

Environmental & Social Assessment of 369.0 kWp Solar Roof-top Project of Khantex Fashions Ltd.

- 1. Name of the Sponsors:** Khantex Fashions Ltd.
- 2. Address:** Factory is located at Barotopa, Mawna, Sreepur, Gazipur
- 3. Type of Industry and Building types:** Khantex is a RMG manufacturing company. The buildings are steel structured and rooftop is industrial corrugated sheet-based shed.
- 4. GPS Coordinates:** 24.20747 N, 90.37515 E
- 5. Project Description:**

a. Location of the project

The project is located at Barotopa, Mawna, Sreepur, Gazipur. (24.208688 N, 90.373954 E). Total rooftop area is around 61,000 sq. ft.

369.0 kWp project will be placed on the roof of the main building which has approximately 57,000 sq. ft. free space. The building has a steel structure and industrial corrugated sheet on the roof. The Sheds were established about 4-5 years ago.

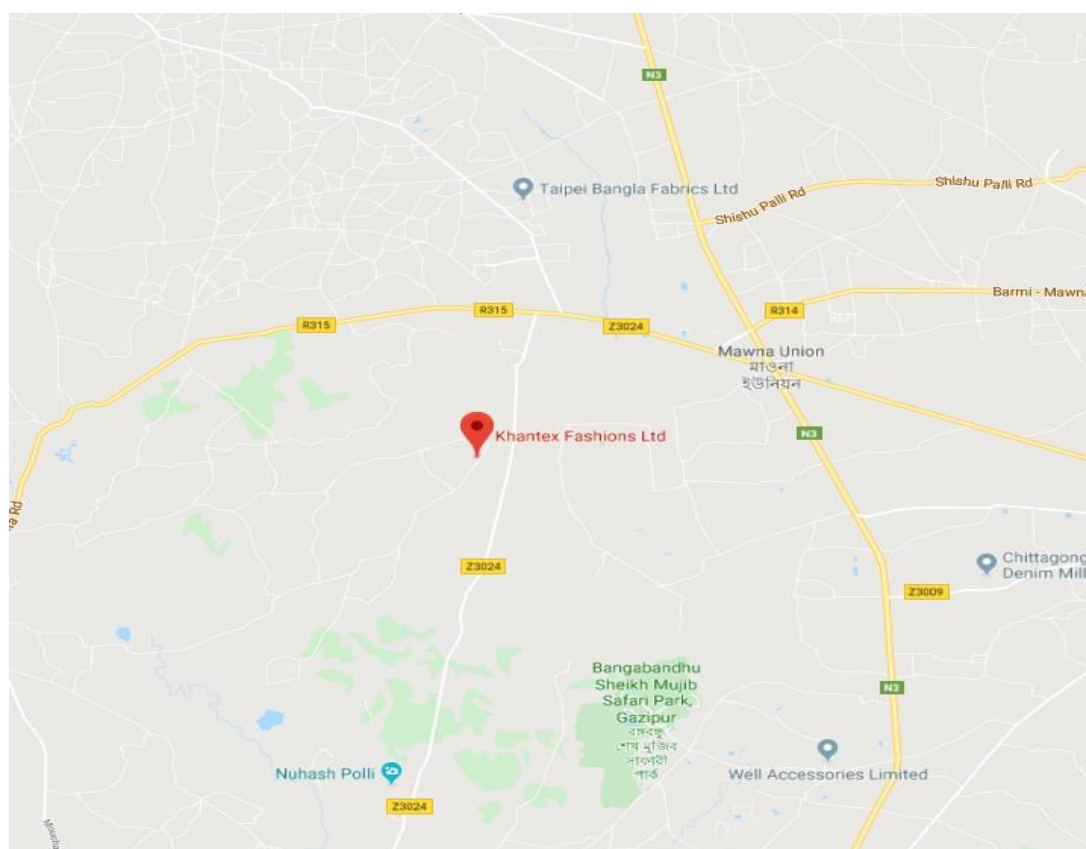


Figure: Project Location Map



Figure: Photos of the main building and the rooftop

The project can be reached in this direction: From Tongi to Bhawal via Dhaka-Mymensingh Highway to Khantex Fashion via Mawna Chowrasta.

b. Rational of the project

Khantex Fashions Ltd is implementing the rooftop project to reduce their dependency on grid electricity. The per unit cost of energy produced by grid-tied solar system is lower than grid tariff. So it will be financially beneficial for them. Also, as rooftop solar is clean energy, it would send a positive message to the stakeholders and buyers of Khantex that they care about the environment.

c. Technical Design

Two main equipment to be used in the proposed project are solar panels and inverters. Sun shines on the solar panels to generate DC electricity. DC electricity produced from the solar panel will be converted to 440V 3-phase AC using the inverters. Then, the energy will be fed into the busbars of industry.

Plant capacity of a roof-top solar power project mainly depends on available space and load while other factors to be taken into consideration being shading effect, orientation of the building, tilt angle of the building, load bearing capacity, backup generator capacity.

Taking all the above parameters into consideration, the optimum plant capacity was decided to be 369 kWp.

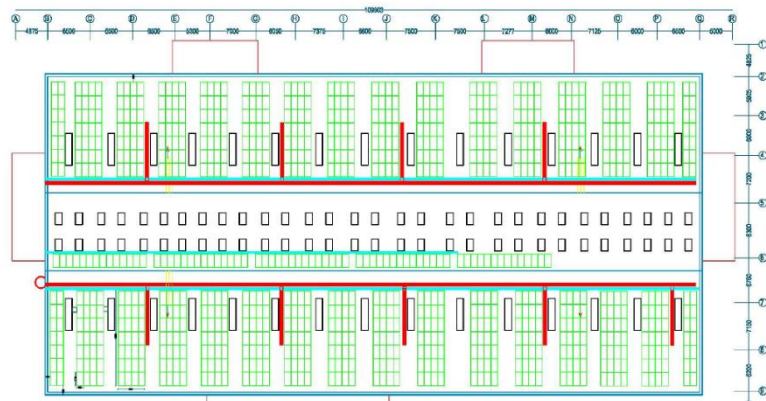


Figure: PV system Layout

The key project equipment are as below-

Equipment	Model	Manufacturers and country of origin	Warranty provisions
Solar PV Panel	TSM-DE17M(II), 455 Wp	Trina Solar, China	25 Years
Inverter	SOFAR 60000TL	SOFARSOLAR, Germany	10 Years

The description of the components of the system is as follows-

Sl.	Item	Quantity
1.	TSM-DE17M(II), 455 Wp	819 Pcs (369 kWp)
2.	Grid-inverter – SOFAR 60000TL (60kW)	5 Pcs
3.	Hybrid/Fuel Save Controller for PV-Generator-Grid (Brand: SMA)	1 Pcs
4.	Monitoring and communication system (Brand: SolarMAN)	1 Pcs
5.	Energy meters (Brand: HOP, DTZ1737)	1 Pcs
6.	PVC pipe with cable tray	1 Lot
7.	Combiner box	1 Lot
8.	Earthing/ Lightning Protection with High Voltage	1 Lot
9.	Cables and connectors (Brand: LAPP)	1 Lot
10	Module Mounting Structures	1 Lot (369 Wp)
11	Spare parts and extended warranty	1 Lot
12	Walkway	1 Lot
13	Safety equipment for O&M (Rapid Shut-down Device, Circuit breaker, Surge protector etc.)	1 Lot

PV Module description:

Brand	Trina Solar
Model	TSM-DE17M(II),
Type of Cell	Monocrystalline
Rated Maximum Power (P_{MAX})	450 Wp (STC)
Panel Efficiency	20.60%
Maximum Power Voltage (V_{MP})	41.0 V (STC)
Maximum Power Current (I_{MP})	10.98 A (STC)
Open Circuit Voltage (V_{oc})	49.60 V (STC)
Short Circuit Current (I_{sc})	11.53 A (STC)
Maximum System Voltage	1500 V DC
Temperature co-efficient for P_{MPP}	-0.340%/°C
Temperature co-efficient for V_{oc}	-0.250%/°C
Temperature co-efficient for I_{sc}	+0.040%/°C

Grid connected inverter description:

Brand	SOFARSOLAR
Model	SOFAR 60000TL
Input (DC)	
Maximum input voltage	1000 V
Maximum operating input current	90 A
Maximum short circuit current per MPPT	40 A
MPP Voltage Range	530-800 V
Rated input voltage	600 V
Number of independent MPPT inputs	6
Output (AC)	
AC nominal output	60 kW
AC voltage range	180-270 V
AC grid frequency	60 Hz
AC grid frequency range	57-63 Hz
Maximum Output Current	90 A
THD	< 3%
Power factor at rated power	1
Maximum Efficiency	98.6%
Degree of Protection	IP65

d. Operation and Maintenance

The operation of solar power plant is relatively simple and restricted to daylight hours in a day. With automated functions of inverter and switchyard controllers, the maintenance will be mostly oriented towards better up keep and monitoring of overall performance of the system. The solar PV system requires the least maintenance among all power generation facility due to the absence of fuel, intense heat, rotating machinery, waste disposal, etc. However, keeping the PV panels in good condition, monitoring and correcting faults in the connected equipment and cabling are still required to get maximum energy from the plant. A maintenance

schedule needs to be planned as per service/ guarantee terms of supplier to maintain optimum availability of plant at all times. The maintenance functions of a typical solar PV power plant can be categorized as given below.

Day to Day Maintenance Checks

- Ensure security of the power plant
- Monitor power generation and export
- Monitor load-center wise power generation values to detect any abnormality
- Entry of unauthorized person and stray animal at the site

Weekly Maintenance Checks

Inspection of PV panel glass surface clean / wash solar PV panels to free from dust and other dirt like bird's dropping etc.

Monthly Maintenance Checks

- Inspection of solar PV modules and arrays for any damage
- Check the power terminals for corrosion and proper torque, clean and apply antioxidant jelly, if necessary

Half Yearly Maintenance Checks

- Check all the wiring for physical damage and for any sign of excessive heating
- Check all the junction boxes for proper covering and sealing
- Check the fasteners of Solar PV panel mounting structure and array for proper torque and tightening

Yearly Maintenance Checks

- Check for discoloration of solar PV cells
- Check all the connections and ensure that they are not loose
- Checking corrosion, cleaning and painting switch yard structures

6. Battery uses for the Project:

There is no battery uses for the project. Any excess energy produced by the system will be exported to grid. The respected units of electricity which were exported, will be adjusted with the electricity bill of consecutive month.

7. Environmental Clearance Certificate (ECC) from DOE (Mandatory, Based on ECR 1997):

ECC is available for Khantex Fashions Ltd. (Identification no. 60254, Valid until 17 February, 2022.

8. Applicable Policies: Environmental Pollution Control Ordinance, 1977; Noise Pollution Control Rules (2006); Environmental Conservation Rules (ECR), 1997;

Environment Court Act, 2000 ; Bangladesh Climate Change Strategy and Action Plan (2008); Bangladesh Wildlife Preservation Order 1973 and Revision 2008 (Draft); National Forest Policy and Forest Sector Review (1994, 2005) ; The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry); National Biodiversity Strategy and Action Plan (2004); Bangladesh Labour Law, 2006; National Land use Policy, 2001; National Environmental Policy, 1992; National Environmental Management Action Plan, 1995; Renewable Energy Policy Of Bangladesh, 2008; Remote Area Power Supply Systems (RAPSS) Guideline, 2007 etc.

ENVIRONMENTAL CLEARANCE

9. Existing Environment:

- a. **Surrounding Environment:** An overview of the Project area is provided in map.



The main features of the project area are outlined below,

Particulars	Detail Description
Location	Barotopa, Mawna, Sreepur, Gazipur
Nearby villages	Barotopa
Nearest Airport	Hazrat Shahjalal International Airport (DAC)
Nearest Railway Station	Bhawal Gazipur Train Station

Climate

Although less than half of Bangladesh lies within the tropics, the presence of the Himalaya mountain range has created a tropical macroclimate across most of the east Bengal land mass. Bangladesh can be divided into seven climatic zones (Rashid 1991). According to the classification, the project area is located in South-central climatic zone.

South-central Zone: In this zone rainfall is abundant, being above 1,900 mm. The range of temperature is, as can be expected, much less than to the west, but somewhat more than in South-eastern zone. This is a transitory zone between the South-eastern, North-western and South-western zones and most of the severe hail storms, nor'westers and tornadoes are recorded in this area.

Like other parts of the country, the project area is heavily influenced by the Asiatic monsoon, and it has these three distinct seasons:

- Pre-monsoon hot season (from March to May),
- Rainy monsoon season (from June to October), and
- Cool dry winter season (from November to February).

The pre-monsoon hot season is characterized by high temperatures and thunderstorms. April is the hottest month in the country with mean temperatures ranging from 27°C in the east and south, to 31°C in the west-central part of the country. After April, increasing cloud-cover reduces the temperature. Wind direction is variable during this season, especially during the early part. Rainfall, mostly caused by thunderstorms, at this time can account for 10 to 25 percent of the annual total.

The rainy monsoon season is characterized by southerly or south-westerly winds, very high humidity, heavy rainfall and long periods of consecutive days of rainfall. The monsoon rain is caused by a tropical depression that enters the country from the Bay of Bengal. About 70%-85% of the annual precipitation occurs during the monsoon season.

The cool dry season is characterized by low temperatures, cool air blowing from the west or northwest, clear skies and meagre rainfall. The average temperature in January varies from 17°C in the northwest and north-eastern parts of the country to 20°C to 21°C in the coastal areas. Minimum temperatures in the extreme northwest in late December and early January reach between 3°C to 4°C.

According to BNBC 2020 seismic zone map, the project area falls in zone III. Zone III represents severe seismic intensity and consists of upper central and northwestern part of Bangladesh including Brahmanbaria, Sirajganj, Rangpur. A list of the flora and fauna around

the project area is given later. The locality around the project area mainly consists of agricultural/barren land.

b. Environmental Screening:

Features	Key Potential Impacts	Mitigation Measure	Remarks
Any cultural heritage near to the project site	None	None	None
Any protected area	None	None	None
Forestry or Mangrove near to the project site	None	None	None
Any tree clearing required in the project site	No	No	None
Name of the Flora	Description given below		
Name of the Fauna	Description Given below		
Planning for water harvesting roof	No	No	None
Is there any plan for future uses, which may affect the projects	No	No	None
Will the project may cause any risks for community safety	No	No	None
Water uses	As the amount of water requirement is not much high, the impact on water resources is not that significant.	-The contractor will dispose of the debris material to a designated disposal site. -All reasonable measures will be taken to prevent the wastewater produced in construction from entering into creek and stream. -Contractor's camp will be provided with sanitary latrines that do not pollute surface waters.	None

		- In case of ground water, proper mitigation measures must be ensured at construction site to avoid any spillage and leakage of oil. All the staffs at construction areas must be refrained of discharge any liquid wastes on the ground.	
Drinking water uses	No	No	None
Air quality monitoring	-Dust generation due to construction activities. -Exhaust Emissions due to operation of construction plant and machinery.	▪ Setting an appropriate site speed limit to reduce dust generation from vehicles travelling over unmade surfaces. ▪ During construction dust generated on unpaved roadways and work areas should be controlled by the application of water on an “as needs” basis. ▪ Unnecessary handling of dusty materials will be avoided such as minimizing drop heights when loaders dump soils into trucks. ▪ Train workers to handle construction materials and debris during construction to reduce fugitive emissions. ▪ Ensure adequate maintenance and inspection of vehicles to minimize exhaust emissions.	None

		Not running engines for longer than is necessary.	
Noise monitoring	Increased noise levels due to constructions activities and use of machineries	The contractor shall use heavy equipment, machinery, and fuels in compliance with national regulations. The contractor shall perform regular maintenance on all equipment, vehicle and machinery to prevent noise emissions.	None

Flora

The project surrounding area is similar to the character of many areas of alluvial delta in Bangladesh with mixed crop vegetation. Rice, other grains and seasonal vegetables etc. are the main crops in the project surrounding area. Terrestrial plants are mainly limited to trees, shrubs and flowers grown alongside roads and in parks and gardens, and the crops and fruit trees planted in agricultural areas. The composition of plant community includes low growing grasses and herbaceous vegetation as well as other flora. A list of some terrestrial floral species found around the project area is shown in following table.

Table: List of Flora in the Project Surrounding Area

Species Name	Local Name	Family
<i>Annona reticulata</i>	Bullocks heart/Sharifa	<i>Annonaceae</i>
<i>Atstonia scholaris</i>	Chettim	<i>Apocynaceae</i>
<i>Averrhoa carambala</i>	Kamranga	<i>Averrhoaceae</i>
<i>Artocarpus heterophyllus</i>	Kanthal	<i>Moraceae</i>
<i>Albizia lebbeck</i>	Koroi	<i>Fabaceae</i>
<i>Amaranthus spinosus</i>	Kantanotey	<i>Amaraanthaceae</i>
<i>Abroma augusta</i>	Ulat kambal	<i>Malvaceae</i>
<i>Acacia moniliformes</i>	Akashmoni	<i>Leguminosae</i>
<i>Areca catechu</i>	Supari	<i>Palmae</i>
<i>Azadirachta indica</i>	Neem	<i>Meliaceae</i>
<i>Borassus flabellifer</i>	Taal	<i>Arecaceae</i>
<i>Bambusa vulgaris</i>	Bansh	<i>Poaceae</i>
<i>Cocos nucifera</i>	Narikel	<i>Palmae</i>
<i>Codiaeum vareigatum</i>	Patabahar	<i>Patabahar</i>
<i>Carica papaya</i>	Pepe	<i>Caricaceae</i>
<i>Delonix regia</i>	Krisnochura	<i>Leguminosae</i>
<i>Delonix regia</i>	Krishnachura	<i>Fabaceae</i>

Species Name	Local Name	Family
<i>Dalbergia sissoo</i>	Sheeshu	Fabaceae
<i>Ficus benghalensis</i>	Bot	Moraceae
<i>Ficus religiosa</i>	Oshwoth	Moraceae
<i>Heliotropium indicum</i>	Hatisur	Boraginaceae
<i>Luffaae gypticea</i>	Dhundul	Cucurbitaceae
<i>Lagerstroemia speciosa</i>	Jarul	Lythraceae
<i>Litchi sinensis</i>	Lichu	Sapindaceae
<i>Mangifera indica</i>	Aam	Anacardiaceae
<i>Musa</i>	Kola	Musaceae
<i>Phoenix sylvestris</i>	Khejur	Palmae
<i>Psidium guajava</i>	Peyara	Myrtaceae
<i>Polyalthia longifolia</i>	Debdaru	Annonaceae
<i>Shorea robusta</i>	Shal	Dipteocarpaceae
<i>Salmaliama labarica</i>	Shimul	Malvaceae
<i>Syzygium cumini</i>	Jaam	Myrtaceae
<i>Streblus asper</i>	Shewra	Moraceae
<i>Swietenia macrophylla</i>	Mahogany	Meliaceae
<i>Tamarindusindica</i>	Tentul	Leguminosae
<i>Terminalia arjuna</i>	Arjun	Combretaceae
<i>Tectonia grandis</i>	Shegun	Lamiaceae

Fauna

A list of some types of animals found around the project area are given in the below table.

Table: List of Fauna in the Project Surrounding Area

Scientific Name	English Name	Local Name
Class: Amphibia		
<i>Bufo melanostictus</i>	Common toad	Kuno bang
<i>Rana tigrina</i>	Indian bull frog	Kula bang
Class: Reptilia		
<i>Gecko gecko</i>	Wall lizard	Tokkhok
<i>Hemidactylus brooki</i>	Common House Lizard	
Class: Aves		
<i>Passer domesticus</i>	House sparrow	Charui
<i>Milvus migrans</i>	Black kite	Cheel
<i>Anatidae anatidae</i>	Duck	Hash
<i>Picononotus barbatus</i>	Common bulbul	Bulbuli
<i>Acrido thestristis</i>	Common myna	Shalik
<i>Copsychus saularis</i>	Magpie robin	Doyel
<i>Egretta garzetta</i>	Little egret	Bok
<i>Corvus splendens</i>	Crow	Kaak

Scientific Name	English Name	Local Name
Class: Amphibia		
<i>Tyto alba</i>	Barn owl	Pecha
Class: Mammalia		
<i>Capra aegagrushircus</i>	Goat	Chagol
<i>Canis lupus familiaris</i>	Dog	Kukur
<i>Ovis aries</i>	Sheep	Bhera
<i>Bos taurus</i>	Cow	Goru
<i>Herpestese dwardsii</i>	Mongoose	Beji
<i>Sciurus carolinensis</i>	Grey Squirrel	Kath birali
<i>Rattus rattus</i>	Rat	Indur

Some aquatic plant species commonly found around the project area are Kochuripana, DholKalmi, Sheola, Malanchi, Kalmi, Helencha etc. Some species of fish found around the area are Mrigel, Rui, Katla, Grass Carp, Silver Carp, Mirror Carp, Big Head, Koi, Tengra etc. Some aquatic birds found around the project area are Pancowri, Kanibok, Sadabok, Borobok, Machranga, Dahuk etc.

In and around the project no environmentally critical areas were found. Some near threatened/threatened species can be found around the project area. But, impacts on the rate of deforestation, loss of habitat, habitat fragmentation, and interruption of wildlife migration patterns are not anticipated.

Air Quality

Following parameters have been included for ambient air quality monitoring.

Table: Test Results

Concentration Present	SPM ($\mu\text{g}/\text{m}^3$)	PM ₁₀ ($\mu\text{g}/\text{m}^3$)	PM _{2.5} ($\mu\text{g}/\text{m}^3$)	SO ₂ ($\mu\text{g}/\text{m}^3$)	NO _x ($\mu\text{g}/\text{m}^3$)	CO (ppm)	O ₂ (%)	Temp (°C)
West Side Near Boundary Area	166	118	58	0	0.23	4.2	19.01	23.1
East Side Near Boundary Area	160	108	52	0	0.20	4.3	19.04	23.1
North Side Near Boundary Area	156	108	48	0	0.23	4.1	18.02	23.2
South Side Near Boundary Area	173	120	53	0	0.26	4.8	18.05	23.5

Table: Standard Requirement

Description	SPM ($\mu\text{g}/\text{m}^3$)	PM ₁₀ ($\mu\text{g}/\text{m}^3$)	PM _{2.5} ($\mu\text{g}/\text{m}^3$)	SO ₂ ($\mu\text{g}/\text{m}^3$)	NO _x ($\mu\text{g}/\text{m}^3$)	CO (ppm)	O ₂ (%)	Temp (°C)
Ambient National Air Quality Standards in Bangladesh (2005) and ECR 97	200 (8 hour)	150 (24 hour)	65 (24 hour)	365 (24 hour)	100 (Annual)	9 (8 hour)	-	-
WHO guidelines (Interim target- 1 value)	-	150 (24 hour)	75 (24 hour)	125 (24 hour)	-	-	-	-
WHO guidelines (guideline value)	-	50 (24 hour)	25 (24 hour)	20 (24 hour)	NO ₂ - 200 (1 hour)	-	-	-

Test Results show ambient air quality of the facility shows concentrations are within the national standards.

Water Quality

Surface Water Quality

Sampling and analysis of surface water quality has been carried out for the following parameters:

Test Results: Surface Water

SL. No.	Parameters	Unit	Test Method	Test Results	Limit of Quantification (LoQ)
1	pH Value	-	USEPA 150.1	8.7	-
2	Dissolved Oxygen (DO)	mg/L	USEPA 360.1	11.13	0.05
3	Chemical Oxygen Demand (COD)	mg/L	APHA 23rd Edition 2017 (5220 D)	74	5
4	Biochemical Oxygen Demand (BOD) (For 5 days at 20 'C)	mg/L	APHA 23rd Edition 2017 (5210 B)	18	5
5	Total Dissolved Solids (TDS)	mg/L	APHA 23rd Edition 2017 (2540 D)	68.6	5
6	Total Suspended Solis (TSS)	mg/L	APHA 23rd Edition 2017 (2540 C)	22	5
7	NH ₄ -N	mg/L	In House/ APHA 23rd Edn,2017 4500- NH ₃	2.07	0.5
8	Electro-conductivity (EC)	µs/cm	USEPA 120.1	145	0.01

Here; (mg/l): milligram per litre; 'c: Degree celsius; (µs/cm): Microsiemens per centimeter.

Ground Water Quality

Sampling and analysis of ground water has been carried for the following parameters:

Test Results: Ground Water

Sl.	Parameters	Unit	Test Method	Test Result	Limit of Quantification (LOQ)
1	Arsenic (as)	mg/L	USEPA 601OC / EN ISO 18412-2005	ND	0.005
2	Dissolved Oxygen (DO)	mg/L	USEPA 360.1	8.08	0.05
3	Electro-conductivity (EC)	µs/cm	USEPA 120.1	275	0.01
4	Total Dissolved Solids (TDS)	mg/L	APHA 23rd Edition 2017 (2540 C)	130.2	5
5	Iron (as Fe)	mg/L	USEPA 601OC / EN ISO 18412-2005	0.4	0.05
6	pH Value	-	USEPA 150.1	6.9	-
7	Temperature	°C	USEPA 170.1	26.8	1
8	Salinity	(%)	APHA 23rd Edition 2017 (2520 B)	0.13	0.01
9	Hardness	mg/L	ASTM D 51 1/ In House	142	10
10	Total Coliform	CFU/100ml	Membrane Filtration	ND	10
11	Faecal Coliform	CFU/100ml	Membrane Filtration	ND	10

Here; (mg/l): milligram per litre; 'C: Degree Celsius; (µs/cm): Microsiemens Per Centimeter. (‰) : parts per thousand (ppt), ND: Not Detected

The water quality assessment results are found mostly satisfactory as per ECR, 97.

Noise

Samplings were done to measure the Sound Level for every section of the facility. The noise levels were measured with the help of a portable precision digital sound level meter (Model-SI-4033DS, made in Taiwan). The instrument calibration was achieved using manufacturer supplied pistaphone calibrator capable of producing known sound pressure level.

Sampling Time & Duration: Samplings were done between 10.00 AM to 4.30 PM.

Table: Test Results

Sl	Name of location	Obtained Value (dB)	Standard (dB)	Remarks
1	East Side N: 24°12'31.032" E: 90°22'29.448"	48.9	75 dB at day time and 70 dB at night time	Acceptable
2	West Side N: 24°12'32.328" E: 90°22'24.402"	54.2	75 dB at day time and 70 dB at night time	Acceptable
3	North Side N: 24°12'32.766" E: 90°22'27.03"	57.8	75 dB at day time and 70 dB at night time	Acceptable
4	South Side N: 24°12'27.972" E: 90°22'28.092"	53.6	75 dB at day time and 70 dB at night time	Acceptable
5	Middle Side N: 24°12'29.442" E: 90°22'27.39"	62.1	75 dB at day time and 70 dB at night time	Acceptable

The noise assessment results are found satisfactory as per national standards.

10. Social Screening:

- a. Is there any recorded litigation issues (e.g.; Land problem with forest dept. or private matters) associated with the project site?

There are no recorded litigation issues.

- b. Is there any Tribal people/Small Ethnic Community leave near to the project site?

There are no tribal people/small ethnic community living near the project site.

c.

Features	Key Potentials	Mitigation Measures	Remarks
Is there any land acquisition of Government or Private land leading to loss of shelter and livelihood (eg ; Forest land or Private land)	No impact	Not required	None
Possible conflicts with the local community	No impact	Not required	None
Is there any significant issues raised by the stakeholders	No impact	Not required	None

11. Environmental and Social Impacts:

a. Summary of Anticipated Environmental & Social Impacts during the Planning and Construction Phase

Environmental Attribute	Likely Impact– Planning and Construction Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Landscape and Visual	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	Short term	Local	Reversible	Likely	Medium	Mild	Moderate Negative	Low Negative
Geology and Hydrology	Only some possible impacts are dumping of solid waste to the surface water sources during construction.	Short term	Local	Reversible	Likely	Medium	Mild	Moderate Negative	Low Negative

Environmental Attribute	Likely Impact– Planning and Construction Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	Risk of soil contamination during the various construction activities from spillage of hazardous material, random discharge of waste and wastewater. No risk of groundwater contamination.	Could be long term	Local	Could be irreversible	Likely	Medium	Mild	Low Negative	High Positive
Biodiversity	Construction activities could disturb existing habitats (flora, fauna, and avifauna) and any threatened or endangered species which might be present within	Long term	Local	Irreversible	Certain	Minor	Mild	Low Negative	High Positive

Environmental Attribute	Likely Impact– Planning and Construction Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	the Project site. In addition, other impacts could be from improper management of the site (e.g. improper conduct and housekeeping practices).								
Air Quality	Construction activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality.	Long term	Local	Reversible	Certain	Medium	Mild	Low Negative	High Positive
Noise	Possible noise emissions to the environment	Long term	Local	Reversible	Certain	Medium	Mild	Moderate Negative	Low Negative

Environmental Attribute	Likely Impact– Planning and Construction Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	from the construction activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities								
Waste Generation	Improper management and handling of hazardous and non-hazardous waste during construction.	Short term	Local	Reversible	Likely	High	Severe	High Negative	Moderate Negative
Socioeconomic	The Project is expected at a minimum to provide job opportunities for local communities.	Not applicable.							

Environmental Attribute	Likely Impact– Planning and Construction Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to local communities.								
Health and Safety	There will be some generic risks to workers health and safety from working on construction sites, as it increases the risk of injury or	Short term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low Negative

Environmental Attribute	Likely Impact– Planning and Construction Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	death due to accidents.								

b. Summary of Anticipated Impacts during the Operation Phase:

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Landscape and Visual	The Project is expected to be visible within the immediate vicinity and up to some long distance around the Project site only and thus is likely to create visual impacts related to interaction with surrounding landscape.	Long term	Local	Reversible	Likely	Medium	Low	Low Negative	Low Negative
	Potential for glare caused by minimal sunlight reflected off the PV panel modules which in turn could affect nearby receptors.	Long term	Local	Reversible	Likely	Medium	Mild	Low Negative	Low Negative
PV panels	The most significant source of soil pollution is the damage of PV	Long term	Local	Reversible	Likely	High	Severe	High Negative	Moderate Negative

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	panels in case of major accidents. These contain chemicals and may be harmful for soil quality. There will be environmental impacts of emission of greenhouse gas, Ozone depletion, photochemical smog, eutrophication and acidification and also health effects on people.								
Heat Generation	Increased heat by radiation, convection and conduction	Long term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low negative
Geology and Hydrology	Risk of soil and groundwater contamination during the various operational	Long term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low negative

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater. However, most significant sources of soil and water pollution are the chemicals from PV panel's damage.								
Biodiversity	Impacts limited to improper management of the site (e.g. improper conduct and housekeeping practices).	Long term	Local	Could be irreversible	Likely	Minor	Low	Low Negative	Moderate Positive
Air Quality	Solar rooftop systems have very low air emissions of air pollutants such as sulfur dioxide, nitrogen	Long term	Local	Could be irreversible	Likely	Minor	Low	Low Negative	High Positive

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	oxides, carbon monoxide, volatile organic compounds, and the greenhouse gas carbon dioxide during operations.								
Noise	The only significant noise source from the operation activities which will likely include the use of backup generators to ensure continuous power supply.	Long term	Local	Reversible	Likely	Medium	Mild	Moderate Negative	Low Negative
Socio-economic	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the	Not applicable.							

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to local communities.								
Occupational and Community Health and Safety	There will be some risks to workers health and safety during the operation and maintenance activities of the Project.	Long term	Local	Could be irreversible	Likely	Medium	Mild	Low Negative	Moderate Positive
	Trespassing of unauthorized personnel into the Project site could result in potential risks from several hazards of the various Project components (e.g. electric shock, thermal burn	Long term	Local	Could be irreversible	Likely	Medium	Mild	Low Negative	Moderate Positive

Environmental Attribute	Likely Impact– Operation Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	hazards, exposure to chemicals and hazardous materials, etc.). Leaching of materials from broken or fire damaged PV modules. Emergency Fire Hazard. Electrocution of workers. Electromagnetic radiation from PV modules.								

c. Summary of Anticipated Impacts during the Decommissioning Phase

Environmental Attribute	Likely Impact– Decommissioning Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
Geology and Hydrology	Risk of soil and groundwater contamination during the various decommissioning activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater.	Short term	Local	Could be irreversible	Likely	Medium	Low	Moderate Negative	Low Positive
Air Quality	Decommissioning activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality.	Short term	Local	Reversible	Certain	Medium	Low	Moderate Negative	Low Negative
Noise	Possible noise emissions to the environment from the	Short term	Local	Reversible	Likely	Medium	Mild	Moderate Negative	Low Negative

Environmental Attribute	Likely Impact–Decommissioning Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	decommissioning activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities.								
Infrastructure and utilities	Of particular importance related to infrastructure and utilities is the final disposal of the panels at the end of their lifetime. Final disposal of panels, which may contain hazardous material, needs to ensure that existing waste facilities would be able accept such solar modules. In addition, it is also important to investigate other	Long term	Local	Reversible	Likely	High	Severe	High Negative	Low Negative

Environmental Attribute	Likely Impact–Decommissioning Phase	Impact Assessment							
		Duration	Spatial Extent	Reversibility	Likelihood	Magnitude	Sensitivity	Significance Prior to Mitigation	Significance After Mitigation
	disposal options such as buy back and recycling programs.								
Health and Safety	There will be some generic risks to workers health and safety from working on decommissioning sites, as it increases the risk of injury or death due to accidents.	Short term	Local	Could be irreversible	Likely	Medium	Mild	Moderate Negative	Low Negative

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

On the basis of identification of the environmental impacts and recommended mitigation measures linked with the project activities, an ESMP has been prepared which will be followed at the pre-construction, construction, operation and decommissioning stages. While preparing the ESMP, medium and significant impacts are taken into consideration to recommend possible mitigation measures. A mitigation measure will be considered as successful when it complies with the Environmental Quality Standards (EQS), policies, legal requirements set by respective development partners, and DoE environmental guidelines & other relevant GoB legal requirements. In absence of DoE's own EQS, other relevant international or other recognized organization's quality standard will be applied.

Environmental and Social Management Plan (ESMP)

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Pre-construction Phase						
Land Use	The proposed project is a rooftop system, so there are no anticipated impacts.	-	-	-	-	-
Construction Phase						
Visual Amenity	Visual impacts from construction activities such as materials lay down, infrastructure development, etc.	The contractor shall ensure general cleanliness and good housekeeping practice at the project site at all times.	Daily	Good housekeeping and tidiness of work areas within the project site.	Contractor	- National Land use Policy, 2001 - National Environmental Policy, 1992 - National Environmental Management Action Plan, 1995
Water Resources	As the amount of water requirement is not much high, the impact on water resources is not that significant.	- The contractor will dispose of the debris material to a designated disposal site. - All reasonable measures will be taken to prevent the wastewater produced in construction from entering into creek and stream.	Daily	Compliance with DoE and National guideline limits for Environmental noise at sensitive receptors.	Contractor	Environmental Pollution Control Ordinance, 1977

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		- Contractor's camp will be provided with sanitary latrines that do not pollute surface waters. - In case of ground water, proper mitigation measures must be ensured at construction site to avoid any spillage and leakage of oil. All the staffs at construction areas must be refrained of discharge any liquid wastes on the ground.				
Noise	Increased noise levels due to construction activities and use of machineries	The contractor shall limit idling of engines when not in use to reduce its contribution to noise emissions.	Every week and after receiving any complaints from worker or third parties.	Compliance with DoE and National guideline limits for Environmental noise at sensitive receptors.	Contractor	- Environmental Pollution Control Ordinance, 1977 - Noise Pollution Control Rules (2006)
Air Quality	- Dust generation due to construction activities. - Exhaust Emissions due to operation of construction plant and machinery.	- Setting an appropriate site speed limit to reduce dust generation from vehicles travelling over unmade surfaces. - During construction dust generated on unpaved roadways and work areas should be controlled by the application of water on an "as needs" basis.	Daily	- No visible dust plumes originating From construction sites. - Regular machineries maintenance records.	Contractor	- Environmental Pollution Control Ordinance, 1977 - Environmental Conservation Rules (ECR), 1997 - Environment Court Act, 2000

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		▪ Unnecessary handling of dusty materials will be avoided such as minimizing drop heights when loaders dump soils into trucks. ▪ Train workers to handle construction materials and debris during construction to reduce fugitive emissions. ▪ Ensure adequate maintenance and inspection of vehicles to minimize exhaust emissions. Not running engines for longer than is necessary.				▪ Bangladesh Climate Change Strategy and Action Plan (2008)
Soil	Soil disturbance due accidental spillage	▪ A spill prevention and response plan shall be prepared by the contractor in order to control any inadvertent leakage or spillage. Spill response measures shall be implemented (as necessary) to contain and clean up any contaminated soil. ▪ Construction of bunds around relevant work and storage areas. Bunds in areas of hazardous chemical storage (including temporary storage) should be lined to contain accidental spillage and	Weekly	▪ Number of spills or incidents to be recorded during onsite audits. ▪ Training records of Personnel trained in spill response procedures must be filed	Contractor	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		minimize the potential for migration to the underlying soil. - Any spilled chemical shall be immediately collected and disposed of in accordance with Spill Prevention and Response Plan and MSDS. - Contractor shall ensure that a spill kit and adequate PPE is available at the site for emergency cleanup activities in case of chemical/oil spillage.				
Terrestrial Ecology	Potential disturbance to birds	- Minimize human and vehicular contact with fauna, including their burrows / nests and feeding grounds. - Waste shall be stored on site within closed container, especially food remnants to avoid attracting birds on site.	Daily	N/A	Contractor	- Bangladesh Wildlife Preservation Order 1973 and Revision 2008 (Draft) - National Forest Policy and Forest Sector Review (1994, 2005) - The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry)

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
						▪ National Biodiversity Strategy and Action Plan (2004)
Waste Generation	Improper management and handling of hazardous and non-hazardous waste during construction.	▪ The contractor shall segregate storage for different types of wastes, such as hazardous, non-hazardous recyclable construction material, plastic, paper, etc. to facilitate proper disposal. ▪ The contractor shall provide a separate storage area for hazardous materials. The hazardous materials/products must be labeled with proper identification of its hazardous properties. ▪ Chemical waste shall be stored in accordance with the provisions of Material Safety Data Sheets (MSDS). The contractor shall keep MSDS onsite. ▪ The contractor shall establish regular intervals for waste collection and disposal as per contractor's waste management procedures.	Daily	▪ Compliance with Waste management procedures. ▪ Current and Complete records of regular waste pickup and disposal.	Contractor	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995 ▪ Environmental Conservation Rules (ECR), 1997

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		▪ The sanitary and organic wastes shall be collected in a septic tank to be installed on site and disposed off regularly.				
Health and Safety risks	▪ Potential of exposure to safety events such as tripping, working at height activities, fire from hot works, smoking, failure in electrical installation, mobile plant and vehicles, and electrical shocks. ▪ Exposure to health events during construction activities such as manual handling and musculoskeletal disorders, hand-arm vibration, temporary or permanent hearing loss, heat	▪ All construction equipment used for the execution of the project works shall be fit for purpose and carry valid inspection certificates and insurance requirements. ▪ Risk assessment shall be prepared and communicated prior to commencement of work for all types of work activities on site. ▪ Provide walkways that are clearly designated as a walkway; all walkways shall be provided with good conditions underfoot; signposted and with adequate lighting. ▪ Signpost any slippery areas, ensure proper footwear with a good grip is worn for personnel working within slippery areas. ▪ Avoid work at height where it reasonably practicable to do so, e.g. by assembly at ground level.	Continuously	▪ Total Recordable ▪ Incidence Rate (TRIR) ▪ Lost Time Incidence Frequency ▪ Fatal Accident Rate ▪ Number of safety Training performed ▪ Number of nonconformance events Reports. ▪ Medical Treatment Case (MTC) ▪ HSE Training Hours	Contractor	▪ Bangladesh Labour Law, 2006

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	stress, and dermatitis.	▪ Prevent any person falling a distance liable to cause personal injury e.g. by using a scaffold platform with double guard-rail and toe boards; ▪ Arrest a fall with equipment to minimize the distance and consequences of a fall, e.g. safety nets, where work at height cannot be avoided or the fall prevented. ▪ Carry out fire risk assessment for the construction areas, identify sources of fuel and ignition and establish general fire precautions including, means of escape, warning and fighting fire. ▪ Set up a system to alert workers on site. This may be temporary or permanent mains operated fire alarm. ▪ Fire extinguishers should be located at identified fire points around the site. The extinguishers shall be appropriate to the nature of the potential fire. ▪ Ensure all plant machines and vehicles are regularly				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		inspected, serviced and maintained; ensure all staff assigned is trained and competent to operate plant machines and vehicles. ▪ Ensure clear signages are in place, such as Warning of speed limits, obstructions, allowable widths/ heights...etc. ▪ Electrical equipment must be safe and properly maintained; works shall not be carried out on live systems. ▪ Only competent authorized persons shall carry out maintenance on electrical equipment, adequate Protective Equipment for electrical works must be provided to all personnel involved in the tasks. ▪ Adequate number of staff and first aiders shall be on site in accordance with Bangladesh Labor Law requirements. ▪ First aid kit with adhesive bandages, antibiotic ointment, antiseptic wipes, aspirin, non-latex gloves, scissors, thermometer, etc. shall be made				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		available by the contractor on site. ▪ Ensure all equipment is suitable for jobs (safety, size, power, efficiency, ergonomics, cost, user acceptability etc.), provide the lowest vibration tools that are suitable and can do the works. ▪ Ensure all tools and other work equipment are serviced and maintained in accordance with maintenance schedules and manufacturer's instructions. ▪ As far as reasonably practical, all steps to reduce noise exposure levels of employees by means other than that of personal protective equipment shall be taken, such as reducing exposure times, enclosures, silencers, machine covers, etc. ▪ Ensure adequate quantity of drinking water is available at different locations within the site, ▪ Provision of sun shades at different locations within the site.				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		▪ Eliminate the risk of exposure whenever possible, provide proper PPE wherever necessary and to ensure that there are satisfactory washing and changing facilities. ▪ Ensure that all workers exposed to a risk are aware of the possible dangers. They should be given thorough training in how to protect themselves and there should be effective supervision to ensure that the correct methods are being used.				
Traffic	Additional traffic load due to transport of equipment and materials to and from the site through the surrounding road network	▪ The contractor to ensure that all trucks and vehicles accessing the facility are operated by licensed operators. ▪ Pedestrians Safety: All project vehicles and trucks shall comply with the proposed speed limits ▪ Ensure adequate maintenance and inspection of vehicles	Continuously	▪ No complains or concerns from traditional users of the area's roads routes are received during the construction activities. ▪ No incidents or accidents (collisions) are recorded	Contractor	
Operation Phase						
Visual Amenity	Reflection from the solar panel	The used technology has Anti-Reflective coating (ARC) that	N/A	N/A	Project Developer	▪ National Land use Policy, 2001

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	will create visual intrusion.	significantly reduces the reflectance of the Panels (from 2.5% to 2.6% only).				▪ National Environmental Policy, 1992 ▪ National Environmental Management Action Plan, 1995
Noise	Significant sound pollution from backup generator	▪ Establish the generator inside an insulated room and use noise reduction canopy to keep the environment free from sound pollution. ▪ Noise barrier should also be given around the generator room. ▪ The worker inside the project area should use earmuffs during the operation of diesel generator.	Every week and after receiving any complaints from worker or third parties.	Compliance with DoE and National guideline limits for Environmental noise at sensitive receptors.	Project Developer	▪ Environmental Pollution Control Ordinance, 1977 ▪ Noise Pollution Control Rules, 2006
Air Quality	Very low air emissions of air pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, volatile organic compounds, and the greenhouse	▪ Check regularly to identify potential source of air pollutants. ▪ Replace the damaged and expired tools, equipment, PV panels as soon as it is notices.	Daily	▪ No visible dust plumes originating from project site. ▪ Regular machineries maintenance records.	Project Developer	▪ Environmental Pollution Control Ordinance, 1977 ▪ Environmental Conservation Rules (ECR), 1997 ▪ Environment Court Act, 2000

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	gas carbon dioxide.					▪ Bangladesh Climate Change Strategy and Action Plan (2008)
Heat Generation	▪ Potential glare from PV panels and Reflected Heat. ▪ Theoretically the solar thermal placement in the shell of the buildings could increase fire risk and water intrusion into the roof.	▪ This can be easily avoided, since only four holes per panel on the roof will be integral part of the roof. ▪ Air gaps will be provided to keep the system cool.	N/A	▪ No heat generation and complains from the worker.	Project Developer	▪ Environmental Pollution Control Ordinance, 1977
Soil	Potential spillage of stored oil and chemicals	▪ Specific procedures shall be developed for the removal of waste or spilled fuel, oil and contaminated soil at approved disposal facilities. ▪ Proper storage for chemicals and fuel within confined areas on site and adopting proper safety measures when handling those chemicals to prevent their leakage and infiltration into the soil.	▪ Post rainfall Event ▪ Weekly	Maintain readily available records of all workers training on spill response procedures.	Project Developer	▪ Environmental Pollution Control Ordinance, 1977; The Environment (Pollution Control) Act, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Terrestrial Ecology	Potential disturbance and harm to birds	- Minimize human and vehicular contact with resident birds including their burrows / nests and feeding grounds. - Ground nests found on site shall be translocated outside the project boundary. - Waste shall be stored on site within closed container, especially food remnants to avoid attracting birds on site.	Weekly	No reported harm to birds.	Project Developer	- Bangladesh Wildlife Preservation Order 1973 and Revision 2008 (Draft); National Forest Policy and Forest Sector Review (1994, 2005) - The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry) - National Biodiversity Strategy and Action Plan, 2004
Waste Generation	- Solid wastes from PV modules which contains toxic metals. - Wasted PV modules and few other solid wastes are generated	- A proper temporary storage facility is needed for the wasted materials to avoid potential lead contamination. - Collect the domestic waste in septic tanks to treat according to the approved procedure.	Continuously	- Compliance with Waste management procedures. - Current and Complete records of regular waste	Project Developer	- Environmental Pollution Control Ordinance, 1977 - The Environment (Pollution Control) Act, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	during the operational stage. These include end-of-life solar PV modules, electrical wastes, metallic wastes and stationary wastes of office works etc.			pickup and disposal.		
PV panels	The most significant source of soil pollution is the damage of PV panels in case of major accidents. These contain chemicals and may be harmful for soil quality. There will be environmental impacts of emission of greenhouse gas, Ozone depletion, photochemical smog, eutrophication and acidification	Photovoltaic (PV) is now a proven technology which is inherently safe as opposed to some dangerous electricity generating technologies. Photovoltaic systems make no air pollution and cause no pollution in operation. PV panel should be clean and maintenance regularly for dust free. The supplier will collect wastage PV panels for maintenance and destroy and they will be responsible for management of PV panels. The project proponent should check these devices regularly and have to replace the damaged and expired or bad devices. However, if possible, the	Continuously	Compliance with DoE Regular machineries maintenance records.	Project Developer	▪ Environmental Pollution Control Ordinance, 1977 ▪ Environmental Conservation Rules (ECR), 1997 ▪ Environment Court Act, 2000

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	and also health effects on people. Wasted PV modules few other solid wastes generated during the operational stage. These include end-of-life solar PV modules, electrical wastes, metallic wastes and stationary wastes of office works etc.	damaged and expired devices should be maintained properly and recycled.				
Health and Safety	▪ Leaching of materials from broken or fire damaged PV modules ▪ Emergency Fire Hazard ▪ Electrocution of workers ▪ Electromagnetic radiation from PV modules	▪ Provide walkways that are clearly designated as a walkway; all walkways shall be provided with good conditions underfoot; signposted and with adequate lighting. ▪ Ensure all works and storage areas are tidy, all material deliveries shall be planned to minimize accumulated materials at project site. ▪ Signpost any slippery areas, provide proper footwear during working within slippery areas.	Continuously	▪ Total Recordable Incidence Rate (TRIR) ▪ Lost Time Incidence Frequency ▪ Number of safeties Training performed ▪ Number of nonconformance events.	Project Developer	▪ Bangladesh Labour Law, 2006

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	- Slipping and tripping, working at height activities - Lead can enter body in two ways: by breathing or by swallowing it. Lead Sulfide dust enters the body through breathing. Very fine lead particles may penetrate into the lungs result in absorption in the bloodstream. - As a power plant, the plant has always some risks of fire hazards. Electrical equipment is the main source of a potential fire hazard. - Risk of electrocution of workers during	- Carry out fire risk assessment during operation to identify sources of fuel and ignition and establish general fire precautions including, means of escape, warning and fighting fire. - Set up a system to alert workers on site. This may be temporary or permanent mains operated fire alarm. - Fire extinguishers should be located at identified fire points around the site. The extinguishers shall be appropriate to the nature of the potential fire. - Establish and communicate emergency response plan with all parties, the ERP to consider such things as specific foreseeable emergency situations, organizational roles and authorities, responsibilities and expertise, emergency response and evacuation procedure, in addition to training for personnel. - Adequate first aiders shall be on site in accordance with				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	performing duties in a power plant is always present.	Bangladesh Labor Law requirements. ▪ First aid kit with adhesive bandages, antibiotic ointment, antiseptic wipes, aspirin, non-latex gloves, scissors, thermometer, etc. shall be made available by the contractor on site.				
Decommissioning Phase						
▪ No impacts with high significance are anticipated to take place during decommissioning of the project since all facilities will be removed, solar power plant decommissioned, and PV panels will be dismantled and sent for recycling or disposal. ▪ The main mitigation and monitoring measures to minimize or reduce the environmental and social impacts during decommissioning are anticipated to be similar to those identified for the construction phase. ▪ The solar PV panels that will be used in the project will have a life span of 25 years. Disposal of wasted solar PV modules is very important because if not properly decommissioned, the greatest health risk from end-of-life crystalline solar modules arises from lead containing solders. Under the right conditions it is possible for the lead to leach into landfill soils and eventually into water bodies. ▪ While the solar cell is the heart of a photovoltaic system, on a mass basis it accounts for only a small fraction of the total materials required to produce a solar panel. The outer glass cover constitutes the largest share of the total mass of a finished crystalline photovoltaic module (approximately 65%), followed by the aluminum frame (~20%), the ethylene vinyl acetate encapsulant (~7.5%), the polyvinyl fluoride substrate (~2.5%), and the junction box (1%). The solar cells themselves only represent about four percent (4%) of the mass of a finished module. ▪ Proper decommissioning and recycling of solar panels both ensures that potentially harmful materials are not released into the environment and reduces the need for virgin raw materials. In recognition of these facts, the photovoltaic industry is acting voluntarily to implement product take-back and recycling programs at the manufacturing level.						