (dry mechanical process)	--	--	--	--	--	--	--	--	**O-W**
32.	74	Rope (plastic and cotton)	--	--	--	--	--	--	--	--	**G-W**

33.	76	Scientific and mathematical instrument manufacturing	--	--	--	--	--	--	--	--	**G-W**
34.	78	Solar module non conventional energy apparatus manufacturing unit	--	--	--	--	--	--	--	--	**G-W**
35.	79	Solar power generation through solar photovoltaic cell, wind power and mini hydel power (less than 25 MW)	--	--	--	--	--	--	--	--	**G-W**
36.	83	Surgical and medical products assembling only (not involving effluent / emission generating processes)	--	--	--	--	--	--	--	--	**G-W**

Note : Under the column Revised Category, the full forms of the abbreviations are as follows :

a. *R-R means original category was Red and revised category is also Red*
b. *R-O means original category was Red and revised category is Orange*
c. *O-O means original category was Orange and revised category is also Orange*
d. *O-G means original category was Orange and revised category is Green*
e. *O-W means original category was Orange and revised category is White*
f. *G-O means original category was Green and revised category is Orange*
g. *G-G means original category was Green and revised category is also Green*
h. *G-W means original category was Green and revised category is White*

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
(पर्यावरण एवं वन मंत्रालय, भारत सरकार)
(MINISTRY OF ENVIRONMENT & FORESTS, GOVT. OF INDIA)

No. B-29012/ESS/CPA/2015-16

19.08.2015

Sub: "Harmonization of Classification of industries under Red / Orange / Green / White Categories".

During the Conference of the Environment Ministers of States held in New Delhi during April 06-07, 2015, it was resolved to adopt pollution potential criteria for categorization of Red, Orange & Green categories of industries and that a Committee be constituted with State representatives. Further, in the 59th Conference of Chairmen & Member Secretaries of Pollution Control Boards/PCCs held in New Delhi on April 08, 2015, it was agreed to constitute a Committee to look into categorization system of industries based on their respective pollution potential index.

2. Accordingly, a Committee comprising the Chairmen of CPCB, APPCB, TNPCB, MPPCB, MPCB, PPCB, WBPCB and MS, CPCB was constituted vide CPCB OM dated 23.04.2015 to review & classify industrial sectors into different categories based on criteria of respective pollution potential indices.

3. The existing Red (85 sectors) , Orange (73 sectors) and Green (86 sectors) industrial sectors have been assessed as per the proposed formula by a group of Scientists from CPCB . For this purpose , concerned Engineers / Scientists from the Member SPCBs of the Committee were also involved & consulted during May28-29, 2015.

4. After careful examination and consideration of the suggestions of concerned stake-holders the "Draft Document on Revised Concept of Categorization of Industrial Sectors " is prepared by the Committee .

In this context, the Undersigned is directed to forward a copy of the " Draft Document on Revised Concept of Categorization of Industrial Sectors to all the SPCBs, PCCs and concerned Ministries for their comments. Accordingly, the same is enclosed herewith and all the SPCBs, PCCs and concerned Ministries are, hereby requested to provide their comments by 04.09.2015. The comments may kindly be sent through hard copy as well as soft copy at e-mail: nkgupta.cpcb@nic.in , nkgcpcb@hotmail.com .

Encl : As above

[N.K. Gupta]
Incharge - ESS

To:

1. All the State Pollution Control Boards / Pollution Control Committees
2. The Secretary, Ministry of Micro Small and Medium Enterprises, New Delhi
3. The Secretary, Ministry of Heavy Industries & Public Enterprises, New Delhi
4. The Advisor & Incharge , CP Division, MoEFCC, New Delhi
5. CPCB Website

'परिवेश भवन' पूर्वी अर्जुन नगर, दिल्ली–110032
'Parivesh Bhawan', East Arjun Nagar, Delhi - 110032
दूरभाष / Tel. : 43102030, फैक्स / Fax : 22305793, 22307078, 22307079, 22301932, 22304948
ई–मेल / e-mail :cpcb@nic.in वेबसाईट / Website : www.cpcb.nic.in

Annexure II

No.3/7/2015-Trans
Government of India
Ministry of Power
Shram Shakti Bhawan
Rafi Marg, New Delhi – 110001

Dated, 15th October, 2015

To

1. Chief Secretaries/Administrators of all the States/UTs
(As per list attached)
2. Chairperson, CEA, New Delhi with the request to disseminate the above guidelines to all the stakeholders.
3. CMD, PGCIL, Gurgaon,
4. CEO, POSOCO, New Delhi.
5. Secretary, CERC, New Delhi.
6. CMD of State Power Utilities/SEBs

Subject: Guidelines for payment of compensation towards damages in regard to Right of Way for transmission lines.

During the Power Ministers Conference held on April 9-10, 2015 at Guwahati with States/UTs, it has, *inter alia*, been decided to constitute a Committee under the chairmanship of Special Secretary, Ministry of Power to analyse the issues related to Right of Way for laying of transmission lines in the country and to suggest a uniform methodology for payment of compensation on this count. Subsequently, this Ministry had constituted a Committee with representatives from various State Governments and others. The Committee held several meetings to obtain the views of State Governments on the issue and submitted its Report along with the recommendations (copy of the Report is at **Annex-1**)

2. The Recommendations made by the Committee are hereby formulated in the form of following guidelines for determining the compensation towards "damages" as stipulated in section 67 and 68 of the Electricity Act, 2003 read with Section 10 and 16 of Indian Telegraph Act, 1885 which will be in addition to the compensation towards normal crop and tree damages. This amount will be payable only for transmission lines supported by a tower base of 66 KV and above, and not for sub-transmission and distribution lines below 66 KV:-

(i) Compensation @ 85% of land value as determined by District Magistrate or any other authority based on Circle rate/ Guideline value/ Stamp Act rates for tower base area (between four legs) impacted severely due to installation of tower/pylon structure;

(ii) Compensation towards diminution of land value in the width of Right of Way (RoW) Corridor due to laying of transmission line and imposing certain restriction would be decided by the States as per categorization/type of land in different places of States, subject to a maximum of 15% of land value as determined based on Circle rate/ Guideline value/ Stamp Act rates;

(iii) In areas where land owner/owners have been offered/ accepted alternate mode of compensation by concerned corporation/ Municipality under Transfer Development Rights (TDR) policy of State, the licensee /Utility shall deposit compensation amount as per (i) & (ii) above with the concerned Corporation/ Municipality/ Local Body or the State Government.

(iv) For this purpose, the width of RoW corridor shall not be more than that prescribed in the table at **Annex-2**and shall not be less than the width directly below the conductors.

3. Necessary action may kindly be taken accordingly. These guidelines may not only facilitate an early resolution of RoW issues and also facilitate completion of the vital transmission lines through active support of State/ UT administration.

4. All the States/UTs etc. are requested to take suitable decision regarding adoption of the guidelinesconsidering that acquisition of land is a State subject.

Yours faithfully,

Jyoti Arora

(Jyoti Arora)
Joint Secretary (Trans.)
Tele: 011-2371 0389

Copy along with enclosure, forwarded to the following:

1. Secretaries of Government of India (Infrastructure Ministries/Deptt including MoEF - As per attached list)
2. Prime Minister's Office (Kind Attn: Shri Nripendra Mishra, Principal Secretary to PM).
3. Technical Director, NIC, Ministry of Power with the request to host on the website of Ministry of Power.

Copy to PS to Hon'ble MoSP (IC) / Secretary (Power) / AS (BNS) / AS (BPP) / All Joint Secretaries/EA/ All Directors/DSs, Ministry of Power.

Report of the Committee for payment of compensation in regard to Right of Way (RoW) for transmission lines

1.0 Background:

1.1 The Transmission Projects in the country are implemented by the licensee in accordance with the provisions of the Electricity Act, 2003. The compensation towards "damages" during implementation of such projects is governed by Section 67 & 68 of the Electricity Act read with Section 10 & 16 of the Indian Telegraph Act, 1885. The present stipulations provide for compensation towards all damages without acquisition of land which are assessed/ reviewed by the Revenue Authorities. However, there is no clear definition of the term "damages", nor are there any guidelines in this regard.

1.2 For laying electricity transmission lines, licensee erects towers at intervals of about 400 m. and conductors are strung on these towers maintaining a safe height depending on the voltage and other geographical parameters. Thus, typical transmission lines have following two kinds of impact:

(i) Tower base area whichis more or less completely lost or loses its productivity due to severe restriction an access;

(ii) Corridor of land underneath strung conductor between two towers may be adversely affected by imposition of restriction on its usage.

1.3 The maximum width of RoW corridor is calculated on the basis of tower design, span, and wind speed, maximum sag of conductor and its swing plus other requirement of electric safety. The requirement of ROW for different voltage types under standard conditions is as follows:

ROW width for different voltage line*

Transmission Voltage	Width of Right of Way (in Meters)
66 kV	18
110 kV	22
132 kV	27
220 kV	35
400 kV S/C	46
400 kV D/C	46
+/-500 kV HVDC	52
765 kV S/C (with delta configuration)	64
765 kV D/C	67
+/-800 kV HVDC	69
1200 kV	85

* Width of Right of Way is as per the MoEF guidelines dated 5.5.2014 **(Annex-A)**

1.4 The Telegraph Act provides for compensation towards damages (without acquisition) while placing the tower and stringing the conductor. The local authorities/ District Magistrates have been provided Power under Section 16 (1) of the

Telegraphic Act for adjudication and fixing the compensation. The provisions of the Electricity Act and Telegraph Act in respect of compensation are as follows:

A. The Electricity Act, 2003, Part-VIII, Section 67 & 68

Section 67 (3 & 4):

*"(3) A licensee shall, in exercise of any of the powers conferred by or under this section and the rules made thereunder, cause as little damage, detriment and inconvenience as may be, **and shall make full compensation for any damage, detriment or inconvenience** caused by him or by any one employed by him.*

(4) Where any difference or dispute [including amount of compensation under sub-section (3)] arises under this section, the matter shall be determined by the Appropriate Commission."

Section 68 (5 & 6):

(5) Where any tree standing or lying near an overhead line or where any structure or other object which has been placed or has fallen near an overhead line subsequent to the placing of such line, interrupts or interferes with, or is likely to interrupt or interfere with, the conveyance or transmission of electricity or to interrupt or interfere with the conveyance or transmission of electricity or the accessibility of any works, an Executive Magistrate or authority specified by the Appropriate Government may, on the application of the licensee, cause the tree, structure or object to be removed or otherwise dealt with as he or it thinks fit.

*(6) When disposing of an application under sub-section (5), an Executive Magistrate or authority specified under that sub-section shall, in the case of any tree in existence before the placing of the overhead line, **award to the person interested in the tree such compensation as he thinks reasonable**, and such person may recover the same from the licensee.*

Explanation - For purposes of this section, the expression tree shall be deemed to include any shrub, hedge, jungle growth or other plant."

B. The Indian Telegraph Act, 1885, Part-III, Section 10 ("C"):

***"Section 10** – The telegraph authority may, from time to time, place and maintain a telegraph line under, over, along, or across, and posts in or upon any immovable property, Provided that –*

a) the telegraph authority shall not exercise the powers conferred by this section except for the purposes of a telegraph established or maintained by the [Central Government], or to be so established or maintained;

*b) **the [Central Government] shall not acquire any right other than that of user only** in the property under, over, along, across in or upon which the telegraph authority places any telegraph line or post; and*

c) except as hereinafter provided, the telegraph authority shall not exercise those powers in respect of any property vested in or under the control or management of any local authority, without the permission of that authority; and

*d) in the exercise of the powers conferred by this section, the telegraph **authority shall do as little damage as possible, and, when it has exercised those powers in respect of any property other than that referred to in clause (c), shall pay full compensation to all persons interested for any damage sustained by them** by reason of the exercise of those powers."*

1.5 As the "damages" have not been defined in the said Acts, licensees, in past, used to pay compensation for the damages caused to crops/ trees and structures. However, the land owners/farmers are now demanding the cost of land for tower base as well as cost diminution of land value in the corridor area due to laying of transmission

line on their land. The present provisions of the Act/ Rules do not provide for any set procedure for calculation of such compensation. In the absence of clarity and notified procedures, the provisions of existing Acts are being differently interpreted by concerned DC/ Revenue Authorities that are also at variance with each other even among neighboring districts which is resulting in the resistance by the farmers causing unwarranted delay in the project implementation. Presently many lines in the States of Maharashtra, Western U.P., Karnataka, Kerala, Andhra, Jharkhand etc. are held up due to resistance by land owners demanding enhanced compensation.

2.0 Constitution of the Committee:

2.1 The matter was deliberated during the Power Ministers' Conference on 9-10 April 2015 at Guwahati and a Committee under the chairmanship of Special Secretary, Ministry of Power was constituted vide order No. 3/7/2015-Trans dated 15th April 2015 to analyse the issues relating to Right of Way for laying transmission lines in the country and to suggest a uniform methodology for payment of compensation on this account. The composition of the Committee is given below:

i. Shri R. N. Choubey, Special Secretary, Ministry of Power – Chairman
ii. Chairperson, Central Electricity Authority
iii. Principal Secretary/Secretary (Energy), Madhya Pradesh
iv. Principal Secretary/Secretary (Energy), U.P
v. Principal Secretary/Secretary (Energy), Maharashtra,
vi. Principal Secretary/Secretary (Energy), Karnataka,
vii. Principal Secretary/Secretary (Energy), Kerala,
viii Jt. Secretary (Trans.), Ministry of Power
ix. CMD/Dir(Projects), POWERGRID
x. Shri K. K. Arya, CE (SP&PA), CEA – Convener & Member Secretary.

The notification of the Committee is at **Annex-I**.

3. **Proceedings of the Committee:**

3.1 The first meeting of the Committee was held on 20.04.2015. During the meeting Powergrid and States mentioned that the difficulties were being faced in construction of transmission lines in more or less all the states due to severe resistance being posed by the land owners/ farmers with the demand of higher compensation including demand for compensation for the diminution value of the land below towers and under

the line corridor. Powergrid also informed about the opinion of Attorney General of India taken by them, which states that the land underneath the legs of the tower is permanently lost by the owner and that the land under the corridor can be conveniently used but with certain restrictions and compensation for such diminution in land value for the line corridor is also payable to land owners. All the states were also of the view that compensation against the land diminution should be paid to the land owners. Most of the participants suggested that a uniform policy should be in place at the central level in terms of fixed percentages of market value of the land under transmission towers and under corridor, however, some of the states were of the view that this should be left to the concerned state to formulate the policy.

3.2 During the meeting, two views were emerged as under;

(i) 100 % compensation for land should be paid for tower footing and 10% for corridor under the line.

(ii) Policy should not be changed as state authorities are solving the compensation issues and it will also affect the financial viability of transmission projects.

The minutes of the meeting are at **Annex-II**.

3.3 The second meeting was held on 30.04.2015. Director (Projects), POWERGRID presented a detailed presentation including Legal & Regulatory framework about the compensation, policies of various States as well as the brief on the order of various Courts on compensation issues and various other order of different DM/DC regarding compensation and interpretation of present provisions. Copy of the presentation is at **Annex-III**. The summary of AG's opinion on legal position and coverage/inclusions of various aspects while deciding compensation including land value diminution was also informed by POWERGRID.

3.4 POWERGRID proposal regarding full compensation for tower base and at least 10% for RoW Corridor was also discussed in detail. The private entities M/s. Sterlite and Essel Infra also emphasized that there should be a standard norms for calculating compensation for transmission line and it should also be revised, reviewed periodically for its regular updation keeping in mind the market rate. M/s Sterlite also suggested that instead of land cost, corridor compensation per km may be fixed based on voltage of

line. Chairperson, CEA informed that possibility of reduction in RoW width is minimal as it has already been fixed based on the required Electricity Safety norms.

3.5 The Committee opined that payment of full value of land cost, tower base seems justified due to severe restriction put in by placing of tower which heavily impact the productivity/use of land area falling below tower base. Principal Secretary (Power), U.P however expressed his reservation on 100% cost without acquisition may be a difficult proposition due to ongoing complication regarding compensation under new Land Acquisition Act. Principal Secretary (Power), U.P and Principal Secretary (Power), M.P expressed their apprehension about the proposal of RoW Corridor payment as in their view such payment may also hamper the implementation of distribution lines and may also put additional financial burden on distribution company. Moreover, they were also of the opinion that we may not be able to resolve compensation issue by paying 10% as in all probabilities the farmers/land owners will demand more as has already been stipulated in the different State policies and DCs orders.

3.6 Due to sensitivity of the proposal and its implementation by the different State Governments, it was decided that this issue may also be discussed during the forthcoming Power Secretaries meetings for wider consultation and acceptance. Minutes of the meeting are at **Annex-IV**.

3.7 The Committee further consulted many States to obtain their views on the issue during the Review, Planning and Monitoring (RPM) meeting held on 11.5.2015 at Delhi, which was attended by Principle Secretaries/ Secretaries (Energy) of various States. The issues related to compensation and deliberations held during last 2 meetings were informed to the participants and they were asked to give their opinion on whether Committee should recommend a minimum uniform standard compensation norm for transmission line RoW for whole country or not. The different States present in the meeting suggested following:

i. **West Bengal:** The state was not very keen on providing compensation for ROW corridor however they suggested for tower base 50 % of the land cost due to restriction and 20 % for corridor. However it should be left to state for final decision.

ii. **Jammu & Kashmir:** It informed that because of the special provision in the state they were already acquiring tower base land by paying full compensation as per the land acquisition norm and accordingly state be granted power on such issue.

iii. **Madhya Pradesh:** It also suggested that such decision be left to state government to decide.

iv. **Uttar Pradesh:** The state was ready to pay the compensation as decided by the district authority and hence suggested there should be a mechanism so that such compensation be pass through as project cost.

v. **Kerala:** Kerala was in favour of uniform compensation norms. It also suggested that beyond such uniform rate, it should be left to state who would also bear the cost if additional compensation is paid.

vi. **Bihar:** The State was also in favor of compensation for tower base and corridor. However, it suggested that decision on deciding percentage be left on state for finalization.

vii. **Karnataka:** It was also in favor of such compensation, however it also suggested that the finalization of percentage cost may be left at the discretion of the state.

viii. **Andhra Pradesh:** The State was of the view that compensation for 100 % land value for tower base be paid to the landowner but no compensation for corridor should be given. It also suggested that such compensation should not be made applicable to line below 33 KV.

ix. **Jharkhand:** The State was also in favor of uniform standard rate at generic level but suggested that state must be authorized for finalizing the quantum of such compensation.

x. **Odisha:** The State was also in favor of uniform standard rate. However, it suggested that district authority must be authorized for finalizing such compensation.

xi. **Uttarakhand:** It also wanted a uniform rate for such compensation considering revenue rate as basis and suggested 80% land value for tower base but no compensation for corridor as agricultural practices take place without any hindrance. However, they suggested that 5% cost of land for corridor for lines below 33 KV be included as these lines put severe restriction on agricultural practices.

xii. **Meghalaya:** it suggested that they will come back after consulting other stakeholders and senior officials.

xiii. **Gujarat:** it favors that certain minimum standard should be defined and state be given power to decide its detailing and these should not be any compensation for corridor. Such compensation should not be applicable for distribution line.

xiv. **Punjab**: The State was in agreement for compensation towards tower base and line corridor and wanted that certain standard uniform norms be made for such compensation.

xv. **Nagaland:** It informed that they will come back later on after consulting all concerned.

xvi. **Maharashtra:** It also favors that it should be left to the discretion of the state and such compensation be made part of project cost.

xvii. **Telangana:** It stated that they are in favor of 85% land value for tower base but no compensation for corridor.

3.8 The views of various states have been classified in four categories and are indicated below:

Category	Name of States
Category-I: States agreeing for payment of compensation for tower base and part compensation for RoW corridor	Odisha(#), Maharashtra(#), Uttarakhand, Punjab West Bengal, Bihar, Karnataka, Kerala, Jharkhand,
Category-II: States agreeing for payment of compensation for tower base and no compensation for RoW corridor	Telangana, Andhra Pradesh
Category-III: States suggesting that decision should be left with State Govt to decide	Madhya Pradesh, Gujarat, Uttar Pradesh.
Category-IV: States to inform later	Meghalaya, Nagaland

(#) States agreed in-principle but want final decision to be left on them.

3.9 The third meeting of the Committee was held on 1st June 2015 and the issue & opinions of various states were deliberated in detail. Based on detailed deliberations, AG's Opinion and views of the states on the issue of RoW compensation and its modalities the committee finalized its recommendations.

4.0 Recommendations:

The GoI may issue following guidelines for determining the compensation payable towards "damages" as stipulated in Indian Telegraph Act which will be in addition to the compensation towards normal crop and tree damages. This amount will be payable only

for transmission Lines of 66 kV and above, and not for sub-transmission and distribution lines below 66 kV:

i. **Compensation @ 85% of land value as determined by District Magistrate or any other authority based on Circle rate/ Guideline value/ Stamp Act rates for tower base area (between four legs) impacted severely due to installation of tower/pylon structure;**

ii. **Compensation towards diminution of land value in the width of RoW Corridor due to laying of transmission line and imposing certain restriction would be decided by the States as per categorization/type of land in different places of States, subject to a maximum of 15% of land value as determined based on Circle rate/ Guideline value/ Stamp Act rates;**

iii. **In areas where land owner/owners have been offered/accepted alternate mode of compensation by concerned corporation/ Municipality under Transfer Development Rights (TDR) policy of State, the licensee /Utility shall deposit compensation amount as per (i) & (ii) above with the concerned Corporation/ Municipality/ Local Body or the State Government.**

iv. **For this purpose, the width of RoW corridor shall not be more than that prescribed in para 1.3 above, and shall not be less than the width directly below the conductors.**

IN WITNESS WHEREOF, the undersigned being duly authorized thereto have signed this Report of the Committee for payment of compensation in regard to Right of Way (RoW) for transmission lines.

(R N Choubey)
Chairman of the Committee
Former Special Secretary,
Ministry of Power

(Jyoti Arora)
Member of the Committee
Joint Secretary (Trans.)
Ministry of Power

(Major Singh)
Member of the Committee
Chairperson, Central Electricity Authority

(I.C.P. Keshari)
Member of the Committee
Principal Secretary (Energy)
Government of Madya Pradesh

(Sanjay Agarwal)
Member of the Committee
Principal Secretary (Energy)
Government of Uttar Pradesh

(Mukesh Khullar)
Member of the Committee
Principal Secretary (Energy)
Government of Maharashtra

(R Ravi Kumar)
Member of the Committee
Secretary (Energy)
Government of Karnataka

(Shivasankar)
Member of the Committee
Secretary (Power)
Government of Kerala

(U.S.Jha)
Member of the Committee
Director (Projects)
Power Grid Corporatio of India Limited

F. No. 7-25/ 2012-FC
Government of India
Ministry of Environment and Forests
(FC Division)

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi - 110 510
Dated: 5th May, 2014

To

The Principal Secretary (Forests),
All State / Union Territory Governments

Sub: Guidelines for diversion of forest land for non-forest purposes under the Forest (Conservation) Act, 1980- Guidelines for laying transmission lines through forest areas - *reg*.

Sir,

I am directed to say that the Hon'ble National Green Tribunal in their Order dated 7th March 2012 in the Appeal No. 10 of 2012 in the matter of Janajagarithi Samiti (Regd.) versus Union of India and Others directed this Ministry to take steps and notify the detailed fresh guidelines for laying transmission lines through forest area, incorporating necessary changes to mitigate the difficulties which arise during granting forest clearance.

Accordingly, this Ministry in consultation with the Central Electricity Authority formulated revised guidelines for laying transmission lines through forest areas. **A copy of the same is enclosed.**

Yours faithfully,

Encl.: As above.

(H.C. Chaudhary)
Assistant Inspector General of Forests

Copy along with a copy of the said guidelines to:-

1. Prime Minister's Office (*Kind attn.:* Shri Santosh D. Vaidya, Director).
2. Secretary, Ministry of Power, Government of India, Shram Shakti Bhawan, New Delhi.
3. Principal Chief Conservator of Forests, all State/UT Governments.
4. Nodal Officer, the Forest (Conservation) Act, 1980, all State/UT Governments.
5. All Regional Offices, Ministry of Environment & Forests (MoEF), Government of India (GoI).
6. Joint Secretary in-charge, Impact Assessment Division, MoEF, GoI
7. All Assistant Inspector General of Forests/ Director in the Forest Conservation Division, MoEF, GoI.

8. Director R.O. (HQ), MoEF, GoI.
9. Sr. Director (Technical), National Informatics Centre (NIC), MoEF with a request to place a copy of the letter on website of this Ministry.
10. Sr. PPS to the Secretary, Environment and Forests.
11. Sr. PPS to the Director General of Forests & Special Secretary, MoEF.
12. Sr. PPS to the Addl. Director General of Forests (Forest Conservation), MoEF.
13. PS to the Inspector General of Forests (Forest Conservation), MoEF.
14. Guard File.

(H.C. Chaudhary)
Assistant Inspector General of Forests

GUIDELINES FOR LAYING TRANSMISSION LINES THROUGH FOREST AREAS

1. Where routing of transmission lines through the forest areas cannot be avoided, these should be aligned in such a way that it involves the least amount of tree cutting.

2. As far as possible, the route alignment through forest areas should not have any line deviation.

3. (i) The width of right of way for the transmission lines on forest land shall be as follows:

Transmission Voltage	Width of Right of Way (Meter)
11kV	7
33 kV	15
66 kV	18
110 kV	22
132 kV	27
220 kV	35
400 kV S/C	46
400 kV D/C	46
+/- 500 kV HVDC	52
765 kV S/C (with delta configuration)	64
765 kV D/C	67
+/- 800 kV HVDC	69
1200 kV	89

(ii) In forest areas, only vertical delta configuration of 400 kV S/C and delta configuration of 765 kV S/C shall be permitted.

4. (i) Below each conductor or conductor bundle, following width clearance would be permitted for stringing purpose:

Transmission line with conductor bundle	Width clearance below each conductor or conductor bundle (meter)
Upto 400kV twin bundle	3

400 kV triple bundle	5
400 kV /+/-500 kV HVDC /765 kV Quadruple bundle	7
+/-800 kV HVDC / 765 kV hexagonal bundle	10

(ii) The trees on such strips would have to be felled but after stringing work is completed, natural regeneration will be allowed to come up. Felling/ pollarding/ pruning of trees will be done with the permission of the local forest officer wherever necessary to maintain the electrical clearance. One outer strip shall be left clear to permit maintenance of the transmission line.

(iii) During construction of transmission line, pollarding/ pruning of trees located outside the above width of the strips, whose branches/ parts infringe with conductor stringing, shall be permitted to the extent necessary, as may be decided by local forest officer.

(iv) Pruning of trees for taking construction/stringing equipments through existing approach/access routes in forest areas shall also be permitted to the extent necessary, as may be decided by local forest officer. Construction of new approach/access route will however, require prior approval under the Act.

(v) In the remaining width of right of way trees will be felled or lopped to the extent required, for preventing electrical hazards by maintaining the following:

Transmission Voltage	Minimum clearance between conductor and trees (Meters)
11 kV	2.6
33 kV	2.8
66 kV	3.4
110 kV	3.7
132 kV	4.0
220 kV	4.6
400 kV	5.5
+/-500 kV HVDC	7.4
765 kV	9.0
+/-800 kV HVDC	10.6
1200 kV	13.0

(vi) The maximum sag and swing of the conductors are to be kept in view while

working out the minimum clearance mentioned as above.

(vii) To avoid any hazard, felling/cutting/pruning of those trees which because of their height /location may fall on conductors shall also be permitted, as may be decided by local forest office.

(viii) In the case of transmission lines to be constructed in hilly areas, where adequate clearance is already available, trees will not be cut except those minimum required to be cut for stringing of conductors.

(ix) In case of transmission lines passing through National Parks, Wildlife Sanctuaries and Wildlife Corridors, insulated conductors shall only be used to prevent electrocution of animals.

5. Where the forest growth consists of coconut groves or similar tall trees, widths of right of way greater than those indicated at Sl. No.3 may be permitted in consultation with CEA.

*****

Annex-I

No.3/7/2015-Trans
Government of India
Ministry of Power
Shram Shakti Bhawan, Rafi Marg
New Delhi - 110001

Dated 15th Apr , 2015

To,

As per distribution list.

Sir,

Subject:- Constitution of the Committee for finalization of compensation in regard to Right of Way for transmission lines

I am directed to inform that during the Power Ministers' Conference held on 9th and 10th April, 2015 at Guwahati with States/UTs, it has *inter alia* been decided to constitute a Committee under the chairmanship of Shri R.N.Choubey, Special Secretary, Ministry of Power to analyse the issues relating to Right of Way for laying of transmission lines in the country and to suggest a uniform methodology for payment of compensation on this account.

2. Accordingly, a Committee is hereby constituted with the following composition:-

1. Shri R.N. Choubey, Special Secretary, Ministry of Power – Chairman
2. Chairperson, Central Electricity Authority
3. Principal Secretary/ Secretary (Energy), Madhya Pradesh
4. Secretary/ Principal Secretary (Energy), U.P.
5. Secretary/Principal Secretary (Energy), Maharashtra
6. Secretary/Principal Secretary (Energy), Karnataka
7. Secretary/Principal Secretary (Energy), Kerala
8. Joint Secretary (Trans), Ministry of Power
9. CMD/Director (Projects), PGCIL
10. Shri K.K.Arya, Chief Engineer (SP&PA), CEA – Convenor & Member Secretary

3. Representative from EPTA (Electric Power Transmission Association) may also be called as a special invitee as and when required.

4. The Committee shall meet once in a week and submit the report within a month. The first meeting of the Committee shall be held at 3.00 pm on 20.4.2015. You are, therefore, requested to attend the meeting in NPMC Room 2nd Floor, Shram Shakti Bhavan, New Delhi.

(Jyoti Arora)
Joint Secretary (Trans)
Tele: 011 2371 0389

To,

1. Chairperson, Central Electricity Authority, New Delhi
2. Principal Secretary/ Secretary (Energy), Madhya Pradesh
3. Principal Secretary/ Secretary (Energy), U.P.
4. Principal Secretary/ Secretary (Energy), Maharashtra
5. Principal Secretary/ Secretary (Energy), Karnataka
6. Principal Secretary/ Secretary (Energy), Kerala
7. CMD/Director (Projects), PGCIL
8. Shri K.K.Arya, Chief Engineer, Chief Engineer (SP&PA), CEA, New Delhi

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Copy to Sr.PPS to SS (RNC)/ JS(Trans) / Director (Trans)/ US (Trans).

Annex-II

No.3/7/2015-Trans
Government of India
Ministry of Power
Shram Shakti Bhawan, Rafi Marg
New Delhi-110001

Dated: 30th April, 2015

Office Memorandum

Sub: Minutes of the meeting held on 20.04.2015 under the chairmanship of Shri R.N. Choubey, Special Secretary, Ministry of Power regarding finalization of compensation in regard to Right of Way for transmission lines

Ref: Ministry of Power letter of even number dated 15.4.2015 from Joint Secretary(Trans), Ministry of Power, New Delhi

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The undersigned is directed to forward herewith a copy of the minutes of meeting taken by Shri R.N. Choubey, Special Secretary, Ministry of Power on 20.4.2015 on the above mentioned subject, for information and necessary action, if any.

(S. Venkateshwarlu)
Under Secretary (Trans)
E-mail: transdesk-mop@nic.in
Telefax: 011-2332 5242

To

1. Chairperson, Central Electricity Authority, New Delhi
2. Principal Secretary/ Secretary (Energy), Madhya Pradesh
3. Principal Secretary/ Secretary (Energy), U.P.
4. Principal Secretary/ Secretary (Energy), Maharashtra
5. Principal Secretary/ Secretary (Energy), Karnataka
6. Principal Secretary/ Secretary (Energy), Kerala
7. CMD/Director (Projects), PGCIL
8. Shri K.K.Arya, Chief Engineer, Chief Engineer (SP&PA), CEA, New Delhi

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Copy to S/ PPS to SS (RNC)/ JS(Trans) / Director (Trans)/ US (Trans)

Minutes of the meeting taken by Shri R.N. Choubey, Special Secretary, Ministry of Power (MoP) on 20.4.2015 regarding finalization of compensation in regard to Right of Ways (RoW) for transmission line

List of participant is given at Annex-I

2. Special Secretary, MoP welcomed the participants and informed that the issue of Right of Ways and its compensation was recently discussed in Power Ministers' Conference held at Guwahati on 9-10th April, 2015 and it was desired to resolve the issue at the earliest. He requested Director (Projects), PGCIL to present brief on the issue.

3. Director(Projects), PGCIL explained the process followed by POWERGRID and other Licensees in respect of compensation for damages reported during the construction of Transmission Lines. He also explained the difficulties faced by POWERGRID in more or less all the States regarding inadequacy of compensation and severe resistance posed by Land Owners/Farmers which is affecting implementation/ commissioning of many important lines in Maharashtra, U.P, Karnataka, Andhra Pradesh, Kerala etc.

4. He also explained that the problem is aggravated because the provisions of Indian Telegraph Act, 1885 are followed for compensation. The provision of the said Act provides that all damages have to be compensated but there is no specific procedure or definition of damages. This ambiguity have been interpreted differently by various courts and DMs/DCs who has ordered compensation for tower base as well as diminishing land value for Corridor. Such orders of different DMs/DCs are also in variance from each other and the difference in compensation cost also varies greatly.

5. He further stated that due to above referred reasons, POWERGRID has approached Attorney General of India (AG) for his opinion on the definition of damages and possibility of payment of compensation towards corridor.

AG opined the following:

- "In my view, it is logical to hold that the land underneath the legs of the tower (permanently fixed to the earth) is permanently lost by the owner. Even though those pieces of land are not required for acquisition and the ownership remains with the owner yet all incidence of the ownership, enjoyment and free use of those pieces of land becomes severely

restricted. In such case compensation ought to be as near as the present value of the land. The compensation of land under the corridor is entirely different. Such land is conveniently usable for agriculture. However, there would be of course diminution of land value due to placing of line over it with certain restriction on land use as brought out in para 9 (in case of Agricultural land, it may have restriction for placing tall trees, pump house and future prospects in corridor area. In case of Residential and Commercial plot, there will be severe restriction to meet the safety guidelines) and also any future prospects for usage other than agriculture. The usage of such land/cost may vary depending upon its location in urban or rural area. The compensation for such diminution in land value for the line corridor is also payable to land owners, quantum of which should commensurate to the damage depending upon the type/location of land and its intended/recorded land use.

- In case of Residential / Industrial area, there is severe restriction on usage for safety of human life & electrical clearance hence compensation need to be commensurate with the damages.
- I am also of the considered view that due to case specific nature of valuation of compensation, State has vested such powers with District Authorities. However, the Authorities have to take a balance view considering intended purpose and reasons mentioned above."

6. Secretary (Energy), Karnataka stated that securing the Right of Way for transmission projects of 66KV and above is getting difficult in recent times. This is more so in the areas which are closer to urban areas and in lands where horticulture and plantation crops are grown. Taking shelter under the Indian Telegraph Act, 1885 may not be correct now when the land prices have become very high. Once a transmission line is drawn across the land, there are number of restrictions in the corridor and additionally the land around would lose its value.

7. In the case of Livisha Vs.KSEB (2007) etc. the Hon'ble Supreme Court has talked about compensating diminution of the value of land and payment of compensation. States like Kerala, Maharashtra and Andhra Pradesh have passed orders for compensation of land for the corridor under the transmission lines. Government of Karnataka is proposing compensation to the extent of 50% of the value for agricultural land in rural areas and 75% of the value for non-agricultural properties in urban areas. In addition, 100% of the cost of the land in the tower footing area is proposed to be paid.

8. In case the transmission lines are drawn in Forest land, the transmission utility has to pay cost of afforestation, cost for environmental protection works in the corridor

and also provide to the Forest Dept. land for compensatory afforestation equal to the land diverted for transmission corridor.

9. Since a number of Transmission projects under the TBCB route are being taken up, it may be better to discuss the issue with private developers and major contractors also. Therefore, this is a strong case for payment of compensation for the Right of Way for laying transmission lines. Necessary legal framework has to be built for the payment of compensation. Amendment to the Indian Telegraph Act/Electricity Act is necessary.

10. Principal Secretary (Power), U.P was of the view that compensation falls under the preview of State and it should be left to the concerned State to formulate the policy. He has informed that as per his experience, 90 to 95% POWERGRID lines are completed without such resistance and it is in the 5% that the problem of farmer resistance and compensation is experienced.

11. Secretary (Power), Kerala stated as under:

- Considering the high land cost, perceived and actual fall in land value consequent to the drawing of transmission lines, and fragmented nature of land holdings with individuals having only 15-20 percent of land acquiring right of way with the present level of compensation is impractical.

- It is also submitted that RoW sought is almost three times the distance between conductor tips. For Kochi – Edamon line the tip to tip conductor spacing is only 16m whereas the RoW sought is at a width of 45 m. This needs to be technically reviewed and possibility of adoption of technology to reduce the land requirements need to be seriously explored.

- If this can be done and the total land requirement brought down by 50%, obviously the issues are also reduced by 50%.

- For the reduced land required, tower standing area may be given full compensation as if it is acquired. For the land below the conductors, a reasonable proportion of market value may be provided. Depending on local conditions, any enhancement above this would have to be provided by the state government, but the decision in this regard would have to be taken in a time bound manner.

- Rather than restricting the compensation to a down payment, if an annuity payment can be offered, say by having a 5 to 10 paise as a transmission surcharge per unit of power transmitted and apportioning the same to all the landholders along the RoW, the issue of perceived reduction of land value can be addressed.

- The possibility of setting up solar panel underneath the transmission lines and sharing part of the revenue to landowners may be considered, especially since the evacuation of power through the land under RoW is much easier.

- CEA may compile a list of permissible activities that can be taken up in the land below the conductors and in the buffer area beyond the conductor tips, which can be taken up by other departments/ state governments. For instance can we have roads constructed along the buffer zone, which will invariably increase the land value.

12. MD, MPPTCL stated that as per Indian Electricity Act and Rules in vogue, the cost of keeping dedicated corridor of transmission line along EHV transmission line works out to 100% to 115% of cost of line based on rate of land including irrigated, non-irrigated, barren etc. as per guidelines issued by Collector. Depending on area, where the EHV transmission line is passing and cost of land, this cost shall vary. In case only the area under Transmission line towers is considered for compensation, then the cost of land for area under the towers works out to 1.5% to 2.5% of cost of transmission lines (**Statement –I attached**).

13. Keeping above in view, the compensation of complete corridor along the transmission lines shall result in large increase in cost of transmission line. Keeping separate corridor for EHV transmission line may also result in non-utilization of land in the corridor for fruitful purposes and there could be chances of encroachment in the land of the corridor after construction of the transmission lines. The transmission tariff for Transmission Companies is on cost plus basis and the transmission charges are ultimately payable by the consumer of the state. Additional cost for dedicated corridor along the transmission line shall result in large burden on the consumers.

14 In view of above, MPPTCL proposed that compensation payment for RoW could be given to farmers for installation of tower (i.e. only area for tower base) by the transmission company based on guidelines of the Collector. This shall help the farmer to get cost of land used for erection of tower, as the farmer is not able to utilize the land at tower location for farming and agriculture purposes. The farmers are currently getting compensation for crop during the erection of transmission line, based on estimation by revenue authorities and the crop compensation may be continued.

15. Principal Secretary Govt of Maharashtra informed that in the state of Maharashtra using powers u/s 67(2) of the Electricity Act, Maharashtra Electricity Work of Licencees Rules, 2012 have been notified. These rules mandate the distribution and the transmission licencees to carry out works to lay down overhead or underground electric supply lines over any land or building. Collector is authorized to remove any obstacles coming in the way of execution of work. Collector has to settle the amount of compensation to be paid by licencees to the land owner. There is power given to State Electricity regulatory commission to revise the order of the Collector in case a representation is made to it by any aggrieved party.

16. MD, Mahatransco informed that it was not possible for Collector to award compensation without any specific directions or formula for working out the amount. State Government had issued an order that guides the settlement of award. But, the farmers were demanding much higher compensation than that fixed in the Government order. He said that a uniform compensation policy should be in place across States. He proposed that full cost of the land coming under the transmission towers should be awarded to the farmers and that for the corridor 10% of the land cost should be awarded. Cost could be determined as per the ready reckoner created for registration purpose.

17. Principal Secretary, Maharashtra suggested that at the Central level a uniform policy should be in place in terms of fixed percentages of market value of the land under Transmission towers and under Corridor. State could set up a Committee to settle the compensation especially in urban areas for which an appropriate mechanism for monetizing the Transfer of Development Rights (TDRs) could be developed for the cost payable by the Licencees to the State Government.

18. Principal Secretary(Power), Maharashtra further stated that progress of many transmission projects in Maharashtra has been affected due to severe RoW issues particularly in Western Maharashtra and land owners have been demanding exorbitant compensation. Therefore, there is a need for review of provision of compensation given in Electricity Act, 2003 as only crop compensation is being paid.

19. Chairperson, CEA stated that there should be uniformity in compensation paid for RoW issues in rural as well as urban area to avoid any dispute.

20 Special Secretary, MoP desired to call private developer separately to discuss the compensation issue and advised PGCIL to prepare a note on policy and practice being followed by each State for paying the compensation towards damages and formulate norms for land compensation alongwith crop compensation. CEA was advised to identify possibilty to reduce the transmission corridor width as per international practice.

21 The meeting ended with a vote of thanks to the chair.

STATEMENT-I

RoW Cost for 220 KV Ashta Indore-II line in MP

(A) ROW cost for dedicated corridor all along Transmission Line :

Sl. No.	Particular	Quantity
1	Length of line	99.69 Kms
2	Width of line for ROW corridor	35 M
3	Total land in ROW along the line	(99.69x1000x35)/10,000 = 348.9 hectare
4	Average rate of land including irrigated, non irrigated, barren etc.	Rs. 16 Lacs per hectare
5	Total value of Land for Corridor	348.9 x 16 Lacs = 55.82 Cr
6	Estimated cost of Line	56.03 Cr.
7	Percentage of compensation against estimated cost of Line	99.63%

(B) ROW cost for Tower area for Transmission Line :

Sl. No.	Particular	Quantity
1	No. of Tower location 320 Location of 150 * sq mtr area at base of tower	48000 sq mtr or 4.8 Hectare
2	Cost of Land	16 Lacs/ Hectare
3	Total value of land at tower base	76.8 Lacs
4	Estimated cost of line	Rs. 56.03 Crore
5	Percentage of compensation against estimated cost	1.5%

*based on average base area of different type of towers

Annex-I

Date/time of the meeting: 20.04.2015 at 4.30 pm
Venue: Ministry of Power, NPMC Room, Shram Shakti Bhawan, New Delhi-110001.

List of Participants

Ministry of Power

1. Shri R.N. Choubey, Special Secretary (Power) - In the chair
2. Shri S. Venkateshwarlu, Under Secretary (Trans)

Central Electricity Authority (CEA)

3. Shri Major Singh, Chairperson
   Phone : 011-26102721/Email : memberplanningcea@yahoo.com
4. Shri K.K. Arya, Chief Engineer (SP&PA)
   Phone : 26102045/Email : kkarya_2003@rediffmail.com
5. Shri B.K. Arya, Chief Engineer (IC) (PSPM)
   Mobile: 9868436594/Email: bkarya1664@gmail.com

Power Grid Corporation of India Limited (PGCIL)

6. Shri I.S. Jha, Director (Projects)
   Phone : 0124-2571930/Email : isjha@powergridindia.com
7. Dr. R.K. Srivastava, AGM (ESMD)
   Mobile : 9910378134

Govt. of Karnataka, Bengaluru

8. Shri P. Ravi Kumar, Secretary (Energy)
   Mobile : 09448124242/Email : prs-energy@karnataka.gov.in

Government of Uttar Pradesh, Lucknow

9. Shri Sanjay Agarwal, Principal Secretary (Power)
   Mobile : 09651789119/Email : sagsa50@yahoo.com

Govt. of Maharashtra/MAHATRANSCO

10. Shri Mukesh Khullar, Principal Secretary (Energy)
    Mobile : 09920066555/Email : khullarm@nic.in
11. Shri Rajeev Kumar Mital, CMD
    Phone : 022-26591253/26595000/Fax : 022-26598595
    Email : md@mahatransco.in

Government of Kerala

12. Shri Sivasankar, M., Secretary (Power)
    Mobile : 09847797000/Email : sivasankar@kseb.in

Government of Madhya Pradesh/MPPTCL, Jabalpur

13. Shri Umesh Rautji, MD
    Mobile : 09425805124

RoW COMPENSATION
And
DIMINUTION OF LAND VALUE DUE TO PLACING OF TRANSMISSION LINE / TOWER
AN OVERVIEW

LEGAL /REGULATORY FRAMEWORK FOR LAYING OF TRANSMISSION LINES

- The provisions of section 67 & 68 of the **Electricity Act, 2003** followed for laying of transmission lines and compensation thereof;
- MoP vide notification dt. 15.4.2006 notified rules for all licensees for laying of transmission lines and compensation thereof;
- The appropriate Govt. has been given powers under section 164 of the Electricity Act, 2003 to grant/vest powers of The Telegraph Act 1885 to licensees for laying of transmission lines too for proper coordination of works;
- Licensees vested with the powers of telegraph authority under section 164 of the Electricity act use provisions of **The Indian Telegraph Act, 1885** for placing of towers /lines and compensation;
- POWERGRID vested with the powers of Telegraph Authority vide MOP's Gazette Notification dated 24.12.03 under section 164 of the Electricity Act ;
- Other licensees viz. Private Entities engaged in power transmission have also been vested with such powers after complying the laid down procedure

ISSUES AGREVATING THE PROBLEM

- Handsome Compensation by Private Entity (Licensee) for Placing Tower:
  - ✓ Licensees not covered under 164 of EA, 2003 paying mutually settled compensation to the land owner for placing tower and laying of overhead transmission in accordance with MOP notification
- Damages its extent not defined for calculating compensation;
- Placement of towers/pylon require much larger land area (144 – 400 sq m) and increased Right of way extending from 27 meter to 69 meter for 132 kV to 800 kV HVDC line;
- Substantial increase in No. of Projects
- Restriction imposed for use of land under transmission line affect land value;
- Farmers getting united/forming joint front for enhanced bargaining power

State Policies Regarding Compensation

1. UPPCL:

- ✓ Cash assistance of **10%** (owners having >1 ha) **& 20%** (owners having <1 ha.) of the registered value for the area occupied by the tower.
- ✓ In case of loss of standing crop and / trees, compensation will be paid at market value of allowed to harvest the final crop.

- **Policy provisions not applied to POWERGRID and were asked to pay for both tower base @ Rs. 5 lakh for ABC type & Rs. 6 lakh for D and for 25 m wide corridor @ actual based on type of crop viz. Rs.26.57/Sq m. for S'cane.**

2. APTRANSCO:

- ✓ Exgratia at the rate of Rs 3.25 per sq.mt for the area occupied by the tower.
- ✓ In case of loss of standing crop and or trees, compensation will be paid at market value as determined by the MRO/Dept of Agriculture or allowed to harvest the final crop.

- **Policy provisions not applied to POWERGRID and were asked to pay for both tower base @ 60% of market value.**

3. Maharashtra:

- ✓ As per classification mentioned below and land used by the tower (by not acquiring the proposed land) and as per prevailing market rate of the proposed land

Land Classification	Type of land	Compensation to be paid
A	Non Cultivable agricultural land	25%
B	Cultivable agricultural land	50%
C	Fruit bearing agricultural land	60%
D	Non agricultural land	66%

- ☐ **Not applied to POWERGRID lines In case of Solapur-Pune, Pune-Parli lines and were asked to pay additional compensation for tower base Rs. 7.5-9 lakhs and corridor Rs. 3-4 lakh to all farmers whose land falls between two towers.**

4. Chhattisgarh*:

- ✓ 50% of land cost for tower base;
- ✓ 20% of land value for corridor restricting to outer point of conductor

* Not applicable to distribution lines

VARIOUS COURT DIRECTIVES / JUDGMENTS

Kerala High Court in their various orders opined that owner can claim compensation for diminishing of land value subject to certain conditions.

Such judgment / orders were challenged in the Hon'ble Supreme Court (SC) and got stayed.

SC observed that there can be no fix formula or policy to arrive the rate of compensation and is of the view that each case is required to be taken on its own merit on following parameters:

- ✓ situation of land;
- ✓ distance between high voltage electricity line laid there over
- ✓ extent of the line there on as also the fact whether the high voltage line passes over a small track of land or through the middle of the land and other similar relevant factors
- ✓ The land value is also a relevant factor and whether the owner of the land losses its substantial right to use the property.

The case still pending with Kerala High Court for final judgment.

RECENT DEVELOPMENTS

- ✓ Government of Kerala addressing similar problem in POWERGRID lines associated with Kudankulam transmission system issued series of Government Order (G.O.) directing POWERGRID to pay compensation towards damages caused at each tower location in addition to normal crop/tree compensation and have framed a criteria for considering some percentage of prevailing land value (5 times of fair value) in the district as a basis for calculating such damages by the District Collector/Revenue Authority.
- ✓ The SC order dated May 8, 2009 in writ petition filed by a Private company against POWERGRID also deals with the issue of compensation and as per this order compensation as per the provision of Section 10'(d)' of Indian Telegraph Act, 1885 are due to land owner on whose land the tower has been placed.
- ✓ District Magistrate of Kutch, Gujarat on representation of affected persons ordered POWERGRID to pay addl. Compensation vide its order dt.25.03.10 @ of Rs. 1 lakh for A type tower, Rs.1.10 lakh for B type tower, Rs. 1.25 lakh for C type of tower and Rs. 1.40 lakh for D type of tower for lines associated with Mundra UMPP.

RECENT DEVELOPMENTS

- ✓ Collector Visakhapatnam, Andhra Pradesh vide its order dt. 21.10.10 has awarded to land owners an additional compensation towards land damages @ 60% of basic land value considering that such damages are covered under damages as contained in the Section 10'(d)' of Indian Telegraph Act, 1885.
- ✓ District Magistrate, Nellore vide order dated 24.08.2013 for 400 KV D/c Vijaywada-Nellore and Nellore-Thiruvallam transmission line fixed compensation amount Rs. 3,50,000 per tower location to farmers in Nellore district for all towers of 400/765 kV lines.
- ✓ DC, South District, Sikkim ordered for payment of complete land value and surface damages as compensation and levied 35 years value of yield as compensation towards crop damages and 8 years yield for fruit bearing trees.
- ✓ District Magistrate, Tumkur vide order dated 08.07.2014 for tower base.

Category of tower Structure	Compensation Amount Decided
Category A	Rs. 2.25 lakhs
Category B	Rs. 2.50 lakhs
Category C	Rs. 2.75 lakhs
Category D	Rs. 7.00 lakhs

- ✓ The additional compensation of Rs. 2.00 Lakh per acre each to land owners for damages to land during stringing;
- ✓ Different rates for trees with 10% exgratia.

RECENT DEVELOPMENTS

✓ **District Magistrate, Ranga Reddy vide** order dt.08.08.2014 for 400 KV D/C Suryapet - Shankarpally line of TRANSCO with following compensation

A. **For Tower base:**

Type of Land	Category-I Area of damage up to 350 sq. yds. (A, B & C Type tower)	Category-II Area of damage above 350 sq. yds. (D Type tower)
a) Land facing to Highways. (up to 0.5 km distance) b) Nearer to the Housing layouts/Industrial Areas/ Commercially developed Areas c) Land through which more than one transmission line is passing Rate @Rs. 1000/- per sq. yds.	Rs. 3.5 lakh per tower	Rs. 4.5 lakh per tower
Interior Lands (All other lands) Rate@Rs. 700 per sq yds.	Rs. 2.45 lakh per tower	Rs. 3.15 lakh per tower

B. **For line Corridor:**

Damage in 20 meter (10 meters on either side from the centre of the line), at Rs. 60 per sq. meter

OPINION OF ATTORNEY GENERAL OF INDIA

- ❑ It is logical to hold that the land underneath the legs of the tower (permanently fixed to the earth) is permanently lost by the owner. Even though those pieces of land are not required for acquisition and the ownership remains with the owner yet all incidence of the ownership, enjoyment and free use of those pieces of land becomes severely restricted. In such case, compensation ought to be as near as the present value of the land.

- ❑ The compensation of land under the corridor is entirely different. Such land is conveniently usable for agriculture. However, there would be of course diminution of land value due to placing of line over it with certain restriction on land use and also any future prospects for usage other than agriculture. The compensation for such diminution in land value for the line corridor is also payable to land owners, quantum of which should commensurate to the damage depending upon the type/location of land and its intended/recorded land use.

- ❑ In case of Residential / Industrial area, there is severe restriction on usage for safety of human life & electrical clearance hence compensation need to be commensurate with the damages.

PROPOSAL OF POWERGRID

- Provisions of act provides compensation only towards damages and there is no mention for compensation towards diminution of land value explicitly though it is a reality.

- In absence of clarity and notified procedures, the provisions of existing acts are being differently interpreted by concerned DC/Revenue Authorities that too varies/fluctuate heavily thus causing unrest and delay in resolving RoW issue resulting in delay.

- POWERGRID in order to resolve this issue in line with AG's opinion proposes that MoP by amending rules framed under section 67 of EA act may provide for a following standard minimum compensation to be paid by all licensee.

  - shall pay 100% cost of land for tower base area as compensation based on the market rate as ascertain by the local Revenue Authorities;
  - shall also pay 10% land value* (of ascertained rate) for line corridor (RoW) towards land value diminution;
  - The respective DC/DM or their authorized representatives shall complete above evaluation of compensation within 30 days.

* **In case enhanced demand by land owners the respective State may review it and if found justified may pay from own resources directly as has been agreed by the State of Kerala.**

Impact on tariff due to Tower Base & RoW Corridor Compensation @ 10%
Compensation @ 15 Lakhs/ acre (Mostly agricultural land in rural setting)

Voltage	Cost/km (Rs. in Lakh)	Tariff on capital cost (Rs. in Cr) @ average 18%	Comp'tion cost for tower base/ km (Rs. in Lakh)	Compensation cost for RoW Corridor (Rs. in Lakh)	Total addl. Comp'tion for 1 km (T base & Corridor) (Rs. in Lakh)	Additional Compensation for 100 km line (Rs. in Lakh)	Revised Capital Cost of 100 km Line (Rs. in Cr)	Tariff on revised capital cost (Rs. in Cr)	% Increase in Tariff
400 KV D/c Twin	140	25.2	15 X 0.172 = 2.58	11.19 X 1.5 = 16.785	2.58 + 16.785 = 19.365	1936.5	159.38	28.68	13.8%
400 KV D/c Quad	250	45	15 X 0.172 = 2.58	11.19 X 1.5 = 16.785	2.58 + 16.785 = 19.365	1936.5	269.38	48.49	7.7%
400 KV D/c HTLS	340	61.2	15 X 0.172 = 2.58	11.19 X 1.5 = 16.785	2.58 + 16.785 = 19.365	1936.5	359.38	64.69	5.69%
765 KV D/c	458	82.44	15 X 0.414 = 6.21	16.135 X 1.5 = 24.2025	6.21 + 24.2025 = 30.4125	3041.25	488.41	87.91	6.63%

Voltage	Land area for tower base per km (1 Acre = 4047 Sq. m.)	Total RoW Corridor area required for 1 km line (1 ha = 2.47 Acres)
400 KV D/C	2.5 X 278.89 = 697.225 Sq. m. = 0.172 Acres	4.6 X 1 = 4.6 ha = 11.362 Acres
765 KV D/C	2.5 X 670.81 = 1677.025 Sq. m. = 0.414 Acres	6.7 X 1 = 6.7 ha = 16.549 Acres

Impact on tariff due to Tower Base & RoW Corridor Compensation @ 10%

Compensation @ 25 Lakhs/ acre (Mostly Urban/Semi-urban land near Cities/Towns)

Voltage	Cost/km (Rs. in Lakh)	Tariff on capital cost (Rs. in Cr) @ average 18%	Comp'tion cost for tower base/ km (Rs. in Lakh)	Compensation cost for RoW Corridor (Rs. in Lakh)	Total addl. Comp'tion for 1 km (T base & Corridor) (Rs. in Lakh)	Additional Compensation for 100 km line (Rs. in Lakh)	Revised Capital Cost of 100 km Line (Rs. in Cr)	Tariff on revised capital cost (Rs. in Cr)	% Increase in Tariff
400 KV D/c Twin	140	25.2	25 X 0.172 = 4.3	11.19 X 2.5 = 27.975	4.3 + 27.975= 32.275	3227.5	172.28	31.01	23.1%
400 KV D/c Quad	250	45	25 X 0.172 = 4.3	11.19 X 2.5 = 27.975	4.3 + 27.975= 32.275	3227.5	282.28	50.81	12.9%
400 KV D/c HTLS	340	61.2	25 X 0.172 = 4.3	11.19 X 2.5 = 27.975	4.3 + 27.975= 32.275	3227.5	372.28	67.01	9.49%
765 KV D/c	458	82.44	25 X 0.414 = 10.35	16.135 X 2.5 = 40.337	10.35+40.337 5 = 50.6875	5068.75	508.88	91.56	11.06%

Impact on tariff due to Tower Base & RoW Corridor Compensation @ 10%

Compensation @ 50 Lakhs/ acre (Mostly Urban land near Big Cities/Metro Towns)

Voltage	Cost/km (Rs. in Lakh)	Tariff on capital cost (Rs. in Cr) @ average 18%	Comp'tion cost for tower base/ km (Rs. in Lakh)	Compensation cost for RoW Corridor (Rs. in Lakh)	Total addl. Comp'tion for 1 km (T base & Corridor) (Rs. in Lakh)	Additional Compensation for 100 km line (Rs. in Lakh)	Revised Capital Cost of 100 km Line (Rs. in Cr)	Tariff on revised capital cost (Rs. in Cr)	% Increase in Tariff
400 KV D/c Twin	140	25.2	11.19 X 5 = 55.95	8.6 + 55.95= 64.55	5455	3227.5	204.55	36.82	46.1%
400 KV D/c Quad	250	45	11.19 X 5 = 55.95	8.6 + 55.95= 64.55	5455	3227.5	314.55	56.62	25.8%
400 KV D/c HTLS	340	61.2	11.19 X 5 = 55.95	8.6 + 55.95= 64.55	5455	3227.5	404.55	72.82	18.99%
765 KV D/c	458	82.44	16.135 X 5 = 80.675	20.7+80.675 = 101.375	10137.5	5068.75	656.88	118.24	22.12%

THANKS

PROVISIONS OF ELECTRICITY ACT, 2003 Part-VIII,
SECTION 67 & 68

Section 67 (3-5):
Quote:

(3) A licensee shall, in exercise of any of the powers conferred by or under this section and the rules made thereunder, **cause as little damage, detriment and inconvenience as may be, and shall make full compensation** for any damage,detriment or inconvenience caused by him or by any one employed by him.

(4) Where any difference or dispute [including amount of compensation under sub -section (3)] arises under this section, the matter shall be determined by the Appropriate Commission.

(5) The Appropriate Commission, while determining any difference or dispute arising under this section in addition to any compensation under sub-section (3), may impose a penalty not exceeding the amount of compensation payable under that sub-section.

Section 68 (5 & 6):

(5) Where any tree standing or lying near an overhead line or where any structure or other object which has been placed or has fallen near an overhead line subsequent to the placing of such line, interrupts or interferes with, or is likely to interrupt or interfere with, the conveyance or transmission of electricity or the accessibility of any works, **an Executive Magistrate or authority specified by the Appropriate Government may, on the application of the licensee, cause the tree, structure or object to be removed or otherwise dealt with as he or it thinks fit.**

(6) When disposing of an application under sub-section (5), an Executive Magistrate or authority specified under that sub-section shall, in the case of any tree in existence before the placing of the overhead line, award to the person interested in the tree **such compensation as he thinks reasonable**, *and such person may recover the same from the licensee*

Explanation. - For purposes of this section, the expression ? tree? shall be deemed to include any shrub, hedge, jungle growth or other plant.

Unquote.

GOVERNMENT OF INDIA
MINISTRY OF POWER

New Delhi, the 18th April 2006.

NOTIFICATION

G.S.R 217(E). - In exercise of the powers conferred by clause (e) of sub-section (2) of section 176 read with sub-section (2) of section 67 of the Electricity Act, 2003 (36 of 2003), the Central Government hereby makes the following rules regarding the works of licensees, namely :-

1. Short title and commencement. (1) These rules may be called the Works of Licensees Rules, 2006.

2. Definitions- (1) In these rules unless the context otherwise requires

(a) 'The Act' means the Electricity Act, 2003.
(b) 'occupier' of any building or land means a person in lawful occupation of that building or land.

(2) All other words and expression used herein and not defined in these rules, shall have the meanings respectively assigned to them in the Act.

3. Licensee to carry out works. - (1) A licensee may -

(a) carry out works, lay down or place any electric supply line or other works in, through, or against, any building, or on, over or under any land whereon, wherever or whereunder any electric supply-line or works has not already been lawfully laid down or placed by such licensee with the prior consent of the owner or occupier of any building or land;

(b) fix any support of overhead line or any stay or strut required for the purpose of securing in position any support of an overhead line on any building or land or having been so fixed, may alter such support.

(2) When making an order under sub-rule (1), the District Magistrate or the Commissioner of Police or the officer so authorised, as the case may be, shall fix , after considering the representations of the concerned persons, if any, **the amount of compensation or of annual rent, or of both, which should in his opinion be paid by the licensee to the owner or occupier.**

(3) Every order made by a District Magistrate or a Commissioner of Police or an authorised officer under sub-rule (1) shall be subject to revision by the Appropriate Commission.

(4) Nothing contained in this rule shall effect the powers conferred upon any licensee under section 164 of the Act.

PROVISIONS OF TELGRAPH ACT FOR COMPENSATION:

The Indian Telegraph Act, 1885, Part-III, Section 10:

Quote:

10. Power for telegraph authority to place and maintain telegraph lines and posts – The telegraph authority may, from time to time, place and maintain a telegraph line under, over, along, or across, and posts in or upon any immovable property. Provided that –

(a)) the telegraph authority shall not exercise the powers conferred by this section except for the purposes of a telegraph established or maintained by the [Central Government], or to be so established or maintained;

(b) the [Central Government] **shall not acquire any right other than that of user only** in the property under, over, along, across in or upon which the telegraph authority places any telegraph line or post; and

(c) except as hereinafter provided, the telegraph authority shall not exercise those powers in respect of any property vested in or **under the control or management of any local authority, without the permission of that authority**; and

(d) in the exercise of the powers conferred by this section, the telegraph authority shall do as little damage as possible, and, when it has exercised those powers in respect of any property other than that referred to in clause (c), **shall pay full compensation to all persons interested for any damage sustained** by them by reason of the exercise of those powers.

Section 16:

(1) If the exercise of the powers mentioned in section 10 in respect of property referred to in clause (d) of that section is resisted or obstructed, the **District Magistrate may, in his discretion, order that the telegraph authority shall be permitted to exercise them:**

(2) If, after the making of an order under sub section (1), any person resists the exercise of those powers, or, having control over the property, does not give all facilities for this being exercised, he shall be **deemed to have committed an offence under section 188 of the Indian Penal Code (45 of 1860).**

Unquote.

Annex-IV

No.3/7/2015-Trans
Government of India
Ministry of Power
Shram Shakti Bhawan, Rafi Marg,
New Delhi-110001

Dated, 8th May, 2015

Office Memorandum

Sub: Minutes of the meeting held on 30.04.2015 under the chairmanship of Shri R.N. Choubey, Special Secretary, Ministry of Power regarding finalization of compensation in regard to Right of Way for transmission lines.

****

The undersigned is directed to forward herewith a copy of the minutes of meeting taken by Shri R.N. Choubey, Special Secretary, Ministry of Power on 30.4.2015 on the above mentioned subject, for information and necessary action.

(S. Venkateshwarlu)
Under Secretary (Trans)
E-mail: transdesk-mop@nic.in
Telefax: 011-2332 5242

To

1. Chairperson, Central Electricity Authority, New Delhi
2. Principal Secretary/ Secretary (Energy), Madhya Pradesh
3. Principal Secretary/ Secretary (Energy), U.P.
4. Principal Secretary/ Secretary (Energy), Maharashtra
5. Principal Secretary/ Secretary (Energy), Karnataka
6. Principal Secretary/ Secretary (Energy), Kerala
7. CMD/Director (Projects), PGCIL
8. Shri K.K.Arya, Chief Engineer, Chief Engineer (SP&PA), CEA, New Delhi.

Copy to Sr.PPS to SS (RNC)/ JS(Trans) / Director (Trans)/ US (Trans)

Minutes of the meeting taken by Shri R.N. Choubey, Special Secretary, Ministry of Power (MoP) on 30.4.2015 regarding finalization of compensation in regard to Right of Ways (RoW) for transmission line

List of participant is given at **Annex-I**

2. Special Secretary, MoP welcomed the participants and informed that in the last meeting held on 20.04.2015 two views were immersed as under:

(i) 100 % compensation for land should be paid for tower footing and 10% for corridor under the line.

(ii) Policy should not be changed as state authority is solving the compensation issues and it will also affect the financial viability of transmission projects.

2.1 Special Secretary, MoP has requested Director (Projects), PGCIL to present brief on policy and practice being followed by the State for paying the compensation towards damages as discussed in last meeting.

3. Director (Projects), PGCIL presented a detailed presentation including Legal & Regulatory framework about the compensation, policies of various States as well as the brief on the Supreme Court order on compensation issues and various other orders of different DMs/DCs regarding compensation and interpretation of present clause(copy of presentation **attached**).

4 The summary of AG's opinion on legal position and coverage/inclusions of various aspects while deciding compensation including land value diminution was also informed by POWERGRID.

5. Members also discussed about the requirement of prior approval of appropriate government under Section 68(1) of Electricity Act as in their opinion all due diligence is applied during the process of grant of License.

6 PGCIL's proposal regarding full compensation for tower base and at least 10% for RoW Corridor was also discussed in detail.

7 The private entities, M/s. Sterlite and M/s.Essel infra also emphasized that there should be a standard norms for calculating compensation for transmission line and it should also be revised, reviewed periodically for its regular updation keeping in mind the market rate. M/s Sterlite also suggested that instead of land cost, corridor compensation per km rate may be fixed based on voltage of line.

8. Chairperson, CEAinformed that possibility of reduction in RoW width is minimal as it has already been fixed based on the required Electricity Safety norms.

9 The Committee also opined that payment of full value of land cost tower base seems justified due to severe restriction put in by placing of tower which heavily impact the productivity/use of land area falling below tower base.

-2/-

10 Principal Secretary (Power), U.P. however, expressed his reservation and stated thatpayment of 100% compensation for the tower base without acquisition of land may be a difficult proposition due to ongoing complication regarding compensation under new Land Acquisition Act.

11 Principal Secretary (Power),U.P. and Principal Secretary (Power),M.P expressed their apprehension about the proposal of RoW Corridor payment as in their view such payment may also hamper the implementation of distribution lines and may also put additional financial burden on distribution company. Moreover they were also of the opinion that we may not be able to resolve compensation issue by paying 10% as in all probabilities the farmers/land owners will demand more as has already been stipulated in the different State policies and DCs orders.

12. Due to sensitivity of the proposal and its implementation by the different State Govt., it was decided that this issue may also be discussed during the forthcoming Power Secretaries meetings for wider consultation and acceptance and POWERGRID was advised to prepare a detailed agenda note in this regard.

Annex-I
No.3/7/2015-Trans

Date/time of the meeting: 30.04.2015 at 3.00 pm
Venue: Ministry of Power, NPMC Room, Shram Shakti Bhawan, New Delhi-110001

List of Participants

Ministry of Power

1. Shri R.N. Choubey, Special Secretary (Power) - In the chair
2. Smt. Jyoti Arora, Joint Secretary (Trans)
3. Shri Ghanshyam Prasad, Director (Trans)
4. Shri S. Venkateshwarlu, Under Secretary (Trans)

Central Electricity Authority (CEA)

5. Shri Major Singh, Chairperson
   Phone : 011-26102721/Email : memberplanningcea@yahoo.com
6. Shri K.K. Arya, Chief Engineer (SP&PA)
   Phone : 26102045/Email : kkarya_2003@rediffmail.com
7. Shri B.K. Arya, Chief Engineer (IC) (PSPM)
   Mobile: 9868438594/Email: bkarya1664@gmail.com

Power Grid Corporation of India Limited (PGCIL)

8. Shri I.S. Jha, Director (Projects)
   Phone : 0124-2571930/Email : isjha@powergridindia.com
9. Dr. R.K. Srivastava, AGM (ESMD)
   Mobile : 9910378134/Email : rks@powergridindia.com

Govt. of Karnataka, Bengaluru

10. Shri P. Ravi Kumar, Secretary (Energy)
    Mobile : 09448124242/Email : prs-energy@karnataka.gov.in

Government of Uttar Pradesh, Lucknow

11. Shri Sanjay Agarwal, Principal Secretary (Power)
    Mobile : 09651789119/Email : sagsal50@yahoo.com
12. Shri Shrikrishna, CE(TW), Meerut
    Mob:09412749801/Email : cetw@upptcl.org

Govt. of Maharashtra/MAHATRANSCO

13. Shri Rajeev Kumar Mital, CMD
    Phone : 022-26591253/26595000/Fax : 022-26598595
    Email : md@mahatransco.in

Government of Kerala

14. Shri Sivasankar, M., Secretary (Power)
    Mobile : 09847797000/Email : sivasankar.s@kseb.in

Government of Madhya Pradesh/MPPTCL, Jabalpur

15. Shri I.C.P. Keshari, Principal Secretary (Energy)
    Mobile : 09425234800
16. Shri R. Seth, C.E. (Planning & Design)
    Mobile : 09425805228/Email : ceps321@yahoo.com
17. Shri M.M. Dhoke, SE (PSS)
    Mobile : 09425805237/Email : ceps321@yahoo.com

Sterlite Grid Limited (SGL)

18. Shri Ajay Bhardwaj, Business Head
    Mobile : 9810446758
19. Shri T.A. Reddy, V.P.
    Mobile: 9310490978/Email: tan.reddy@sterlite.com

Essel Infra (DMTCL)

20. Shri Sudip Dutta
    Mobile : 9650516244/Email : sudipdutta@esselinfraproject.com
21. Shri Rajnish Mahajan, Essel Infra (NRSS-XXXI (B)
    Mobile : 8558889504/Email : rajnish.mahajan@infra.esselgroup.com

RoW COMPENSATION
And
DIMINUTION OF LAND VALUE DUE TO PLACING OF TRANSMISSION LINE / TOWER
AN OVERVIEW

LEGAL AND REGULATORY FRAMEWORK FOR IMPLEMENTATION OF TRANSMISSION PROJECT AND COMPENSATION.

- Prior Permission of Appropriate Govt. under **Section-68 (1)**;
- **Obtain License** from Appropriate Commission under **Section 14**;
- **Central Transmission Utility (CTU)** and **State Transmission Utility (STU)** are deemed to be a transmission licensee under this Act.
- The appropriate Govt. has powers under **Section 164** to grant/vest powers of The Telegraph Act 1885 to Licensees for laying of transmission lines too for proper coordination of works.
- Licensees vested with the powers of telegraph authority under **Section 164** of the Electricity act use provisions of **The Indian Telegraph Act, 1885** for placing of towers /lines and compensation.
- Other licensees viz. Private Entities engaged in power transmission have also been vested with such powers after complying the laid down procedure.
- The Central Government may, by notification, make rules under **Section 176(1 & 2 (e)}**for carrying out the provisions of this Act;
  - (e) the works of licensees affecting the property of owner or occupier under sub-section (2) of section 67;

PROVISIONS OF ELECTRICITY ACT, 2003 Part VIII,SECTION 67 & 68

Section 67 (2-5):
Quote:

(2) The Appropriate Government may, by rules made by it in this behalf, specify:

(a) the cases and circumstances in which the consent in writing of the Appropriate Government, local authority, owner or occupier, as the case may be, shall be required for carrying out works;
(b) the authority which may grant permission in the circumstances where the owner or occupier objects to the carrying out of works;
(c) the nature and period of notice to be given by the licensee before carrying out works;
(d) the procedure and manner of consideration of objections and suggestions received in accordance with the notice referred to in clause (c);
(e) the determination and payment of compensation or rent to the persons affected by works under this section.

→ **MoP vide notification dt. 18.4.2006 notified rules for all licensees for laying of transmission lines and compensation thereof.**

(3) A licensee shall, in exercise of any of the powers conferred by or under this section and the rules made thereunder, cause as little damage, detriment and inconvenience as may be, and shall make full compensation for any damage, detriment or inconvenience caused by him or by any one employed by him.

(4) Where any difference or dispute (including amount of compensation under sub-section (3)) arises under this section, the matter shall be determined by the Appropriate Commission.

The Appropriate Commission, while determining any difference or dispute arising under this section in addition to any compensation under sub-section (3), may impose a penalty not exceeding the amount of compensation payable under that sub-section.

Section 68 (5 & 6):

(5) Where any tree standing or lying near an overhead line or where any structure or other object which has been placed or has fallen near an overhead line subsequent to the placing of such line, interrupts or interferes with, or is likely to interrupt or interfere with, the conveyance or transmission of electricity or the use, to interrupt or interfere with, the conveyance or transmission of electricity or the accessibility of any works, an Executive Magistrate or authority specified by the Appropriate Government may, on the application of the licensee, cause the tree, structure or object to be removed or otherwise dealt with as he or it thinks fit.

2

(6) When disposing of an application under sub section (5) an Executive Magistrate or authority specified under that sub-section shall, in the case of any tree in existence before the placing of the overhead line, award to the person interested in the tree such compensation as he thinks reasonable, and such person may recover the same from the licensee.

Explanation. - For purposes of this section, the expression "tree" shall be deemed to include any shrub, hedge, jungle growth or other plant.

PROVISIONS OF TELGRAPH ACT FOR COMPENSATION: COMPENSATION ISSUES ARE DEALT IN SECTION-10 OF THE ACT

The Indian Telegraph Act, 1885 Part-III. Section 10:

10. Power for telegraph authority to place and maintain telegraph lines and posts. - The telegraph authority may, from time to time, place and maintain a telegraph line under, over, along, or across, and posts in or upon any immovable property:

Provided that –

(a) the telegraph authority shall not exercise the powers conferred by this section except for the purposes of a telegraph established or maintained by the [Central Government], or to be so established or maintained;

(b) the [Central Government] shall not acquire any right other than that of user only in the property under, over, along, across, in or upon which the telegraph authority places any telegraph line or post; and

(c) except as hereinafter provided, the telegraph authority shall not exercise those powers in respect of any property vested in or under the control or management of any local authority, without the permission of that authority; and

(d) in the exercise of the powers conferred by this section, the telegraph authority shall do as little damage as possible, and, when it has exercised those powers in respect of any property other than that referred to in clause (c), shall pay full compensation to all persons interested for any damage sustained by them by reason of the exercise of those powers.

Section 16:

(1) If the exercise of the powers mentioned in section 10 in respect of property referred to in clause (d) of that section is resisted or obstructed, the District Magistrate may, in his discretion, order that the telegraph authority shall be permitted to exercise them.

(2) If, after the making of an order under sub section (1), any person resists the exercise of those powers, or having control over the property, does not give all facilities for this being exercised, he shall be deemed to have committed an offence under section 188 of the Indian Penal Code (45 of 1860).

ISSUES AGREVATING THE PROBLEM

- Damages its extent not defined for calculating compensation;
- Substantial increase in No. of Projects;
- Placement of towers/pylon require much larger land area (144 – 400 sq m) and increased Right of way extending from 27 meter to 69 meter for 132 kV to 800 kV HVDC line;
- Restriction imposed for use of land under transmission line affect land value;
- Farmers getting united/forming joint front for enhanced bargaining power ;
- Activist and NGOs intervention.

State Policies Regarding Compensation

1. UPPCL:

- Cash assistance of **10%** to owners having < 1 bigha & **20%** to owners having >1 bigha of the registered value for the area occupied by the tower.
- In case of loss of standing crop and / trees, no compensation will be paid at market value allowed to harvest the final crop.

- POWERGRID in western UP asked to pay for both tower base @ Rs. 5 lakh for ABC type & Rs. 8 lakh for D and for 25 m wide corridor still work heldup

2. APTRANSCO:

- Payable at the rate of Rs 3.25 per sq m for the area occupied by the tower.
- In case of loss of standing crop and or trees, compensation will be paid at market value as determined by the MRO/Dept of Agriculture or allowed to harvest the final crop.

- POWERGRID asked by DM V patnam to pay for tower base @ 60% of market value and for Vijayawada-Nellore line asked to pay huge compensation for corridor too in Vijayawada area.

3. Maharashtra:

- ✓ As per classification mentioned below and land used by the tower (by not acquiring the proposed land) and as per prevailing market rate of the proposed land

Land Classification	Type of land	Compensation to be paid
A	Non Cultivable agricultural land	25%
B	Cultivable agricultural land	50%
C	Fruit bearing agricultural land	80%
D	Non-agricultural land	85%

❑ In case of Solapur-Pune, Pune-Parli lines and were asked to pay additional compensation for tower base Rs. 7.5-9 lakhs and corridor Rs. 3-4 lakh to all farmers whose land falls between two towers.

4. Chhattisgarh*:

- ✓ 50% of land cost for tower base,
- ✓ 20% of land value for corridor restricting to outer point of conductor.

* Not applicable to distribution lines

VARIOUS COURT DIRECTIVES / JUDGMENTS

Kerala High Court in their various orders opined that owner can claim compensation for diminishing of land value subject to certain conditions.

Such judgment / orders were challenged in the Hon'ble Supreme Court (SC) and got stayed.

SC observed that there can be no fix formula or policy to arrive the rate of compensation and is of the view that each case is required to be taken on its own merit on following parameters:

- ✓ situation of land;
- ✓ distance between high voltage electricity line laid there over
- ✓ extent of the line there on as also the fact whether the high voltage line passes over a small track of land or through the middle of the land and other similar relevant factors
- ✓ The land value is also a relevant factor and whether the owner of the land losses its substantial right to use the property

The case still pending with Kerala High Court for final judgment

RECENT DEVELOPMENTS

- Government of Kerala addressing similar problem in POWERGRID lines associated with Kudankulam transmission system issued series of Government Order (G.O.) directing POWERGRID to pay compensation towards damages caused at each tower location in addition to normal crop/tree compensation and have framed a criteria for considering some percentage of prevailing land value (5 times of fair value) in the district as a basis for calculating such damages by the District Collector/Revenue Authority.
- The SC order dated May 8, 2009 in writ petition filed by a Private company against POWERGRID also deals with the issue of compensation and as per this order compensation as per the provision of Section 10 (d) of Indian Telegraph Act, 1885 are due to land owner on whose land the tower has been placed.
- District Magistrate of Kutch, Gujarat on representation of affected persons ordered POWERGRID to pay addl. Compensation vide its order dt.25.03.10 @ of Rs. 1 lakh for A type tower, Rs 1.10 lakh for B type tower, Rs. 1.25 lakh for C type of tower and Rs. 1.40 lakh for D type of tower for lines associated with Mundra UMPP.

RECENT DEVELOPMENTS

- Collector Visakhapatnam, Andhra Pradesh vide its order dt. 21.10.10 has awarded to land owners an additional compensation towards land damages @ 60% of basic land value considering that such damages are covered under damages as contained in the Section 10(d) of Indian Telegraph Act, 1885.
- District Magistrate, Nellore vide order dated 24.08.2013 for 400 KV D/c Vijaywada-Nellore and Nellore-Chennai transmission line fixed compensation amount Rs. 3,50,000 per tower location to farmers in Nellore district for all towers of 400/765 kV lines.
- DC, South District, Sikkim ordered for payment of complete land value and surface damages as compensation and extra 35 years value of yield as compensation towards crop damages and 8 years yield for fruit bearing trees.
- District Magistrate, Tumkur, vide order dated 08.07.2014 for tower base

Category of Tower Structure	Compensation Amount Decided
Category A	Rs. 2.75 lakhs
Category B	Rs. 2.50 lakhs
Category C	Rs. 1.50 Lakhs
Category D	Rs. 1.07 lakhs

- The additional compensation of Rs. 2.00 Lakh per acre each to land owners for damages to land during stringing.
- Different rates for trees with 10% ex-gratia.

RECENT DEVELOPMENTS

✓ **District Magistrate, Ranga Reddy vide** order dt.08.08.2014 for 400 KV D/C Suryapet - Shankarpally line of TRANSCO with following compensation

A. For Tower base:

Type of Land	Category-I Area of damage up to 350 sq. yds. (A, B & C Type tower)	Category II Area of damage above 350 sq. yds. (D Type tower)
a) Land facing to Highways (up to 0.5 km distance). b) Abutting to the Housing layouts/Urban Areas/ Commercially developed Areas c) Land through which more than one transmission line is passing Rate @Rs. 1000/- per sq. yds	Rs. 5.0 lakh per tower	Rs. 4.5 lakh per tower
Interior Lands (All other lands) Rate@Rs. 700 per sq yds	Rs. 2.45 lakh per tower	Rs. [illegible] lakh per tower

B. For line Corridor:

Damage in 20 meter (10 meters on either side from the centre of the line) at Rs. 6[illegible] per sq. meter

OPINION OF ATTORNEY GENERAL OF INDIA

- It is logical to hold that the land underneath the legs of the tower (permanently fixed to the earth) is permanently lost by the owner. Even though those pieces of land are not required for acquisition and the ownership remains with the owner yet all incidence of the ownership, enjoyment and free use of those pieces of land becomes severely restricted. In such case, compensation ought to be as near as the present value of the land.

- The compensation of land under the corridor is entirely different. Such land is conveniently usable for agriculture. However, there would be of course diminution of land value due to placing of line over it with certain restriction on land use and also any future prospects for usage other than agriculture. The compensation for such diminution in land value for the line corridor is also payable to land owners, quantum of which should commensurate to the damage depending upon the type/location of land and its intended/recorded land use.

- In case of Residential / Industrial area, there is severe restriction on usage for safety of human life & electrical clearance hence compensation need to be commensurate with the damages

PROPOSAL OF POWERGRID

- Provisions of act provides compensation only towards damages and there is no mention for compensation towards diminution of land value explicitly though it is a reality.
- In absence of clarity and notified procedures, the provisions of existing acts are being differently interpreted by concerned DC/Revenue Authorities that too varies/fluctuate heavily. Thus causing unrest and delay in resolving RoW issue resulting in delay.
- POWERGRID in order to resolve this issue in line with AG's opinion proposes that MoP by amending rules framed under section 67 of EA act may provide for a following standard minimum compensation to be paid by all licensee.
  - 100% cost of land for tower base area as compensation based on the market rate as ascertained by the local Revenue Authorities.
  - Certain % say 10% (land value) of ascertained rate for line corridor (RoW) towards land value diminution.
  - The respective DC/DM or their authorized representatives shall complete above evaluation of compensation within 30 days.
  - In case enhanced demand by land owners the respective State may review it and if found justified may pay from own resources directly as has been agreed by the State of Kerala.

Impact on tariff due to Tower Base & RoW Corridor Compensation @ 10%

Compensation @ 15 Lakhs/ acre (Mostly agricultural land in rural setting)

Voltage	Cost/km (Rs. in Lakh)	Tariff on capital cost (Rs. in Cr) @ average 18%	Comp'tion cost for tower base/ km (Rs. in Lakh)	Compensation cost for RoW Corridor (Rs. in Lakh)	Revised Capital Cost of 100 km Line (Rs. in Cr)	Tariff on revised capital cost (Rs. in Cr)	% increase in Tariff
400 KV D/c Twin	146	[illegible]	[illegible] 2.58	[illegible] 16.785	[illegible]	[illegible]	13.8[illegible]%
400 KV D/c Quad	[illegible]	[illegible]	[illegible] 2.88	[illegible] 16.785	[illegible]	[illegible]	7.7[illegible]%
400 KV D/c HTLS	[illegible]	[illegible]	[illegible] 7.20	[illegible] 16.785	[illegible]	[illegible]	[illegible]
765 KV D/c	[illegible]	[illegible]	15 X 0.414 = [illegible]	[illegible] X 1.5 = 24.2023	[illegible]	[illegible]	[illegible]

Voltage	Land area for tower base [illegible]	Total RoW corridor area [illegible]
400 KV D/c	[illegible] Acres	[illegible] Acres
765 KV D/c	[illegible] Acres	[illegible] Acres

Impact on tariff due to Tower Base & RoW Corridor Compensation @ 10%

Compensation @ 26 Lakhs/ acre (Mostly Urban/Semi-urban land near Cities/Towns)

Voltage	Cost/km (Rs. in Lakh)	Tariff on capital cost (Rs. in Cr) @ average 15%	Compn cost for tower base/ km (Rs. in Lakh)	Compensation cost for RoW Corridor (Rs. in Lakh)	Revised Capital Cost of 100 km Line (Rs. in Cr)	Tariff on revised capital cost (Rs. in Cr)	% Increase in Tariff
400 KV D/c Twin	[illegible]	25.2	[illegible] 4.3	11.19 X 2.5 = 27.975	172.28	[illegible]	23.1%
400 KV D/c Quad	[illegible]	[illegible]	[illegible] 4.3	11.19 X 2.5 = 27.975	202.28	[illegible]	12.9%
400 KV D/c HTLS	340	51.3	[illegible] 4.3	11.19 X 2.5 = 27.975	312.28	[illegible]	6.49%
765 KV D/c	456	82.94	20 X 0.414 = 10.35	15.135 X 2.5 = 40.337	508.80	91.58	11.06%

Impact on tariff due to Tower Base & RoW Corridor Compensation @ 10%

Compensation @ 50 Lakhs/ acre (Mostly Urban land near Big Cities/Metro Towns)

Voltage	Cost/km (Rs. in Lakh)	Tariff on capital cost (Rs. in Cr) @ average 15%	Compn cost for tower base/ km (Rs. in Lakh)	Compensation cost for RoW Corridor (Rs. in Lakh)	Revised Capital Cost of 100 km Line (Rs. in Cr)	Tariff on revised capital cost (Rs. in Cr)	% Increase in Tariff
400 KV D/c Twin	340	51.3	11.19 X 5 = 55.95	8.6 + 55.95= 64.55	324.55	48.82	46.1%
400 KV D/c Quad	390	45	11.19 X 5 = 55.95	8.6 + 55.95= 64.55	314.55	50.02	25.8%
400 KV D/c HTLS	340	51.3	11.19 X 5 = 55.95	8.6 + 55.95= 64.55	404.55	72.82	18.36%
765 KV D/c	456	82.44	16.135 X 5 = 80.675	20.4+80.675 = 101.075	669.34	103.38	22.12%

THANKS

GOVERNMENT OF INDIA
MINISTRY OF POWER

New Delhi, the 18th April 2006.

NOTIFICATION

G.S.R. [illegible] (E). – In exercise of the powers conferred by clause (e) of sub-section (2) of section 176 read with sub-section (5) of section 67 of the Electricity Act, 2003 (36 of 2003), the Central Government hereby makes the following rules regarding the works of licensees, namely:-

1. Short title and commencement.- (1) These rules may be called the Works of Licensees Rules, 2006.

2. Definitions.- (1) In these rules unless the context otherwise requires:-

(a) "The Act" means the Electricity Act, 2003;
(b) "occupier" of any building or land means a person in lawful occupation of that building or land.

(2) All other words and expressions used herein and not defined in these rules, shall have the meanings respectively assigned to them in the Act.

3. Licensee to carry out works.- (1) A licensee may -

(a) carry out works, lay down or place any electric supply line or other works in, through, or against, any building, or on, over or under any land whereon, whereover or whereunder any electric supply-line or works has not already been lawfully laid down or placed by such licensee, with the prior consent of the owner or occupier of any building or land.

(b) fix any support of overhead line or any site or spot required for the purpose of securing in position any support of an overhead line on any building or line or having been so fixed, may alter such support.

(2) When making an order under sub-rule (1), the District Magistrate or the Commissioner of Police or the officer so authorised, as the case may be, shall fix, after considering the representations of the concerned persons, if any, **the amount of compensation or of annual rent, or of both, which should in his opinion be paid by the licensee to the owner or occupier.**

(3) Every order made by a District Magistrate or a Commissioner of Police or an authorised officer under sub-rule (1) shall be subject to revision by the Appropriate Commission.

(4) **Nothing contained in this rule shall effect the powers conferred upon any licensee under section 164 of the Act.**

Annex-2

Extract of para 1.3 of the Report

1.3 The maximum width of RoW corridor is calculated on the basis of tower design, span, and wind speed, maximum sag of conductor and its swing plus other requirement of electric safety. The requirement of ROW for different voltage types under standard conditions is as follows:

ROW width for different voltage line*

Transmission Voltage	Width of Right of Way (in Meters)
66 kV	18
110 kV	22
132 kV	27
220 kV	35
400 kV S/C	46
400 kV D/C	46
+/-500 kV HVDC	52
765 kV S/C (with delta configuration)	64
765 kV D/C	67
+/-800 kV HVDC	69
1200 kV	89

* Width of Right of Way is as per the MoEF guidelines dated 5.5.2014.

Annexure III

Objective

At any Project construction site th developing countries requires that the constructor or company shall establish Emergency Response Procedures for every project. This document provides a plan to assist constructors in developing these procedures.

Emergency preparedness helps to minimize the human suffering and economic losses that can result from emergencies.

How To Develop A Plan

A good emergency response plan can be generic and, with some minor changes, can be easily adapted to specific sites and readily implemented. This is especially the case where a constructor specializes in similar types of projects.

It has to prepare by keeping below points in mind.

- Hazard identification/assessment
- Emergency resources
- Administration of the plan
- Emergency response procedure
- Communication of the procedure

Hazard Identification/assessment

It's normally meant for the identification and marking of the most to least possible causes of any Hazard, losses and accident at site by any of the source, method, procedure, or equipment's like

- Transportation, materials handling, hoisting, equipment or product installation, temporary
- Structures, material storage, start-up, and commissioning activities
- Environmental concerns
- Consultation with the client regarding potential hazards when working in or adjacent to operating facilities
- Resources such as material safety data sheets (MSDSs) to determine potential hazards from onsite materials
- Proximity to traffic and public ways.

Emergency Resources

It is important to identify which resources are available and have contingency plans to adopt and apply at time of emergency at site, like direct call on “100” number or “108” but it is important to know the facilities or limitations available in that location. Is any rescue team available? What is the response time? What must site personnel do in the meantime?

Other on-site resources such as fire extinguishers, and first aid kits must be maintained and clearly identified. Construction equipment may be included among potential emergency resources. Personnel, especially on-site safety representative has trained in first aid, should be included in the plan.

Administration of the Plan

The task of administering and organizing the plan is vital to its effectiveness. The person who has this task or site SHE representative will normally be the person in charge of the emergency response operation. It is their task to ensure.

- That everyone clearly understands their roles and responsibilities within the emergency response plan (a chart may be helpful in this regard)
- That emergency resources, whether people or equipment, are kept at adequate levels in step with the progress of the project.

Emergency Response Procedure

An emergency can be reported from any source—a worker on site, an outside agency, or the public. Remember that circumstances may change during the course of an emergency. Any procedures you develop must be able to respond to the ongoing situation.

The following list covers basic actions to take in an emergency. These steps apply to almost any emergency and should be followed in sequence.

- Stay calm.
- Assess the situation.
- Take command.
- Provide protection.
- Aid and manage.
- Maintain contacts.
- Guide emergency services.

Communication of the Procedure

To be effective, an Emergency Response Procedure must be clearly communicated to all site personnel. The following activities should be considered:

- Review the procedure with new site subcontractors and new workers to ensure that it covers their activities adequately.
- Review the procedure with suppliers to ensure that it covers any hazards that the storage or delivery of their materials might create.
- Review new work areas in operating plants with owner/client to ensure that new hazards are identified and covered in the procedure.
- Review the procedure with the Joint Health and Safety Committee or Health and Safety Representative on a regular basis to address new hazards or significant changes in site conditions

Site Safety Arrangements

We are following all the required safety and Emergency plan related activities at site by adopting below procedures at site

- Safety Chart and Emergency Contact Details
- Marking of Common Assembly point at time of emergency
- Fire extinguishers and First Aid Kits
- Complete PPE;s wearing by the staff/labours at site

Annexure IV

MYTRAH ENERGY (INDIA) LIMITED

Corporate Social Responsibility (CSR) Policy

2016

Acronyms & Abbreviations

AIM	Alternative Investment Market
CSR	Corporate Social Responsibility
KPIs	Key Performance Indicators
MW	Megawatt
NGO	Non-governmental Organisation
SDGs	Sustainable Development Goals
SPVs	Special Purpose Vehicles

Definitions

i. "Act" means the Companies Act, 2013 and the rules made thereunder, including any modifications, amendments or re-enactment thereof.

ii. "Agency" (or Agencies) means any Section 8 Company or a registered trust/ society/NGO/ institution, performing social services for the benefit of the society and excluding a registered trust/society/ NGO/institution/ Section 8 Company which is formed by the Company or its holding or subsidiary company/companies.

iii. "Board" shall mean the Board of Directors of the Company.

iv. "Company" shall mean Mytrah and wherever the context requires shall signify the Company acting through its Board.

v. "CSR" means Corporate Social Responsibility.

vi. "CSR Annual Plan" shall mean the annual plan detailing the CSR expenditure for the year

vii. "CSR Committee" means the Corporate Social Responsibility Committee constituted by the Board of the Company in accordance with the Act, consisting of three or more directors, out of which at least one Director shall be independent director.

viii. "CSR Expenditure" means all CSR Expenditure of the Company as approved by the Board upon recommendation of the CSR Committee, including the following:-

a) contribution to CSR Projects which shall be implemented and/or executed by the Company;

b) Contribution to CSR Projects (including for corpus as required) which shall be implemented and/or executed by any Agency.

c) Any other contributions covered under Schedule VII to the Act.

ix. "CSR Policy" relates to the CSR outlook of the Company and the activities to be undertaken by the company as specified in Schedule VII to the Act and the expenditure thereon, excluding activities undertaken in pursuance of normal course of business of a company.

1. INTRODUCTION

1.1 Preamble

Corporate Social Responsibility in its current and evolving form might be incompatible with the historical perspective of serving the needs and interests of the society in India, but the concept of business houses contributing to the development of society and addressing the issues relating to the growth of the country at large has been in existence for over a century. The early leading business houses in India, though started their ventures with business focus, but soon comprehended their responsibility towards the communities and society at large. The words of JRD Tata, ***"That no success or achievement in material terms is worthwhile, unless it serves the needs or interests of the country and its people"*** amply reflects this reality. The fact that the business houses and corporate entities derive certain benefits from the society for their success, concepts like "giving back to the society" or "work for the welfare of the society" have emerged.

Mytrah Energy (India) Limited, along with its subsidiaries, which have been set-up as Special Purpose Vehicles (SPVs), hereinafter collectively referred to as "Mytrah" is in the business of setting up of Wind Power Projects across India.

Social Responsibility is a proposition that is aligned with our values and with the Commitment to contribute to energy security of India. We believe that CSR is an essential element of our core business. Mytrah derives its inspiration for continued commitment to CSR from the Indian tradition of giving back to society and Gandhiji's "Trusteeship" concept.

Towards achieving harmony between business interests and our socio-economic and environmental responsibility, a conscious effort is being made to align ourselves with the charitable activities defined under section 2 (15) of Income Tax Act 1961, activities specified in Schedule VII of the Companies Act 2013 and the upcoming Sustainable Development Goals (SDGs).

1.2 The Mytrah Group

Mytrah is India's Smart Utility. A pioneer in the renewable energy sector, its innovative approach has created a dynamic, cost-efficient power company poised for accelerating growth. Mytrah's end-to-end model enables it to identify, plan and execute projects rapidly and cost effectively, ensuring a sustainable competitive advantage.

Mytrah's fully-integrated project team has delivered 10 sites with a generating capacity of 543 MW across six states in India in only four years. With the largest proprietary wind data bank among its peers, Mytrah has also created a highly visible pipeline of 3,500 MW. This will enable continued rapid growth as the Company looks to be generating 5,000 MW of renewable energy in India. Listed on the Alternate Investment Market (AIM) of the London Stock Exchange, Mytrah has access to international capital, expertise and industry partners; it's smart approach positions Mytrah as a progressive force in the global renewable energy sector, delivering sustainable energy without subsidies.

2. PURPOSE

2.1 A clear and approved CSR Policy is desirable for any company for more than one reason – good corporate governance; placing it in public domain for increased visibility and transparency; providing clear guidance and approach to the CSR teams implementing and monitoring the CSR activities and building employee awareness on management commitment on CSR.

2.2 Further, the section 135 of the Companies Act 2013 made it mandatory to constitute a Corporate Social Responsibility Committee of the Board, which formulates and recommends to the Board a Corporate Social Responsibility Policy, which shall indicate the activities to be undertaken by the Company as specified in Schedule VII. The Committee shall also monitor the Corporate Social Responsibility Policy of the Company from time to time, thus making the CSR Policy a statutory requirement as well.

3. SCOPE

3.1 The CSR Policy will meet the statutory requirements as per section 135 of the Companies Act 2013 and the Rules framed to implement various social and economic development activities. Besides doing so, the policy will also cover various broad activities, approaches, methods to be considered in taking up CSR activities of the Mytrah Group in the four widely recognized CSR domains affecting and impacting – ***Workplace*** (employees and their families), ***Market place*** (clients, customers, contractors and shareholders and secondary stakeholders), ***Community*** (neighbourhood communities and society at large) and ***Environment*** (Sustainable climate change adaptation measures). While the Section 135 (5) of the Companies Act 2013 lays emphasis on giving preference to the local area and areas around the company where it operates, it disallow spending the amount earmarked for CSR on business related expenditure on employees. Further, as directed by section 135 of the Companies Act 2013, the activities will be implemented in a project and programme mode and therefore, avoid spending money on one time-events.

3.2 MYTRAH CSR Policy is applicable to all its subsidiaries, which have been set-up as Special Purpose Vehicles (SPVs) implementing CSR activities and also to all locations where MYTRAH operates.

3.3 MYTRAH CSR Policy will be placed in the public domain and can be accessed by general public and also employees of the Group. This policy provides the employees

Diagram 1: CSR DOMAINS

Standards required to uphold the CSR Policy. This policy also makes clear to all stakeholders – our customers, employees, shareholders, investors, supplier and business partners, non-government organization and pressure groups and the community in which it operates – what our Vision for CSR and how we propose to work towards achieving it.

4. OBJECTIVES

4.1 To share MYTRAH's commitment to Corporate Social Responsibility across all stakeholders.

4.2 to provide guidance on strategy, programme and geographical approaches, methods of planning and implementation of projects and all types of activities to be taken up on the ground among all stakeholders.

4.3 To bring about standardization and uniformity across approaches and projects, duly recognizing the location-specific issues and aspects.

4.4 To periodically measure outputs, outcomes and impacts of the project implemented through review mechanism and mid-term and ex-post evaluations.

4.5 To comply with statutory requirements under the Companies Act 2013 and the IT Act 1961.

5. CSR POLICY

5.1 CSR Policy Framework

MYTRAH endeavors to bring in synergy to create value across all our stakeholders and implement focused and sustainable CSR projects and programmes across the Group. To implement effective CSR policy, it is important to align all relevant elements of CSR. These include clear Policy Statement, Strategic CSR domain based interventions, CSR governance structure, CSR implementation approaches and CSR Communication strategies for both internal and external communication.

The overall synergy is achieved through understanding of the stakeholder needs at locations, organizational mandate in vogue, interaction with key stakeholders across the Group and participation at all levels of the Group in taking forward the CSR mandate.

Mytrah is committed to ensuring social wellbeing of the society and communities through its Corporate Social Responsibility (CSR) initiatives. While we will endeavor to achieve our larger objective of community empowerment, our focus will be on

a) Projects or programmes relating to activities specified in Schedule VII to the Act, Charitable activities defined in Section 2 (15) of the IT Act and Sustainable Development Goals or
b) Projects or programmes relating to activities undertaken by the board of directors of a Company in pursuance of recommendations of the CSR committee of the Board as per declared CSR policy of the company subject to the condition that such policy will cover subjects enumerated in Schedule VII of the Act and Section 2 (15) of the IT Act.

c) In addition, Mytrah is committed to build a sustainable society and preserving environment through core business and community based initiatives. We endeavor to significantly improve our performance in the areas of energy, fuel and water conservation, green plantation and waste management & recycling. We are committed to promotion of bio-diversity and environment protection in our neighborhood and beyond.

5.2 CSR Policy Statement

Mytrah considers Community as priority area of intervention and is committed to take up result oriented projects/programmes essentially guided by Needs analysis and Consultations.

Mytrah may also consider undertaking or supporting CSR initiatives beyond its geography and Affirmative Action on matters of national importance based on community need and exigencies including natural disasters etc. involving stakeholders opinion and evaluative process.

Vision

To be the catalysts of positive change in the society

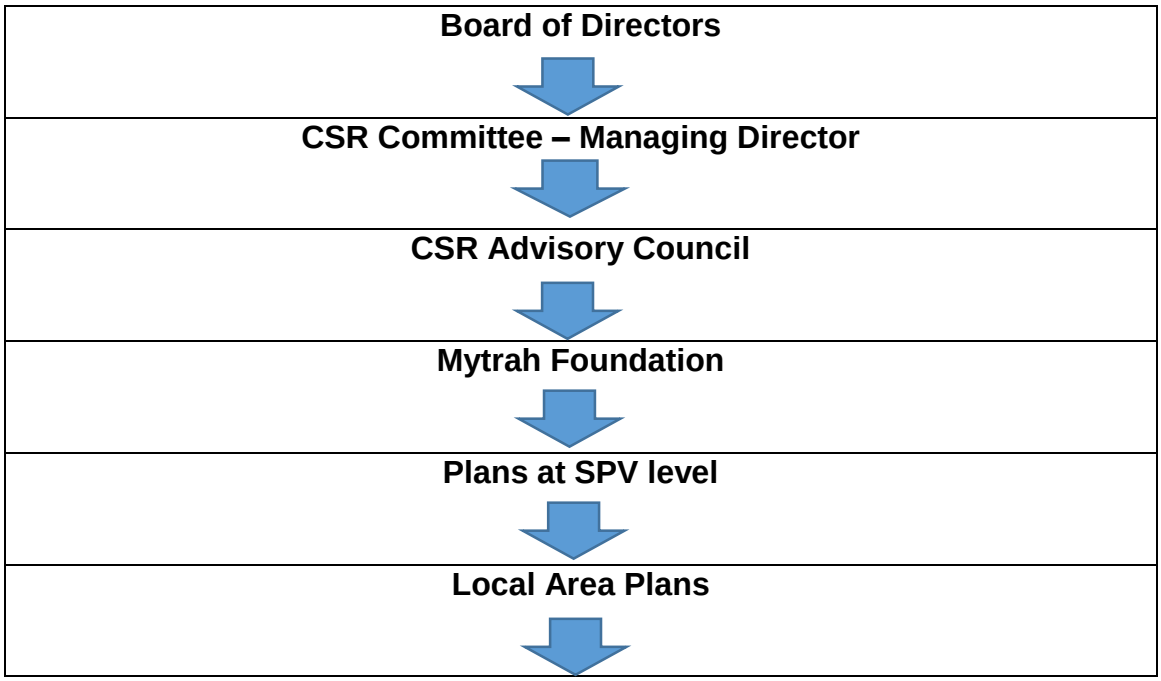
Mission:

To contribute towards improving the quality of life of our neighborhood communities and society at large following a participatory development-oriented approach

Based on this thought process, the Mytrah CSR policy has been framed to drive planning, implementation and evaluation of initiatives and resources.

5.3 CSR Governance Structure

Diagram 2: CSR GOVERNANCE STRUCTURE



i. Composition, Roles & Responsibilities of the CSR Committee

a. Keeping in line with section 135 of the Companies Act, 2013 and the rules thereunder (hereinafter referred to as 'the Act'), the Board of Directors of the Company shall form a Corporate Social Responsibility Committee (hereinafter referred to as the 'CSR Committee') headed by an independent director, to *inter alia,* carry out the following functions:-

b. To formulate and recommend to the Board, a Corporate Social Responsibility Policy which shall indicate the activities to be undertaken by the Company as specified in Schedule VII of the Companies Act, 2013 and rules made thereunder;

c. To recommend the amount of expenditure to be incurred on the CSR activities.
d. To monitor the implementation of framework of CSR Policy.

e. To carry out any other function as mandated by the Board from time to time and / or enforced by any statutory notification, amendment or modification as may be applicable or as may be necessary or appropriate for performance of its duties.

ii. Duties of the Board and CSR Committee

Board of Directors

The Board shall include in its Report the annual report on CSR Projects as per the format provided in the Annexure to the Rules prescribed under the Companies Act, 2013.

CSR Committee

a. The CSR Committee shall monitor the implementation of the CSR Policy and CSR Plan. For this purpose, the CSR Committee shall meet at least twice a year.
b. In discharge of CSR functions of the Company, the CSR Committee shall be directly responsible to the Board for any act that may be required to be done by the CSR Committee in furtherance of its statutory obligations, or as required by the Board.
c. The CSR Committee shall place before the Board in May/July every year a responsibility statement of the CSR Committee that the implementation and monitoring of CSR Policy, is in compliance with CSR objectives and Policy of the company for inclusion in the Board's Report.
d. The CSR Committee shall ensure that the CSR Policy and finalized Annual Plan is displayed on the Company's webs
e. Review Periodicity and Amendment: CSR Annual Plan may be revised/modified/amended by the CSR Committee at such intervals as it may deem fit.

iii. **Fund allocation**

a) The Company, in every Financial Year, shall endeavor to spend such feasible amount as CSR Expenditure, which shall not be restricted by the statutory limit of a specified percentage of its average net profits of the immediately preceding three Financial Years. However, the aforementioned CSR Expenditure in any Financial Year shall be 2% of Company's average Net profits for the three immediately preceding Financial Years.

b) The CSR Committee shall prepare a CSR Annual Plan for the above which shall include:

- Identified CSR Projects
- Planned outlay (Budget)
- Implementation Schedules

c) Total outlay in the CSR Annual Plan shall be approved by the Board upon recommendation by the CSR Committee

d) In case the Company fails to spend the statutory minimum limit of 2% of Company's average net profits of the immediately preceding three years, in any given financial year, the Board shall specify the reasons for the same in its report in terms of clause (o) of sub-section (3) of section 134 of the Act.

5.4 CSR Policy Owner

The Group Policy owner for this CSR Policy is the Managing Director. He is responsible for:

a. Maintaining the veracity of the policy in spirit and providing support and guidance, advice and direction, including application of waivers and notification of breaches.
b. He will also control CSR applications in a way that risks are identified and managed.
c. He will also act as a policy champion to spearhead the entire gambit of CSR at the apex level of the Group.

6. CSR STRATEGY

6.1. CSR Portfolio Framework

The Group will endeavour to bring in synergy between the Projects and Programmes under the 4 major domains-Workplace, Marketplace, Society and Environment-, Triple Bottom Line Approach –Social, Environment and Ethical- and the activities listed in Schedule VII of the Companies Act 2013. The most accepted and widely used triple bottom line approach – focusing on Society at large, Environment and Responsible Business Practices will underline the CSR canvas of the Group.

Diagram-3: TRIPLE BOTTOM LINE/3 P APPROACH

The CSR Committee shall ensure that major portion of the CSR expenditure in the Annual Plan shall be for the Projects as per CSR objectives. However, there shall not be any preference given to any particular projects for budgetary allocation and it shall be made purely as per the identified CSR Projects on need basis.

Any surplus arising out of the CSR Projects shall not form a part of the business profit of the Company.

6.2 Area of Operation

The Projects, Programmes and activities referred to in Schedule VII of Companies Act 2013 and charitable activities defined under the Income Tax Act 1961 will be implemented in local areas where Mytrah Group operates.

Mytrah Group will also serve the communities and the Society at large, where required or desirable, in any part of the Country.

6.3 Stakeholders and beneficiaries

All the benefits of the Projects, Programmes and activities shall reach the end beneficiaries, who are the primary stakeholders. The primary stakeholders are the general public and all the benefits of all the projects, Programmes and activities shall be targeted towards them without any bias towards Religion, Caste, Region, Sex, Language and disability.

6.4 Sectoral Interventions

Mytrah Group do not lay any particular emphasis on any particular sectoral projects and programmes. All the projects, programmes and activities shall be taken up based on:

- The need
- Technical feasibility
- Economic viability
- Social acceptability
- Partner credibility

7. CSR IMPLEMENTATION

7.1 CSR Delivery Structure

Mytrah Group will set up a Trust or Section 8 Company or Society or Foundation or any other form of entity operating in India to facilitate implementation of its CSR activities in accordance with its stated CSR Policy.

Mytrah Group will:

a) Specify the projects/programmes to be undertaken by such an organization, for utilizing funds provided by it;
b) Shall establish a monitoring mechanism to ensure that the allocation is spent for the intended purpose only.

Mytrah Group will also implement CSR projects and programmes:

a) Through Trusts, Societies, or section 8 companies operating in India, which are not set-up by the company itself. Following First Provisio to Rule 4 (2) of the Company (Corporate Social Responsibility) Rules, 2014 Mytrah shall ensure that

such organisations have an established track record of at least three years in carrying out activities in related areas.

b) Also following Rule 4 (6), Mytrah shall ensure that the expenditure on capacity building of personnel shall not exceed 5% of total CSR spend.

Mytrah Group shall also implement CSR Projects and Programmes by pooling resources or collaborations with other companies, but report separately on such projects in accordance with Rules 4 (3) of the Corporate Social Responsibility Rules 2014.

7.2 CSR Key Performance Indicators (KPIs)

Setting C-SMART Objectives and measuring results through agreed Key Performance Indicators (KPIs) in terms of output, outcome and impact are the pre-requisite to any successful project/programme.

- Challenging
- Specific
- Measurable
- Attainable
- Replicable and Reliable
- Time-bound

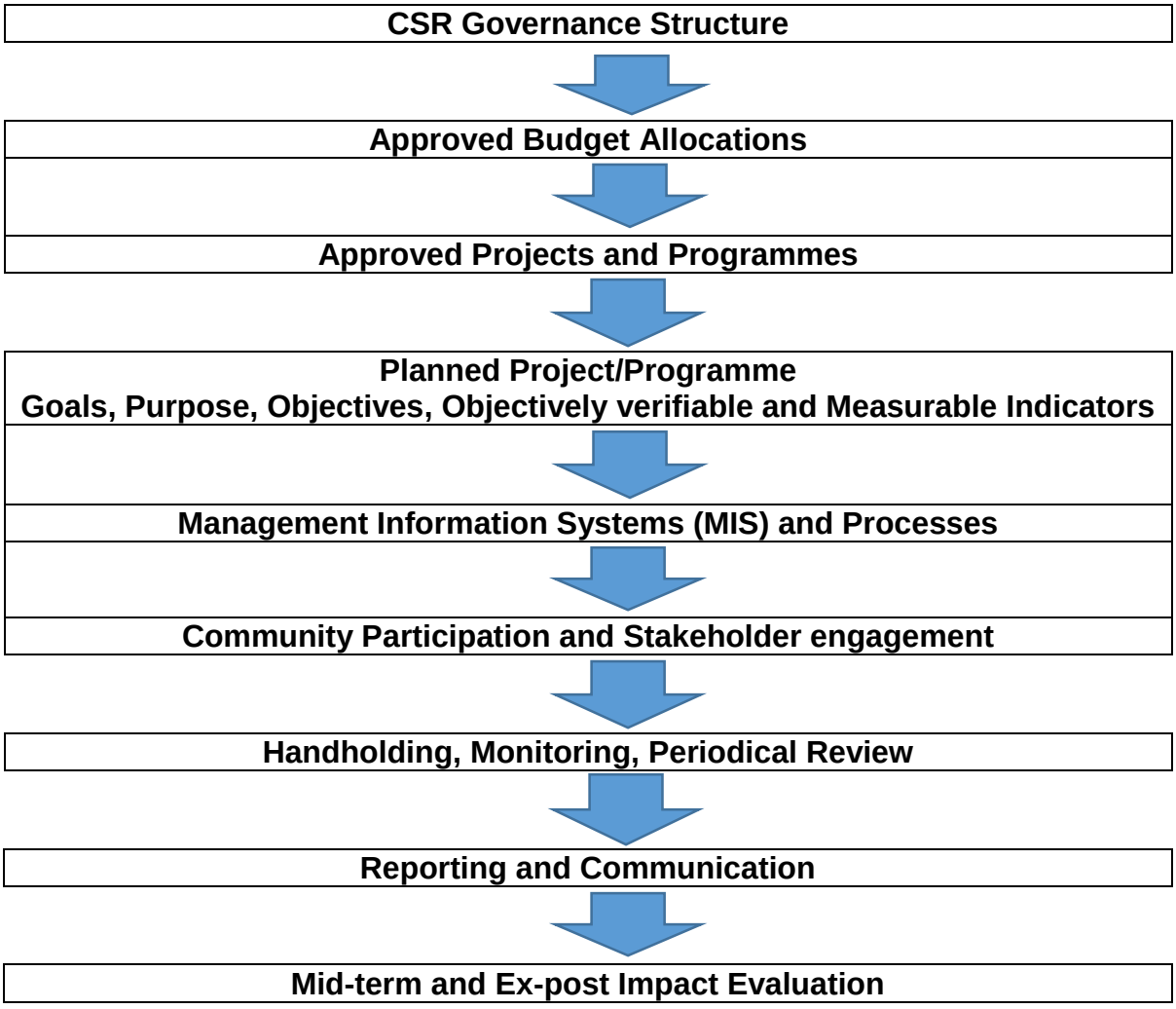
Social Cost Benefit Analysis, Social Return on Investment (SROI) and other measurement methods may also be used where applicable or feasible to measure the success of the projects/programmes.

Mytrah Group will also partner, collaborate or pool resources with state and central governments to achieve the CSR objectives laid down in its policy.

7.3 CSR Implementation Framework

All the Projects and Programmes recommended by the CSR Committee and approved by the Board of Directors through Annual Plans or otherwise, shall be implemented across all its operating entities.

Diagram 4: CSR IMPLEMENTATION FRAMEWORK



7.4 Project Review, Monitoring & Evaluation

Project Reviews, periodical monitoring and evaluations will be part of the project cycle management. Besides this, Records and Registers will be maintained at all relevant levels to capture data and for the purposes of increased accountability.

The following parameters will be followed in monitoring the project and programmes:

- Utilization of grants against approved budgets
- Achievement of KPIs and targets
- No. beneficiaries and unit cost
- Timeframe for each project
- Quality parameters set.

Ex-post impact evaluation will be conducted by a third party comparing the controlled area vs. project area.

7.5 Audit and Control

Internal checks and controls will be built in appropriately for day-to-day accountability, besides conducting the Annual Statutory Audits.

8. CSR COMMUNICATION FRAMEWORK

8.1 Context

In recent years, CSR has become a buzz word all over the world and it has gained momentum in India, particularly after it is made mandatory through the Companies Act 2013.

In the context of government regulations and reporting mechanisms, investor concerns, civil society demands, media focus, community apprehensions, shareholders and other secondary stakeholders sentiments and employee awareness, both internal and external communication gains significance.

Therefore, Mytrah Group endeavours to put in place a sound CSR Communication Strategy that communicates both internally and externally to share it sincere efforts, success and failures and lessons learned from time to time in the process of implementation of CSR activities.

8.2 CSR and Corporate Communications

There are a number of ways and means through which CSR communication can be strengthened; example sharing the CSR with the employees right from the induction to the Reporting CSR through publishing Annual Reports.

The Corporate Communication Department shall play a vital role in not only developing the CSR Communication Strategy, but also delivering the same to various stakeholders.

Annexure V

Annex E

E&S Screening Checklist

I Preliminary Screening Checklist

Project Site Selection - Primary Criteria			Project Location	Bareta (Village), Budhlada (Thesil), Mansa (Dist.), Punjab	
S. No.	**Criteria / Things to Check for**	**Go**	**No Go/Check**	**Evidence Details**	**Remarks**
1	Is the Project located in ecologically sensitive zones (10 km).	No	Yes	No	Check the permission required and account for it in the project schedule. (Permission from National Board for Wildlife) unless otherwise State has demarcated its own eco sensitive zone.
2	Is there any Wild life sanctuary, Bio- reserve, National Park or notified Eco Sensitive Zone in the area of influence (i.e. within 10 km)?	No	Yes	No	
3	Are there any Reserve forests, Protected forest, or reserved land in the area of influence?	No	Yes	No	
4	Coastal Areas - Site falling within High Tide line (HTL) as per CRZ notification	> 500 M	< 500 M	>500 M	Check the permission required and account for it in the project schedule.
5	Is the site at a sufficient distance from National Highway/ State Highway and Railway line	> 500 M	< 500 M	Railway line at < 500 M	
6	Distance from flood plains or riverine systems	> 500 M	< 500 M	>500 M	
7	Metropolitan Cities (More than 3,00,000 population) at least 25 km of the projected growth boundary of the settlement	No	Yes	No	
8	Are there any sites of cultural or archaeological importance at the site?	No	Yes	No	
9	Solar Radiation (More than 5.2 kWh/sq. m.)	No	Yes	Yes	
10	Seismic Zone	< IV	$\geq$ IV	< IV	
11	Availability of Land for plant & township (Area, Orientation & shape of plot, Extent of land available for Plant, Township etc.).	Yes	No	Yes	No township area

Project Site Selection - Primary Criteria			Project Location	Bareta (Village), Budhlada (Thesil), Mansa (Dist.), Punjab	
S. No.	**Criteria / Things to Check for**	**Go**	**No Go/Check**	**Evidence Details**	**Remarks**
12	Is the land being used for economic/livelihood purposes	No	Yes	No	Conduct site visit, consult with local people and provide evidence/proof that land is not being used for residential, economic or livelihood purposes all year round (there may be seasonal or temporary use which cannot be identified in one site visit.)
13	Are there any residences in the land that will need to be removed?	No	Yes	No	
14	Is the land categorised as tribal land?	No	Yes	No	
15	Is there any settlement within 300 m of the boundary of the land parcel?	No	Yes	No	
16	If Forest Land, has the Forest Rights Act (FRA) been implemented and all Forest Rights settled by the law?	Yes	No	Yes	No forest land is aquired
Note:	**Only after majority of Primary Siting Criteria is met for a particular Site, it will be subjected to more rigorous Social and Environmental Screening Checklist for the selected Site at a later stage of the project (i.e. during ESDD stage) to trigger the need for specialized studies.**				

II Social Screening Checklist

Social Safeguards Screening Checklist for Land which passed primary screening criteria				
No.	**Criteria / Things to Check for**	**Yes/No***	**Remarks/ Checks in place/ Additional information**	**Likely source of information**
	Involuntary Resettlement			
1	Is there any National / local policy guidelines and laws on the kind of land available/ to be used for solar power projects and will they affect the project adversely?	Yes	Check, if it is being followed.	Govt. of Punjab – Solar policy and laws are available like registration process

Social Safeguards Screening Checklist for Land which passed primary screening criteria				
No.	**Criteria / Things to Check for**	**Yes/No***	**Remarks/ Checks in place/ Additional information**	**Likely source of information**
2	Is Private land available for buying or the mandatory land acquisition is necessary?	No	Understand the nature of land - Cultivated, Barren and unused, current fallow, long term fallow etc.	1) Check with Revenue officials at tehsil level for identifying nature of land (private/ government/gram Sabha/tribal land).
3	Will land acquisition involve displacement of people and resettlement and is enough land available for the resettlement?	No	Consider both physical and economic displacement. If yes, prepare resettlement action plan (RAP) as per the outline suggested in relevant Annexure G.	1) Freeze land location required based on information gained from Revenue department and Forest Department. 2) Socio-economic survey of the land parcel to ascertain physical and economic displacement. 3) Consultation with District Administration for identifying resettlement site.
4	What impact will the displacement have on the people in the short run or long run?	No	If yes, prepare RAP after conducting SIA. Understand the nature of ownership of land - Private land, revenue land, forest land.	1) Get SIA study done to ascertain impact
·	Impact on livelihood	No		
·	Cropping pattern	No		
·	Employment opportunity	No		
·	Loss of Business/ Enterprises	No		
5	Will access to common property resources (e.g. community facilities, public grazing lands, forest etc.) be restricted by the project?	No	If there is restricted access, such assets may need to be replaced or alternate routes acceptable to communities may be provided. Such measures will be outlined in the RAP.	1) This aspect to be covered in socio-economic survey and SIA
6	Are there any non-titled people who live or earn their livelihood at the site or within the right-of-way?	No	If yes, prepare RAP	1) This aspect to be covered in socio-economic survey and SIA
Land Encumbrances				
7	Does the land involve conversion from agricultural to non-agricultural use?	Yes	Ensure appropriate permits from district authorities are taken	1) Check applicability of Gram Sabha approval for seeking land use conversion

Social Safeguards Screening Checklist for Land which passed primary screening criteria				
No.	**Criteria / Things to Check for**	**Yes/No***	**Remarks/ Checks in place/ Additional information**	**Likely source of information**
8	Are the land parcels free of any encumbrances or disputes?	No	Seek appropriate legal opinion on status of land is No	
9	If government land is involved, are any local clearances from panchayats required?	Yes	Local clearance from Municipal committee due to Govt./Panchayat land	
Security				
10	Is security an issue in the nearby project area? Is there any threat from local outfits/ terror groups?	No		1) Discussion with local administration
·	Does any other project in the nearby area face such challenges?	No		
·	What could be the possible losses?			
·	How can the issues like vandalism and theft be addressed and what could be the possible cost?			
Scheduled Tribes (ST) Concerns				
11	Are there any tribal populations occupying / deriving benefit from the site? Is the area a Scheduled Area?	No	If specific sites and impacts are not known but STs are present in the area, Scheduled Tribes Development Plan (STDP) is required.	1) Check with List of Scheduled V Area. 2)Discuss with District Administration for more specific detail (If required for identification)
12				
13	Do STs maintain distinctive customs or economic activities that may make them vulnerable to hardship?	No	If yes, prepare a STDP.	1) This aspect to be covered in socio-economic survey and SIA
14	Will the project restrict STs' economic and social activity and/or make them particularly vulnerable in the context of project?		If yes, prepare a STDP.	1) This aspect to be covered in socio-economic survey and SIA

Social Safeguards Screening Checklist for Land which passed primary screening criteria				
No.	**Criteria / Things to Check for**	**Yes/No***	**Remarks/ Checks in place/ Additional information**	**Likely source of information**
15	Will the project change their socioeconomic and cultural integrity and disrupt their community life?		If yes, prepare a STDP.	1) This aspect to be covered in socio-economic survey and SIA
16	Will the project negatively affect their health, education, livelihood, or social security status?		If yes, prepare a STDP.	1) This aspect to be covered in socio-economic survey and SIA
17	In case there is no disruption of indigenous community life as a whole, will there be loss of housing, strips of land, crops, trees, and/or other fixed assets owned or controlled by individual indigenous households?		If relocation is required, prepare an STDP along with RAP	1) This aspect to be covered in socio-economic survey and SIA
Archaeological/Religious Concerns				
17	Is the site considered sacred by any community?			1) This aspect to be covered in socio-economic survey and SIA
18	If any site of Cultural/ Archaeological importance available,			1) This aspect to be covered in socio-economic survey and SIA
·	What adverse impacts are perceived on those sites?			
·	What are the options for mitigating the impacts?			
·	What do the local or national laws state?			
·	What will be the cost of such an exercise?			
Note	* If the answer is not available in yes/no, fill details in remarks column.			
	Depending on the expected scale of impacts, adequate management plans will have to be prepared after undertaking ESIA report based on categorization of the project.			

III Environment Screening Checklist

Environmental Screening Checklist for Land which passed primary screening criteria			
No.	**Criteria / Things to Check for**	**Yes/No**	**Remarks/ Checks in place/ Additional information**
1	Will project cause aesthetic degradation and property value loss due to establishment of facilities?	No	
2	Will the project alter the pattern of land use or cause land use conflicts?	Yes	
3	Will the project impact the surface water resources?	No	
4	Availability of water source.	Yes	Ground water
5	Visual effects.	No	
·	Impact on the nearby built up areas or community	No	
6	Will the project cause pollution to surface or ground water bodies from the project's construction or operations, sanitary sewage, sludge, residues and miscellaneous discharges?	No	
7	Is the site home to any endemic fauna/floral population?	No	Is so, are appropriate mitigation measures adopted for the project in the biodiversity management plan.
8	Will access to site require removal of vegetation?	Yes	
9	Is the site under dense vegetation cover?	No	
10	Availability of hydrological data or flood level within the project site within the last 3 to 5 years especially for solar farm.	Yes	Climate change effect
11	Will the selection of site result in habitat fragmentation?	No	
Other Relevant Information			

Environmental Screening Checklist for Land which passed primary screening criteria			
No.	**Criteria / Things to Check for**	**Yes/No**	**Remarks/ Checks in place/ Additional information**
12	Other Linear Facility		
·	Distance to the existing transmission line and other electrical infrastructure	Yes	Approx. 6 km. from project site
·	Is the site suitable for all associated facilities like evacuation of power etc.?	Yes	
·	Existing road and their condition		Good condition (State highway)
·	Distance of the road		100 M from project (State highway no. 10 Jakhal – Budhlada road)
·	Disturbance to the access road	No	
Note	* If the answer is not available in yes/no, fill details in remarks column.		
	Depending on the expected scale of impacts, adequate management plans will have to be prepared after undertaking ESIA report based on the category of project.		

Annexure VI

VOYANTS

FGD

LIST OF PARTICIPANTS

Place: Municipal Panchayat office, Bareta

Date: 5/5/2016 Time: 12:30 PM

S.No.	Name	Occupation	Sex	Age	Social Category	Signature
1	Harmohinder Singh	खेती	Male	54	G	Harmohinder Singh
2	Balvir Singh	खेती	M	55	G	Balvir Singh
3	गोविंद सिंह	खेती	M	50	G	गोविंद सिंह
4	उदय सिंह	खेती	M	54	G	उदय सिंह
5	दयाल सिंह	खेती	M	45	G	दयाल सिंह
6	मुखराम सिंह	खेती	M	38	G	मुखराम सिंह
7	हरिंदर सिंह	खेती	M	22	G	हरिंदर सिंह
8	राम सिंह	खेती	M	65	G	राम सिंह
9	Padam Singh	खेती	M	35	G	
10	Gramadhyam Pradhan	खेती	M	40	G	
11	Amrik Singh	खेती	M	65	G	
12	मान सिंह	खेती	M	50	G	मान सिंह
13	राम सिंह	खेती	M	40	G	राम सिंह
14	Rabi @ Raghbir Singh	Agriculture	M	48	G	@ Raghbir
15						
16						
17	Balvir Singh	Agriculture	M			
18						K.T.S
19						
20	Abhijeet Singh		M			
21						
22						
23						
24						
25						

Name & Signature of Surveyor/ Supervisor/ FAE .....

VOYANTS

FGD

LIST OF PARTICIPANTS

Place: Dayalpura

Date: 6/5/16 Time: 01:00 PM

S.No.	Name	Occupation	Sex	Age	Social Category	Signature
1	Baljeet Singh	Agriculture	M	48	General	Baljeet Singh
2	Teja Singh	Agriculture	M	72	G	
3	Paramjeet Singh	Ag.	M	44	G	
4	Jasbir Singh	AG.	M	36	"	
5	Jagdip Singh	AG.	M	23	"	
6	Dharmel Singh - AG		M	40	"	
7	Birbal Singh	AG.	M	22	"	
8	Jagga Singh	Student	M	22	"	
9	Jasvendra Singh	AG.	M	24	"	Jasvendra Singh
10	Jasvendra Sing	AG.	M	26	"	Jasvinder Singh
11	Jagmel Sing	AG.	M	40	"	
12	Kamaljeet Singh	Service	M	29	"	
13	Jagtar Singh	AG.	M	32	SC	Jagtar Singh
14	Amarjeet Kaur	Panchayat Member	F	60	G	Amarjeet
15	Vimala Devi	H.W.	F	62	G	
16	Murti Devi	H.W	F	51	G	
17	Darbara Devi	H.W.	F	58	G	
18	Ranjeet Kumar	Business	M	37	G.	
19						
20						
21						
22						
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25						

Name & Signature of Surveyor/ Supervisor/ FAE .....

Annexure VII

QUESTIONNAIRE FOR SOCIO-ECONOMIC SURVEY

Questionnaire No…… Date:…….

1. GENERAL IDENTIFICATION

1.1 Name of the Project…….

1.2. Address a. Village/Town: ……..

b. Taluka/Tehsil: ……..

c. District: ……..

1.4. Settlement Type: 1 Rural 2 Semi- Urban 3 Urban ☐

2. HOUSEHOLD INFORMATION

2.1. Name of the head of Household…….

2.2. Household Composition

No. of Family Member	Male	Female	Total
Adult (10 to 60 Year)			
Children (Below 10 Years)			
Aged (Above 60 Year)			
TOTAL			

2.3. Family Type: 1 Joint 2 Nuclear 3 Extended 4 Other ☐

2.4. Religious Group: 1 Hindu 2Muslim 3 Sikh 4 Christian 5 Budhist 6 Jain 7 Other…… ☐

2.5. Social Stratification: 1 SC 2 ST 3 OBC 4 Higher Castes ☐

3. LANDHOLDING

Cultivable	Non-Cultivable	Total Land Area (Acres)

4. CROPPING PATTERN

Sl No.	Type of Crops	Total Cultivated Land (Acres)	Total Yield (Rs)
1	Kharif		
2	Rabi		
3	Summer Crop		
TOTAL			

5. ANNUAL INCOME

Sl. No.	Source	Income (Rs)
1	Agriculture	
2	Service	
3	Business	

4	Labour	
5	Professional	
6	Any other	
Grand Total		

6. CONSUMPTION PATTERN

Kindly indicate the consumption/expenditure on different items in last one year.

Sl. No.	Particulars / Source	Expenditure (Rs.)	
		Monthly	Annual
A	Food		
B	Cooking Fuel		
C	Clothing		
D	Health		
E	Education		
F	Communication		
G	Social functions		
H	Agriculture (such as seeds, hiring of farm implements etc.)		
I	Others (Specify)		
Grand total (A-I)			

7. POSSESSION OF DURABLE CONSUMER ITEMS:

Do you possess following items?

Sl. No.	Items	1. Yes 2. No
1	Radio	
2	Bicycle	
3	Television	
4	Oven	
5	L.P.G Connection	
6	Computer	
7	Refrigerator	
8	Washing Machine	
9	Motor cycle/Scooter	
10	Car	
11	Air Conditioner	
12	Any other (specify)	

8. INDEBTEDNESS

Please indicate your borrowings during last one year:

SL. No	Source	Amount taken (Rs.)	Amount returned (Rs.)	Balance (Rs)
1	Bank (specify which bank)			
2	Private money lender			

3	Others (Specify)			
Total				

9. COVERAGE UNDER GOVERNMENT DEVELOPMENT SCHEMES

9.1. Have you availed any benefit under any govt. scheme? 1. Yes 2. No

9.2. If 'Yes', kindly give us the following details

Name of the scheme	Kind of Help 1 Loan, 2 Training, 3 Employment

9.3. If '1', kindly indicate the amount Rs: ……

9.4. If '2', kindly indicate the type of training…….

9.5. After availing this scheme did your annual income increase? 1 Yes 2 No

9.6 If 'Yes', how much? Rs: ……..

9.7. If 'No', why…….

10. HEALTH STATUS

10.1. Was any member of your family affected by any illness in last one year? 1 Yes 2 No

10.2. If 'Yes', please indicate the details

No. of Cases	Type of disease/ illness	Treatment Taken*

* 1. Allopathic 2. Homeopathic 3. Ayurvedic 4. Traditional 5. No treatment

11. WOMEN STATUS

11.1. Kindly indicate, female members of your family are engaged in what kind of economic/ non-economic activities.

Sl. No.	Economic/Non-economic Activities	1. Yes 2. No
1	Cultivation	
2	Allied Activities*	
3	Collection and Sale of forest products	
4	Trade & Business	
5	Agricultural Labour	
6	Non Agricultural Labour	

7	HH Industries	
8	Service	
9	Households Work	
10	Others (Specify): ……..	

* Dairy, Poultry, Piggery, Sheep rearing, Grocery etc.

11.2. If, engaged in economic activities total income of the year: Rs……..

11.3. Do your female member have any say, in decision making of household matters? 1 Yes 2 No

11.4. If 'Yes, give the following details?

Sl.No.	Issues	1 Yes 2 No
1	Financial matters	
2	Education of child	
3	Health care of child	
4	Purchase of assets	
5	Day to day activities	
6	On social functions and marriages	
7	Others……	

12. LITERACY

	Entered College/ Universiy	Completed Secondary only	Completed Primary only	Illiterate	**Total**
Male adult					
Female adult					
Total					

13. AMENITIES

13.1. Source of Drinking Water: 1. Piped-water supply 2. Spring 3. Well 4. Stream 5. Others

13.2. Type of Toilet: 1. Flush toilet 2. Latrine 3. Other:…….. 4. No toilet

13.3. Fuel for Heating: 1. Electricity 2. Wood 3. Others:…… 4. None

13.4. Usage of electricity: 1. Lighting 2. Cooking 3. Business 4. Other (specify)……

13.5. How many hours per day you get electricity usually? ……..

13.6. What do you use when electricity is not available?

1. kerosene 2. Battery 3. Wood 4. Nothing 5. Other: ……

14. STRUCTURE/ BUILDING/ HOUSE/ HOME INFORMATION

14.1. Use of Structure……

14.2. Age of the Structure……..

14.3. Type of Construction

1 Mud made 2 Brick made 3 Cemented 4 Thatched 5 Wooden 6 Others…….

14.4. Type of Structure 1Temporary 2 Semi Permanent 3 Permanent

14.5. Distance from the project site (in km.): ……..

15. TRANSPORT USES

Sl. No	Purpose	Starting from	Destination	transport Mode	One-way fare	One-way time	use of mian road	use of local road	frequency	Distance Km

16. PROFESSION OF PERSON

Sl. No.	Name of Earning Member of the Family	Name of Profession	1. Part Time, 2. Full Time
1			
2			
3			
4			
5			

17. MIGRATION

17.1. Do you migrate for work? 1 Yes 2 No ☐

17.2. If 'Yes', for how many months in a year……

17.3. Where do you migrate? 1. Within the District 2. Outside the District 3. Outside the State ☐

17.4. What kind of job do you undertake?
1 Agricultural Labour 2 Non Agricultural Labour 3 Trade & Business 4 Others (Specify) ☐

17.5. How much do you earn Rs……..

17.6. Trend of Migration 1. Once in a year 2. Twice in a year 3.Every alternative year
4. Once in every three years 5. No regular interval/as and when required ☐

17.7. At what time of the year do you migrate? 1 Summer 2 Winter 3 Rainy Season ☐

18. What is your view about the proposed project?

Date…… Name and Signature of FAE……

Format for Public Consultation & Focused Group Discussions (Socio-Economic and Environment)

Name of the Village/ Township:

Name of the Block/Tehasil:

Name of the District:

Date:

Time:

S. No.	Issues	Participants' Opinion, Comments and Suggestions
1.	Do you know about the project and where is it located?	
2.	General perception and awareness about the proposed project?	
3.	Support of local people for the proposed project?	
4.	Will there be likely involvement of local people in the implementation of the project?	
5.	Any critical issue or concern by the local people regarding the project?	
6.	Any criteria you would like to see considered during project design, construction and operation stage?	
7.	Do you have any problem due to the existing/proposed project?	
8.	Ancillary Facility?	
9.	How many and which types of Industrial Units exists in the surrounding area?	
10.	**General socio-economic Condition:** i) What are the economic activities? ii) Land use pattern? iii) Cropping pattern (Seasonal), iv) Types of crops? v) Value of the crops? vi) Average land holding size?	

11.	Access to the forest land and the use of the forest land (if any)	
12.	**Water Facility:** i) Source of Drinking Water & household use? ii) Is here shortage of water for human consumption? iii) Requirement of water for plant?	
13.	Loss of residential/commercial structures, if any due to the project	
14.	Loss of community life like any Market Places or community activities to be affected	
15.	Resettlement and Land acquisition (if foreseen due to any other project nearby) Has there been land acquisition before? If yes, what was the process of land acquisition and compensation package?	
16.	Protected areas (national park, protected forest, religiously sensitive sites, historical or archaeological sites), if any	
17.	**Health status:** i) Availability of Hospitals? ii) Is there any chronic disease prevalent in this area? iii) Are you aware about HIV/AIDS and STP? iv) Environmental condition of the study area?	
18.	**Poverty Level:** i) Is the area poor? ii) Very poor? iii) Well off? Or iv) High Income Group?	
19.	**Education Status:** i) Literate, ii) Illiterate.	

20.	**Employment Status:** i) Percentage of employment, ii) Unemployment, iii) Underemployment	
21.	**Migration Pattern (If any):** i) Inward, or ii) Outward iii) Where do people migrate? (within district/outside district/outside the state) iv) How many months in a year?	
22.	What is the possibility of shifting the religious structure(s)? And how do we mitigate it? What are the options?	
23.	Perceived benefits from the project	
24.	Perceived losses from the project	
25.	What other organizations of a social nature (NGOs/CBOs/ Civil Society) are active in the area? Name of these organizations	
26.	Any Other Issues you may feel to share:	
27.	Is this consultation useful? Comments	

FGD Annexure VII (B)

LIST OF PARTICIPANTS

Place:

Date: …….. Time:…….

S.No.	Name	Occupation	Sex	Age	Social Category	Signature
1						
2						
3						
4						
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Name & Signature of Surveyor/ Supervisor/ FAE ……..

Annexure VIII

Annexure IX: Socio-economic Profile of Project Affected Family (Land Leasor)

Table 1: Socio-economic Profile of Project Affected Family

S. No.	Village	Name of the Head of the Household	Religious Belief	Social Category (General Caste/SC/ST/OBC)	Willingness in of leasing the land	Number of Family member	Total Annual Income (in INR)	Total Annual Expenditure (in INR)	Source of Drinking Water	Toilet Facility	Electricity Facility
1	Bareta	Sh. Jagtar Singh	Sikh	General	Yes	3	6,50,000	4,80,000	Bore-well	Flush Toilet	20 Hours
2	Bareta	Bant Singh	Sikh	General	Yes	4	6,50,000	4,20,000	Bore-well	Flush Toilet	20 Hours
3	Dayalpura	Rabi@Raghbir Singh	Sikh	General	Yes	1	1,50,000	1,20,000	Bore-well	Flush Toilet	20 Hours
4	Dayalpura	Najar Singh	Sikh	General	Yes	4	2,50,000	2,40,000	Bore-well	Flush Toilet	20 Hours
5	Bareta	Major Singh/Hakim Singh/Gurjant Singh	Sikh	General	Yes	5	7,00,000	4,80,000	Bore-well	Flush Toilet	16 Hours
6	Dayalpura	Bahal Singh (Mob. 9464000129)	Sikh	General	Yes	15	40,90,000	6,00,000	Bore-well	Flush Toilet	24 Hours
7	Dayalpura	Harmendra Singh	Sikh	General	Yes	6	14,48,000	4,80,000	Bore-well	Flush Toilet	24 Hours
8	Bareta	Darshan Singh	Sikh	General	Yes	5	7,00,000	4,80,000	Bore-well	Flush Toilet	20 Hours
9	Bareta	Vidya Devi S/o Attari	Sikh	General	Yes	7	12,00,000	4,80,000	Bore-well	Flush Toilet	20 Hours
10	Bareta	Billu Singh S/o Kaka Singh	Sikh	General	Yes	5	14,00,000	4,92,000	Bore-well	Flush Toilet	20 Hours

S. No.	Village	Name of the Head of the Household	Religious Belief	Social Category (General Caste/SC/ST/OBC)	Willingness in of leasing the land	Number of Family member	Total Annual Income (in INR)	Total Annual Expenditure (in INR)	Source of Drinking Water	Toilet Facility	Electricity Facility
11	Bareta	Harjeevan Singh S/o Labh Singh	Sikh	General	Yes	4	7,00,000	4,92,000	Bore-well	Flush Toilet	20 Hours
12	Bareta	Sukhdev Singh S/o Govind Singh	Sikh	General	Yes	1	2,50,000	96,000	Bore-well	Flush Toilet	20 Hours

Source: VSPL's Primary Socio-economy Survey

Table:2: Socio-economic Activity of Project Affected Family

S. No.	Village	Head of the Household	Educational Status		Land Holding (Area in Acre)			Cropping Pattern (Area in Acre)			Annual Yield with Agriculture (in INR)
			Literate	Illiterate	Cultivable	Non-cultivable	Total	Kharif Crop	Rabi Crop	Summer Crop	
1	Bareta	Sh. Jagtar Singh	1	2	13	0	13	13	13	0	650000
2	Bareta	Bant Singh	1	3	13	0	13	13	13	0	650000
3	Dayalpura	Rabi@Raghbir Singh	0	1	3	0	3	3	3	0	150000
4	Dayalpura	Najar Singh	3	1	3	0	3	3	3	0	150000
5	Bareta	Major Singh/Hakim Singh/Gurjant Singh	2	3	11	0	11	11	11	0	550000
6	Dayalpura	Bahal Singh (Mob. 9464000129)	15	0	80	0	80	80	80	0	4000000
7	Dayalpura	Harmendra Singh	6	0	20	0	20	20	20	0	1000000
8	Bareta	Darshan Singh	4	1	15	0	15	15	15	0	700000

S. No.	Village	Head of the Household	Educational Status		Land Holding (Area in Acre)			Cropping Pattern (Area in Acre)			Annual Yield with Agriculture (in INR)
			Literate	Illiterate	Cultivable	Non-cultivable	Total	Kharif Crop	Rabi Crop	Summer Crop	
9	Bareta	Vidya Devi S/o Attari	6	1	38	0	38	38	38	0	1200000
10	Bareta	Billu Singh S/o Kaka Singh	5	0	30	0	30	30	30	0	1400000
11	Bareta	Harjeevan Singh S/o Labh Singh	3	1	15	0	15	15	15	0	700000
12	Bareta	Sukhdev Singh S/o Govind Singh	1	0	6	0	6	6	6	0	250000

Source: VSPL's Primary Socio-economy Survey

Table:3: Possession of Durable Consumer Items

S. No.	Village	Head of the Household	Durable Consumer Items Particulars										
			Radio	Bicycle	Television	Oven	LPG Connection	Computer	Refrigerator	Washing Machine	Motor Cicle/Scooor	Car	Air Conditioner
1	Bareta	Sh. Jagtar Singh	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	No
2	Bareta	Bant Singh	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No
3	Dayalpura	Rabi@Raghbir Singh	No	Yes	Yes	No	Yes	No	Yes	No	Yes	No	No
4	Dayalpura	Najar Singh	No	Yes	Yes	No	Yes	No	Yes	No	Yes	No	No
5	Bareta	Major Singh/Hakim	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No

S. No.	Village	Head of the Household	Durable Consumer Items Particulars										
			Radio	Bicycle	Television	Oven	LPG Connection	Computer	Refrigerator	Washing Machine	Motor Cicle/Schoor	Car	Air Conditioner
		Singh/Gurjant Singh											
6	Dayalpura	Bahal Singh (Mob. 9464000129)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
7	Dayalpura	Harmendra Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
8	Bareta	Darshan Singh	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Bareta	Vidya Devi S/o Attari	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Bareta	Billu Singh S/o Kaka Singh	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	No
11	Bareta	Harjeevan Singh S/o Labh Singh	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No
12	Bareta	Sukhdev Singh S/o Govind Singh	No	Yes	Yes	No	Yes	No	Yes	No	Yes	No	No

Source: VSPL's Primary Socio-economy Survey

Table 4: Status of Women's Status in Economic and Non-Economic Activity

S. No.	Village	Head of the Household	Women's Status in Economic and Non-economic Activity										
			Cultivation	Allied Activities	Collection and Sale of Forest Product	Trade and Business	Agricultural Labour	Non-agricultural Labour	HH Industries	Services	Household Work	Others	If engaged Total Income (in INR)
1	Bareta	Sh. Jagtar Singh	No	No	No	No	No	No	No	No	Yes	No	0
2	Bareta	Bant Singh	No	No	No	No	No	No	No	No	Yes	No	0
3	Dayalpura	Rabi@Raghbir Singh	No	No	No	No	No	No	No	No	Yes	No	
4	Dayalpura	Najar Singh	No	No	No	No	No	No	No	No	Yes	No	0
5	Bareta	Major Singh/Hakim Singh/Gurjant Singh	No	No	No	No	No	No	No	No	Yes	No	0
6	Dayalpura	Bahal Singh (Mob. 9464000129)	No	No	No	No	No	No	No	Yes	Yes	No	60,000
7	Dayalpura	Harmendra Singh	No	No	No	No	No	No	No	No	Yes	No	0
8	Bareta	Darshan Singh	No	No	No	No	No	No	No	No	Yes	No	0
9	Bareta	Vidya Devi S/o Attari	No	No	No	No	No	No	No	No	Yes	No	0
10	Bareta	Billu Singh S/o Kaka Singh	No	No	No	No	No	No	No	No	Yes	No	0

S. No.	Village	Head of the Household	Women's Status in Economic and Non-economic Activity										
			Cultivation	Allied Activities	Collection and Sale of Forest Product	Trade and Business	Agricultural Labour	Non-agricultural Labour	HH Industries	Services	Household Work	Others	If engaged Total Income (in INR)
11	Bareta	Harjeevan Singh S/o Labh Singh	No	No	No	No	No	No	No	No	Yes	No	0
12	Bareta	Sukhdev Singh S/o Govind Singh	No	No	No	No	No	No	No	No	Yes	No	0

Source: VSPL's Primary Socio-economy Survey

Table:5: Right to Say in Decision Making of Household Matters

S. No.	Village	Head of the Household	Involvement of Women in Day to Day Decision Making Matters						
			Financial Matters	Education of Child	Health Care of Child	Purchase of Assets	Day to Day Activities	Social Function and Marriage	Others
1	Bareta	Sh. Jagtar Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Bareta	Bant Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Dayalpura	Rabi@Raghbir Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Dayalpura	Najar Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Bareta	Major Singh/Hakim Singh/Gurjant Singh	No	No	No	No	No	No	No
6	Dayalpura	Bahal Singh (Mob. 9464000129)	Yes	Yes	Yes	Yes	Yes	Yes	Yes

S. No.	Village	Head of the Household	Involvement of Women in Day to Day Decision Making Matters						
			Financial Matters	Education of Child	Health Care of Child	Purchase of Assets	Day to Day Activities	Social Function and Marriage	Others
7	Dayalpura	Harmendra Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	Bareta	Darshan Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Bareta	Vidya Devi S/o Attari	Yes	Yes	Yes	Yes	Yes	Yes	No
10	Bareta	Billu Singh S/o Kaka Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	Bareta	Harjeevan Singh S/o Labh Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	Bareta	Sukhdev Singh S/o Govind Singh	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: VSPL's Primary Socio-economy Survey

Annexure IX

Mytrah Energy (India) Limited
(CIN : U40108TG2009PLC065804)
8001, S.No.109, Q-City,
Nanakramguda, Gachibowli,
Hyderabad - 500032, India.
Tel: +91 40 33760100,
www.mytrah.com

Quality, Safety, Health & Environment Policy

Policy Statement: Mytrah Energy India Limited (MEIL) , wholly owned subsidiary of Mytrah Energy Limited (MEL) with its all Special Purpose Vehicles (SPVs) are committed to provide Safe, Clean and Healthy Working Environment to its employees and stake holders as an integral part of its business ethics and philosophy.

Company reaffirms continual improvement for its Quality, Safety, Health & Environment (QSHE) performance with full satisfaction of customer in Power generation through renewable sources and transmission services by implementing a structured QSHE management framework in a sustainable and balanced manner.

Scope: Policy applies to employees, contractors across all its operative and applicable stake holders at large in the periphery of Asset management and will be displayed suitably in office/public domain

Objectives: 1) Ensure customer satisfaction with product and services offered by us with proper feedback mechanism.

2) Promote a Safe, Clean and Healthy Environment to eliminate /minimise and/or control adverse environmental impact and occupational health and safety risks arising out of our operations.

3) Establish and achieve QSHE objectives and Targets with adequate management plan and programs.

4) Adhere and comply with applicable QSHE legislations, regulations and other requirements pertaining to EHS and community at large.

5) Conserve natural resources and energy and promote waste avoidance and recycling measures in a sustainable way not impacting the nature.

6) Ensure involvement of employees, contractors, stake holders by providing appropriate training and awareness with effective communication for sound QSHE performances.

7) Focus on continual improvement of applicable process and performances through reporting, monitoring and reviewing at regular intervals.

(Vikram Kailas)
Managing Director

Date : 12.02.2016