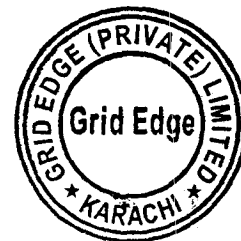


# APPLICATION FOR GENERATION LICENSE FOR 3,064 kWp (DC) SOLAR POWER PLANT

SUBMITTED BY: GRID EDGE (PRIVATE) LIMITED



# GRID EDGE (PRIVATE) LIMITED

To:

Iftikhar Ali Khan

Director

Registrar Office, NEPRA

NEPRA Tower, Ataturk Avenue (East) G-5/1, Islamabad

August 7<sup>th</sup>, 2019

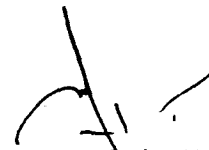
**Subject: APPLICATION OF GRID EDGE (PRIVATE LIMITED) FOR GRANT OF GENERATION LICENSE IN RESPECT OF 3.06 MW SOLAR POWER PROJECT, PINDI BHATTIAN, PUNJAB**

I, Mujtaba Haider Khan, Chief Executive Officer, being the duly authorized representative of GRID EDGE (PRIVATE) LIMITED by virtue of BOARD RESOLUTION dated (29<sup>th</sup> July 2019), hereby apply to National Electric Power Regulatory Authority for the grant of a Generation License to GRID EDGE (PRIVATE) LIMITED pursuant to section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

I certify that the documents-in-support attached with this application are prepared and submitted in conformity with the provisions of the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, and undertake to abide by the terms and provisions of the above-said regulations. I further undertake and confirm that the information provided in the attached documents-in-support is true and correct to the best of my knowledge and belief.

A PAY ORDER in the sum of Rupees 175,272 being the non-refundable license application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999, is also attached herewith.

I hope this meets all the requirements. Feel free to contact me for any further queries.



Mujtaba Haider Khan  
Chief Executive Officer  
GRID EDGE (Private) Limited  
3<sup>rd</sup> Floor, Dawood Centre,  
MT Khan Road, Karachi



# GRID EDGE (PRIVATE) LIMITED

## Extract of the Board of Directors Resolution Passed on July 29, 2019

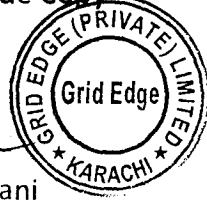
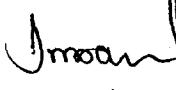
I, Imran Chagani, Company Secretary of Grid Edge (Private) Limited, hereby certify that the following Resolution was passed by the Board of Directors on July 29, 2019.

**"RESOLVED** that the Company shall proceed with all acts necessary to comply with the legal and regulatory requirements in relation to its business objects and activities.

**FURTHER RESOLVED** that Mr. Mujtaba Haider Khan, Chief Executive Officer has been duly authorized to file (i) an application for grant of Generation License for its project at Crescent Bahuman, (ii) any other clarification submission application petition or document in support thereof, (iii) to make any oral or written representations on behalf of the Company before the National Electric Power Regulatory Authority and any other body, organization, department judicial and quasi-judicial body in relation to the aforesaid filings, and to do all other acts, deeds, things and matters as may be deemed expedient in giving effect to the aforesaid resolution.

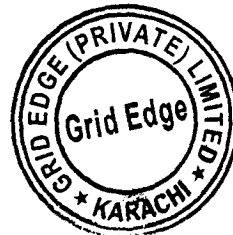
**FURTHER RESOLVED** that Mr. Mujtaba Haider Khan may further delegate the aforesaid powers, in writing, to one or more persons, as deemed expedient from time to time."

Certified True Copy



Imran Chagani  
Company Secretary

Dated: July 30, 2019



# GRID EDGE (PRIVATE) LIMITED

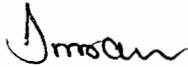
## Extratt of the Board of Directors Resolution Passed on July 9, 2019

I, Imran Chagani, Company Secretary of Grid Edge (Private) Limited, hereby certify that the following Resolution was passed by the Board of Directors on July 9, 2019.

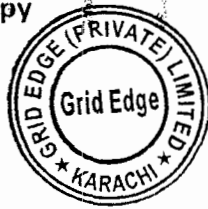
**"RESOLVED** that the signing of Power Purchase Agreement (PPA) made with Crescent Bahuman (Private) Limited (P&G) be and is hereby approved.

**FURTHER RESOLVED** that Mr. Mujtaba Haider Khan, Chief Executive Officer has been duly authorized to sign the PPA with P&G on behalf of Grid Edge (Private) Limited".

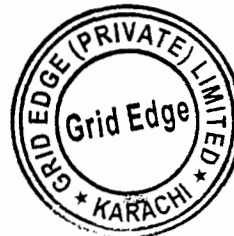
Certified True Copy



Imran Chagani  
Company Secretary

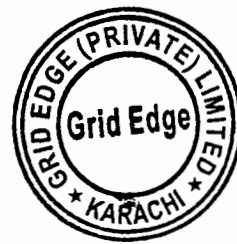


Dated: July 30, 2019



## ANNEXURE – 6

3(5)(b) Profile of experience of the applicant its management, staff and its members in power sector.



## Grid Edge Private Limited

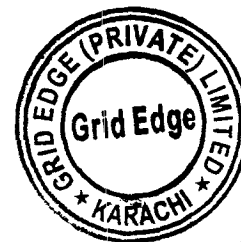
The applicant Grid Edge Private Limited is Joint Venture between REON Energy Limited and ENI.

The electricity market is changing fast. Technology advancements, evolving consumer preferences, and new policies are leading to a surge of adoption of solar, energy storage, microgrids, electric vehicles, and other new energy technologies. These distributed energy resources are forcing new models to rethink how the energy market works, consequently, new models for customer energy management, grid infrastructure and electricity market design are arising to address these changes.

The Company, has been incorporated by the two partners to bring innovation in the energy market by providing power purchase agreements via renewable technologies to private sector and public-sector customers in Pakistan by setting up Solar PV plants on the site of the customer by offering hybrid or grid tied solutions.

This allows savings on transmission infrastructures to the government of Pakistan and allows customers to take advantage of cheaper renewable power without having to undertake expensive capex on its own accord as asking clients to undertake expensive capex on technology, which has capacity risk, has inhibited the growth of this industry in Pakistan even with all the great effort of NEPRA and Ministry of Water and Power to unlock the value of Solar in Pakistan.

Accordingly, the company has decided to apply for a generation license for its proposed project with Crescent Bahuman Limited.



## REON Energy Limited

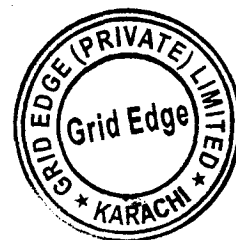
Reon Energy Limited, a wholly owned subsidiary of Dawood Lawrencepur Limited is renewable solar energy arm of Dawood Group looking after the solar energy business for the Group and is in the process of crafting the best possible business portfolio within the solar energy realm for better long term shareholder returns.

REON is the largest solar national leading EPC (Engineering, Procurement and Construction) solution providers in Pakistan. These solutions include designing of system, procurement of material from distinct manufacturers and construction of complete PV System (on-grid and hybrid) to deliver cost effective & trustworthy solutions.

Projects have been delivered at various sites with projects greater than 1MW for a variety of customers, including Servis Industries, Kohinoor Textiles and Nobel Energy - a part of the Wah Nobel Group. The Company with an installed distributed captive capacity of over 30MW in the C&I sector with further 30 MW underway, is now recognized as the leader in high quality installations whilst providing customers with clean energy and minimizing their energy price risk. Key projects executed recently include 12.5MW solar installation at Fauji Cement Limited.

Since inception, REON has focused on supply chain management and engineering collaborations to bring in efficiencies, which have ultimately benefited customers. The Company is now directing all focus to the high-growth areas in the solar energy space. Solar energy solutions help provide energy security and minimize energy costs for businesses. In addition, renewable energy addresses environmental concerns regarding carbon emissions and greenhouse gases. These factors together with declining prices of solar generation equipment indicate a huge potential in the market.

Reon Energy believes in adhering to the highest levels of safety for all stakeholders; customers, staff, contractors. Company safety policies and procedures are strictly complied with and zero tolerance is exercised for misdemeanors. As a step towards reaffirming its safety commitment, the Company successfully obtained ISO 14001 Certification.



## ENI

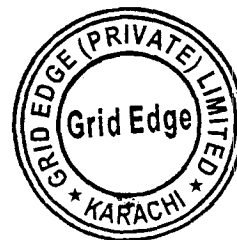
Eni International B.V. is a wholly owned subsidiary of an Italian company, Eni S.p.A. (Eni), which is one of the world's largest integrated energy company. Eni is operating in 71 countries worldwide and employing around 33,000 people. As of March 31, 2018, the company's market capitalisation was calculated at \$64 billion. Eni is consistently ranked among the top 150 companies on the Fortune Global 500 list according to revenue.

Eni is engaged in oil and natural gas exploration, field development and production, as well as in the supply, trading and shipping of natural gas, LNG, electricity and fuels, and operates across the entire energy chain (including Renewable Energy).

Eni places about 25 TWh of production on the Italian market each year with bilateral sales and sales on the energy market. Eni is the second producer of electricity in Italy with a share of 9% of Italian electricity production. Eni is one of the market leaders in the services and dispatching market (MSD), thanks to the flexibility of its generating fleet. As of December 2017, Eni installed operational capacity of electricity production is 4,700 MW.

Eni is working closely with all the stakeholder towards improving access to energy in the countries where it operates and making maximum effort to reduce direct emissions of CO<sub>2</sub>. With these goals in mind Eni launched a new business unit called Energy Solutions Department (DES) in November 2015 to lead the energy transition process of the group towards a low carbon future by introducing renewable energies development at industrial level as part of the Company core business.

In this regard, different development projects, both solar and wind, have been identified in countries of strategic interest in which Eni already operates both in Italy and abroad. Eni is currently developing a 50MW wind project in Kazakhstan and a number of cooperation/framework agreements have also been executed with the Northern Territory in Australia, Pakistan, Ghana, Angola, Algeria, Tunisia and Egypt, in order to strengthen Eni's historic presence in those territories and to expand the company's sphere of activities in the field of Renewables.





# Type, Technology, Model, Technical Details and Design of facility

## Technical Summary:

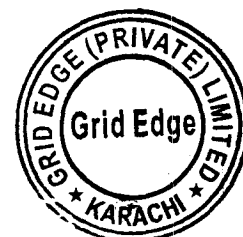
- Polycrystalline 320W Solar Modules with efficiency 17% are used in the design
- 60 KW grid connected solar inverters, 480V three phase, 98.3% have been considered
- Step up Transformers 0.48 / 11KV ONAN are used
- Medium Voltage Switchgears 11KV / 630A
- System will be connected to the auxiliary load of the Existing factory
- Maximum AC output of the system is assumed to be 2200 KW
- Output of the system is based on instantaneous Irradiation values of Solar Energy
- 10 Acres of land area required for the installation of solar plant

## Bill of Materials:

S. No.	Components	Qty (No.)
1	Polycrystalline Solar Modules 320W	9576
2	Grid Connected Solar Inverters 60KW 3 Phase	42
3	0.48 / 11KV Step up Transformers	3
4	Medium Voltage Switchgears	3
5	Diesel Gensets and Solar Energy Control System	1

## Energy Generation:

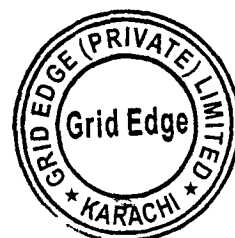
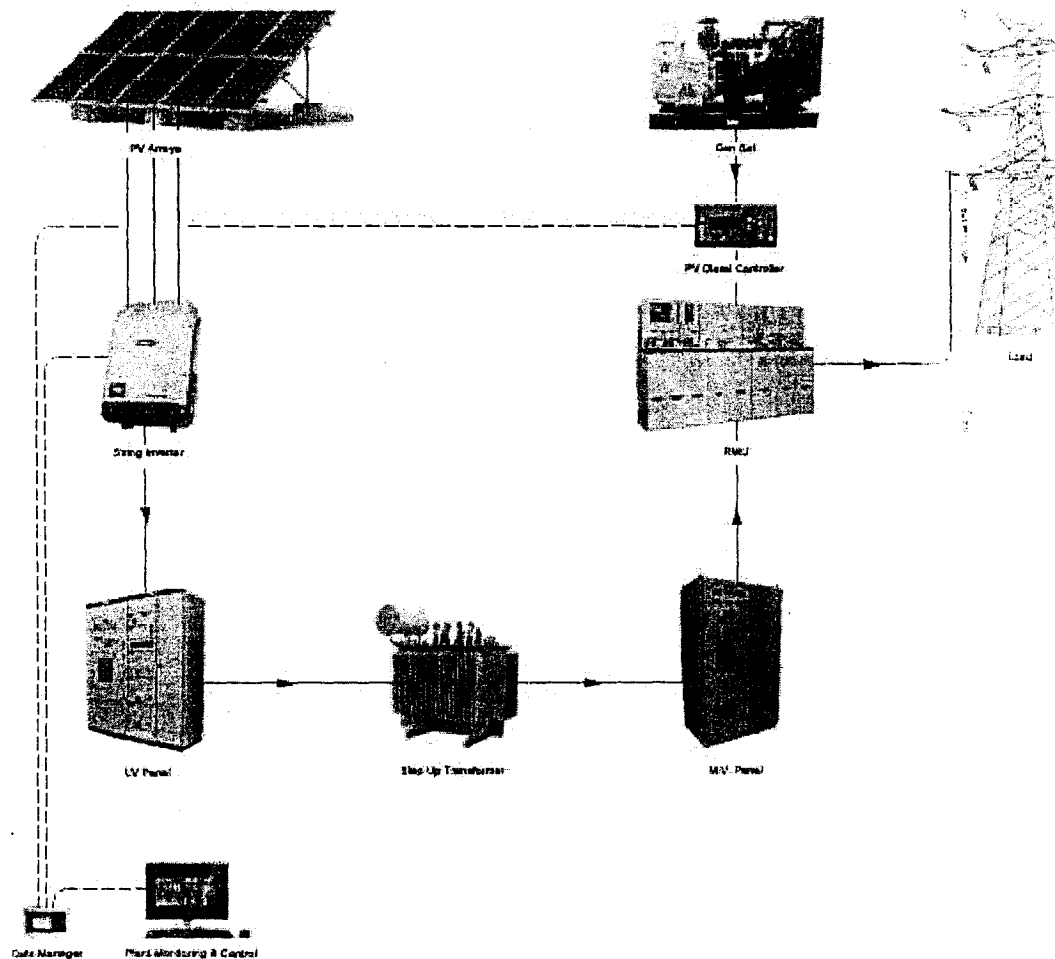
S. No.	Efficiency Parameters	
1	Performance Ratio of the System	77.39%
2	Capacity Utilization Factor	16.7%
3	Energy Generation Units	4.3 Million KWh



## Technology used

S.No.	Parameters	
1	Technology	Solar Photovoltaic (SPV)
2	Size of Plant	3.0 MW
3	Solar Modules	Polycrystalline Solar Modules 320W Tier 1
4	Inverter	60kW Grid Connected Inverter
5	Transformers	1500KVA 0.48 /11KV ONAN Transformers Siemens or Equivalent
6	Medium Voltage Switchgears	11KV 630 Amps 25KA

## Conceptual Design



## General Layout

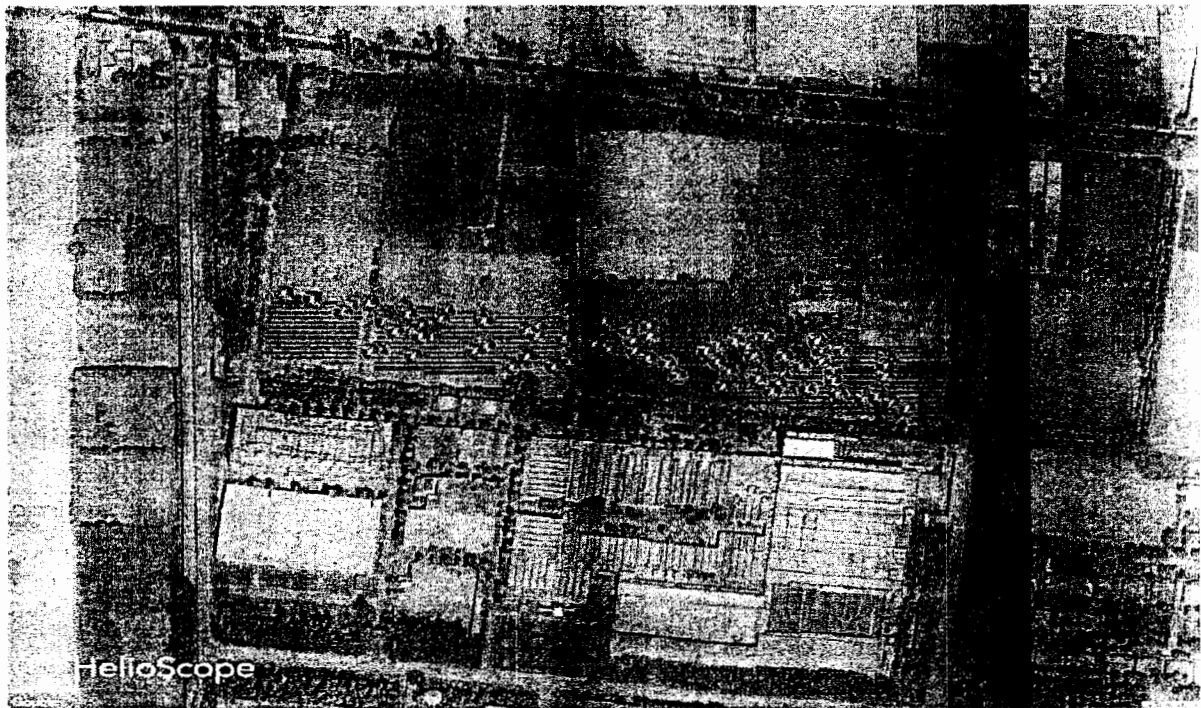
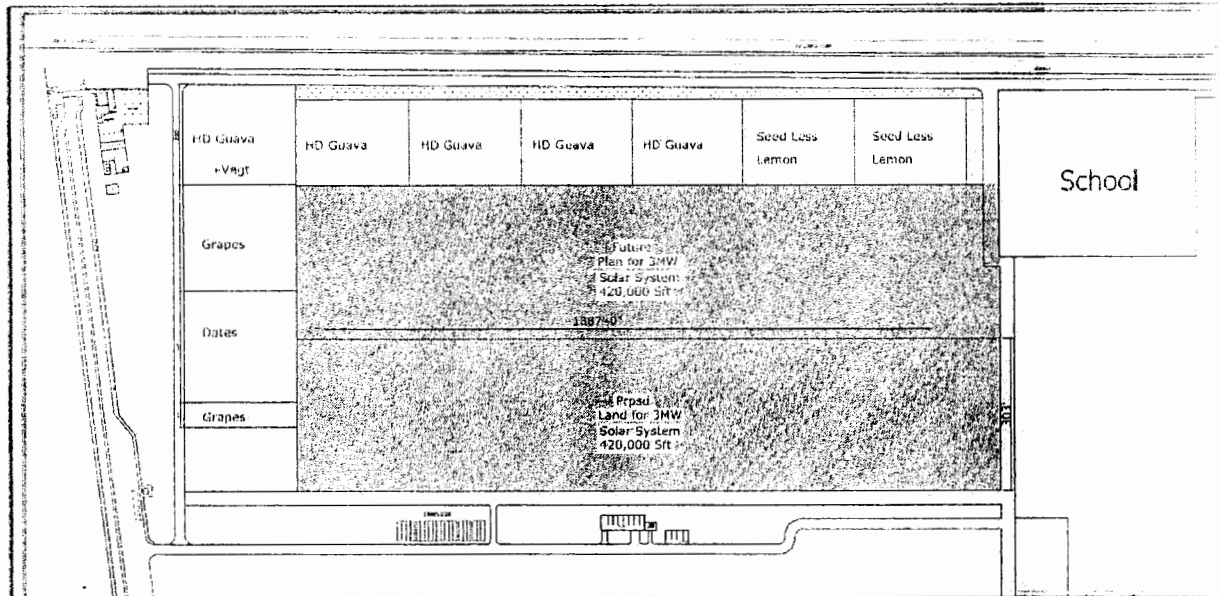
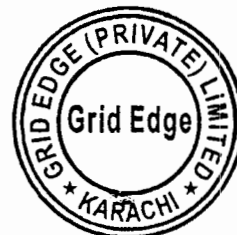
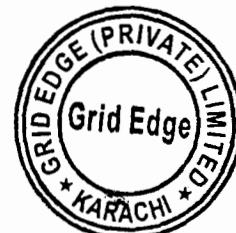
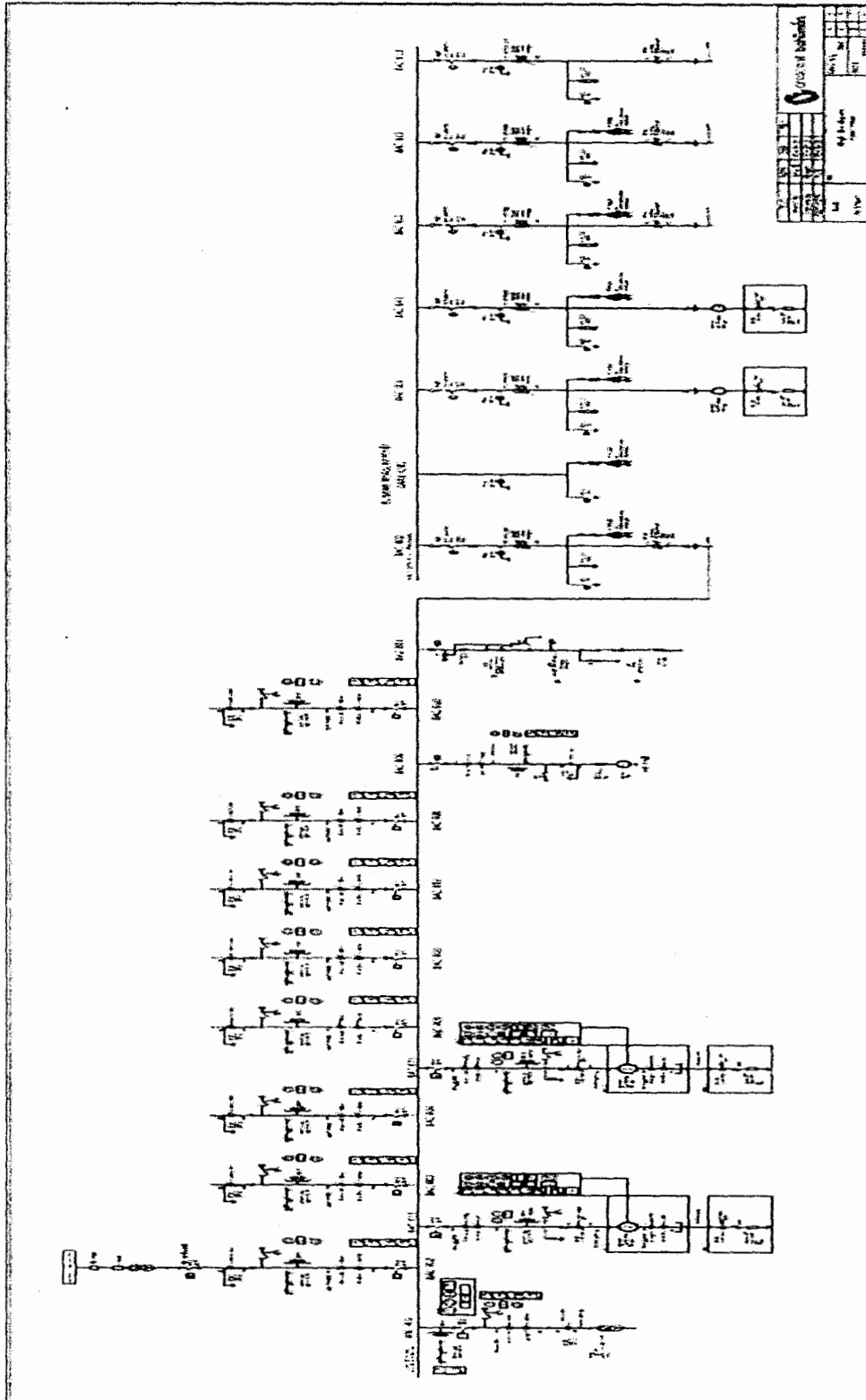



Figure No: 2.13 Detailed Layout of Project



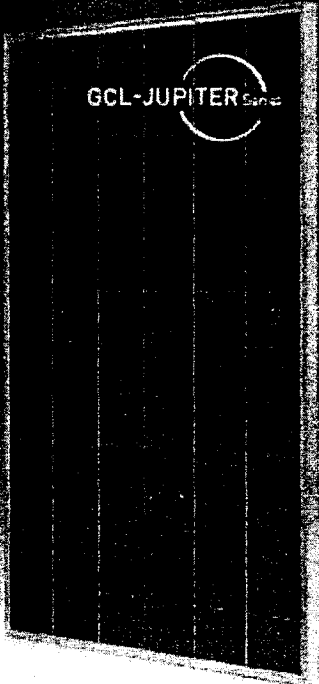
SLD



## Data Sheet (PV)



**GCL-P6/72**  
**GCL-P6/72H**  
Polycrystalline Module  
325-360W




GCL-JUPITER Solar

**360W**  
Maximum Power Output


**18.6%**  
Maximum Module Efficiency

**0~+5W**  
Power Output Guarantee




Cell Type


SB2 MB2




Ideal choice for large scale ground installation.




High conversion efficiency due to top quality wafers and advanced cell technology.




Selected encapsulating material and stringent production process control ensure the product is highly PID resistant and snail trails free.




Sand blowing test, salt mist test and ammonia test passed to endure harsh environments.



Optimized system performance due to module level current sorting.



Special cell process ensures great performance under low irradiance conditions.



Highly transparent self-cleaning glass brings additional yield and easy maintenance.

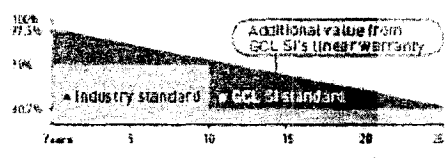
### Company Introduction

GCL System Integration Technology Co., Ltd. (002506 Shenzhen Stock) (GCL System) is part of GOLDEN CONCORD Group (GCL) which is an international energy company specializing in clean and sustainable power production. The group, founded in 1990, now employs 30,000 people.

### GCL Delivers Reliable Performance Over Time

- World-class manufacturer of crystalline silicon photovoltaic modules
- Fully automatic facility and world-class technology
- Rigorous quality control to meet the highest standard: ISO9001:2008, ISO 14001: 2004 and OHSAS: 18001:2007
- Tested for harsh environments (salt mist, ammonia corrosion and sand blowing test: IEC 61701, IEC 62716, DIN EN 60668-2-68)
- Long term reliability tests
- 2\*100% EL inspection ensuring defect-free modules

### Linear Performance Warranty




Additional value from GCL's linear warranty

Industry standard vs GCL Standard

20 Years Linear Power Warranty

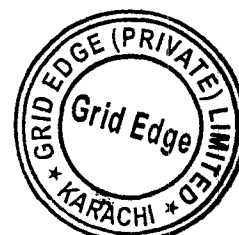
Additional Insurance Backed by Swiss RE



\* Please refer to GCL for details

**Bringing Green Power To Life**

[en.gclat.com](http://en.gclat.com)



# GCL-P6/72

## GCL-P6/72H

# GCL-Jupiter Series

## Polycrystalline Module 325-360W

### Electrical Specification (STC)

Maximum Power	(P <sub>max</sub> )	325	330	335	340	345	350	355	360
Maximum Power Voltage	(V <sub>mp</sub> )	37.80	38.00	38.30	38.50	38.70	39.00	39.40	39.70
Maximum Power Current	(I <sub>mp</sub> )	8.58	8.70	8.80	8.90	9.00	9.10	9.19	9.25
Short Circuit Current	(I <sub>sc</sub> )	9.25	9.35	9.45	9.55	9.65	9.75	9.85	9.95
Open Circuit Voltage	(V <sub>oc</sub> )	46.00	46.20	46.40	46.60	46.80	47.00	47.20	47.40
Module Efficiency	(%)	15.7%	15.8	15.9	16.0	16.1	16.2	16.3	16.4
Power Output Tolerance	(W)	±5							

\* At Standard (1000W/m<sup>2</sup>) Module Temperature 25°C Air Mass 1.5

### Electrical Specification (NOCT)

Maximum Power	(P <sub>max</sub> )	298.82	303.94	307.19	310.42	313.64	316.82	320.02	323.19
Maximum Power Voltage	(V <sub>mp</sub> )	34.45	34.70	34.90	35.10	35.40	35.70	36.00	36.30
Maximum Power Current	(I <sub>mp</sub> )	8.65	8.75	8.82	8.88	8.92	8.95	9.00	9.05
Short Circuit Current	(I <sub>sc</sub> )	9.27	9.34	9.41	9.47	9.53	9.59	9.67	9.72
Open Circuit Voltage	(V <sub>oc</sub> )	45.10	45.25	45.40	45.55	45.70	45.85	46.00	46.15

### Mechanical Data

Solar Cell Type	Polycrystalline Silicon
Number of Cells	72 Cells (6x12)
Dimensions of Module (mm) (inch)	1950x990x35mm (77" x 39.0" x 1.38 inch)
Weight (kg)	22.2kg
Frame	High strength anodized aluminum
Backsheet	White
Temco	Sealed tempered aluminum alloy
Wiring	16AWG (1.5mm <sup>2</sup> )
Cable	16AWG (1.5mm <sup>2</sup> ) x 1200mm (39" x 1200mm)
Number of diodes	3
Max. Snow Load	2400N/m <sup>2</sup> (50PSF)
Connector	MC4 Compatible

\* For more details please check the specification manual of GCL

### Temperature Ratings

Normal Operating Cell Temperature (NOCT)	45±2°C
Temperature Coefficient of P <sub>max</sub>	-0.45%/°C
Temperature Coefficient of V <sub>oc</sub>	-0.32%/°C
Temperature Coefficient of I <sub>sc</sub>	+0.03%/°C

### Maximum Ratings

Operating Temperature	-40~+85°C
Maximum System Voltage	1500V DC
Max. Single Diode Rating	1W

### Packaging Configuration

Module per box	20 pieces
Module per 40' container	720 pieces

### Optional

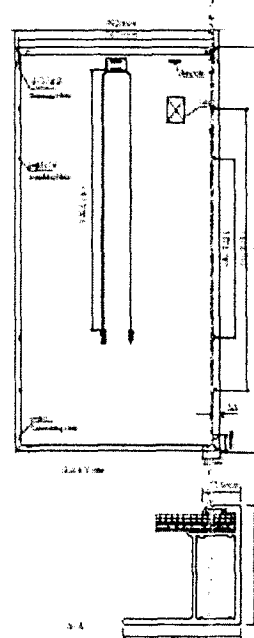
Connector	<input type="checkbox"/> Original MC4
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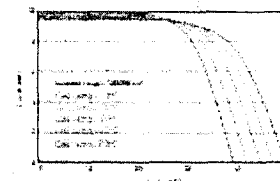
Contact Us for More Information

Website: [en.gcl.com](http://en.gcl.com) Email: [gclsales@gcl.com](mailto:gclsales@gcl.com)

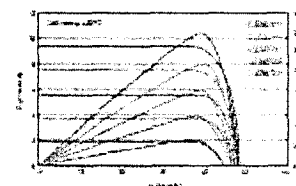
### Module Dimension



U-I Curve at Different Temperature (360W)



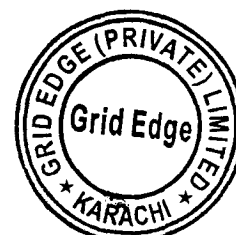
U-V<sub>mp</sub> Curve at Different Irradiation (360W)



CAUTION: READ THIS INFORMATION BEFORE USING THE PRODUCT

Bringing Green Power To Life

GCL-EN-P6/72-2018-V1.0



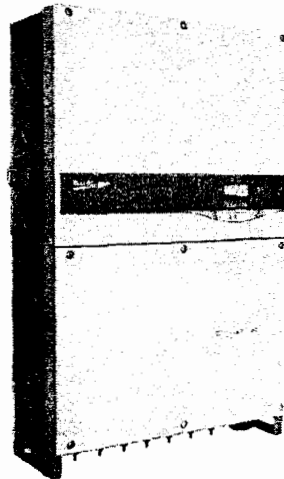
## Datasheet (Inverter)

SUNGROW



SG60KTL

String Inverter



## High Yield

- Max. efficiency 98.9 %, European efficiency 98.7 %
- Long-term overload at 1.1 P<sub>n</sub>
- Full power operation without derating at 50 °C



## Easy O&amp;M

- Compact design and light weight for easy installation
- Plug-in design of fan and SPD, convenient for on-site maintenance
- Integrated string current monitoring function for fast trouble shooting



## Saved Investment

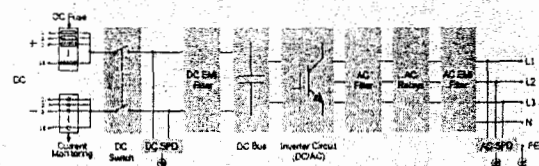
- Max. DC/AC ratio up to 1.4
- Integrated DC combiner box and DC/AC overvoltage protection



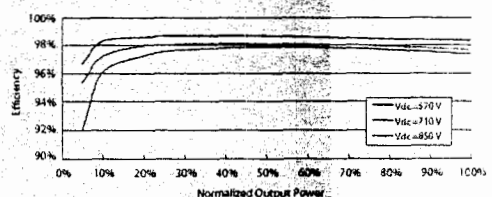
## Grid Support

- Compliance with standards: IEC 62109, IEC 61727, IEC 62116, VDE0126-1-1, G59/3, VDE-AR-N-4105, VDE-AR-N-4120, BDEW
- Low/High voltage ride through (L/HVRT)
- Active & reactive power control and power ramp rate control

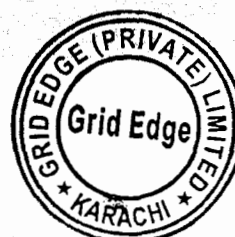
Circuit Diagram



Efficiency Curve

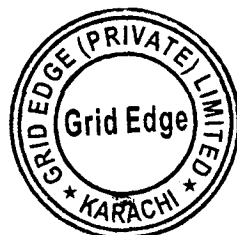


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60KTL

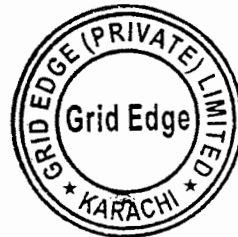
<b>Input (DC)</b>		SG60KTL
Max. PV input voltage		1000 V
Min. PV input voltage / Startup input voltage		570 V / 620 V
Nominal input voltage		710 V
MPP voltage range		570 – 950 V
MPP voltage range for nominal power		570 – 850 V
No. of independent MPP inputs		1
Max. number of PV strings per MPPT		14
Max. PV input current		120 A
Max. current for input connector		12 A
Max. DC short-circuit current		140 A
<b>Output (AC)</b>		
AC output power		66000 VA @ 45 °C / 60000 VA @ 50 °C
Max. AC output current		96 A
Nominal AC voltage		3 / N / PE or 3 / PE, 230 / 400 V
AC voltage range		310 – 480 V
Nominal grid frequency / Grid frequency range		50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
THD		< 3 % (at nominal power)
DC current injection		< 0.5 % In
Power factor at nominal power / Adjustable power factor		> 0.99 / 0.8 leading – 0.8 lagging
Feed-in phases / Connection phases		3 / 3
<b>Efficiency</b>		
Max. efficiency / Euro. efficiency		98.9 % / 98.7 %
<b>Protection</b>		
DC reverse connection protection		Yes
AC short-circuit protection		Yes
Leakage current protection		Yes
Grid monitoring		Yes
DC switch / AC switch		Yes / No
DC fuse		Yes (positive, 15A)
PV string current monitoring		Yes
Overvoltage protection		DC Type II / AC Type III
<b>General Data</b>		
Dimensions (W*H*D)		634*959*267 mm
Weight		80 kg
Isolation method		Transformerless
Degree of protection		IP65
Night power consumption		< 1 W
Operating ambient temperature range		-25 to 60 °C (> 50 °C derating)
Allowable relative humidity range (non-condensing)		0 – 100 %
Cooling method		Smart forced air cooling
Max. operating altitude		4000 m (> 3000 m derating)
Display / Communication		Graphic LCD / RS485
DC connection type		MC4 (Max. 6mm <sup>2</sup> )
AC connection type		Screw clamp terminal (Max. 95 mm <sup>2</sup> )
Compliance		IEC 62109, IEC 61727, IEC 62116, IEC 60068, IEC 61683, VDE0126-1-1, GS9/3, VDE-AR-N-4105, VDE-AR-N-4120, BDEW, IEC 61000-3-11/-12, EN 50438, UTE C 15-712-1/07.13, CEA, PEA, MEA LVRT, HVRT, active & reactive power control and power ramp rate control
Grid support		
Type designation		SG60KTL-182





ANNEXURE – 15

# 3(5)(h) Feasibility Report



# FEASIBILITY REPORT

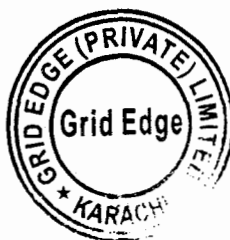
## Crescent Bahuman 3 MW Solar Power Plant

### Executive Summary:

Grid Edge (Private) Limited intends to setup 3 MW captive Solar Power Plant (DC) at Crescent Bahumans premises (Pindi Bhattian, Punjab, Pakistan) to provide electricity under 15-year power purchase agreement to sole customer. The DC installed capacity of the plant is proposed by critically analyzing the current load and future load projections of the site. Main objective of this Solar plant is to provide clean energy from solar plant to partially meet energy needs in an affordable and environment friendly way.

Key highlights of the project are as follows:

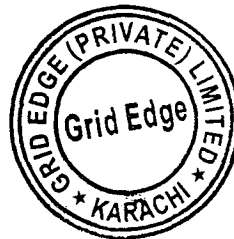
Customer	Crescent Bahuman
Project Model	BOT
System Type	Ground Mounted, On Grid
System Size	3 MWp
Annual CO <sub>2</sub> Reduction	300 Tonnes
Solar PV Type	Poly-crystalline



## Introduction:

This report has the objective to assess the feasibility of this project and is structured as follows:

- Introduction to Solar
- Solar Potential in Pakistan
- Project Overview
- Conceptual Design
- Technical Summary



## Introduction to Solar:

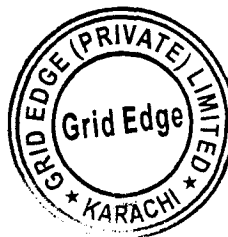
Solar power is the conversion of energy from sunlight into electricity, either directly using photovoltaics (PV), indirectly using concentrated solar power, or a combination. Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaic cells convert light into an electric current using the photovoltaic effect.

Photovoltaics were initially solely used as a source of electricity for small and medium-sized applications, from the calculator powered by a single solar cell to remote homes powered by an off-grid rooftop PV system.

As the cost of solar electricity has fallen, the number of grid-connected solar PV systems has grown into the millions and utility-scale solar power stations with hundreds of megawatts are being built. Solar PV is rapidly becoming an inexpensive, low-carbon technology to harness renewable energy from the Sun.

The productivity of solar power in a region depends on solar irradiance, which varies through the day and is influenced by latitude and climate.

The locations with highest annual solar irradiance lie in the arid tropics and subtropics. Deserts lying in low latitudes usually have few clouds and can receive sunshine for more than ten hours a day. These hot deserts form the Global Sun Belt circling the world. This belt consists of extensive swathes of land in Northern Africa, Southern Africa, Southwest Asia, Middle East, and Australia, as well as the much smaller deserts of North and South America. Africa's eastern Sahara Desert, also known as the Libyan Desert, has been observed to be the sunniest place on Earth according to NASA.

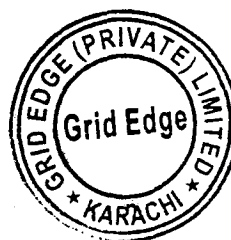


## Solar Potential in Pakistan:

There is an increasing demand for power in the domestic, commercial and industrial sectors as Pakistan's population and its economy continue to expand—with annual GDP growth forecasts averaging 5 percent for the medium term. Currently, electricity consumption is severely suppressed by supply shortfalls and persistent load shedding, and there also exist significant levels of latent demand in the country as rising income levels allow more people to switch to electricity from using traditional fuels. The validity of the assumption that electricity use in Pakistan remains constrained due to availability—rather than access—issues is borne out by the fact that the penetration of the power network in the country is the highest in the South Asian region at 93.6 percent, as compared to 88.7 percent in Sri Lanka, 78.7 percent in India, 76.3 percent in Nepal, and 59.6 percent in Bangladesh.

Pakistan's per capita electricity consumption is currently significantly lower in comparison to other countries in a similar development stage, and much below that of OECD countries. Per capita electricity consumption is strongly correlated with the human development index (HDI), and the current trends of rising incomes and energy supplies, falling poverty levels, and increasing economic activity are predicted to lead to rapid increases in per capita consumption rates in Pakistan, creating a healthy demand for additional power generation.

Even with the projected surplus in power generation capacity by 2020, there will still be sufficient economic feasibility for small and medium-sized (50-100 MW) renewable energy-based power projects in the Pakistan, especially those located near remote and isolated load centers and extremities of the grid network or based on bilateral bulk contracts or for augmenting peak supplies on the grid. The viability of such projects will be further enhanced by the continued decline in technology prices and the emphasis by the government on indigenous energy resources that also help the country meet its environmental objectives and reduce carbon emissions.



## Project Overview:

### Introduction:

Grid Edge (Private) Limited intends to setup 3 MW captive Solar Power Plant (DC) at Crescent Bahuman's premises (near , Pindi Bhattian, Punjab, Pakistan) to provide electricity under 15-year power purchase agreement to sole customer. The DC installed capacity of the plant is proposed by critically analyzing the current load and future load projections of the site.

### Project Rationale:

Crescent Bahuman, Pakistan's first vertically integrated denim facility was inaugurated in 1995. Since then, CBL – as it's lovingly known in the industry – has gone from strength to strength by creating an eco friendly environment that enables its most important resources, our people, to develop and deliver to the satisfaction of our clientele.

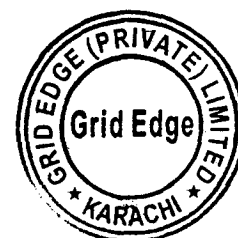
With over 22 years of experience in handling the blue fabric we have all come to know and love, CBL's shade is definitely deep, dark, pure indigo.

CBL is proud to be providing clothing for more than 10 million people annually. As always, with such a large stake in global fashion, comes great responsibility. This sense of responsibility is creatively engineered into our products and processes to ensure that our customers are given tangible results that reemphasize our commitment to the planet and our environment.:

- On site affordable energy production from solar plant to partially meet energy needs
- Sustainable energy source in line with triple bottom line impact for client
- Capex free deployment under power purchase agreement for 15 years
- Reliance on localized energy sources and hedge for the term of the contract for 15+ years

### Technology:

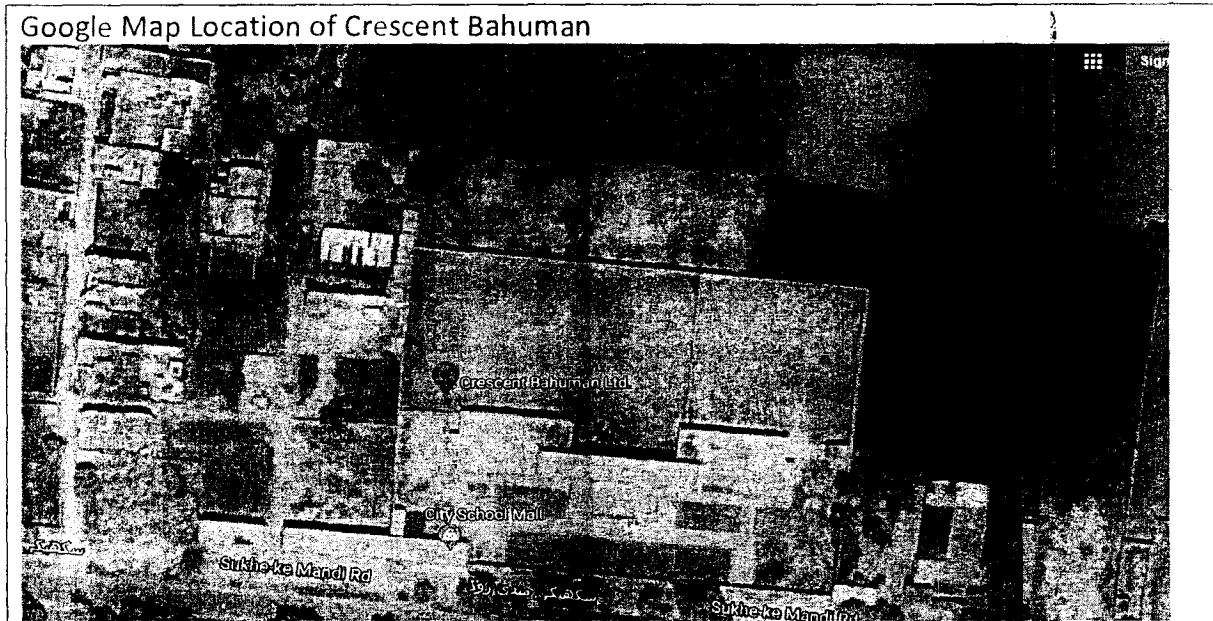
- Solar based Power Generation System, civil structures and Auxiliaries.
- Complete Solar Based Power Generating Panels with their protection, instrumentation, monitoring, control and synchronizing panels with existing power sources
- All technical parameters covered including but limited to Net Efficiency, Net Output, Power Plant Availability, Construction of Power Plant Building including all facilities as well as all related sub-systems such as:
  - Plant Ventilation and air-conditioning in office and similar areas,
  - Electrification and lighting systems
  - Emergency Lighting System, etc.
  - Fire Protection System
- The installed system shall meet applicable codes and standards. Safety signage and labelling should be mounted on the system as required



- All Solar Panels shall be made of Crystalline Silicon solar cells
- All the electrical installations and wiring for the PV system in accordance with codes and standards

**Project Location:**

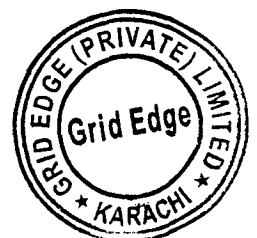
The Solar Plant will be located within the Crescent Bahuman factory in Pindi Bhattian, Multan Road, Lahore, Pakistan.



**Operations and Maintenance:**

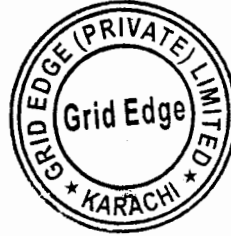
The project also includes 24/7 O&M of the complete Power Plant including all its related systems and equipment. The O&M services shall be carried out for a period of 15 years (180 Months) and shall include but not be limited to the following items and their related costs, inclusive of all importation and local charges, duties, taxes, etc.

- Provision of all manpower as duly approved by the Company.
- Provision of all consumable material and parts.
- Provision of all routine and preventive maintenance parts. (Bidders are required to provide a priced list).
- Full costs relating to any repairs and replacements due to defects in the or break down of the equipment and systems strictly in accordance with OEMs requirements. The cost shall also include all dismantling, handling, shipment, etc.
- Provision of all emergency spare parts as per the recommendations of the OEMs or as directed by the Company. (Bidders are required to provide a priced list).



**Feasibility & Financing:**

The Project will cost approximately PKR 280 Million funded through 25% equity (ENI and partners) and 75% debt through SBP Green Financing





## Conceptual Design:

### Generation Voltage:

Solar Power plant will be generating AC power at Low voltage levels of 480V 4W+PE system. Low voltage level will then step up through power transformers to the existing Diesel Genset Voltage levels i.e. 11KV to be synced with Electrical Network.

### Power Factor & Frequency

The Solar power plant is using solar grid connected string Inverters of 60KW each to convert DC power of solar panels to Alternating Power. Grid connected inverters have the functionality to adapt the power factor of existing diesel genset grid. The range of Power Factor can be set from 0 – 1 leading /lagging, making it suitable for absorbing or delivering reactive power. the nominal power factor for Inverters is 0.995. Nominal Frequency of generation is 50Hz.

### Automatic Generation Control & Ramp Rate:

Automation would be added into the solar system to ensure safe synchronization with the Grid and Diesel Gensets. The automation controller added would ensure no reverse power is fed into the Grid or Diesel Generator. The controller achieves this by actively sensing the difference in power produced by solar system and power consumed by the CBL Factory. It is programmed to curtail solar power generation in case of excess power generation by the solar system.

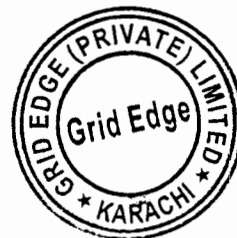
### Metering and Protection:

Metering of solar units will be performed at the main 11KV load bus bar. It is designed that all auxiliary loads will be connected before the point of connection to get the true reading for energy being evacuated into the diesel gensets' grid for mine loads.

Sensitivity Class for meter is 0.5s with bidirectional 4 quadrant calculations algorithm. Features including, total import and export units can be extracted over the period, TOD calculations, MDI, active and reactive power calculations, Et al.

Solar power plant is designed to have the following protections for the line and load side;

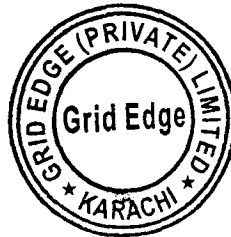
- Over and Under voltage protections
- Short Circuit protections
- Earth Fault detection
- Over current protection
- Emergency system shutdown protection.



**Environmental Benefits:**



This system will help curtailing CO<sub>2</sub> emissions by 265 tonnes a year. A life cycle assesment of the CO<sub>2</sub> produced by solar PV is 40g per kWh as opposed to 700g CO<sub>2</sub> per kWh for diesel fuel/grid sources



## Technical Summary:

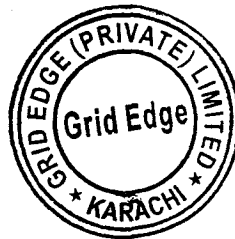
- Polycrystalline 320W Solar Modules with efficiency 17% are used in the design
- 60 KW grid connected solar inverters, 480V three phase, 98.3% have been considered
- Step up Transformers 0.48 / 11KV ONAN are used
- Medium Voltage Switchgears 11KV / 630A
- System will be connected to the auxiliary load of the Existing factory
- Maximum AC output of the system is assumed to be 2200 KW
- Output of the system is based on instantaneous Irradiation values of Solar Energy
- 10 Acres of land area required for the installation of solar plant

## Bill of Materials:

S. No.	Components	Qty (No.)
1	Polycrystalline Solar Modules 320W	9576
2	Grid Connected Solar Inverters 60KW 3 Phase	42
3	0.48 / 11KV Step up Transformers	3
4	Medium Voltage Switchgears	3
5	Diesel Gensets and Solar Energy Control System	1

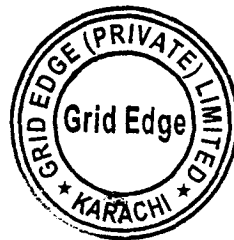
## Energy Generation:

S. No.	Efficiency Parameters	
1	Performance Ratio of the System	77.39%
2	Capacity Utilization Factor	16.7%
3	Energy Generation Units	4.3 Million KWh



ANNEXURE - 16

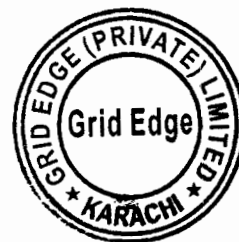
SCHEDULE – III



# LOCATION MAPS, SITE MAPS, LAND

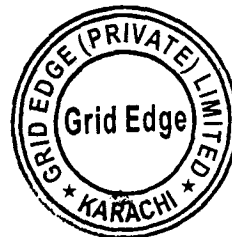
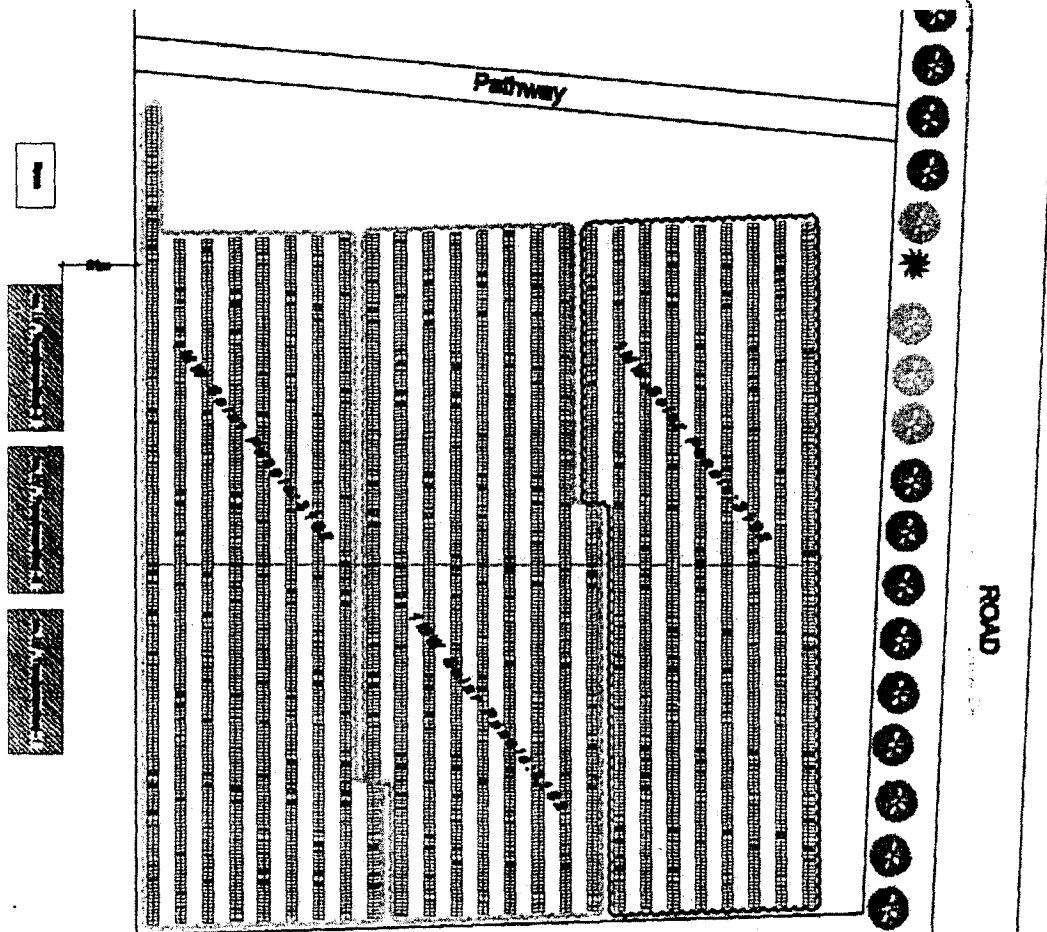
## Location Map:

The Solar Plant will be located within the Crescent Bahuman factory on Sargodha Road, Hafizabad, Pakistan.



## Site Location and Layout:

Site Location Summary	Layout of Plant
Solar Site covers an area of 10 Acres located within the Crescent Bahuman Factory on Sargodha Road, Hafizabad near Pindi Bhattian.	



# TECHNOLOGY, SIZE OF PLANT, NUMBER OF UNITS

## Technical Summary:

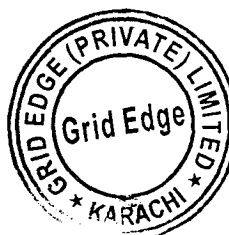
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## Energy Generation:

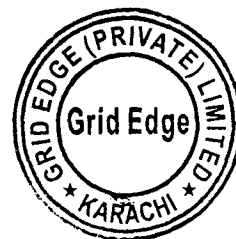
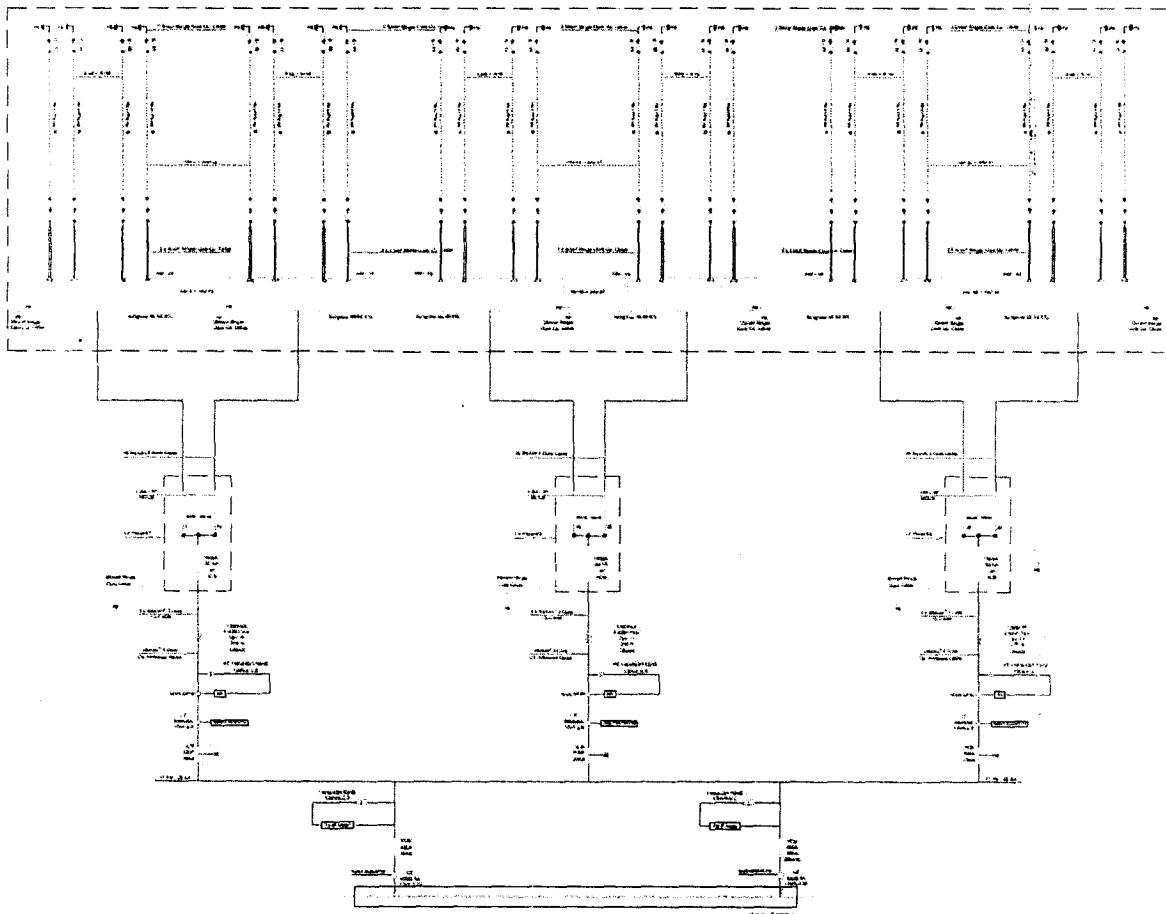
S. No.	Efficiency Parameters	
1	Performance Ratio of the System	77.39%
2	Capacity Utilization Factor	16.7%
3	Energy Generation Units	4.3 Million KWh



## Technology &amp; Number of Units:

S. No.	Components	Qty (No.)
1	Polycrystalline Solar Modules 320W	9576
2	Grid Connected Solar Inverters 50KW 3 Phase	42
3	0.48 / 11KV Step up Transformers	3
4	Medium Voltage Switchgears	3
5	Diesel Gensets and Solar Energy Control System	1

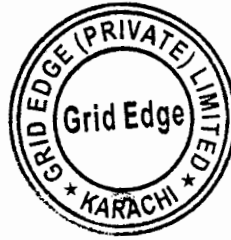
## Single Line Diagram:





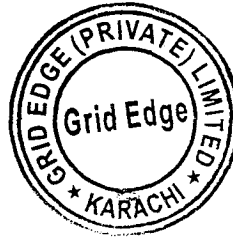
# Interconnection with National Grid

- Not Applicable: Power generated is to be consumed by Crescent Bahuman



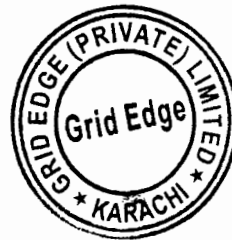
# Infrastructure

- The Solar Project is located on Sargoda Road, near district hafizabad (100km away from Lahore) near Pindi Bhattian, highway and is easily accessible by all traffic. All utilities (electricity, water, boarding lodging and fuel) is readily available on site.

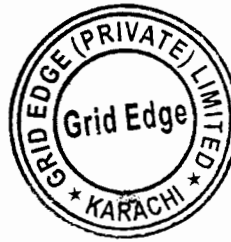


ANNEXURE – 2

3(2) Application fee (including  
Indexation)

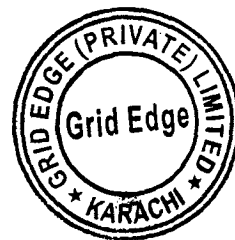


- Please refer to annexed documents/receipts



ANNEXURE – 3

3(5)(a)(i) Certified Copies of  
Certificate of Incorporation  
(Certified by SECP)



THE COMPANIES ACT, 2017  
THE COMPANIES (GENERAL PROVISIONS AND FORMS) REGULATIONS, 2018  
[Section 197 and Regulations 4 and 20]  
PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE,  
SECRETARY, CHIEF FINANCIAL OFFICER, AUDITORS AND LEGAL ADVISER OR OF  
ANY CHANGE THEREIN

FORM 29

PART-I

Please complete in typewritten or bold black capital

1.1 CUIIN (Incorporation Number) 0122474

1.2 Name of Company GRID EDGE (PRIVATE) LIMITED

1.3 Fee Payment Details

1.3.1 Challan Number E-2019-1004021 1.3.2 Amount 400.0

PART-II

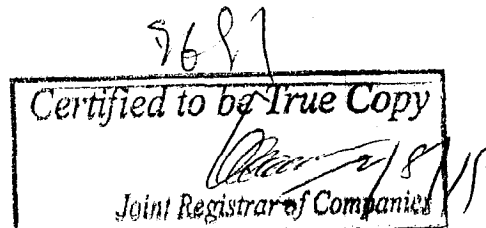
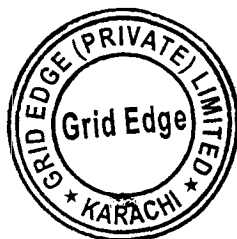
2. Particulars:

2.1. New Appointment/Election

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)	Nature of directorship (nominee/indepen- dent/additional/ other) (j)
Mujtaba Haider Khan	4220104922121	Ansar Haider Khan	Bhayani Sunview, Gulshan-e-Iqbal, House No. 124, Block 11, Karachi Central Pakistan	Chief Executive	Pakistan		30/04/2019	Appointed	
Mujtaba Haider Khan	4220104922121	Ansar Haider Khan	Bhayani Sunview, Gulshan-e-Iqbal, House No. 124, Block 11, Karachi Central Pakistan	Director	Pakistan		30/04/2019	Elected	
Inam ur Rahman	3520113784748	Fazal Rahmaan	House No. 3/300, Sarwar Road, Lahore Cantt. Karachi Sindh Pakistan	Director	Pakistan		30/04/2019	Elected	
A. F. Ferguson and Co., Chartered Accountants	N/A	N/A	State Life Building No. 1-C, I.I. Chundrigar Road, Karachi	Auditor	Pakistan	None	30/04/2019	Appointed	
Syed Amjad Wahab	4220107924787	Syed Abdul Wahab	House No. 78/B/1, Street Q, Phase 7, D.H.A., Karachi	Director	Pakistan		30/04/2019	Elected	
Saad Faridi	4210168534451	Ghayoor Hussain Faridi	A-261, Block H, North Nazimabad, Karachi	Chief Accountant/C FO	Pakistan		29/04/2019	Appointed	

2.2. Ceasing of Officer/Retirement/Resignation

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation** (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)	Nature of directorship (nominee/indepen- dent/additional/ other) (j)
Kamran Ajmal Mian	4210134026413	Ajmal Mian	House No. 9-B, 1 East Street, Phase 1, D.H.A, Clifton Cantt, Karachi South Karachi Sindh	Director	Pakistan		30/04/2019	Retired	



**2.11 Chief Financial Officer**

Name

Address

NIC No

**2.12 Secretary**

Name

Address

NIC No

**2.13 Legal Advisor**

Name

Address

NIC No

**2.14 Particulars of Auditors**

Name

Address

**2.15 Particulars of Shares Registrar (if applicable)**

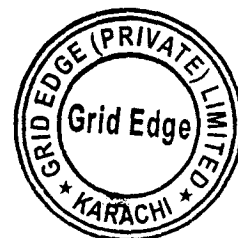
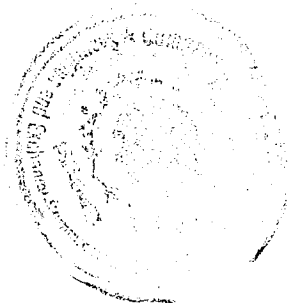
Name

Address

Email

**Section-B****2.16 List of Directors on the date Annual return is made**

S#	Name of Director	Residential Address	Nationality	NIC (Passport No. if foreigner)	Date of appointment or election
1	Inam ur Rahman	House No. 3/300, Sarwar Road, Lahore Cantt. Karachi Sindh Pakistan	Pakistan	3520113784749	30/04/2019
2	Mujtaba Haider Khan	Bhayani Sunview, Gulshan-e-Iqbal, House No. 124, Block 11, Karachi Central Pakistan Karachi Sindh Pakistan	Pakistan	4220104922121	30/04/2019
3	Syed Amjad Wahab	House No. 78/B/1, Street Q, Phase 7, D. H.A., Karachi	Pakistan	4220107924787	30/04/2019



2.18 Transfer of shares (debentures) since last Form A was made

S#	Name of Transferor	Name of Transferee	No of Shares Transferred	Date of Registration of transfer
Members				
Debenture Holders				

PART-3

3.1 Declaration:

I do hereby solemnly, and sincerely declare that the information provided in the form is:

- (i) true and correct to the best of my knowledge, in consonance with the record as maintained by the Company and nothing has been concealed; and  
(ii) hereby reported after complying with and fulfilling all requirements under the relevant provisions of law, rules, regulations, directives, circulars and notifications whichever is applicable.

3.2 Name of Authorized Officer with designation/ Authorized Intermediary

Imran Chagani	Secretary
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3.3 Signatures

Electronically signed by Imran Chagani
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3.4 Registration No of Authorized Intermediary, if applicable

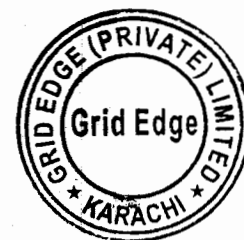
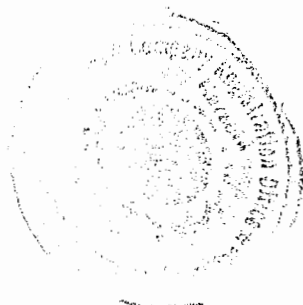
Day Month Year

3.5 Date

27/05/2019
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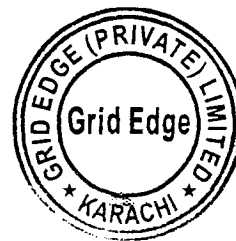


# Project cost, information regarding sources and amounts of equity, debt.

## Feasibility & Financing:

The Project will cost approximately PKR 280 Million funded through 25% equity (ENI and REON) and 75% debt.

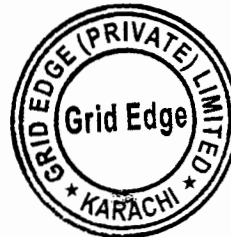
An EOI from Lenders to provide financing for this project is attached.



# Project Commencement & Completion

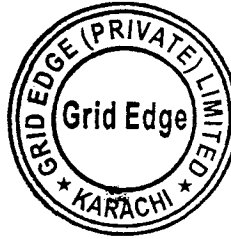
This project will be completed in a period of 6 months. Major activities of project involve, Detailed Engineering Design, procurement of Local and Imported Equipment, and Construction involving civil, electrical and mechanical works. Major Milestones are;

S. No.	Major Milestone	Timeline
1	Detailed Engineering Design	1 month
2	Procurement	1.5 months
3	Construction	2.5 months
4	Commissioning and Testing	1 month



# ESSA (Environmental and Social Soundness Assessment)

Please find attached the IEE and NOC from Environment Agency





# ENVIRONMENT PROTECTION DEPARTMENT

Government of the Punjab  
National Hockey Stadium, Lahore.



NO. AD (EIA)/EPA/F-752(IEE)/0101/2018/ 102  
Dated: 29/01/2019

To

Mr. Mdassar Jabbar,  
R/o House No. 204-N, Phase-08,  
Defence Housing Authority, Lahore Cantt.

Subject:

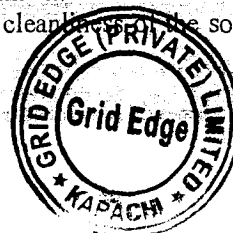
**DECISION OF EPA PUNJAB REGARDING "INSTALLATION OF 3-MW SOLAR POWER PROJECT AT CRESCENT BAHUMAN INDUSTRY, SARGODHA ROAD, PINDI BHATTIAN, DISTRICT HAFIZABAD"**

1. Description of Project: Installation of 3-MW Solar Power Plant.
2. Location of Project: Crescent Bahuman Limited Sargodha Road Pindi Bhattian, District Hafizabad
3. Date of filing of IEE: 26.10.2018

4. EPA Punjab has reviewed the Initial Environmental Examination (IEE) Report and considered Site Inspection Report received from Assistant Director (Environment), Hafizabad vide letter No. 2628/18/AD(EPA)/Hfd dated 31.10.2018. EPA Punjab has also considered the recommendations of Committee of Experts (Meeting dated 01.01.2019) and other relevant record to take the lawful decision.

5. Environmental Protection Agency, Punjab accords Environmental Approval under Section 12 of Punjab Environmental Protection Act, 1997 for installation of your aforesaid Project subject to the following conditions:

- i. The proponent shall ensure compliance of Punjab Environmental Quality Standards (PEQS).
- ii. Mitigation Measures suggested in the IEE report and Environmental Management Plan (EMP) shall be strictly adhered to minimize any negative impacts on soil, ground water, air and biological resources of the project area.
- iii. Monitoring shall be carried out during the entire period of the project activities. Monitoring reports of the whole operation shall be submitted to EPA, Punjab on monthly basis.
- iv. The proponent shall dispose of solid waste, electronic waste, discarded solar panels and condemn batteries etc. in a proper scientific way in consultation with TMA / District Government.
- v. The proponent shall plant 5000 trees of 6-7 feet height of indigenous species in the area in consultation with Divisional Forest Officer within six months. The proponent shall also take measures for protection and maintenance of these trees and maintain their proper record for verification by EPA.
- vi. The proponent shall do proper landscaping after completion of the project.
- vii. The construction material shall be piled / stored in such a way that it shall not destroy the flora / environment of the locality.
- viii. The proponent shall care about noise issues during construction and operation stage of the project.
- ix. The objections / complaints of the locals / stakeholders (if any) shall be redressed on priority basis.
- x. The proponent shall obtain NOC / clearance from all other concerned departments before commencement of work.
- xi. The proponent shall appoint Environmental Manager (having relevant qualification) for the project and shall convey his name along with his complete Mailing Address and Phone Numbers.
- xii. The proponent shall take effective measures for safe transportation and disposal of Photovoltaic Cell / Solar Panel.
- xiii. The proponent shall dispose of wastewater after treatment.
- xiv. The proponent shall adopt latest techniques for the cleaning of the solar panels to minimize water use as much as possible.



P.T.O

- xv. The proponent shall take measures for rainwater harvesting in the building design.
- xvi. The proponent shall follow the SOPs regarding dengue larvae eradication and shall ensure removal of stagnant water on daily basis.
- xvii. The proponent shall ensure all necessary measures for the protection of sensitive / protected areas in the vicinity (if any).
- xviii. The proponent shall prepare a Community Development Plan and implement it for the benefit of communities of the project area.

6. The Proponent shall, before commencing construction of the Project, acknowledge acceptance of the stipulated conditions by executing an Undertaking in the form prescribed in Schedule VII of Review of IEE/EIA Regulations 2000.

7. The Proponent shall be liable for correctness and validity of information supplied to the Department by the Environmental Consultant.

8. This approval is accorded only for the construction phase of the Project. The Proponent shall apply for confirmation of compliance under Regulation 14 of IEE / EIA Regulation, 2000 by submitting Environmental Management Plan for operational phase along with compliance status report of the Environmental Approval of the construction phase of the project.

9. The Proponent shall be liable for compliance of Regulations 13, 14, 18 and 19 of IEE/EIA Regulations, 2000, regarding Approval, Confirmation of Compliance, Entry, Inspections and Monitoring.

10. EPA reserves the right to impose any other condition based on its monitoring.

11. Any change in the approval Project shall be communicated to EPA, Punjab and shall be commenced after obtaining the approval.

12. This approval shall be treated as null and void if all or any of the conditions mentioned above is/are not complied with. This approval does not absolve the proponent of the duty to obtain any other approval or consent that may be required under any law in force and is subject to legal proceedings in any legal for a / court.

13. This approval shall be valid (for commencement of construction) for a period of Three Year from the date of issue under the Regulation 16 of IEE/ EIA Regulations, 2000.

14. This approval can be withdrawn at anytime without any prior notice if deemed necessary in the Public/ National interest.

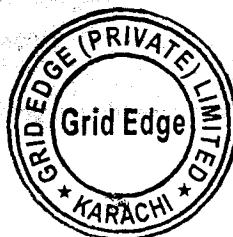
15. This decision is issued with approval of Director General, EPA, Punjab.

  
ASSISTANT DIRECTOR (EIA)

NO. & DATE EVEN:

A copy is forwarded to the Assistant Director (Environment), Hafizabad w.r.t. letter No 2628/18/AD(EPA)/Hfd dated 31.10.2018. He is requested to:

- i. Obtain Undertaking from the Project Proponent mentioned at Para 6 for the record of EPA Headquarter and Field Office.
- ii. Ensure compliance of the conditions mentioned in the Environmental Approval and maintain the file / record of correspondence with the Project Proponent properly.



  
ASSISTANT DIRECTOR (EIA)

# Safety and Emergency Plan

## EMERGENCY RESPONSE PLAN (ERP)

### Purpose

To describe responsibilities in preparation for, response to and recovery from any reasonably foreseeable incident.

### Priorities

Secure the Health and Safety of all personnel involved Minimize any impact on the environment Minimize any impact on property and assets.

## Roles and Responsibilities

(For events deemed to be major, CUSTOMER may be obliged, by its responsibilities under its agreements with the Government, to assume control of emergency response activities. In these circumstances the CUSTOMER Representative shall clearly advise REON that CUSTOMER is assuming control and the REON Project Manager will work under CUSTOMER instruction).

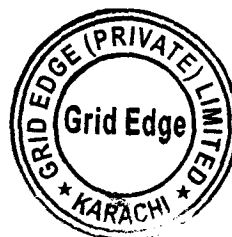
For emergency response activities managed by REON, key roles and responsibilities are detailed below.

### Emergency Response Team Leader (Project Manager)

The ERT Leader shall carry overall responsibility for REON emergency response execution. Key responsibilities shall include:

- Providing leadership and direction in the event of an emergency.
- Ensuring that emergency response planning, preparedness and execution is consistent with the requirements of CUSTOMER.
- Ensuring that appropriate emergency response teams are defined and prepared for the various emergency response scenarios identified in this plan.
- Notification to CUSTOMER Project Manager of any emergency incident. This is a mandatory requirement for all emergencies. Notification of an emergency incident should be made via radio, telephone or messenger to CUSTOMER Operations CCR as soon as practicable upon receiving advice of same.
- Following initial notification, liaison with CUSTOMER Project Manager during the execution of any emergency response.

Mobilization of additional resources, third party assistance etc. Liaison with management.



## Site Engineer HSE

Reporting to the ERT Leader, the Site Engineer HSE and/or his substitute is responsible for ensuring at site that provisions are in place for emergency response, including:

- Muster points.
- Arrangements for conducting head counts.
- Identification and Mobilization of the Fire Team.
- Setting up drills and exercises.
- Procurement of firefighting equipment.

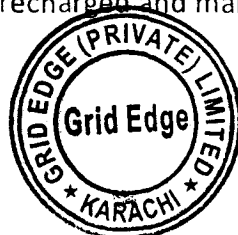
In the event of any emergency the Site Engineer HSE or a member of the HSE team shall take the following actions:

- Shall attend the site of the incident, assess the situation and issue direction to the concerned parties and to the Fire Team.
- Ensure that messages have been communicated to The Emergency Response Team Leader.
- Evaluate the scale of the incident and decide whether additional resources are required to adequately deal with it.
- Liaise with site supervision for withdrawing any permits.
- Liaise with site supervision for the mobilisation of any plant and equipment necessary for dealing with the emergency.
- Limit access to the area with barriers or other means to prevent unauthorised access.
- Co-ordinate the reinstatement measures following stabilisation of incident.
- Prepare a full report.

## Fire Team

- The fire team will be selected and trained appropriately.
- The Site Engineer HSE shall appoint a Fire Team Leader (and his substitute) who will direct personnel under his control.
- The fire team leader will have had training and preferably previous experience in emergency response actions.
- All the members of the fire team shall report to the Fire Team Leader.
- Appropriate training shall be provided to members of the fire team.
- An electrician or instrument specialist will be included in the fire team. His responsibility the electrical isolation of areas as necessary.

Firefighting appliances shall be maintained in accordance with their specifications. Sufficient redundancy shall be incorporated into the facilities to allow for periodic unavailability during maintenance. A designated member of the HSE Team shall regularly confirm that fire extinguisher and other appliances are recharged and maintained as appropriate.



## General Considerations

Emergency response drills shall be conducted at least quarterly for each principal area i.e. camp and the work site, the observations and debrief notes shall be recorded. The Site Engineer HSE shall analyse the findings and identify any remedial actions required.

The emergency procedure shall be updated from time to time to reflect observations made.

- Training shall be conducted on regular basis for emergency response teams.
- The location of emergency facilities e.g. firefighting appliances shall be clearly identified on plans displayed at conspicuous locations.

### Raising the alarm and plan activation

Activate the alarm and notify the ERT Leader.

Provide the following details:

- Location of the Incident.
- Natures of incident e.g. fire, number of injuries, etc.
- If it is a fire, state type - oil, gas, electric or other and state wind direction and strength.
- Identify yourself giving your name and telephone number or radio channel.

### Alarm and Communication

Communication is a critical factor in handling an emergency. To control the situation by the earliest possible action, any employee must be able to act and raise an emergency alarm.

The assembly points shall be clearly indicated.

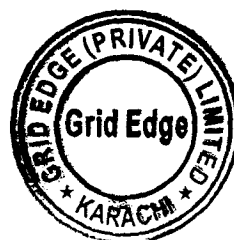
- On hearing an alarm all personnel shall vacate the work place. Before leaving, each person shall ensure that the area is as safe as possible by switching off all power tools, running machines etc.
- All personnel shall muster at the assembly point as per the plan. The designated members of the HSE team shall provide guidance and assistance for mustering at the correct assembly point.
- The subcontractor's HSE team members shall take directions from the Site HSE co-ordinator.

### Emergency Contacts List

List of all emergency services contacts will be displayed at site, including contact numbers of ERT and key persons (Project Manager REON, subcontractor Manager, Site HSE Engineer)

#### Incident response

Emergency situations occurring at the work site have the potential to cause serious injury, loss of life and property damage.





The following is a list of incidents that may be classed as emergencies for this procedure:

- Scaffold collapse
- Fire involving fuels, gases and other materials
- Medical emergency / Serious Injury
- Failure of lifting equipment
- Pressure test failure
- Collapse of an excavation involving personnel
- Vehicle accidents
- Collapse of structures/steelwork
- Snake Bite

In an emergency, or on hearing the "Stop Work Alarm", every supervisor shall ensure the following:

- All work is stopped at once.
- All equipment is shut down and put in a safe place.
- All men are evacuated to a pre-determined assembly point in an orderly manner.
- Arrange best possible interim medical arrangements for patient or injured person during transfer to hospital or while attendance by doctor is being arranged.
- Ensure the presence of ambulance 24 hours with driver.
- Anti-Snake Venom must be present at site.
- A roll call is taken and every man is accounted for, awaiting further instructions
- Keep the zone affected by the emergency clear and remove any vehicles that could cause a restriction to the emergency team

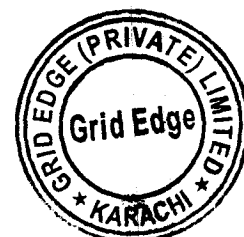
### Evacuation

Activate the emergency alarm to evacuate the area safely and ensure that unnecessary personnel leave the site by a safe route. Assign someone to advise security to open the Facility main gate for emergency vehicles.

## System Studies

Depending on the size of the PV Plant, distribution is carried out via different busbars. These multiple configurations usually depend upon:

- Current carrying capacity in Normal and Fault conditions
- No of outputs
- Fault Isolation
- Connection method used

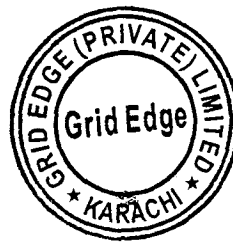


The project 4 Transformers of 1500 KVA which are terminated on a PV Bus through individual separate MV panels.

The breakers used for connection at MV are 630A ACBs which can withstand 25kA of short circuit. The normal operating current is calculated to be around 100A. The breaker will be adjusted to 125A of overcurrent tripping using relays. The short circuit from Solar Panels is not expected to exceed 125A due to the nature of the solar panels used. Major short circuit faults are expected from the load and grid side.

Each MV breaker will have an earth connection (along with an earth fault relay) to isolate the faults (if they occur).

The connection of the solar system to the load is by single busbar topology.



# Plant Characteristics

## Generation Voltage:

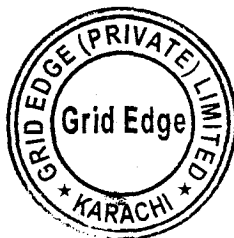
Solar Power plant will be generating AC power at Low voltage levels of 400V 4W+PE system. Low voltage level will then step up through power transformers to the existing Diesel Genset Voltage levels i.e. 11KV to be synced with Electrical Network.

## Power Factor & Frequency

Solar power plant is using solar grid connected string Inverters to covert DC power of solar panels to Alternating Power. Grid connected inverters have the functionality to adapt the power factor of existing grid. The range of Power Factor can be set from 0 – 1 leading /lagging, making it suitable for absorbing or delivering reactive power. the nominal power factor for Inverters is 0.995. Nominal Frequency of generation is 50Hz.

## Automatic Generation Control & Ramp Rate:

Automation would be added into the solar system to ensure safe synchronization with the Grid and Diesel Gensets. The automation controller added would ensure no reverse power is fed into the Grid or Diesel Generator. The controller achieves this by actively sensing the difference in power produced by solar system and power consumed by the CBL Factory. It is programmed to curtail solar power generation in case of excess power generation by the solar system.



# Training and Development

## ORIENTATION, SITE HSE INDUCTION AND OTHER TRAINING ACTIVITIES

### Initial HSE Orientation Program

Each and every person will undergo a HSE orientation program. On completion of orientation he will be permitted to enter the site.

REON Site Engineer HSE with the help of CUSTOMER HSE personnel shall perform the initial orientation based on but not limited to the following:

- Explaining REON HSE Policy and organizations of REON site and CUSTOMER.
- General HSE rules and regulations for working on site including use of Personal Protective Equipment, incident reporting, getting first aid, emergency response (alarm system, escape route, assembly point), HSE inspection, housekeeping, etc.
- Hazards at construction site
- Environmental hazards

### Note:

This Initial HSE Orientation would also be given to all the workers of the sub-contractors working at site.

Site Engineer HSE will keep a record of staff having completed induction.

### Specific Induction for Workers (On Job)

Subsequent to the general induction first line supervisor shall conduct a specific orientation for new staff, which would comprise:

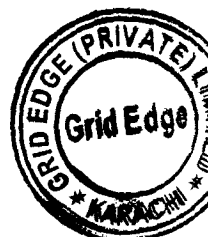
- Introduction of the workers on the nature of their jobs.
- Explaining to the workers the work environment of a particular location and specific job hazards

### Permit to Work System Course

- It is mandatory for all work permit recipient and signatories to attend a permit to work course held by CUSTOMER. Work permits will often be required prior to commencement of work.
- Refresher courses will be arranged by REON HSE.

### Tool Box Talk by Line Supervisors

All supervisors will be trained to deliver daily tool box talk in their respective areas.



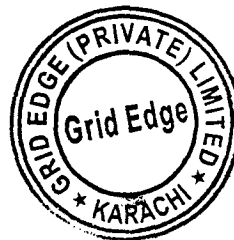
- Subjects for "tool box talks" would be selected to reflect the specific hazards of a particular site, feedback from first line supervisors/ HSE inspectors and observation / input from any other employee.
- Incidents, which may occur in the site/works, shall also be discussed in "tool box talks".
- Records of "tool box talks" shall be maintained by site HSE supervisor.

### Management Employees Training Program

- The management employees training program will be conducted during the project to ensure that all management employees are trained.
- Site HSE Engineer will conduct HSE trainings for all staff based on training plan.

### Task Specific Training Courses (Whenever Required)

In addition to the above, specific training courses shall also be provided for staff and workers. Subjects for the training courses will be identified in the training plan as advised by the CUSTOMER.



# Efficiency Parameters

PV power plant efficiency can be judged per its performance ratio, expressed as a percentage. This ratio compares a plant's actual energy production to its theoretical energy-generating potential and describes how efficient a PV power plant is in converting sunlight incident on the PV array into AC energy delivered to the utility grid. AS per IEC definition, Performance Ratio defines as;

$$\text{Performance Ratio} = \frac{Z1}{Z2} \div \frac{Z3}{Z4}$$

Where,

Z1 = Accumulated electricity generated during testing period (KWh)

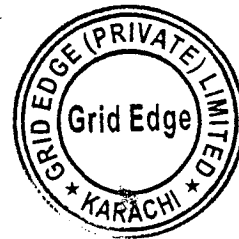
Z2 = Total system installed capacity (KWs)

Z3 = Accumulated irradiation during testing period (Wh/m2)

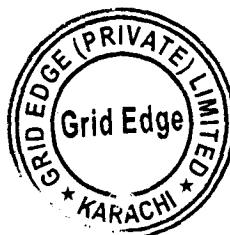
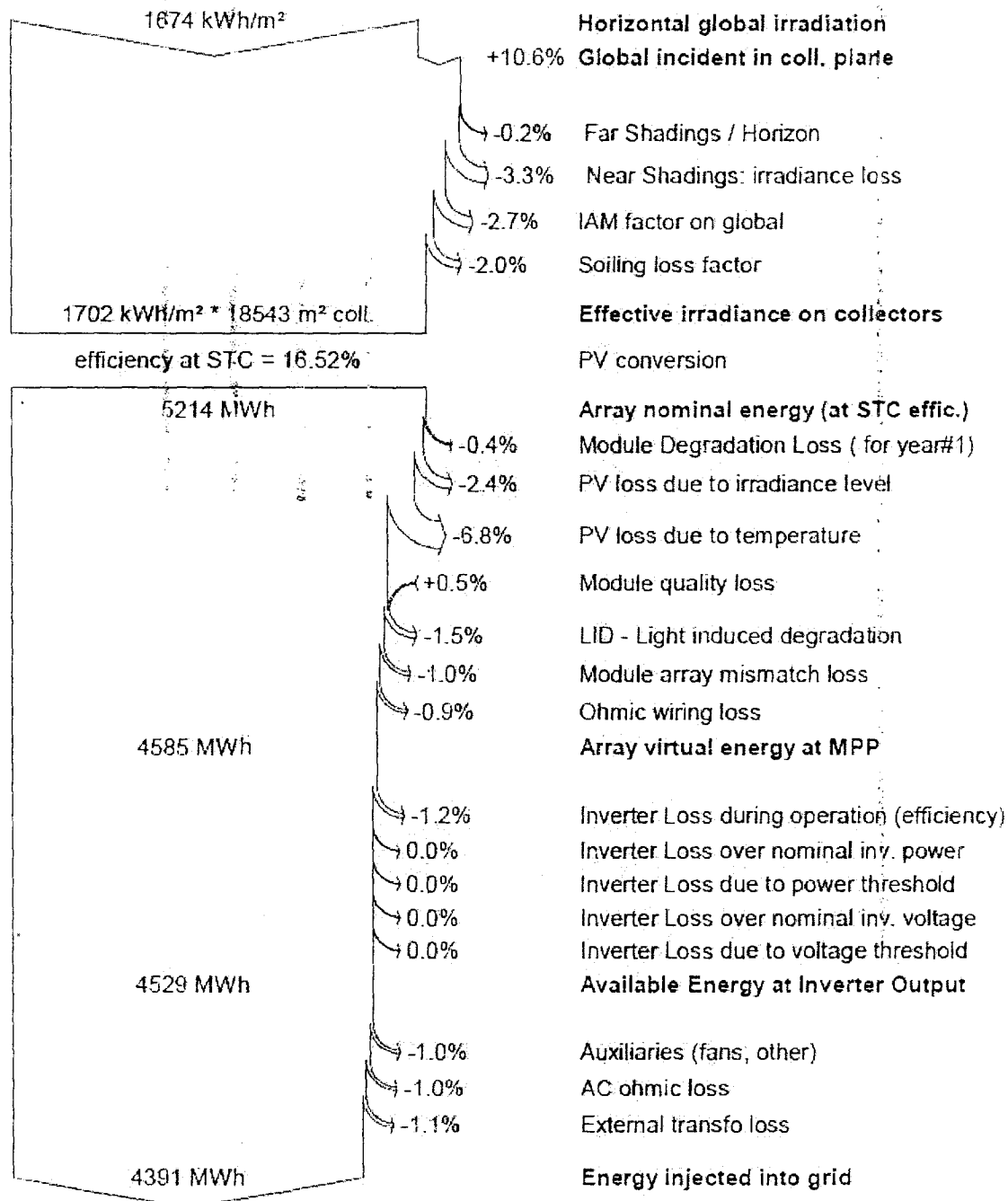
Z4 = Intensity of irradiance under STC condition = 1,000W/m2

## Energy Generation:

S. No.	Efficiency Parameters	
1	Performance Ratio of the System	77.39%
2	Capacity Utilization Factor	16.7%
3	Energy Generation Units	4.3 Million KWh



## Loss diagram over the whole year





A044063

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE, KARACHI

CERTIFICATE OF INCORPORATION

[Under section 16 of the Companies Act, 2017 (XIX of 2017)]

Corporate Universal Identification No. 0122474

I hereby certify that GRID EDGE (PRIVATE) LIMITED is this day incorporated under the Companies Act, 2017 (XIX of 2017) and that the company is limited by shares.

Given under my hand at Karachi this Eighth day of August, Two Thousand and Eighteen

Incorporation fee of 12000/= on



(Kashif Mahmood)  
Additional Joint Registrar

8/8/18



**THE COMPANIES ACT, 2017**  
**THE COMPANIES (GENERAL PROVISIONS AND FORMS) REGULATIONS, 2018**  
**[Section 197 and Regulations 4 and 20]**  
**PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE,**  
**SECRETARY, CHIEF FINANCIAL OFFICER, AUDITORS AND LEGAL ADVISER OR OF**  
**ANY CHANGE THEREIN**

FORM 29

**PART-I**

1.1 CUIIN (Incorporation Number)

1.2 Name of Company

1.3 Fee Payment Details

1.3.1 Challan Number  1.3.2 Amount

**PART-II**

**2. Particulars\*:**

**2.1. New Appointment/Election**

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation** * (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)	Nature of directorship (nominee/indepe ndent/additional/ other) (j)
Mujtaba Haider Khan	4220104922121	Ansar Haider Khan	Bhayani Sunview, Gulshan-e-Iqbal, House No. 124, Block 11, Karachi Central Pakistan	Chief Executive	Pakistan		30/04/2019	Appointed	
Mujtaba Haider Khan	4220104922121	Ansar Haider Khan	Bhayani Sunview, Gulshan-e-Iqbal, House No. 124, Block 11, Karachi Central Pakistan	Director	Pakistan		30/04/2019	Elected	
Inam ur Rahman	3520113784749	Fazal Rahmaan	House No. 3/300, Sanwar Road, Lahore Cantt. Karachi Sindh Pakistan	Director	Pakistan		30/04/2019	Elected	
A. F. Ferguson and Co., Chartered Accountants	N/A	N/A	State Life Building No. 1-C, I.I. Chundrigar Road, Karachi	Auditor	Pakistan	None	30/04/2019	Appointed	
Syed Amjad Wahab	4220107924787	Syed Abdul Wahab	House No. 78/B/1, Street Q, Phase 7, D.H.A., Karachi	Director	Pakistan		30/04/2019	Elected	
Saad Fandi	4210168534451	Ghayoor Hussain Faridi	A-261, Block H, North Nazimabad, Karachi	Chief Accountant/C FO	Pakistan		29/04/2019	Appointed	

**2.2. Ceasing of Officer/Retirement/Resignation**

Present Name in Full (a)	NIC No. or Passport No. in case of Foreign National (b)	Father / Husband Name (c)	Usual Residential Address (d)	Designation (e)	Nationality** (f)	Business Occupation** * (if any) (g)	Date of Present Appointment or Change (h)	Mode of Appointment / change / any other remarks (i)	Nature of directorship (nominee/indepe ndent/additional/ other) (j)
Kamran Ajmal Mian	4210134026413	Ajmal Mian	House No. 9-B, 1 East Street, Phase 1, D.H.A, Clifton Cantt, Karachi South Karachi Sindh	Director	Pakistan		30/04/2019	Retired	

**Certified to be True Copy**  
  
**Joint Registrar of Companies**

Form A  
THE COMPANIES ACT, 2017  
THE COMPANIES (GENERAL PROVISIONS AND FORMS) REGULATIONS, 2018  
[Section 130(1) and Regulation 4]  
ANNUAL RETURN OF COMPANY HAVING SHARE CAPITAL

**PART-I**

(Please complete in typescript or in bold block capitals)

1.1 CUIN (Registration Number) 0122474

1.2 Name of the Company GRID EDGE (PRIVATE) LIMITED

1.3 Fee payment details  
1.3.1 Chalan No E-2019-1015104 1.3.2. Amount 400.0

1.4 Form A made upto dd mm yyyy 30/04/2019

1.5 Date of AGM 30/04/2019

**PART - II**

**Section A**

2.1 Registered Office Address DAWOOD CENTRE, M.T. KHAN ROAD, KARACHI SADDAR TOWN SINDH 75530

2.2 Email Address INFO.REON@DAWOODHERCULES.COM

2.3 Office Tel. No 021-35632200

2.4 Office Fax No 021-35633970

2.5 Principle line of business --POWER GENERATION - ALLIED (OTHER)

2.6 Mobile No. of Authorized officer (Chief Executive/ Director/ Company Secretary/ Chief Financial Officer) 03008495892

2.7 Authorized Share Capital

Classes and kinds of Shares	No. of Shares	Amount	Face Value
Ordinary Shares		1,200,000.00	

2.8 Paid up Share Capital

Classes and kinds of Shares	No. of Shares	Amount	Face Value
Ordinary Shares		1,200,000.00	

2.9 Particulars of the holding /subsidiary company, if any

Name of Company	Holding/Subsidiary	% Shares Held

2.10 Chief Executive

Name Mujtaba Haider Khan

Address Bhayani Sunview, Gulshan-e-Iqbal, House No. 124, Block 11, Karachi Central Pakistan Karachi

NIC No 4220104922121

Next Page

Certified to be True Copy  
*[Signature]*  
Joint Registrar of Companies

2.17 List of members & debenture holders on the date upto which this Form is made

S#	Folio#	Name	Address	Nationality	No of shares held/Debenture	NIC No(Passport if foreigner)
<b>Members</b>						
1	01	Reon Energy Limited	Dawood Centre, M.T. Khan Road, Karachi	Pakistan	71998	N/A
2	02	ENI International B.V.	Strawinskylaan 1725, 1077 XX Amsterdam, t	Netherlands	48000	N/A
3	03	Mujtaba Haider Khan	Bhayani Sunview, Gulshan-e-Iqbal, House N	Pakistan	1	4220104922121
4	04	Inam ur Rahman	House No. 3/300, Sarwar Road, Lahore Cantt	Pakistan	1	3520113784749
<b>Debenture Holders</b>						

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**THE COMPANIES ACT, 2017 (XIX of 2017)**

**(COMPANY LIMITED BY SHARES)**

**MEMORANDUM**

**OF**

**ASSOCIATION**

**OF**

**GRID EDGE (PRIVATE) LIMITED**

1. The name of the Company is Grid Edge (Private) Limited.
2. The registered office of the Company will be situated in the Province of Sindh.
3. (i) The principal line of business of the Company shall be to generate, accumulate, transmit, distribute, purchase, sell and supply electric power or any other energy and power generated by any source, from conventional or non-conventional energy by bio-mass, hydro, thermal, gas, air, diesel oil, or solar, hydrocarbon fuel or any other form, kind or description or through renewable energy sources, wind mill or another means/ source on a commercial basis and to construct, lay down, establish, operate and maintain power/energy generating stations, including buildings, structures, works, machineries, equipments, cables, wires, lines, accumulators, lamps, and works and to undertake or to carry on the business of managing, owning, controlling, erecting, commissioning, operating, running, leasing or transferring power plants and plants based on conventional or non-conventional energy source, thermal power plants, solar energy plants, wind energy plants, mechanical, electrical, hydel, civil engineering works, boiler houses, steam turbines, switch yards, transformer yards, sub stations, transmission lines, accumulators, workshops and to do all such other things and acts as may appear to be incidental or conducive to the attainment of the above objects and to have full power to exercise all powers to achieve or to endeavour to achieve the above objects.
- (ii) Except for the businesses mentioned in sub-clause (iii) hereunder, the company may engage in all the lawful businesses and shall be authorized to take all necessary steps to do all such other things and acts in connection therewith and ancillary thereto as may appear to be incidental or conducive to the attainment of the above objects.
- (iii) Notwithstanding anything contained in the foregoing sub-clauses of this clause nothing contained herein shall be construed as empowering the Company to undertake or indulge, directly or indirectly in the business of a Banking Company, Non-banking Finance Company (Mutual Fund, Leasing, Investment Company, Investment Advisor, Real Estate Investment Trust management company, Housing Finance Company, Venture Capital Company, Discounting Services, Microfinance or Microcredit business), Insurance Business, *Modaraba* management company, Stock Brokerage business, forex, real estate

We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a company, in pursuance of this memorandum of association, and we respectively agree to take the number of shares in the capital of the Company as set opposite our respective names:

Name and surname (present & former) in full (in Block Letters)	NIC No. (in case of foreigner, Passport No)	Father's/ Husband's Name in full	Nationality (ies) with any former Nationality	Occupation	Usual residential address in full or the registered/ principal office address for a subscriber other than natural person	Number of Shares taken by each subscriber (in figures and words)	Signatures
ENI International B.V.  Through Nominee	33264964	Subscriber	Netherlands		Strawinskylaan 1725, 1077 XX Amsterdam, the Netherlands.	48,000(Forty Eight Thousand Shares Only)	
Kamran Ajmal Mian	42101-3402641-3	Ajmal Mian	Pakistan	Services	House no 9-B, 1 East Street, Phase 1 DHA Clifton Cantt Karachi South		
Mujtaba Haider Khan	42201-0492212-1	Ansar Haider Khan	Pakistan	Services	Bhayani Sunview, Gulshan-e-Iqbal, House no 124 Block 11, Karachi Central Pakistan	1 (One Share Only)	
Inam ur Rahman	35201-1378474-9	Fazal Rahmaan	Paksitan	Services	House no 3/300, Sarwar Road, Lahore Cantt	1 (One Share Only)	

**THE COMPANIES ACT, 2017 (XIX of 2017)**

(Company Limited by Shares)

**ARTICLES OF ASSOCIATION**

**OF**

**GRID EDGE (PRIVATE) LIMITED**

**PRELIMINARY**

1. (1) The Regulations in Table A in the First Schedule to the Companies Act 2017, shall not apply to the Company except in so far as they are repeated or contained in these Articles.

- (2) In these Articles-

“REON” means Reon Energy Limited, a company incorporated and existing under the laws of Pakistan, being the holder of 60% shareholding in the Company;

“ENI” means ENI International BV, a company incorporated and existing under the laws of the Netherlands, being the holder of 40% shareholding in the Company;

“section” means section of the Act;

“the Act” means the Companies Act, 2017; and

“the Company” means Grid Edge (Private) Limited;

“the seal” means the common seal or official seal of the Company as the case may be.

“these Articles” means these Articles of Association as originally framed or as from time to time altered by Special Resolution.

- (3) Unless the context otherwise requires, words or expressions contained in these Articles shall have the same meaning as in the Act; and words importing the singular shall include the plural, and *vice versa*, and words importing the masculine gender shall include feminine, and words importing persons shall include bodies corporate.

**REGISTERED OFFICE**

2. The registered office of the Company will be situated in the Province of Sindh.

**BUSINESS**

3. The directors shall have regard to the restrictions on the commencement of business imposed by section 19 if, and so far as, those restrictions are binding upon the Company.

**SHARES**

4. In case of shares in the physical form, every person whose name is entered as a member in the register of members shall, without payment, be entitled to receive, within thirty days after allotment or within fifteen days of the application for registration of transfer, a certificate under the seal specifying the share or shares held by him and the amount paid up thereon. Provided that if the shares are in book entry form or in case of conversion of physical shares and other transferable securities into book entry form, the Company shall, within ten days after an application is made for the registration of the transfer of any shares or other securities to a central depository, register such transfer in the name of the central depository.

11. The shares or other securities of a deceased member shall be transferred on application duly supported by succession certificate or by law ful award, as the case may be, infavour of the successors to the extent of their interests and their names shall be entered to the register of members.

#### ALTERATION OF CAPITAL

12. The Company may, by special resolution, passed at a shareholders meeting-

- (a) increase its authorised capital by such amount as it thinks expedient, provided that the nominal value of shares is PKR10/- each;
- (b) consolidate and divide the whole or any part of its share capital into shares of larger amount than its existing shares;
- (c) Any capital raised by the creation of new shares shall be considered part of the authorized capital and the new shares be subject to provisions herein contained with reference to transfer, transmission, voting an otherwise.

13. Subject to the provisions of the Companies Act, 2017 all new shares, before issue, shall at the first instance be offered to the Shareholders of the Company strictly in proportion to the number of existing shares held by such shareholder. The offer shall be made, following the unanimous approval of the issuance of new shares, by letter of offer specifying the number of shares offered, and limiting a time within which the offer, if not accepted, will deem to be declined, and after the expiration of that time, or on the receipt of an intimation from the person to whom the offer is made that he/she declines to accept the shares offered, the directors under Section 83 of the Companies Act, 2017, may dispose of the same in such manner as they think most beneficial to the Company. The directors may like wise so dispose of any new shares which (by reason of the ratio which the new shares bear to shares held by persons entitled to an offer of new shares) cannot, in the opinion of the directors, be conveniently offered under this Article.

14. The new shares shall be subject to the same provisions with reference to transfer, transmission and otherwise as the shares in the original share capital.

15. The Company may, by special resolution, passed by the Shareholders of the Company reduce its share capital in any manner and with, and subject to any incidental authorisation and consent required, by law.

16. Subject to provisions of Section 85 of the Companies Act, 2017 the Company may, by special resolution, passed by the Shareholders of the Company at unanimity, alter the conditions of the Memorandum so as to cancel any shares which at the date of passing of the resolution in that respect have not been taken or agreed to be taken by any person, any diminish the amount of its authorized share capital by the amount of shares so cancelled.

#### GENERAL MEETINGS

17. The Statutory General Meeting of the Company shall be held within a period of one hundred and eighty days from the date on which the Company is entitled to commence business or nine months from the date of incorporation, which ever is earlier, as required by Section 131 of the Companies Act, 2017.

18. An Annual General Meeting, shall be held, in accordance with the provisions of section 132 of the Companies Act, 2017, within sixteen months from the date of incorporation of the Company and there after once atleast in every year within a period of one hundred and twenty days following the close of its financial year. All such General Meetings will be called 'Annual General Meetings' and all other General Meetings will be called 'Extraordinary General Meetings'.

19. Subject to provision of Section 133 the directors may, when ever they think fit, call an Extra ordinary General Meeting of the Company which require approval of the Shareholders in a General Meeting and shall, on requisition of Shareholders representing not less than 10% of the voting power on the date of deposit of such requisition, forthwith proceed to call an Extraordinary General meeting. Any director of the Company may call an Extra ordinary



may be.

31. A vote given in accordance with the terms of an instrument of proxy shall be valid notwithstanding the previous death or insanity of the principal or revocation of the proxy or of the authority under which the proxy was executed, or the transfer of the share in respect of which the proxy is given, provided that no intimation in writing of such death, insanity, revocation or transfer as aforesaid shall have been received by the Company at the office before the commencement of the meeting or adjourned meeting at which the proxy is used.

## DIRECTORS

32. Unless otherwise agreed by the Shareholders in General Meeting, the Company shall have at least three (3) directors the majority of which being resident in Pakistan, with REON appointing two (2) directors and ENI appointing one (1) director. The following shall be the first directors of the Company, so, however, that the number of directors shall not in any case be less than that specified in section 154 of the Act and they shall hold office until the election of directors in the first Annual General Meeting:

1. Mujtaba Haider Khan
2. Inam ur Rahman
3. Kamran Ajmal Mian

33. The Board shall fix the number of directors thirty-five (35) days before convening the General Meeting at which the directors are to be elected, and the number so fixed shall not be changed except with the prior approval by special resolution of the Company in a General Meeting. It is clarified that in no event shall the number of directors increase beyond three (3) until the same has been so approved by all the Shareholders in a General Meeting.

34. The directors shall appoint a nominee director from REON as the Chairman of the Company. The Board may remove Chairman at any time by unanimous vote (except the vote of the Chairman to be removed) and appoint a new Chairman and such Chairman shall be appointed from amongst the nominee directors of REON on the Board. The term of the Chairman shall be co-terminous with the term of the Board. A retiring Chairman shall be eligible for reappointment and shall preside over the General Meeting at which an election of directors shall be held.

35. An elected director shall hold office for a period of three (3) years. Election of directors to be held every three years.

36. The Company may by resolution in a General Meeting remove a director in accordance with Companies Act, 2017.

37. If any director resigns or becomes disqualified or ceases for whatever reason prior to the expiry of the three year term, the Board shall appoint any person to be a director to fill such vacancy within ninety (90) days of the vacancy. Any director so appointed shall complete remainder of the term of the director in whose place he is appointed.

38. The remuneration of the directors shall from time to time be determined by the Board, provided that unless otherwise agreed the nominee directors of REON and ENI shall not be entitled to any remuneration, directors may be reimbursed all reasonable travelling, hotel and other expenses properly incurred by him/ her in attending and returning from meetings of directors or General Meetings of the Company or in connection with the discharge of their duties as directors of the Company.

39. Save as provided in section 153 of the Act, no person shall be appointed as a director unless he is a member of the Company or the only nominee of a corporate Shareholder.

instrument to which the seal of the Company is so affixed in their presence.

### DISQUALIFICATION OF DIRECTORS

47. No person shall become the director of a Company if he suffers from any of the disabilities or disqualifications mentioned in section 153 or disqualified or debarred from holding such office under any of the provisions of the Act as the case may be and, if already a director, shall cease to hold such office from the date he so becomes disqualified or disabled:

Provided, however, that no director shall vacate his office by reason only of his being a member of any company which has entered into contracts with, or done any work for, the Company of which he is director, but such director shall not vote in respect of any such contract or work, and if he does so vote, his vote shall not be counted. In case of such conflict of interest, the resolution shall be adopted by the General Meeting.

### PROCEEDINGS OF DIRECTORS

48. The directors may meet together for the dispatch of business, adjourn and otherwise regulate their meetings, as they think fit; provided that the directors shall meet at least once in each quarter of a calendar year. A director may, and the secretary on the requisition of a director shall, at anytime, summon a meeting of directors. Notice sent to a director or through the mail whether such director is in Pakistan or outside Pakistan shall be a valid notice.

49. The directors shall from among the directors appointed by REON, elect a chairman of the Board of directors and determine the period for which he is to hold office. If at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as chairman, the directors present may choose one of their number to be chairman of the meeting.

50. At least two (2) directors of whom at least one nominated by each Shareholder, for the time being of the Company, present personally or through video-link, shall constitute a quorum.

51. Save as otherwise expressly provided in the Act, ordinary questions at meetings of the board shall be determined by a majority of votes of the directors present in person or through video-link, each director having one vote. In case of an equality of votes or tie, the chairman shall have a casting vote in addition to his original vote as a director.

52. Other questions as listed in the Shareholder Agreement, at meetings of the Board shall be determined by unanimity of votes of the directors from each Shareholder present.

53. The directors may delegate any of their powers not required to be exercised in their meeting to committees consisting of such member or members of their body as they think fit; any committees formed shall, in the exercise of the powers so delegated, conform to any restrictions that may be imposed on them by the directors.

54. (1) A committee may elect a chairman of its meetings; but, if no such chairman is elected, or if at any meeting the chairman is not present within ten minutes after the time appointed for holding the same or is unwilling to act as chairman, the members present may choose one of their number to be chairman of the meeting.

(2) A committee may meet and adjourn as it thinks proper. Questions arising at any meeting shall be determined by a majority of votes of the members present. In case of an equality of votes, the chairman shall have and exercise a second or casting vote.

55. All acts done by any meeting of the directors or of a committee of directors, or by any person acting as a director, shall, notwithstanding that it be afterwards discovered that there was some defect in the appointment of any such directors or persons acting as aforesaid, or that they or any of them were disqualified, be as valid as if every such person had been duly appointed and was qualified to be a director.

56. A copy of the draft minutes of meeting of the board of directors shall be furnished to every director within seven working days of the date of meeting.

57. A resolution in writing signed by all the directors – signatures being in the same document or severally – for

## ACCOUNTS

71. The directors shall cause to be kept proper books of account as required under section 220.
72. The books of account shall be kept at the registered office of the Company or at such other place as the directors shall think fit and shall be open to inspection by the directors during business hours.
73. The directors shall from time to time determine whether and to what extent and at what time and places and under what conditions or regulations the accounts and books or papers of the Company or any of them shall be open to the inspection of members not being directors, and no member (not being a director) shall have any right of inspecting any account and book or papers of the Company except as conferred by law or authorised by the directors or by the Company in General Meeting.
74. The directors shall as required by sections 223 and 226 of the Act cause to be prepared and to be laid before the company in General Meeting the financial statements duly audited and reports as are referred to in those sections.
75. The financial statements and other reports referred to in Article 79 shall be made out in every year and laid before the Company in the annual General Meeting in accordance with sections 132 and 223.
76. A copy of the financial statements and reports of directors and auditors shall, at least twenty-one days preceding the meeting, be sent to the persons entitled to receive notices of General Meetings in the manner in which notices are to be given here under.
77. The directors shall in all respect comply with the provisions of sections 220 to 227.
78. Auditors shall be appointed and their duties regulated in accordance with sections 246 to 249.

## NOTICES

79. (1) A notice may be given by the Company to any member to his registered address or if he has no registered address in Pakistan to the address, if any, supplied by him to the Company for the giving of notices to him against an acknowledgement or by post or courier service or through electronic means or in any other manner as may be specified by the Commission.
- (2) Where a notice is sent by post, service of the notice shall be deemed to be effected by properly addressing, prepaying and posting a letter containing the notice and, unless the contrary is proved, to have been effected at the time at which the letter will be delivered in the ordinary course of post.
80. A notice may be given by the company to the joint-holders of a share by giving the notice to the joint-holder named first in the register in respect of the share.
81. A notice may be given by the company to the person entitled to a share in consequence of the death or insolvency of a member in the manner provided under Article 84 addressed to them by name, or by the title or representatives of the deceased, or assignees of the insolvent, or by any like description, at the address, supplied for the purpose by the person claiming to be so entitled.
82. Notice of every General Meeting shall be given in the manner here in before authorised to (a) every member of the Company and also to (b) every person entitled to a share in consequence of the death or insolvency of a member, who but for his death or insolvency would be entitled to receive notice of the meeting, and (c) to the auditors of the Company for the time being and every person who is entitled to receive notice of General Meetings.

## WINDING UP

83. (1) In the case of members' voluntary windingup, with the sanction of a special resolution of the Company, and, in the case of creditors' voluntary windingup, of a meeting of the creditors, the liquidator shall exercise any of the powers given by sub-section (1) of section 337 of the Act to a liquidator in a windingup by the Court including *inter-alia* divide amongst the members, in specie or kind, the whole or any part of the assets of the Company, whether

We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a Company, in pursuance of these articles of association, and we respectively agree to take the number of shares in the capital of the Company set opposite our respective names:

Name and surname (present & former) in full (in Block Letters)	NIC No. (in case of foreigner, Passport No)	Father's/ Husband's Name in full	Nationality (ies) with any former Nationality	Occupation	Usual residential address in full or the registered/ principal office address for a subscriber other than natural person	Number of Shares taken by each subscriber (in figures and words)	Signatures
ENI International B.V.  Through Nominee  Kamran Ajmal Mian	33264964   42101-3402641-3	Subscriber   Ajmal Mian	Netherlands   Pakistan	   Services	Strawinskylaan 1725, 1077 XX Amsterdam, the Netherlands.  House no 9-B, 1 East Street, Phase 1 DHA Clifton Cantt Karachi South	48,000 (Forty eight Thousand Shares Only)	
Mujtaba Haider Khan	42201-0492212-1	Ansar Haider Khan	Pakistan	Services	Bhayani Sunview, Gulshan-e-Iqbal, House no 124 Block 11, Karachi Central Pakistan	1 (One Share Only)	
Inam ur Rahman	35201-1378474-9	Fazal Rahmaan	Pakistan	Services	House no 3/300, Sarwar Road, Lahore Cantt	1 (One Share Only)	
Reon Energy Limited  Thorough Nominee  Mujtaba Haider Khan	0089881   42201-0492212-1	Subscriber   Ansar Haider Khan	Pakistan   Pakistan	   Services	Dawood Centre, M.T. Khan Road, Karachi  Bhayani Sunview, Gulshan-e-Iqbal, House no 124 Block 11, Karachi Central Pakistan	71,998 (Seventy One Thousand Nine Hundred and Ninety Eight Shares Only)	
		Total number of shares taken (in figures and words)				120,000 (One Hundred and Twenty Thousand Shares Only)	

Dated the 7th day of August, 2018

9682

*Certified to be True Copy*

*Joint Registrar of Companies*

Annexure B

**INSTRUMENT OF PROXY**  
**XXXXXXX (Private) Limited**

"I.....s/o.....r/o.....  
 ..... being a member of the **GRID EDGE (PRIVATE) LIMITED**, hereby  
 appoint .....s/o.....r/o..... as my proxy  
 to attend and vote on my behalf at the (statutory, annual, extraordinary, as the case may be) General Meeting of the  
 Company to be held on the.....day of....., 20.....and at any adjournment thereof."



# GRID EDGE

## Conceptual Design: Information regarding Control, Monitoring

### Generation Voltage:

Solar Power plant will be generating AC power at Low voltage levels of 400V 4W+PE system. Low voltage level will then step up through power transformers to the existing Diesel Genset Voltage levels i.e. 11KV to be synced with Electrical Network.

### Power Factor & Frequency

CBL solar power plant is using solar grid connected string Inverters of 60KW each to convert DC power of solar panels to Alternating Power. Grid connected inverters have the functionality to adapt the power factor of existing diesel genset grid. The range of Power Factor can be set from 0 – 1 leading /lagging, making it suitable for absorbing or delivering reactive power. the nominal power factor for Inverters is 0.995. Nominal Frequency of generation is 50Hz.

### Automatic Generation Control & Ramp Rate:

The Automatic Sustainable Controller (DEIF ASC-4) is a controller designed to serve as a link between sustainable power plant (Solar) and genset plants, combining them so they work as one common hybrid system. The concept of the ASC-4 is to maximize sustainable power penetration, depending on the total load demand to the hybrid without compromising constraints such as minimum genset load demand.

The ASC-4 Solar is the variant designed for PV control, and it enables integration of PV power and genset power. The PV plant is handled as a base loading power- and reactive power provider, not as a voltage- and frequency provider. Therefore, the ASC-4 only operates the PV in case either utility or a genset constitutes a grid to which the PV can dispatch power.

Ramp rate of inverters is the function of MPPT algorithm. Normally solar power is set to ramp up or ramp down the generation within the period of 5-10 seconds from 0 – 100 percent. Ramp rate can be adjusted according to the behavior of gensets over loading and unloading due to Solar power variations.

### Metering and Protection:

The distance between solar field and point of common coupling (POCC) has been calculated as 2 kilometers approximately. The metering of solar units will be performed at the main 11KV load bus bar. It is designed that all auxiliary loads will be connected before the point of connection to get the true reading for energy being evacuated into the diesel gensets' grid for mine loads.

Sensitivity Class for meter is 0.5s with bidirectional 4 quadrant calculations algorithm. Features including, total import and export units can be extracted over the period, TOD calculations, MDI, active and reactive power calculations, Et al.

3 MWp Solar power plant will be terminated on a single RMU unit having following protections for the line and load side;

- Over and Under voltage protections
- Short Circuit protections
- Earth Fault detection
- Over current protection
- Emergency system shutdown protection.

### Grid Edge (Private) Limited

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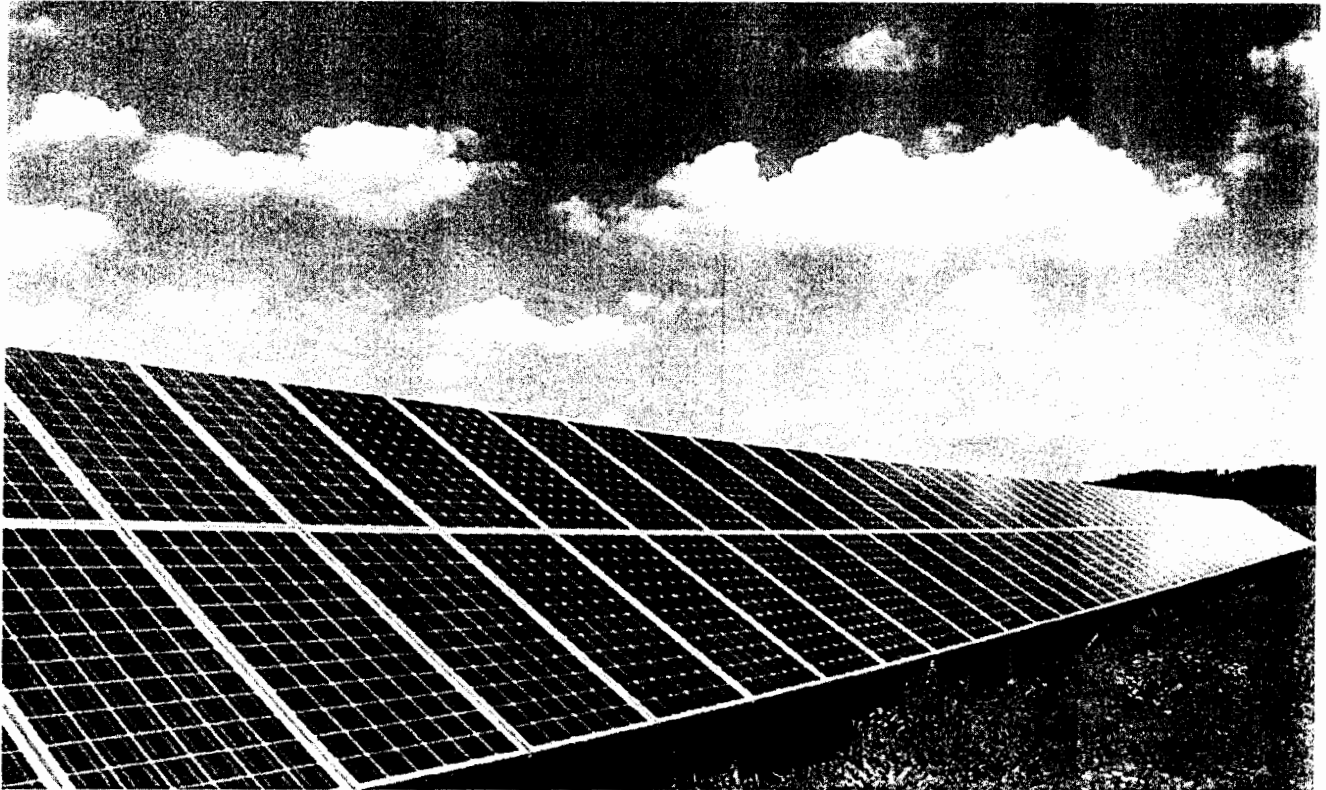
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# GRID EDGE

## Company Prospectus



3MW Solar Project at P&G Facility



### **Grid Edge (Private) Limited**

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# GRID EDGE

## **1. Company Background**

### **Grid Edge Private Limited**

The applicant Grid Edge Private Limited is Joint Venture between REON Energy Limited and Eni.

The electricity market is changing fast. Technology advancements, evolving consumer preferences, and new policies are leading to a surge of adoption of solar, energy storage, microgrids, electric vehicles, and other new energy technologies. These distributed energy resources are forcing new models to rethink how the energy market works, consequently, new models for customer energy management, grid infrastructure and electricity market design are arising to address these changes.

The Company, has been incorporated by the two partners to bring innovation in the energy market by providing power purchase agreements via renewable technologies to private sector and public-sector customers in Pakistan by setting up Solar PV plants on the site of the customer by offering hybrid or grid tied solutions.

This allows savings on transmission infrastructures to the government of Pakistan and allows customers to take advantage of cheaper renewable power without having to undertake expensive capex on its own accord as asking clients to undertake expensive capex on technology, which has capacity risk, has inhibited the growth of this industry in Pakistan even with all the great effort of NEPRA and Ministry of Water and Power to unlock the value of Solar in Pakistan.

Accordingly, the company has decided to apply for a generation license for its proposed project with P&G Pakistan.

### **Reon Energy Limited**

Reon Energy Limited, a wholly owned subsidiary of Dawood Lawrencepur Limited is renewable solar energy arm of Dawood Group looking after the solar energy business for the Group and is in the process of crafting the best possible business portfolio within the solar energy realm for better long term shareholder returns.

REON is the largest solar national leading EPC (Engineering, Procurement and Construction) solution providers in Pakistan. These solutions include designing of system, procurement of material from distinct manufacturers and construction of complete PV System (on-grid and hybrid) to deliver cost effective & trustworthy solutions.

Projects have been delivered at various sites with projects greater than 1MW for a variety of customers, including Servis Industries, Kohinoor Textiles and Nobel Energy - a part of the Wah Nobel Group. The Company with an installed distributed captive capacity of over 10MW in the C&I sector with further 15 MW underway, is now recognized as the leader in high quality installations whilst providing customers with clean energy and minimizing their energy price risk.

Since inception, REON has focused on supply chain management and engineering collaborations to bring in efficiencies, which have ultimately benefited customers. The Company is now directing all focus to the high-growth areas in the solar energy space. Solar energy solutions help provide energy

#### **Grid Edge (Private) Limited**

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# GRID EDGE

security and minimize energy costs for businesses. In addition, renewable energy addresses environmental concerns regarding carbon emissions and greenhouse gases. These factors together with declining prices of solar generation equipment indicate a huge potential in the market. Reon Energy believes in adhering to the highest levels of safety for all stakeholders; customers, staff, contractors. Company safety policies and procedures are strictly complied with and zero tolerance is exercised for misdemeanors. As a step towards reaffirming its safety commitment, the Company successfully obtained ISO 14001 Certification.

## Eni

Eni International B.V. is a wholly owned subsidiary of an Italian company, Eni S.p.A. (Eni), which is one of the world's largest integrated energy company. Eni is operating in 71 countries worldwide and employing around 33,000 people. As of March 31, 2018, the company's market capitalisation was calculated at \$64 billion. Eni is consistently ranked among the top 150 companies on the Fortune Global 500 list according to revenue.

Eni is engaged in oil and natural gas exploration, field development and production, as well as in the supply, trading and shipping of natural gas, LNG, electricity and fuels, and operates across the entire energy chain (including Renewable Energy).

Eni places about 25 TWh of production on the Italian market each year with bilateral sales and sales on the energy market. Eni is the second producer of electricity in Italy with a share of 9% of Italian electricity production. Eni is one of the market leaders in the services and dispatching market (MSD), thanks to the flexibility of its generating fleet. As of December 2017, Eni installed operational capacity of electricity production is 4,700 MW.

Eni is working closely with all the stakeholder towards improving access to energy in the countries where it operates and making maximum effort to reduce direct emissions of CO<sub>2</sub>. With these goals in mind Eni launched a new business unit called Energy Solutions Department (DES) in November 2015 to lead the energy transition process of the group towards a low carbon future by introducing renewable energies development at industrial level as part of the Company core business.

In this regard, different development projects, both solar and wind, have been identified in countries of strategic interest in which Eni already operates both in Italy and abroad. Eni is currently developing a 50MW wind project in Kazakhstan and a number of cooperation/framework agreements have also been executed with the Northern Territory in Australia, Pakistan, Ghana, Angola, Algeria, Tunisia and Egypt, in order to strengthen Eni's historic presence in those territories and to expand the company's sphere of activities in the field of Renewables.

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# GRID EDGE

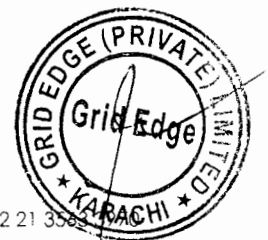
## 2. Project Brief:

Grid Edge (Private) Limited intends to setup 3 MW captive Solar Power Plant (DC) at Crescent Bahumans premises (Pindi Bhattian, Punjab, Pakistan) to provide electricity under 15-year power purchase agreement to sole customer. The DC installed capacity of the plant is proposed by critically analyzing the current load and future load projections of the site. Main objective of this Solar plant is to provide clean energy from solar plant to partially meet energy needs in an affordable and environment friendly way.

The DC installed capacity of the plant is proposed by critically analyzing the current load and future load projections of the site. Main objective of this Solar plant is to provide smooth low-cost energy production from solar plant.

In a move that speaks of the confidence multinationals have in Pakistan's economy, CBL has decided to enter into a 15 year Power Purchase Agreement for its factory in Hafizabad where in addition to its home care products, the company also intends to start local production of its bestseller Pampers brand.

For this energy project, the company has partnered with Grid Edge, a company backed by energy conglomerate Dawood Hercules, and ENI, one of the biggest names in oil and gas internationally, with Reon Energy chosen as the preferred EPC partner.



**Grid Edge (Private) Limited**

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# GRID EDGE

## 3. Project Rationale:

Grid Edge (Private) Limited intends to setup 3 MW captive Solar Power Plant (DC) at Crescent Bahumans premises (Pindi Bhattian, Punjab, Pakistan) to provide electricity under 15-year power purchase agreement to sole customer.

Due to falling solar prices internationally and the presence of a strong EPC contractor in Pakistan, Reon Energy, the multinational CBL decided to solicit proposal for a 15 year energy sale agreement structured as a Power Purchase Agreement. The electricity will be sold by the company Grid Edge and deliver savings for each unit of electricity sold, which will be on Take or Pay terms.

The financing will be a combination of debt and equity capital with the terms and tariff set at a level to ensure substantial savings for the customer while ensuring reasonable returns for providers of capital.

The contractors through EPC and O&M contracts will ensure performance of the system throughout the contract term, 15 years.



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# GRID EDGE

## 4. Technology

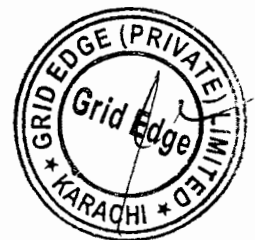
- Polycrystalline 320W Solar Modules with efficiency 17% are used in the design
- 60 KW grid connected solar inverters, 480V three phase, 98.3% have been considered
- Step up Transformers 0.48 / 11KV ONAN are used
- Medium Voltage Switchgears 11KV / 630A
- System will be connected to the auxiliary load of the Existing factory
- Maximum AC output of the system is assumed to be 2200 KW
- Output of the system is based on instantaneous Irradiation values of Solar Energy
- 10 Acres of land area required for the installation of solar plant

## Bill of Materials:

S. No.	Components	Qty (No.)
1	Polycrystalline Solar Modules 320W	9576
2	Grid Connected Solar Inverters 60KW 3 Phase	42
3	0.48 / 11KV Step up Transformers	3
4	Medium Voltage Switchgears	3
5	Diesel Gensets and Solar Energy Control System	1

## Energy Generation:

S. No.	Efficiency Parameters	
1	Performance Ratio of the System	77.39%
2	Capacity Utilization Factor	16.7%
3	Energy Generation Units	4.3 Million KWh



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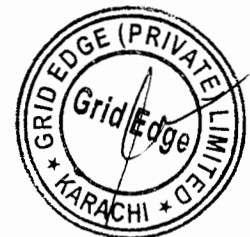
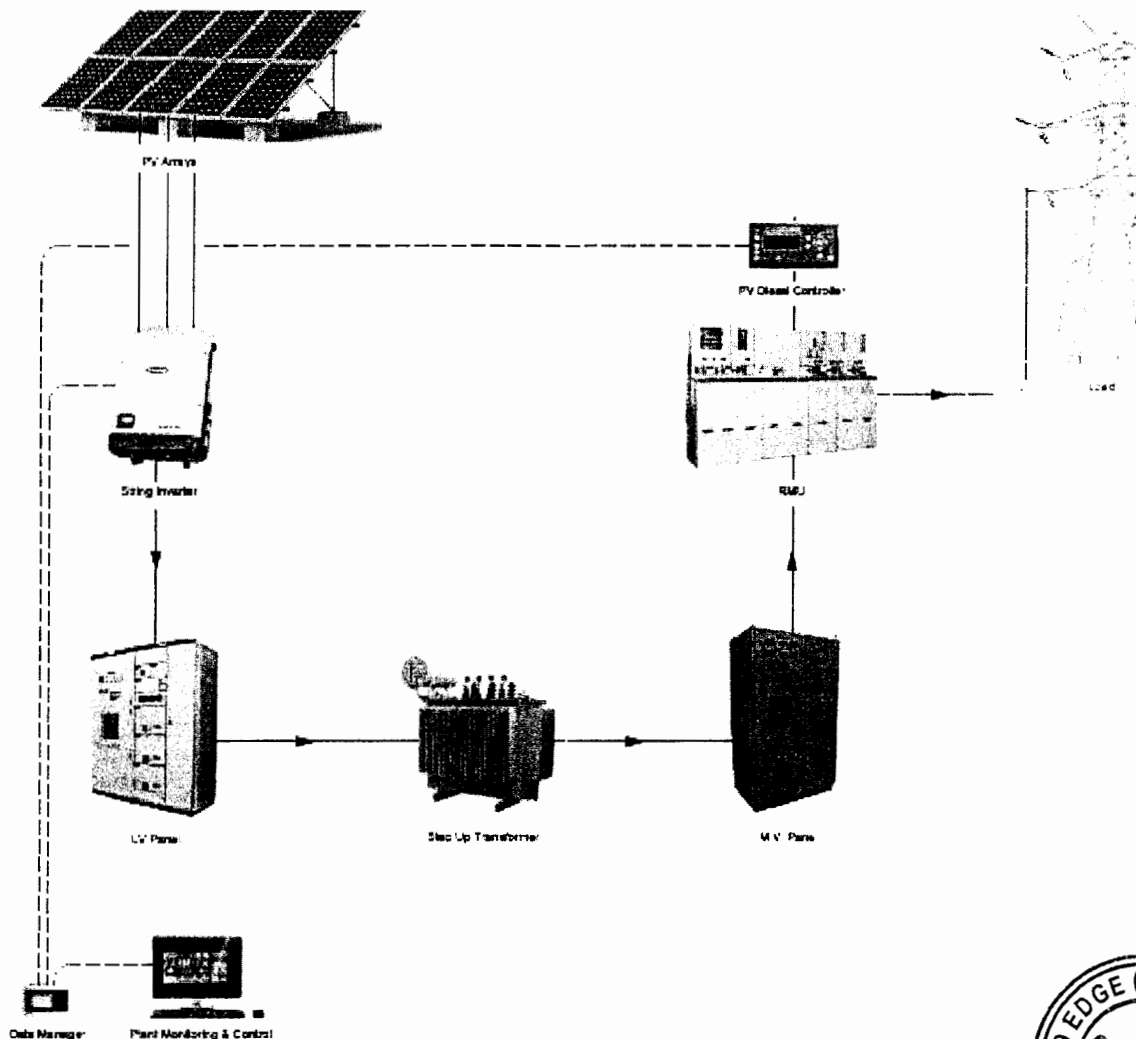
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## Technology used

S. No.	Components	Qty (No.)
1	Polycrystalline Solar Modules 320W	9576
2	Grid Connected Solar Inverters 60KW 3 Phase	42
3	0.48 / 11KV Step up Transformers	3
4	Medium Voltage Switchgears	3
5	Diesel Gensets and Solar Energy Control System	1

## Conceptual Design



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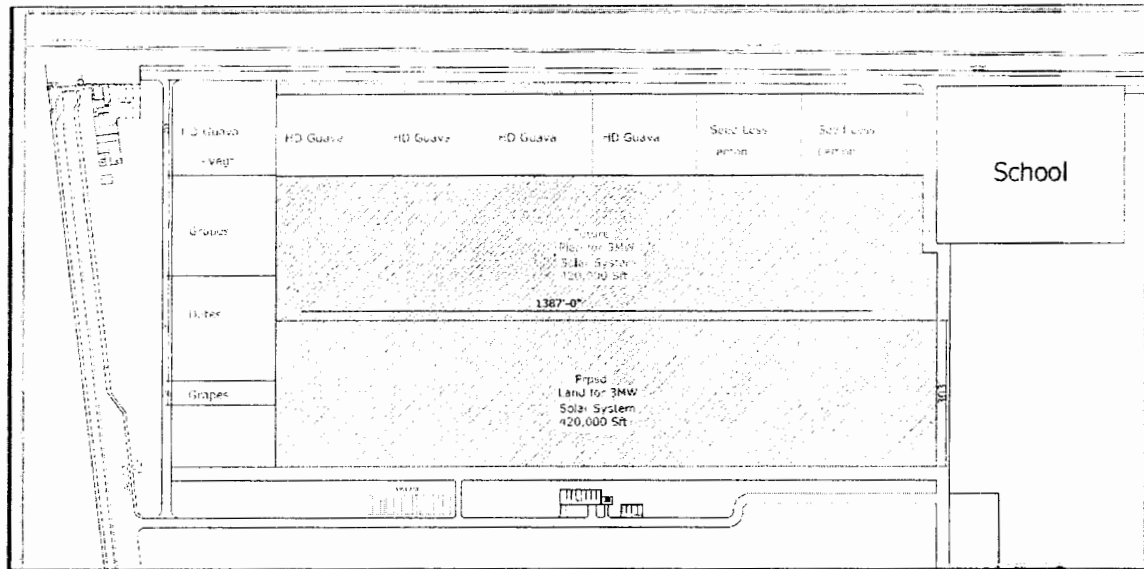
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## General Layout



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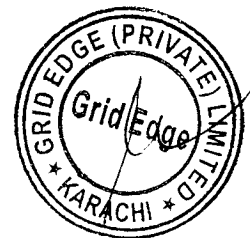
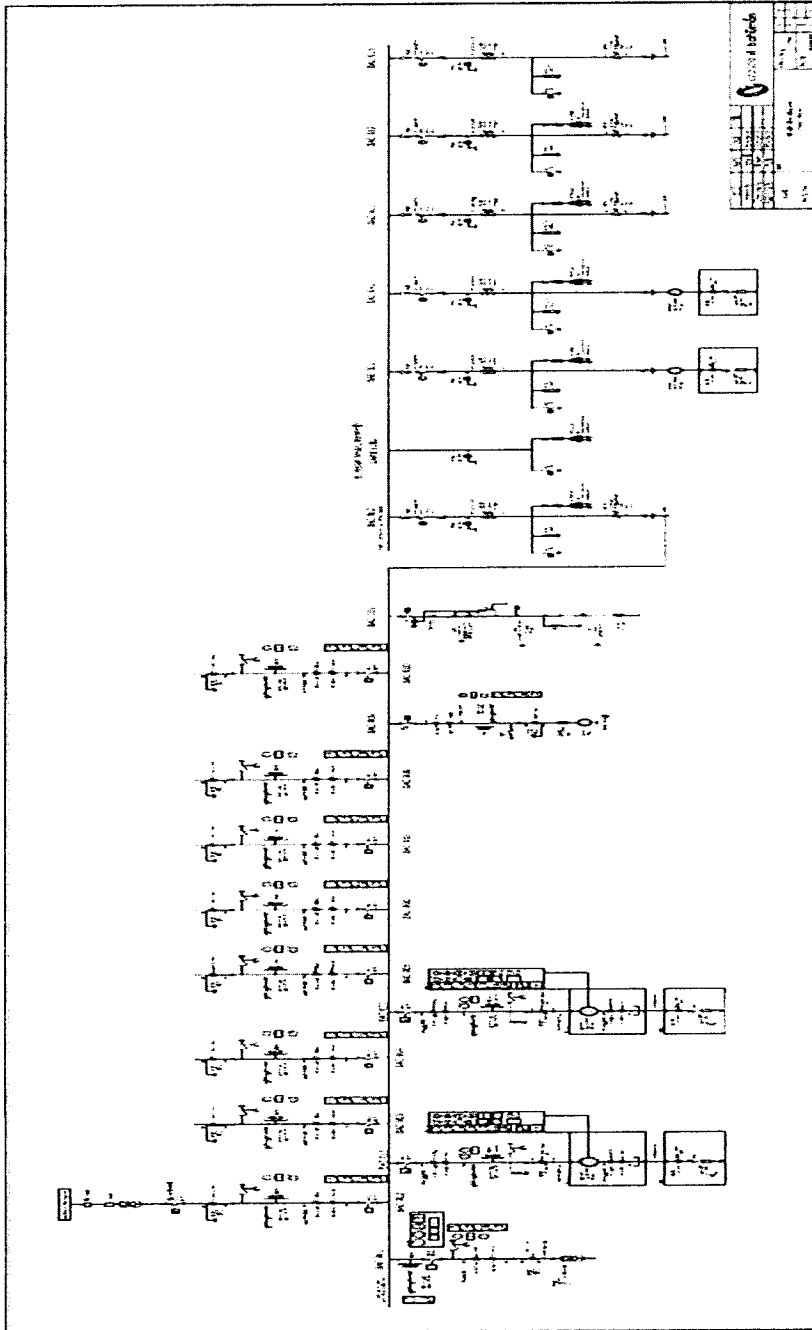
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SLD



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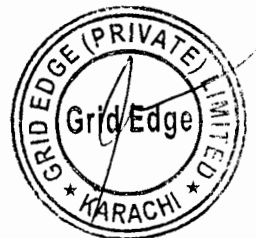
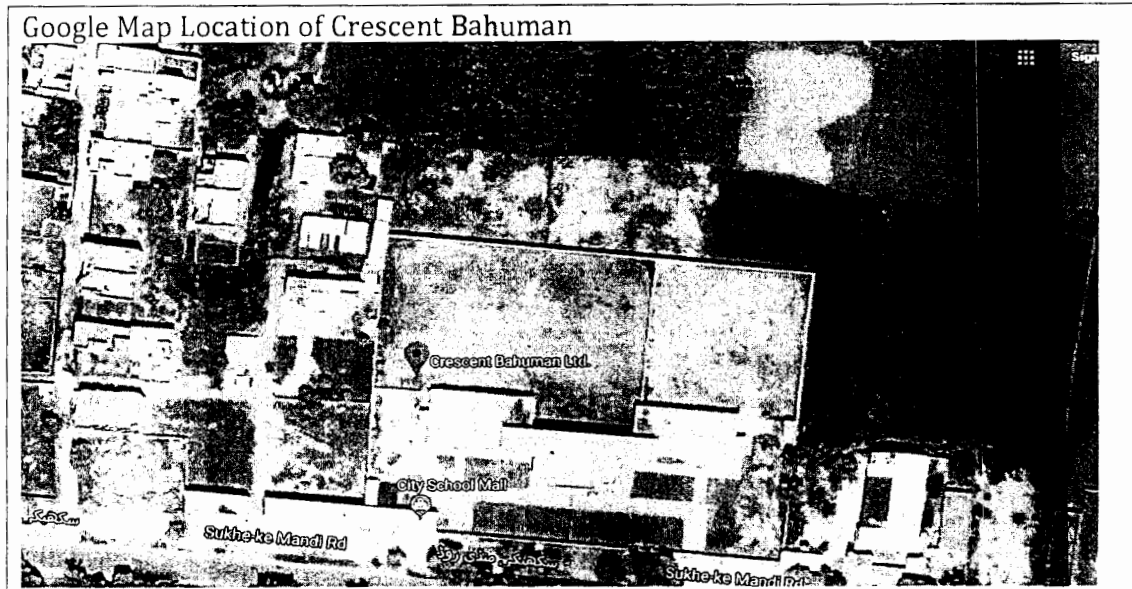
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## 5. Project Location

Project Location:

The Solar Plant will be located within the Crescent Bahuman factory in Pindi Bhattian, Multan Road, Lahore, Pakistan.



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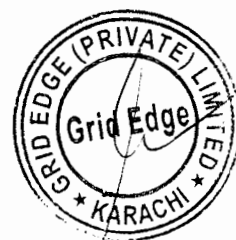
## 6. Operations and Maintenance Costs

The project also includes 24/7 O&M of the complete Power Plant including all its related systems and equipment. The O&M services shall be carried out for a period of 15 years (180 Months).

1. Provision of all manpower as duly approved by the Company.
2. Provision of all consumable material and parts.
3. Provision of all routine and preventive maintenance parts.
4. Full costs relating to any repairs and replacements due to defects in the or break down of the equipment and systems strictly in accordance with OEMs requirements. The cost shall also include all dismantling, handling, shipment, etc.
5. Provision of all lubricating oils, greases, coolants, rust inhibitors, and any other items as recommended by the original equipment manufacturers (OEMs).
6. Provision of all emergency spare parts as per the recommendations of the OEMs or as directed by the Company.
7. Capital and Operational spares for 02 years to be kept in the inventory which will handed over to Company at the end of the Project.

It's specifically pointed out that the O&M shall also be inclusive of following as incurred throughout the O&M contract period

1. Vehicles and their drivers for travel within and outside the Project site, including purchase, insurance, taxes, etc. relating to vehicles, their O&M and safety.
2. All return travel costs of company's personnel coming from abroad (if required).
3. Medical expenses, insurance, etc. as required on company's personnel.
4. Regular monitoring of requirements of all necessary items for O&M and arrangements for their timely availability at site.
5. Reporting on all aspects of Power Plant operation and performance.



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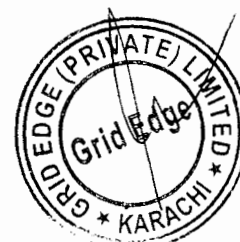
## 6. Environmental Assessment Report

The site allocated is private land within the perimeter of the CBL Factory, and the applicant has carried out a detailed environment assessment of the site in preparation of the Solar PV Plant.

### Overall Environmental Impact Findings

Environmental Parameter	Level of Impact	Reasons	Mitigation Measures
Air Impact	Low	No atmospheric Emissions from the process	Use of PV based solar power technology
Water	Low	Plant will require a very low amount of water No effluent is envisaged to be discharged from the plant that may have impact.	The project will be setting up an RO plant and a pond to store this water and this water will be used for the cleaning the modules. No effluent should be discharged.
Land	Low	Impact of change in land use.	Site selection has been made in consideration of SECMC identifying the land where it already holds the lease. CSR activity will be undertaken as agreed between the Company and community stakeholders.
Ecosystem	Low	As no ecologically sensitive place lies within 10 km	There is no significant vegetation cover within the selected area
Socio Ecosystem	Low	Total land identified for the project is barren land: No land acquisition is anticipated as this will be on private land may have socioeconomic impact.	Construction worked will be housed on temporary construction camps specially developed for this purpose with all basic amenities. CRS activities will help to improve the quality of life as well as education status of the nearby villagers

The assessment of the project has been considered for both positive and negative effects. The proposed photovoltaic power project has been located as per international guidelines. Adoption of green power generation technology for power generation with no emissions and effluent discharge will have least impact on the ambient environment and on the host community. However, in the long term the project and related activities in the area may bring about slight change in ambient air quality of the area.



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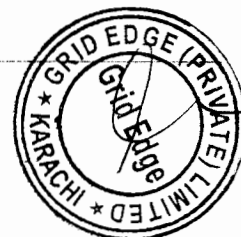
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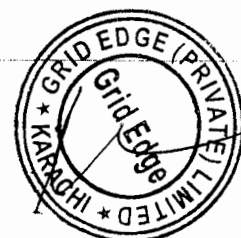
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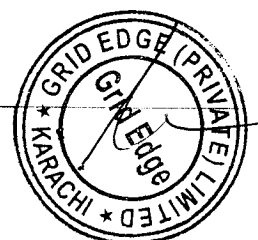
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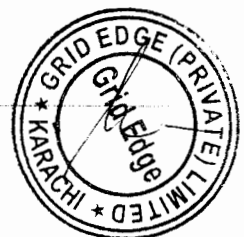


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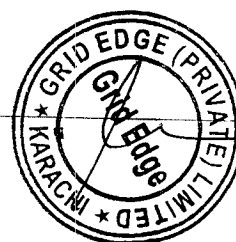


## LIST OF ABBREVIATIONS

AC	Alternating Current
BDL	Below Detectable Level
CBL	Crescent Bahuman Limited
CSP	Concentrated Solar Power
DC	Direct Current
EA	Environmental Approval
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency –Punjab
EPC	Environmental Protection Council
GOP	Government of Pakistan
GWh	Gigawatt hour
HSE	Health Safety & Environment
IEE	Initial Environmental Examination
Kg	Kilogram
Km	Kilometers
LAA	Land Acquisition Act
Mg/l	Milligram per liter
MW	Mega Watt
NOC	No Objection Certificate
NTU	Nephelometric Turbidity Unit
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
Pak-EPA	Pakistan Environment Protection Agency
PEPA	Punjab Environmental Protection Amendment Act
PEPC	Pakistan Environment Protection Council
PEQS	Punjab Environmental Quality Standards
PIU	Program Implementation Unit
PKR	Pak Rupees
PM	Particulate Matter
PPE	Personal Protective Equipment



PV	Photovoltaic
RNR	Renewable Natural Resources
Sft	Square feet
TCU	True Color Unit
HSE	Health Safety Equipment
V	Voltage
W	Watts
WAPDA	Water and Power Development Authority
( $\mu\text{g}/\text{m}^3$ )	Micrograms per cubic meter



## EXECUTIVE SUMMARY

Solar power is arguably the cleanest, most reliable form of renewable energy available, and it can be used in several forms to help power your home or business. Solar-powered photovoltaic (PV) panels convert the sun's rays into electricity by exciting electrons in silicon cells using the photons of light from the sun. This electricity can then be used to supply renewable energy to home or business.

M/S Crescent Bahuman Ltd. They intend to install a 3MW solar power project within the premises of existing textile unit of Crescent Bahuman Limited. Solar panels to be install in the area of 9 Acres.

### I. Title and Location of Project

This project is an **installation of 3MW solar power plant project within the premises of existing textile unit of Crescent Bahuman Limited**

### II. Name of the Proponent

Muddassar Jabbar

House # 204-N, Muhallah Phase 8, Defense Housing Authority, Lahore Cant,  
Tehsil Lahore.

### III. Name of the Organization Preparing the Report

Integrated Environment Consultants

**Office:** Office # 11, 2nd Floor, Anwar Tower, 99-Shadman Chowk, Lahore, Pakistan.

**Phone:** (042)-35960091;

**Email:** inenvconsultants@yahoo.com

### IV. A Brief Outline of the Project

Renewable energy resources are unlimited, widely available and should be exploited. One of those renewable energy resources is concentrated solar power (CSP), which presents the greatest potential for commercial exploitation because of its nature, because it can be stored in the form of thermal energy, and because it can hybridized. This project is installation of 3MW solar power plant at Crescent Bahuman Ltd to produce green energy by using solar panels. This project is located in the site located



within the premises of existing textile unit of crescent Bahuman limited. Project is located at Sarghoda Road, Pindi bhattian, Hafizabad, Punjab Pakistan.

## **V. The Major Impacts and Mitigation Measures**

### **i. Land Use and Thermal Pollution**

Solar cells (photovoltaics) have miscellaneous impacts on the natural ecosystem. These impacts are related to some specific factors, like the area and the topography of land that would be covered, sensitive ecosystems, and biodiversity. Large-scale utilization of the land also effects thermal balance of the area by absorbing more energy by the earth than otherwise would be reflected by the surface back to space. Thermal balance of this land space can certainly be affected by such an application. Also, additional heat might destroy a few species living in this kind of harsh environment. To mitigate this impacts plantation will be done around the surroundings of proposed project area.

### **ii. Discharge of Pollutants**

Solar cells do not emit any pollutants during their operations.

### **iii. Impacts on Natural Resources**

Solar cells have some negative impacts on the environment during their production phase like many other systems. But the current project involves only the installation of solar power plant, which will not harm the natural resources

### **iv. Noise**

Intrusion Solar cells do not make a noise during operation. But during the construction phase, there will be a little noise as usual in other construction activities

### **v. Air Pollution**

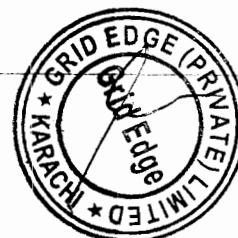
Solar cells do not emit any substances to the air during operation

### **vi. Solid Waste Disposal**

During operation there will no significant amount of solid waste generated

## **VI. Proposed Monitoring**

The monitoring program is designed to ensure that the requirements of the environmental approval awarded by the EPA are met. Monitoring Program (MP) provides important information that allows for more effective planning and an adaptive response based on the assessment of the effectiveness of mitigation measures. The monitoring of various parameters will help to determine the extent



to which project construction/operation activities will cause an environmental disturbance

**TABLE A: ENVIRONMENTAL MONITORING PLAN**

Environmental segment/element	Monitoring parameters	Reference location/monitoring point	Monitoring frequency
<b>Construction phase</b>			
Water Quality	As prescribed by the Punjab environmental Drinking Water Quality Standards	Main Drinking Water Source	Quarterly
Ambient air emissions	Dust, smoke, PM, VOCs, SO <sub>x</sub> , NO <sub>x</sub> , CO, O <sub>3</sub>	Use of generators, movement of materials, digging or excavation.	Quarterly
Waste water including Sewage	Ensure that all wastewater is treated to the level set by the PEQS-Pakistan.	The sewage or sanitary wastewater by the campsite and use for other construction activities.	Quarterly
Noise	The Levels prescribed as in Punjab environmental quality standards	The noise produced by the machinery during construction work.	Quarterly
Solid Waste Disposal	Ensure that all wastes are disposed of according to legal requirements of the country.	The waste material, rubble and solid waste produced by the camp site	Quarterly
<b>OPERATIONAL PHASE</b>			
Water Quality	As prescribed by the Punjab environmental Drinking Water Quality Standards	Main Drinking Water Source	Monthly
Ambient air emissions	Methane and carbon dioxide, PM, VOCs,	Generator Area	Quarterly



Environmental segment/element	Monitoring parameters	Reference location/monitoring point	Monitoring frequency
	CO, O <sub>3</sub>		
Waste water including Sewage	Ensure that all wastewater is treated to the level set by the PEQS-Pakistan.	Main Disposal Site	Monthly
Noise	Noise levels	Project site	Once monthly at all involved places
Solid Waste Disposal	Ensure that all wastes are disposed of according to legal requirements of the country.	Workers area	Regularly in connection with environmental and safety rounds.

#### VII. Stakeholder Consultations

Public discussions were held with the inhabitant of the surrounding area. They are quite positive about the project and see the project as growing the business and accomplishing towards the positive development in the area at local and in the country as a whole. The people observe strong positive impacts regarding employment, business and structural development due to this project. IEE findings depict that people perceive overall positive social and economic impacts by the project. Their attitude towards the project installation is highly optimistic. Majority of the people are convinced for development in the area and they correlate this progress with the pace of their social mobility

#### VIII. Conclusion And Recommendation

The report provides a conclusion based on the impacts assessed and mitigation measures suggested. The report recommends that EMP will be made a part of all contract documents. The design of the scheme should meet the PEQS parameters in all aspects. The contractor will be bound to completely implement relevant mitigation measures set out in the EMP during construction phase while during regular operation of the project. The proponent will be responsible to ensure all the compliance of PEQS. If there are any changes in the design/ layout, or any



other changes in project description then changes should be carried out through amendments in environmental assessment report and EMP of the IEE

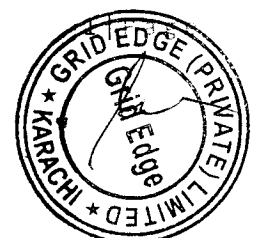


## 1. INTRODUCTION

Solar power is arguably the cleanest, most reliable form of renewable energy available, and it can be used in several forms to help power your home or business. Solar-powered photovoltaic (PV) panels convert the sun's rays into electricity by exciting electrons in silicon cells using the photons of light from the sun. This electricity can then be used to supply renewable energy to home or business.

Solar energy components that make up a complete solar power system are the roof system, solar panels, invertors and net meters. In most **solar systems**, **solar panels** are placed on the roof. Solar panels, also known as modules, contain photovoltaic cells made from silicon that transform incoming sunlight into electricity rather than heat. ("Photovoltaic" means electricity from light — **photo** = light, **voltaic** = electricity.) Solar photovoltaic cells consist of a positive and a negative film of silicon placed under a thin slice of glass. As the photons of the sunlight beat down upon these cells, they knock the electrons off the silicon. The negatively-charged free electrons are preferentially attracted to one side of the silicon cell, which creates an electric voltage that can be collected and channeled. This current is gathered by wiring the individual solar panels together in series to form a solar photovoltaic array. Depending on the size of the installation, multiple strings of solar photovoltaic array cables terminate in one electrical box, called a fused array combiner. Contained within the combiner box are fuses designed to protect the individual module cables, as well as the connections that deliver power to the inverter. The electricity produced at this stage is DC (direct current) and must be converted to AC (alternating current) suitable for use in your home or business.

The inverter is typically located in an accessible location, as close as practical to the modules. The inverter turns the DC electricity generated by the solar panels into 120-volt AC that can be put to immediate use by connecting the inverter directly to a dedicated circuit breaker in the electrical panel. In a solar electric system that is also tied to the utility grid, the DC power from the solar array is converted into 120/240 volt AC power and fed directly into the utility power distribution system of the building. The power is "net metered," which means it reduces demand for power from the utility when the solar array is generating electricity – thus lowering the utility bill.





For the same purpose, M/S Crescent Bahuman Ltd. They intend to **install a 3MW solar power** project within the **premises of existing textile unit** of Crescent Bahuman Limited. Solar panels to be install in the **area of 9 Acres**.

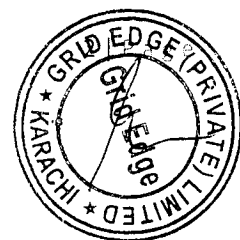
The proposed project for the commissioning of its objective and construction requires fulfilling the legal requirements of the Punjab Environmental Protection Act (amended act 2012), Section 12, this initial Environmental Examination (IEE) report is being submitted.

### 1.1 PURPOSE OF THE REPORT

In accordance with the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2000, SRO # 339 (1)/2000, the project for installation of 3MW solar power project falls in Schedule –I, for which Initial environmental examination (IEE) report is required for Environmental Approval.

According to the Punjab Environmental Protection Act (PEPA), Section 12 - Initial environmental examination, and environmental impact assessment: “No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Provincial Environmental Protection Agencies, as the case may be, or, where the project is likely to cause an adverse environmental effects an environmental impact assessment, and has obtained from the Government Agency approval in respect thereof.” It is this legal requirement from the Government of Punjab that this Initial Environmental Examination report has been prepared to get Environmental Approval (EA) from the Environmental Protection Agency, Government of Punjab, Lahore.

This report provides detailed basic information and facts of project; including especially among others environmental, economic, social, etc., enabling its assessment and justification that the project will meet the requirements of environmentally sustainable practices; both during installation and regular operation stages; as desired under the Punjab Environmental Protection Act, 1997 (amended 2012), the National Environment Quality Standards and the rules and the regulations thereof. The other relevant regulations and guidelines considered while preparing this IEE report include:



- Policy and procedures for filing, review, and approval of environmental assessments.
- Guidelines for the preparation and review of environmental reports.
- Guidelines for public participation.
- Guidelines for sensitive and critical areas.
- Detailed sectoral guidelines

Different environmental aspects like social, physical and biological etc and other related features of the project both during installation and its regular occupancy are highlighted in this IEE report. Measures necessary to be adopted to mitigate any environmental impacts on any part of the environment around are also described. All the important information is also provided as described under the format used to help decision-makers, EPA Punjab in the present case, before issuing the desired Environmental Approval (EA).

## 1.2 IDENTIFICATION OF PROJECT AND PROPONENT

This project is an installation of 3MW solar power plant project within the premises of existing textile unit of Crescent Bahuman Limited.

### ➤ PROPONENT

Muddassar Jabbar

House # 204-N, Muhallah Phase 3, Defense Housing Authority, Lahore Cant,  
Tehsil Lahore.

## 1.3 DETAILS OF CONSULTANTS

Integrated Environment Consultants

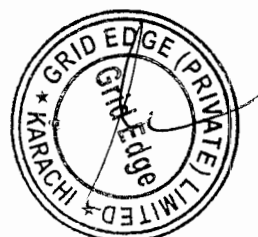
**Office:** Office # 11, 2nd Floor, Anwar Tower, 99-Shadman Chowk, Lahore, Pakistan.

**Phone:** (042)-35960091;

**Email:** inenvconsultants@yahoo.com

## 1.4 PERSONS PERFORMING THE IEE STUDY (TEAM MEMBERS)

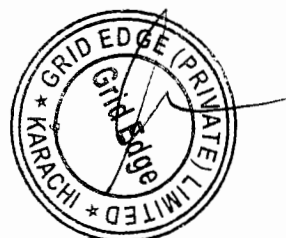
The proponent has assigned the task of preparing IEE report to M/S Integrated Environment Consultants, Lahore. The IEE study of the proposed project has been conducted according to Environmental Assessment Procedures, 1997, Review of IEE



and EIA Regulation 2000 as prescribed by the Federal Environmental Protection Agency (Pak EPA), Government of Pakistan. The study team of M/S Integrated Environment Consultants which completed the IEE report consists of following experts as mentioned in Table -1.1.

**Table - 1.1: Members Completed IEE Process**

NAME	QUALIFICATION	STATUS IN PROJECT	TERM OF REFERENCES
Mr. Ahtasham Raza	Ph.D. Scholar, (Environmental Sciences) University of the Punjab, Pakistan	Project In-charge	<ul style="list-style-type: none"> <li>➤ Environmental Assessment &amp; Management.</li> <li>➤ Supervision of monitoring team.</li> <li>➤ Preparation of technical EMP</li> </ul>
Mr. Adnan Sharif	B.S (Environmental Sciences)	Team Leader	<ul style="list-style-type: none"> <li>➤ Detailed survey of project sites.</li> <li>➤ Social Assessment</li> <li>➤ Report Writing</li> <li>➤ Quality Check</li> </ul>
Mr. Mehmood Amjad	B.S (Environmental Sciences)	Monitoring In-charge	<ul style="list-style-type: none"> <li>➤ Site Monitoring</li> <li>➤ Soil &amp; water samples collection</li> <li>➤ Onsite Monitoring</li> </ul>
Ms. Anmol Islam	M.Phil (Environment sciences)	Senior Environmentalist	<ul style="list-style-type: none"> <li>➤ Project impacts on flora and fauna</li> <li>➤ Risk Assessment (OHS &amp; EMP)</li> <li>➤ Report Writing</li> <li>➤ Preparation of Environment monitoring plan</li> </ul>
Ms. Aqasha Maqsood	M.Phil (Environment sciences)	Environmentalist	<ul style="list-style-type: none"> <li>➤ Social Assessment</li> <li>➤ Report Writing</li> <li>➤ Field surveys and</li> </ul>



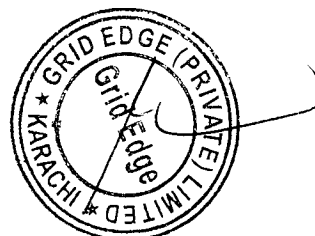
NAME	QUALIFICATION	STATUS IN PROJECT	TERM OF REFERENCES
			consultation with stakeholders
Ms. Usma Azad	B.S (Environmental Sciences)	Environmental	<ul style="list-style-type: none"> <li>➤ Identification of sensitive receptors</li> <li>➤ Report Writing</li> <li>➤ Socio-Economic survey &amp; analysis</li> </ul>
Mr. Muhammad Maqsoom	B.S (Environmental Sciences)	Environmental	<ul style="list-style-type: none"> <li>➤ Detailed survey of project sites.</li> <li>➤ Social Assessment</li> <li>➤ Identification of sensitive receptors</li> </ul>

\*Only the main roles of the team members are given. However, their role was not restricted to these, rather it also includes many other studies in their respective fields in the context of this IEE studies.

## 1.5 OBJECTIVE OF THE REPORT

Objectives to conduct this IEE are as following:

- A legal binding in accordance to Punjab Environmental Protection Act-2012 (amended Act).
- To identify the potential environmental issues pertaining to the proposed site.
- To evaluate the ability of the site by keeping in view the social acceptance and environmental soundness.
- Providing maximum information to the proponent and other stakeholders, regarding existing environmental conditions and the implications of the proposed project.
- Collection of available data, reports, drawings and other relevant information about the proposed project.
- Review of applicable existing environmental legislation and Punjab environmental quality standards (PEQS).
- Propose mitigation measures to eliminate or to reduce the negative impacts to an acceptable level.



- Development of well resourced environmental management and monitoring plans to identify mitigation strategies targeted towards avoidance, minimization, and rehabilitation of the impacts.

## 1.6 EXTENT OF THE STUDY

In compliance with PEPA-2012 (amended act) requirements, an IEE report has been prepared by M/S Integrated Environment Consultants, Lahore. This document covers all environmental impacts, due to the proposed project, in and around the project area comprising the physical, ecological and socio-economic aspects together with identification of the potential positive and negative impacts. Any developmental activities outside the project area and establishment of the other factories outside the project vicinity have not been covered under this study.

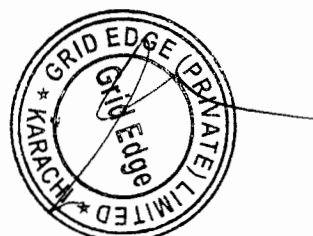
## 1.7 METHODOLOGY

The methodology adopted to carry out the IEE study of the proposed project was as follow:

- a) Orientation
- b) Planning of Data Collection
- c) Data Collection
- d) Site Reconnaissance Surveys
- e) Analysis of Maps and Plots
- f) Literature Review
- g) Public Consultations
- h) Field Studies/visits
- i) Laboratory Analysis
- j) Evaluation of Impacts and their analysis
- k) Categorization of impacts based on their potential environmental significance and prescription of preventive / mitigation measures.

In addition to the evaluation and review of the available records, data and the facts for the previous project, detailed discussions were held with the concerned members of the project management as well as other project stakeholders.

Notes and proposals for measures to be taken to mitigate and compensate for any determined/detrimental environmental impacts are contained in the Environmental



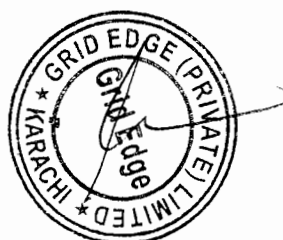
Management Plan (EMP) as well as a Monitoring Plan, including all parameters that need to be measured, and the frequency of monitoring actions.

A comprehensive qualitative and quantitative methodology was adopted to conduct this study inter-alia in due compliance with the IEE requirements. The study included a collection of both primary and secondary data regarding environmental status and other relevant factors. This IEE report has been accomplished after carrying out thorough visit to the proposed site and detailed investigation to identify the following Environmental areas of concern:

- 1) To achieve the desired environmental compliance standards; as per the national environmental regulatory requirements; as applicable to the project.
- 2) Plans and activities to prevent/mitigate any potential impacts and the gaps that could probably remain after implementation.
- 3) Any other points/steps to be taken which could be beneficial to mitigate environmental adverse impacts that may accrue both during construction and regular operation of the project.

**TABLE 1.2: ENVIRONMENTAL ASSESSMENT PROCESS**

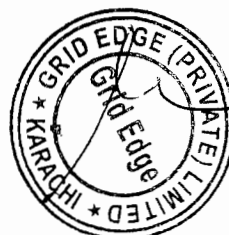
Phase	Activities	Status	Responsibility
Screening and Scoping	Reconnaissance and initial site visit and consultations, identification of environmental and social issues & applicable safeguard environment policy, categorization and working out an action plan.	Carried out during the present IEE	Consultants
Impact Assessment	Identification of potential environmental and social impacts through site visits, stakeholders consultations, review of	during the present IEE	Consultants



Phase	Activities	Status	Responsibility
	drawings, alternatives etc		
Impact categorization	The significant potential impacts were tabulated and mitigation/preventive measures were prescribed	during the present IEE	Consultants
EMP Preparation	Stakeholders/Women consultation	Carried out during/prepared as part of the present IEE	Consultants
	EMP		
	Social Framework Agreement (SFA)		
Final EMP	Final version of EMP produced	Included in the present IEE	Consultants

## 1.8 BRIEF DESCRIPTION OF NATURE, SIZE AND LOCATION OF PROJECT

Renewable energy resources are unlimited, widely available and should be exploited. One of those renewable energy resources is concentrated solar power (CSP), which presents the greatest potential for commercial exploitation because of its nature, because it can be stored in the form of thermal energy, and because it can be hybridized. This project is installation of 3MW solar power plant at Crescent Bahuman Ltd to produce green energy by using solar panels. This project is located in the site located within the premises of existing textile unit of crescent Bahuman limited. Project is located at Sarghoda Road, Pindibhattian, Hafizabad, Punjab Pakistan. Google Earth map of this location is given below in Figure 1.1:



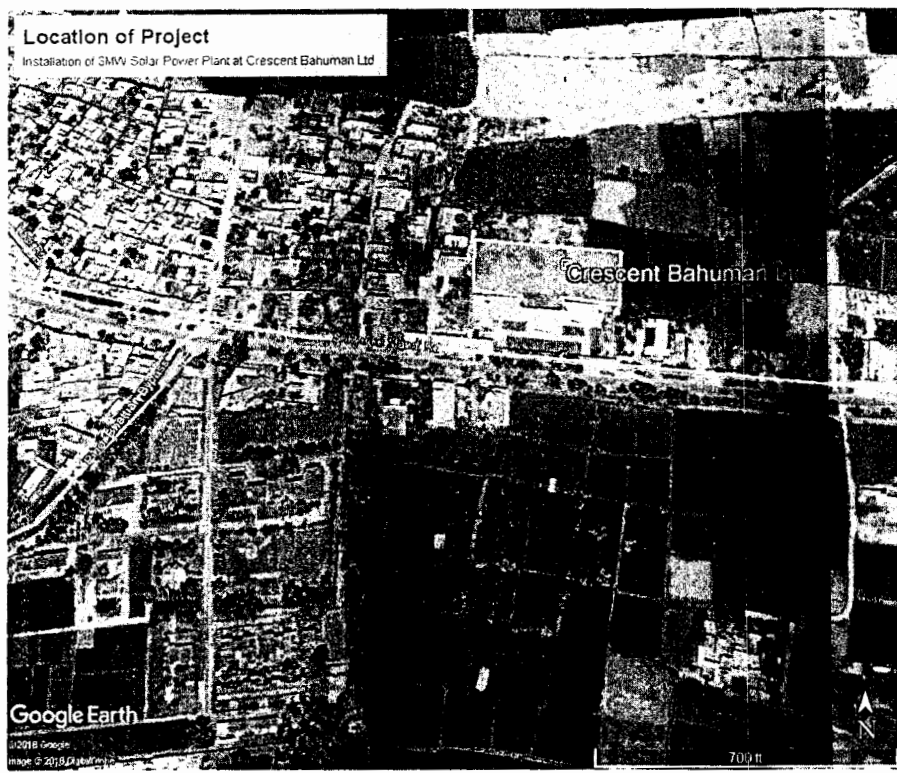
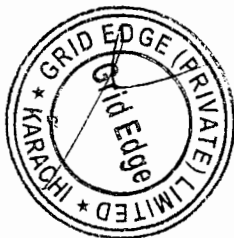


Figure 1.1: Location of Project





## 2. DESCRIPTION OF THE PROJECT

### 2.1 GENERAL

This section deals with project components, which are the part of the utility and its related activities. It also describes the category of the project; the information presented in this section is based on project site survey, preliminary design report, and other related details provided by the provided by the client.

### 2.2 TYPE AND CATEGORY OF THE PROJECT

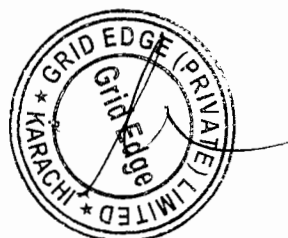
In accordance with the Environmental Protection Agency, Government of the Punjab, Lahore, “List of Projects Requiring an IEE”, the project under consideration fall into the **Series B** of **Schedule I** that is the category of the projects requiring Initial Environmental Examination (IEE). Therefore, to fulfill the legal requirements of the Section-12 of the Punjab Environment Protection Act (amended 2012), the client is required to submit the IEE report in the Environmental Protection Agency, Government of the Punjab, Lahore to obtain the required Environmental Approval (EA).

### 2.3 OBJECTIVES OF PROJECT

Objective of this project is to utilize clean energy, effectively convert solar energy into electricity, reduce environmental pollution, and combine economic and social benefits. This project will produce cheap, emission-free electricity without causing undue environmental damage.

### 2.4 ALTERNATIVES CONSIDERED REALISTICALLY AND REASON FOR THEIR REJECTION

The world has experienced a major economic growth that humanity had never seen before. The development of industry, the increasing number of vehicles and the increase of the number of household appliances have caused a significant growth in energy demand. Unfortunately this growth in demand has been mainly covered by importing fossil fuel because of economic considerations. Other factors such as CO2 emissions, fossil fuel depletion, and national energy independence have not been taken into consideration.



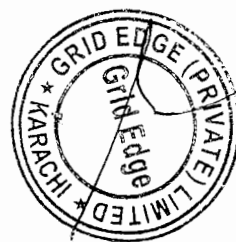
As an alternative to these concerns, the development and implementation of renewable energy is unavoidable. Renewable energy resources are unlimited, widely available and should be exploited. One of those renewable energy resources is concentrated solar power (CSP), which presents the greatest potential for commercial exploitation because of its nature, because it can be stored in the form of thermal energy, and because it can be hybridized. However, not all areas are suitable for this technology; there are certain criteria and methodology in order to select the right place to install the concentrated solar power plant to obtain the maximum efficiency. Also, there are some economic reasons. The selected site for the installation of 3MW solar power plant is suitable for this project. This will benefit the existing textile unit by providing sustainable renewable power supply. Using solar as a power generation is the only way we can secure energy for all and avoid environmental catastrophe. By lowering a building's utility bills, these systems not only pay for themselves over time, they help reduce air pollution caused by utility companies. For example, solar power systems help increase something called "peak load generating capacity," thereby saving the utility from turning on expensive and polluting supplemental systems during periods of peak demand. The more local-generating solar electric power systems that are installed in a given utility's service area, the less capacity the utility needs to build, thus saving everyone from funding costly additional power generating sources. Contributing clean, green power from your own solar electric system helps create jobs and is a great way to mitigate the pollution and other problems produced by electricity derived from fossil fuel. Solar-powered electrical generating systems help to reduce impact on the environment and save money at the same time!

## 2.5 LOCATION OF PROJECT

The site located within the premises of existing textile unit of Crescent Bahuman Ltd, at Sarghoda Road, Pindibhattian, Hafizabad, Punjab Pakistan.

## 2.6 LAND USE ON THE SITE

Land is already in use by Crescent Bahuman Limited at Sarghoda Road, Pindibhattian, Hafizabad, Punjab Pakistan.





## 2.7 ROAD ACCESS

Project site is accessible through Sukheke Main Road and also accessible through Pindi Bhattian Bypass and Hadri Road. All roads are good in condition and paved

## 2.8 VEGETATION FEATURES OF THE SITE

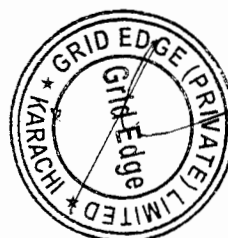
There are no vegetative features present on the land because site is already in operations by textile mill crescent Bahuman limited.

## 2.9 COST AND MAGNITUDE OF OPERATION

The total cost that has to be spending on the project is approximately **Two Hundred Twenty-Five Million Two Hundred Eighty Thousand Rupees Only** rupees (225.280 million PKR). The total area for the proposed project is 9 Acres. The quantities have been worked out from the design drawings and project feasibility.

**Table No: 2.1 Premier 2.82MW Solar Grid - Tied Power Plant**

NO	PRODUCT CODE	PRODUCT/ SERVICE DESCRIPTION	UOM	QUANTITY
2	SDS-00017	Premier Solar Panel Poly 320 W- Canadian Solar -5 Busbar Series	PCS	8,800.00
3	INV-00008	PE- ABB Grid Tied Inverter 30 kW	PCS	88.00
4	FRM-00002	Assembled Galvanized Iron Frames with Mounting Accessories	PCS	8,800.00
5	CAB-00002	DC Cable 10 mm Dual Core	MTR	25,000.00
6	SER-00038	Premier Distribution Box with Safety Equipment - 2.82 MW	PCS	1.0



7	SER-00011	Installation and Commissioning - 2.82 MW	NO	1.0
8	SER-00017	Transportation, Labor and Delivery - 2.82 MW	NO	1.0
9	SER-00030	Data Logger, Power Production Monitoring & Control- Software + Accessories - 2.82 MW	NO	1.0
10	SER-00036	Installation Accessories APA - 2.82 MW	NO	1.0

Total Cost: **225,280,000.00**

In Words: Two Hundred Twenty-Five Million Two Hundred Eighty Thousand Rupees Only rupees

## 2.10 SCHEDULE OF IMPLEMENTATION

It is planned that the following schedule of project implementation will be adhered to. This is subject to the conditions that everything goes according to planning and no serious bottlenecks are encountered.

The implementation stages of the project activity include:

### 1st Stage

The stage-1 comprises the onsite contouring studies

### 2nd Stage

The stage -2 comprises Start of civil and mechanical work and Fitting of instrumentation

### 3rd Stage

The stage -3 comprises the Commissioning and regular operation

## 2.11 DESCRIPTION OF THE PROJECT

The ultimate source of much of the world's energy is the sun, which provides the earth with light, heat and radiation. While many technologies derive fuel from one form of solar energy or another, there are also technologies that directly transform the sun's energy into electricity. Since generating electricity directly from sunlight does not deplete any of the earth's natural resources and supplies the earth with energy continuously, solar energy is a renewable source of electricity generation. Solar



energy is our earth's primary source of renewable energy.

## 2.12 EQUIPMENT SUMMARY

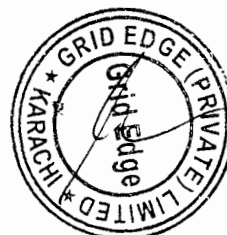
Equipment used for this project will be solar panels, invertors and cables etc. summary of equipments used is as following in table No 2.2

**Table No: 2.2 Equipment Summary**

EQUIPMENT	QUANTITY
Solar Panels	8800
Inverter	02
Two Panels Mounting Structure	4400
Three Panels Mounting Structure	0
Four Panels Mounting Structure	0
Raised Mounting Structure	0
PV to Inverter DC Cables	1 Lot
Inverter to AC Mains	1 Lot
Safety Equipment	ABB / Schneider

## 2.13 SOLAR PANELS

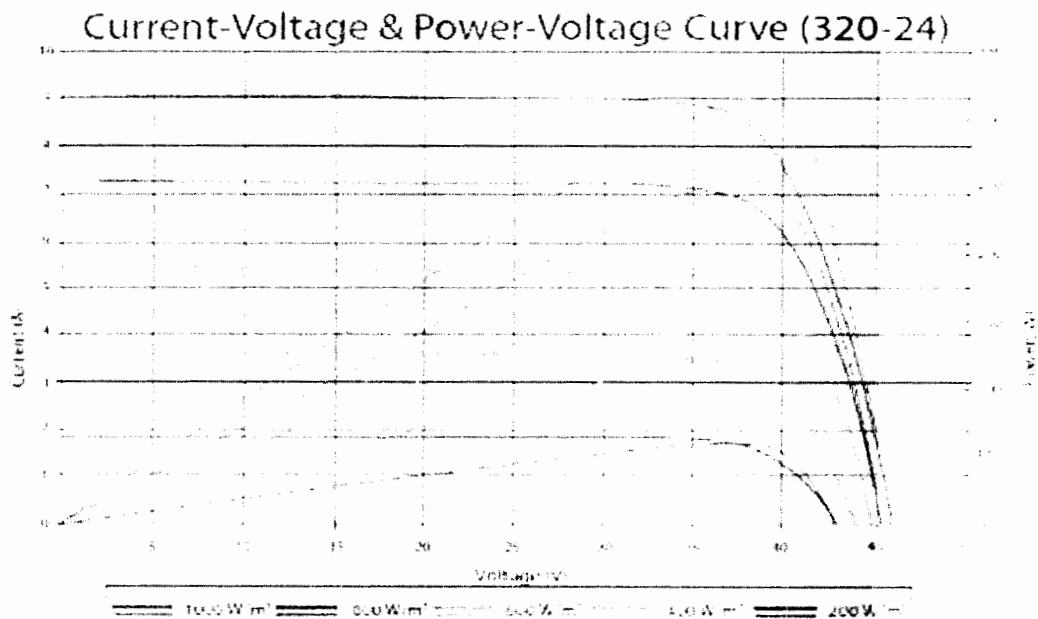
Summary and specifications of solar panels are as given below in Table No: 2.3



**Table No: 2.3 Solar Panels Specifications**

Brand Name	Canada Solar
Module Type	Polycrystalline
Module Name	CSUP320
Rated Power	320 Wp
Module Efficiency	16.5%
Module Workmanship Warranty	10 Years
Linear Performance Warranty	25 Years
Weight Per Module	22.4 kgs

**CURRENT VOLTAGE & POWER-VOLTAGE CURVE**



**Figure No 2.1 Current & Power Voltage Curve**



## SOLAR PANELS

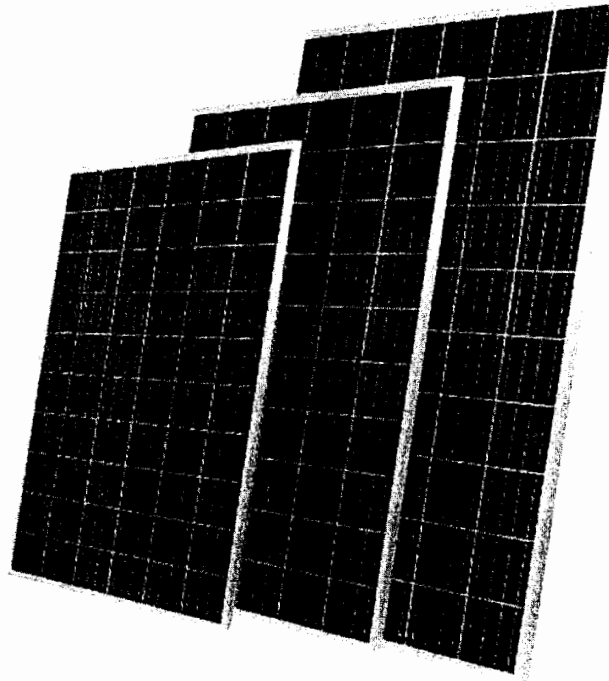


Figure No 2.2 Solar Panel

### 2.14 SOLAR INVERTOR

The three-phase commercial inverter offers more flexibility and control to installers who have large installations with varying aspects or orientations. The dual input section containing two independent (MPPT), allows optimal energy harvesting from two sub-arrays oriented in different directions. The TRIO features a high speed and precise MPPT algorithm for real power tracking and improved energy harvesting.

#### **High efficiency at all output levels:**

Flat efficiency curves ensure high efficiency at all output levels ensuring consistent and stable performance across the entire input voltage and output power range. This device has an efficiency rating of up to 98.2%. The very wide input voltage range makes the inverter suitable for installations with reduced string size. In addition to its new look, this inverter has new features including a special built-in heat sink compartment and front panel display system. The unit is free of electrolytic capacitors, leading to a longer product lifetime

## Highlights

- True three-phase bridge topology for DC/AC output converter
- Transformer less topology
- Each inverter is set on specific grid codes which can be selected in the field
- Detachable wiring box to allow an easy installation
- Wide input voltage range
- 'Electrolyte-free' power converter to further increase the life expectancy and long term reliability

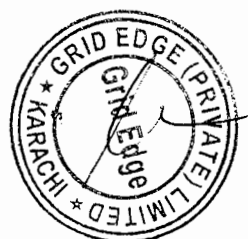
Summary and specifications of solar invertors are as given below in Table No: 2.4

**Table No: 2.4 Solar Invertors Specifications**

Brand Name	ABB – Power One Italy
Inverter Model	27.6TL OUTD-S2X
Inverter Type	On-Grid
Rated AC Name Plate	27.6kW
Rated DC Name Plate	32 kWp
Max AC Power Output	30000 W
Max Efficiency	98.2 %
Output	Three-phase
AC Voltage Range	320 – 480V
Grid Frequency Range	47 – 53 Hz
Total Harmonic Distortion	< 3%
Protections	Anti-Islanding – DC Fuses – Surge Arrestors – DC/AC Switch

## Additional highlights

- Integrated string combiner with different options of configuration which include DC and AC disconnect switch in compliance with international standards (-S2, -S2F and -S2X versions)
- Natural convection cooling for maximum reliability





- Outdoor enclosure for unrestricted use under any environmental conditions
- Capability to connect external sensors for monitoring environmental conditions
- – Availability of auxiliary DC output voltage (24 V, 300 mA)

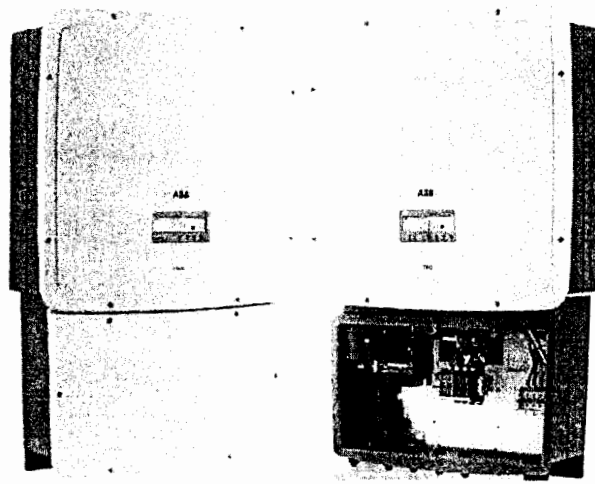
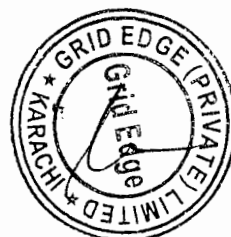


Figure No 2.3 Solar Inverters

#### Block Diagram of Inverter

Block diagram of inverter is shown in Figure No 2.4



Block diagram of TRIO-20.0/27.6-TL-OUTD

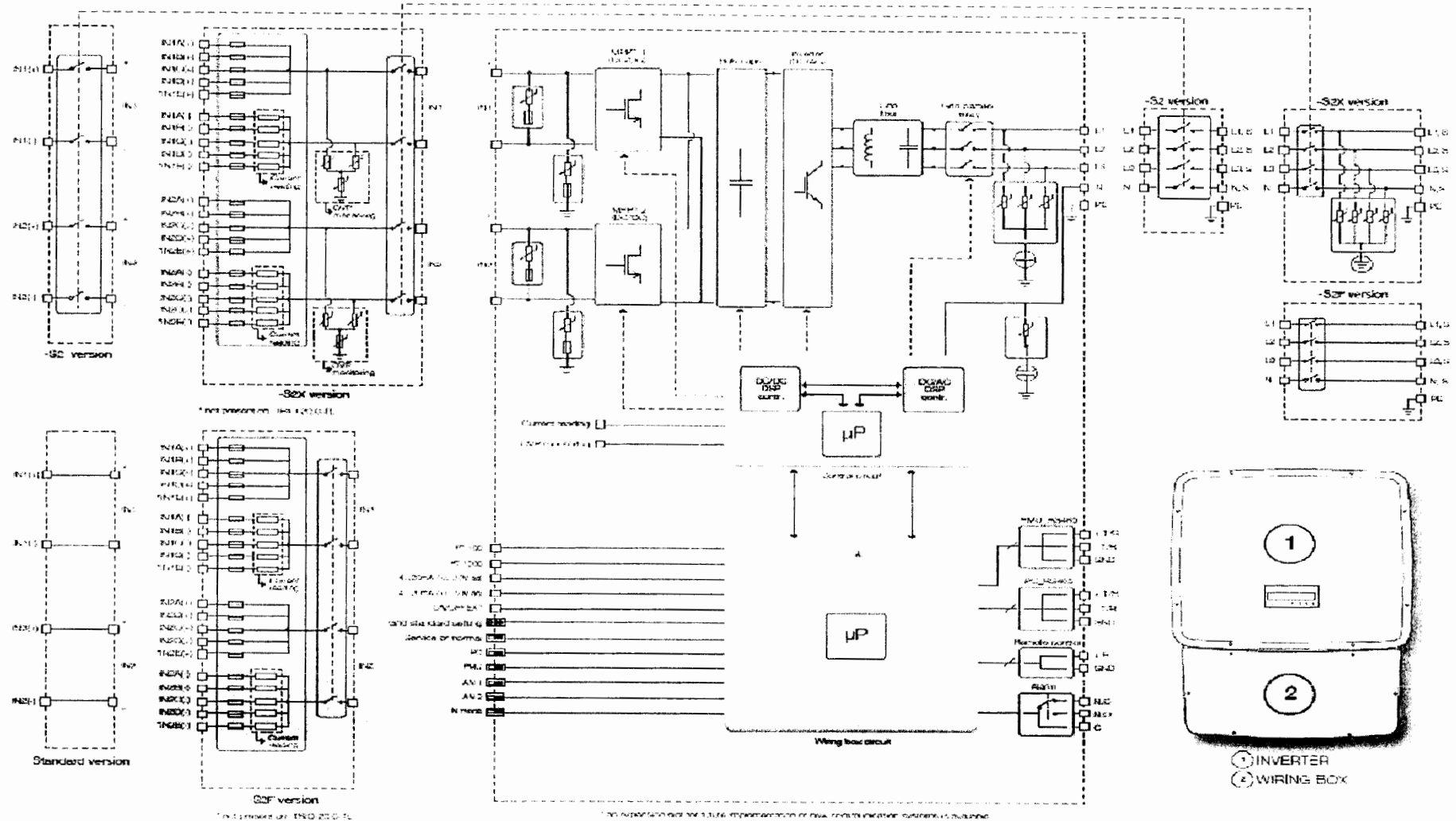


Figure No 2.4 Block Diagram of Inverter

## Technical data and types

Type code	TRIO-20.0-TL-OUTD	TRIO-27.6-TL-OUTD
Communication		
Wired local monitoring	PVI-USB-RS232_485 (opt.)	
Remote monitoring	VSN300 Wifi Logger Card (opt.), PVI-AEC-EVD (opt.), VSN700 Data Logger (opt.)	
Wireless local monitoring	VSN300 Wifi Logger Card (opt.)	
User interface	Graphic display	
Environmental		
Ambient temperature range	-25...+60°C / +13...140°F with derating above 45°C/113°F	
Relative humidity	0...100% condensing	
Sound pressure level, typical	50 dBA @ 1 m	
Maximum operating altitude without derating	2000 m / 6560 ft	
Physical		
Environmental protection rating	IP 65	
Cooling	Natural	
Dimension (H x W x D)	1061 mm x 702 mm x 292 mm / 41.7" x 27.6" x 11.5"	
Weight	< 70.0 kg / 154.3 lbs (Standard version) < 75.0 kg / 165.4 lbs (Standard version)	
Mounting system	Wall bracket	
Safety		
Isolation level	Transformerless	
Marking	CE (50 Hz only), RCM	
Safety and EMC standard	EN 50178, IEC/EN 62109-1, IEC/EN 62109-2, AS/NZS 3100, AS/NZS 60950.1, EN 61000-6-2, EN 61000-6-3, EN 61000-3-11, EN 61000-3-12	
Grid standard (check your sales channel for availability)	CEI 0-21, CEI 0-16, DIN V VDE V 0126-1-1, VDE-AR-N 4105, G59/3, C10/11, EN 50438 (not for all national appendices), RD 1699, RD 413, RD 661, P.O. 12.3, AS 4777.2, AS 4777.3, BDEW, NRS-097-2-1, MEA, IEC 61727, IEC 62116, Ordinul 30/2013	
Available products variants		
Standard	TRIO-20.0-TL-OUTD-400	TRIO-27.6-TL-OUTD-400
With DC+AC switch	TRIO-20.0-TL-OUTD-S2-400	TRIO-27.6-TL-OUTD-S2-400
With DC+AC switch and fuse	TRIO-20.0-TL-OUTD-S2F-400	TRIO-27.6-TL-OUTD-S2F-400
With DC+AC switch, fuse and surge arrester	TRIO-20.0-TL-OUTD-S2X-400	TRIO-27.6-TL-OUTD-S2X-400

<sup>1)</sup> The AC voltage range may vary depending on specific country grid standard

<sup>2)</sup> Limited to 27600 W for Germany

<sup>3)</sup> The Frequency range may vary depending on specific country grid standard

<sup>4)</sup> Optional mating parts

<sup>5)</sup> Limited to 20000 W for Germany

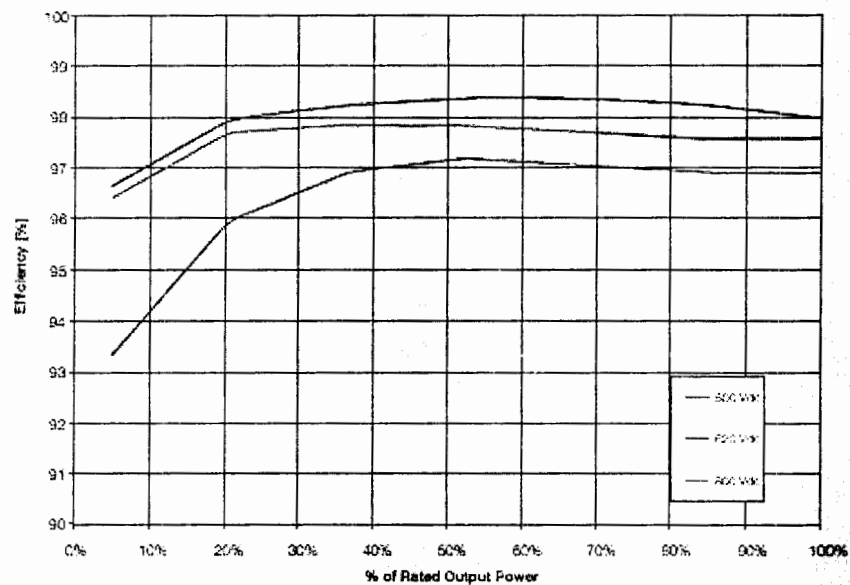
Remark. Features not specifically listed in the present data sheet are not included in the product

Figure No: 2.5 Technical Data & Types of Inverter



## Efficiency Curve Comparisons of Inverters

### Efficiency curves of TRIO-27.6-TL-OUTD



### Efficiency curves of TRIO-20.0-TL-OUTD

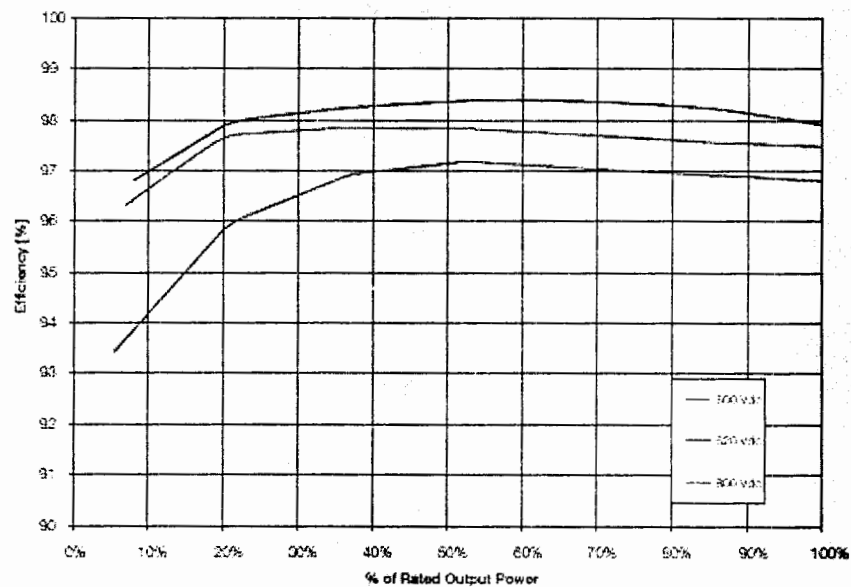
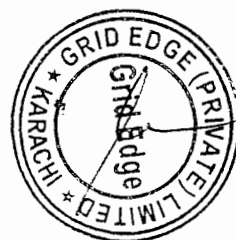


Figure No: 2.6 Efficiency Curve Comparisons

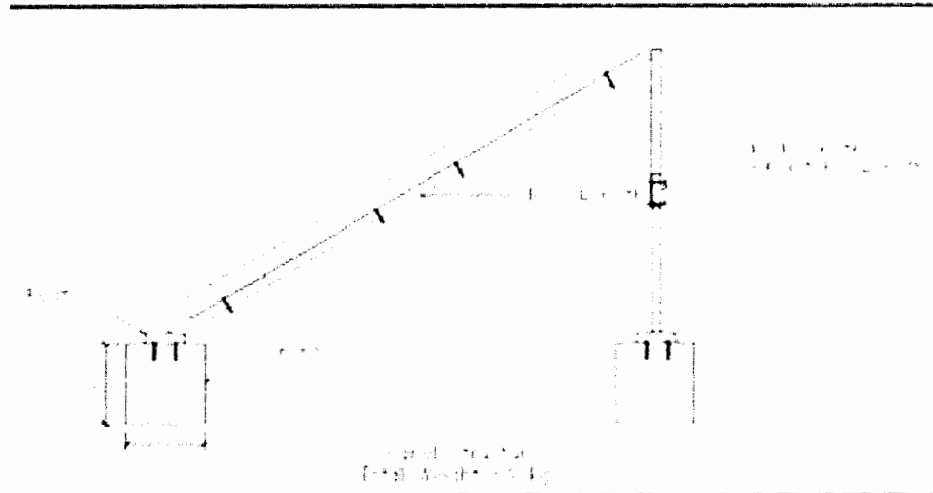


## 2.15 MODULE STRUCTURE

Summary of module structure is given below in table No 2.5

**Table No: 2.5 Module Structure**

Type	Ground Mount
Framing	Two/Three/Four Panel structure
Specifications	GI 14 Gauge
Orientation	South
Ground Support	Piling

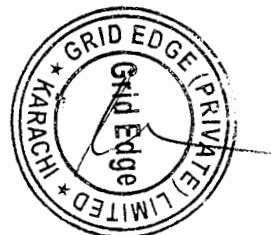


**Figure No: 2.7 Module Structure**

## 2.16 CELL TECHNOLOGY

Maxpower latest innovative cell technology increasing module power output and system reliability will be used. Key feature of cell technology is as following:

- Excellent module efficiency of up to 16.97 %
- Outstanding low irradiance performance of up to 96.0 %
- High PTC rating of up to 91.55 %

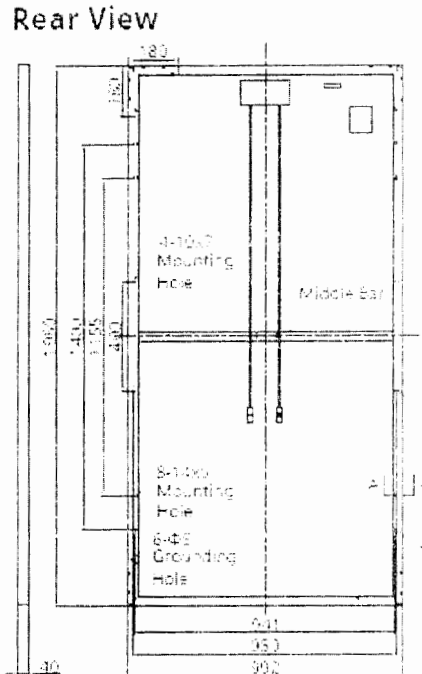


- IP67 junction box for long-term weather endurance

### Engineering Drawing

Rear view engineering drawing of cell technology is shown below in Figure No: 2.8

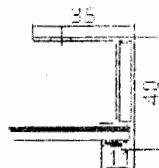
(a)



**Figure No: 2.8(A) Rear View Of Cell Technology**

Frame cross section and mounting hole engineering drawing of cell technology is shown below in Figure No: 2.8 (b) & (c)

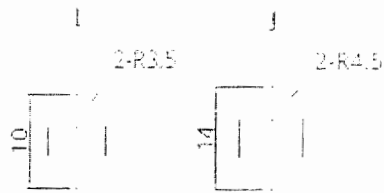
### Frame Cross Section A-A



**Figure No: 2.8(B) Frame Cross Section of Cell Technology**



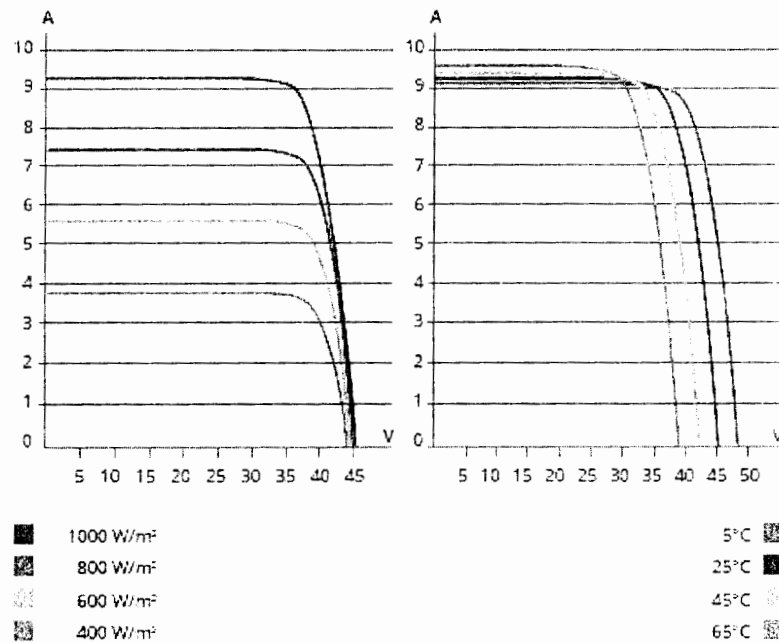
### Mounting Hole



**Figure No: 2.8(C) Mounting Hole Of Cell Technology**

### Cell Technology Curves

Cell technology curves at different temperature and power are shown below in Figure No 2.9:



**Figure No: 2.9 Cell Technology Curves**

### Front & Isometric View of Cells

Front and isometric view of cell technology is shown below in Figure No: 2.10



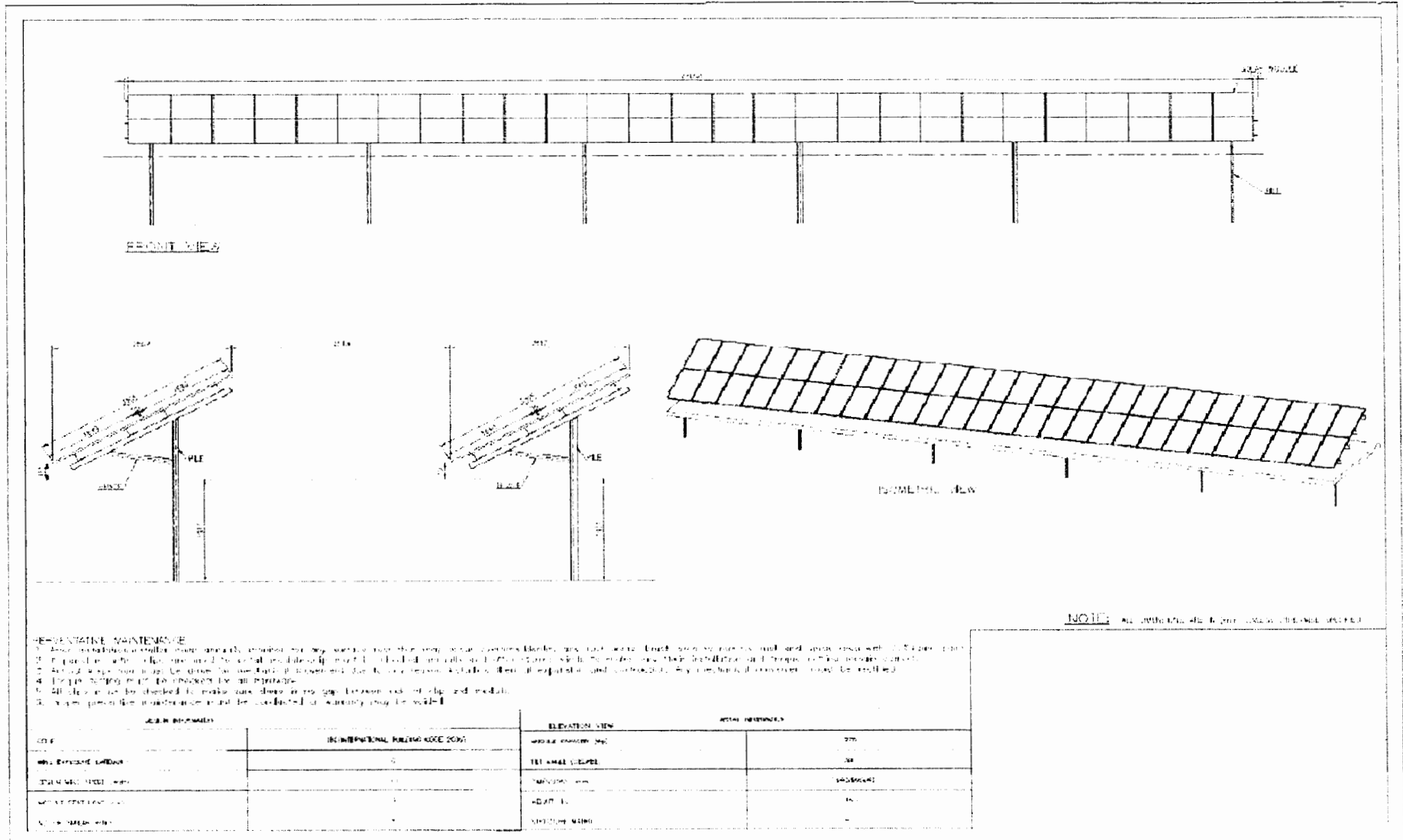


Figure No: 2.10 Front &amp; Isometric View of Cells



## 2.17 SYSTEM METRICS

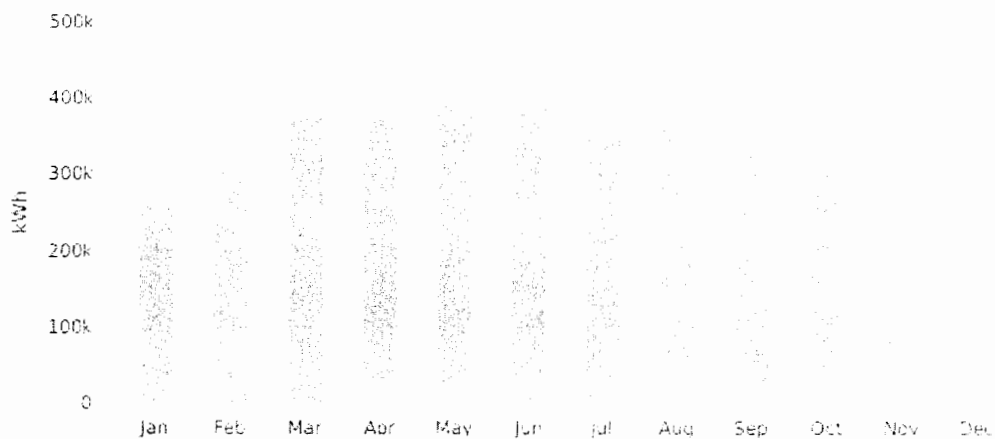
System metrics of on grid solar power plant at crescent Bahuman is summarized in table given below

**Table No: 2.6 System Metrics**

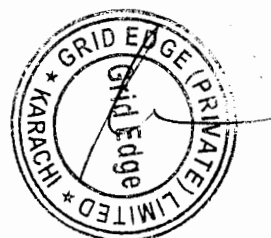
Design	On-Grid Solar Power Plant
Module DC Nameplate	2.82 MW
Inverter AC Nameplate	2.26 MW Load Ratio: 1.24
Annual Production	4.102 GWh
Performance Ratio	78.6%
kWh/kWp	1456.6
Weather dataset	TMY, 10km, Grid, meteonorm
Simulator version	66635f87cf2057fb166f-39fda081a4-58846b297f

### Monthly Production Data

Average estimation data of monthly production is shown below in graph



**Figure No: 2.11 Monthly Production Data**



## System Loss

Sources of system loss in On-Grid Solar Power Plant is due to shading, reflection, wiring clipping temperature AC system, soiling, irradiance, invertors and mismatch. Percentage of loss is shown below in Figure No 2.12

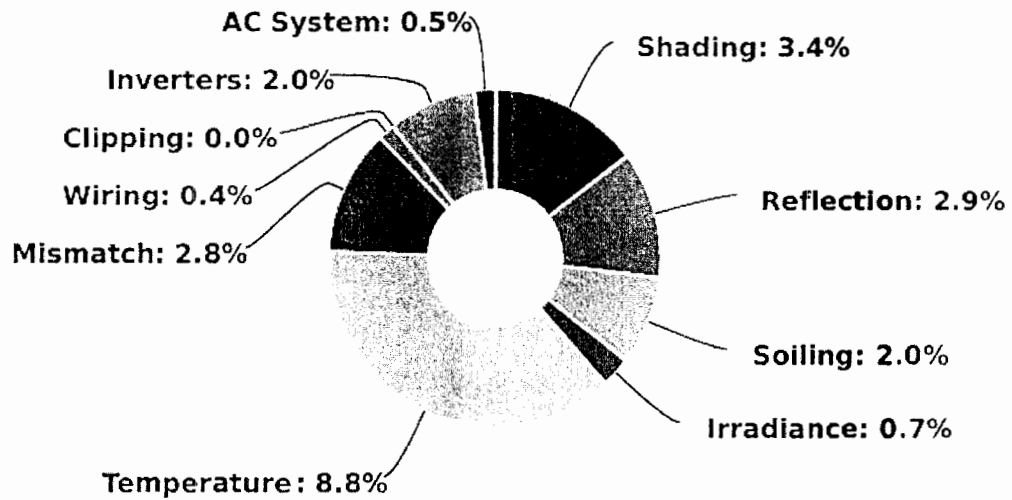
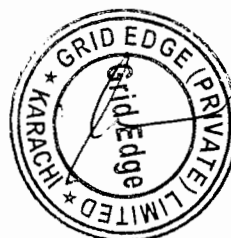


Figure No 2.12 Sources of System Loss

## 2.18 DETAILED LAYOUT

Detailed layout picture of project is shown below in Figure No 2.13



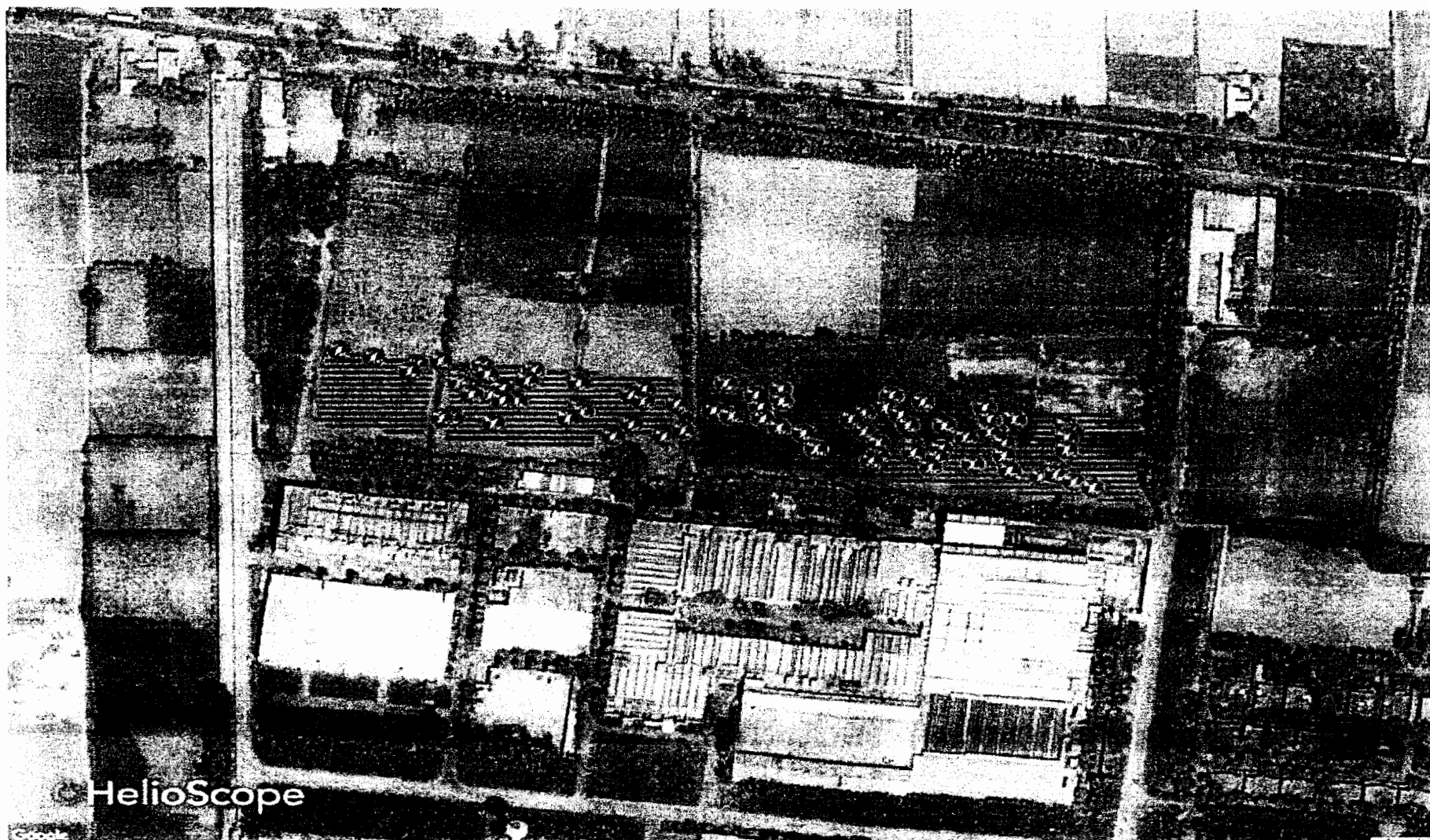


Figure No: 2.13 Detailed Layout of Project

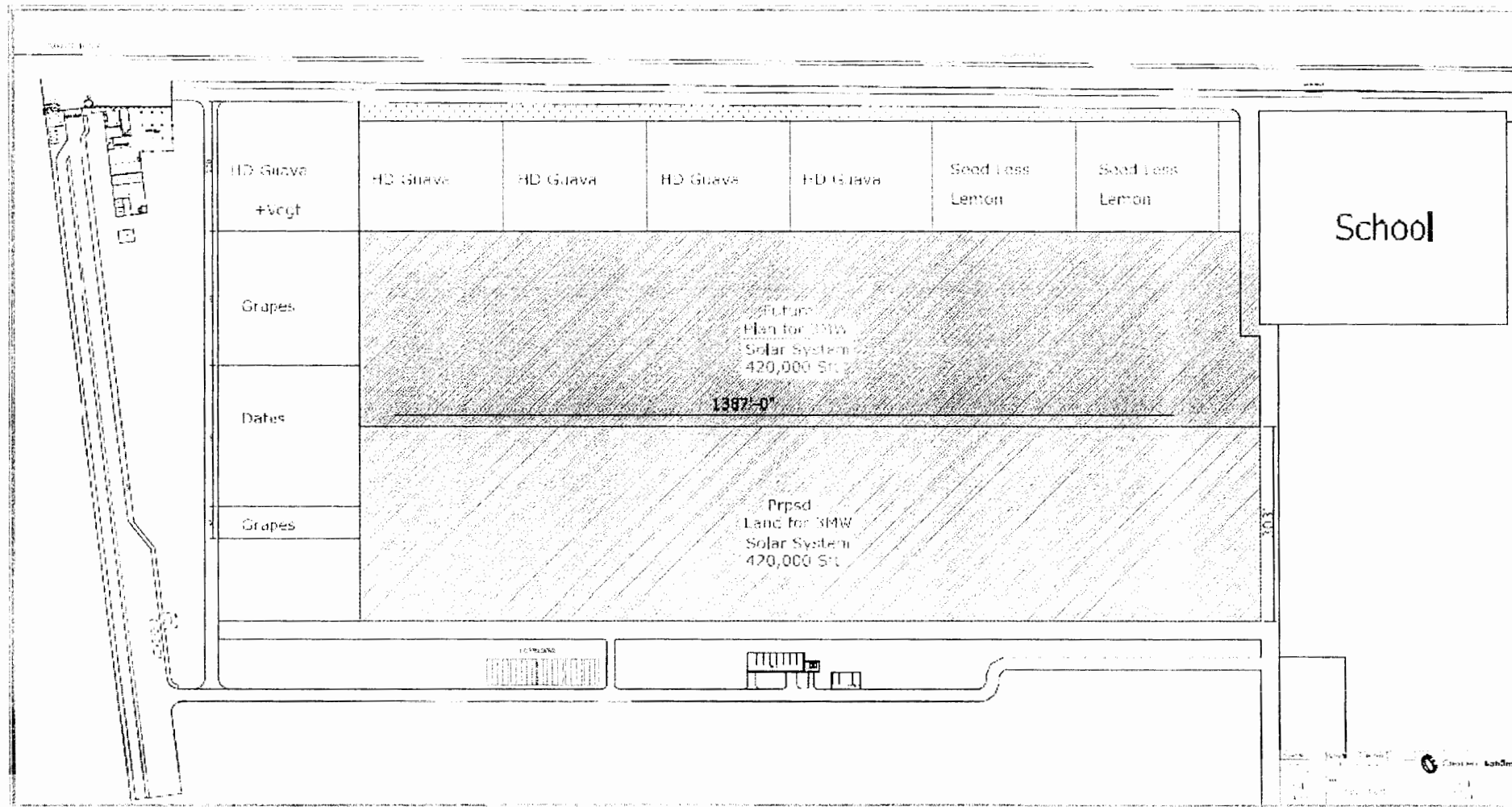


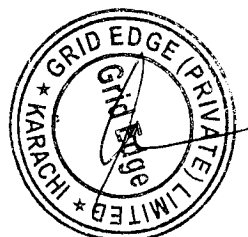
Figure No: 2.14 Proposed Land for Solar System

## **2.19 RESTORATION AND REHABILITATION PLANS**

There will be no any matter of rehabilitation as the proposed site is already owned by the project proponent. There will not be any let regarding safety factors as applicable from time to time for such projects on all accounts. However, at the end of the life of the building, it will be duly dismantled with special precautions to avoid/minimize pollution and at the same time taking all safety precautions to protect human life and property around the project site. Debris or any other wastes resulting from demolishing will be disposed off in environmentally sustainable fashion. The materials capable of recycling/reuse will be either sold in the market or to be reused for other suitable purposes. While dismantling all Government rules and regulations as applicable to such activities will be strictly adhered to. During entire construction period, necessary precautions will be taken to ensure that no damage is done to the basic infrastructures like sewer system, power transmission lines roads, private or public property and daily human life as well. Safety measures as desired under the code of demolition will be adopted to avoid any harm to humans, property around, or the environment in the project area. Dust to be generated will be minimized by constant sprinkling of water. After completion; all construction matrix, debris and garbage will be removed off immediately from the site within the minimum possible time under safe conditions. Any minor spill over of these materials will be cleared adequately. The land, if and where pitted will be adequately leveled. On the whole, the project site and the area in its near vicinity will be made neat and clean.

## **2.20 GOVERNMENT APPROVALS**

The environmental approval according to the Section-12 of Punjab Environmental Protection Act-2012 is the mandatory requirement of the project.



### **3. DESCRIPTION OF ENVIRONMENT**

Gives clear cut picture of existing environmental resources including its physical, ecological and socioeconomic conditions. Quality of human values related to project area is also described in this chapter

#### **3.1 INTRODUCTION**

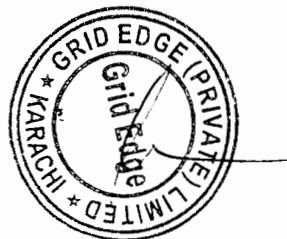
This chapter describes the baseline conditions, which cover the existing physical, ecological, and socio-economic environment of the Study Area. Information on these aspects has been derived from the desk study of available data, field visits to the project area as well as information obtained through visits to the Government departments and other agencies namely Health Department, Irrigation Department, Meteorological Department, Forest offices and prevailing environmental laws and environmental quality standards etc.

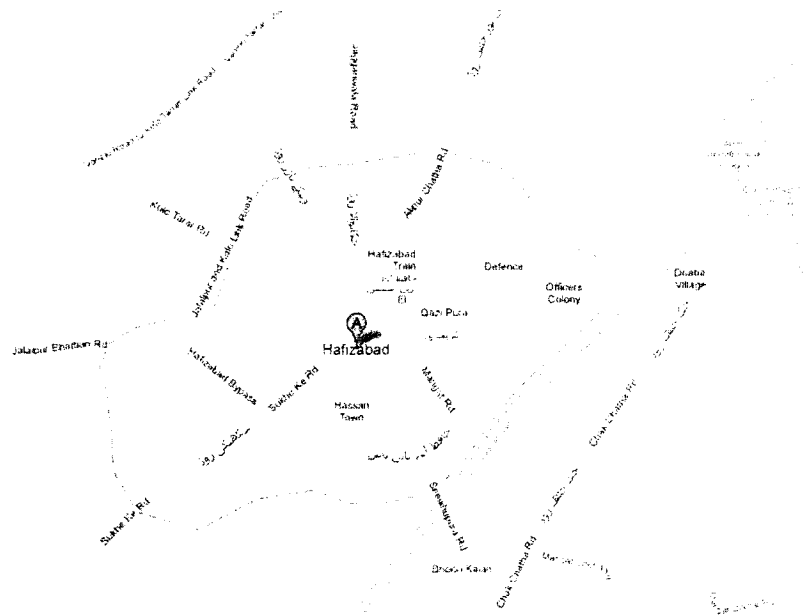
#### **3.2 SPATIAL AND TEMPORAL BOUNDARIES ADOPTED FOR THE VARIOUS ASPECTS OF THE STUDY**

The existing status of the environmental settings around the project site along with future likely trends of development and any change to occur in the land use pattern, especially industrialization trends and associated environmental and socio-economic concerns were the major considerations/spatial and temporal boundaries while taking stock of the existing and expected conditions.

#### **3.3 EXISTING (BASELINE) CONDITION**

Existing (baseline) condition of the biophysical and socio-economic environment, trends and anticipated future environmental conditions should the project not go ahead:



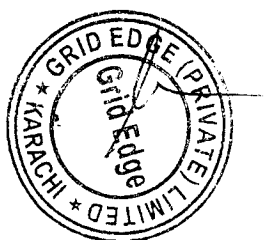


**Figure No: 3.1 City Map of Hafizabad**

The project area is located in the rural zone of the city of Pindi Bhattian. The industrial area is markedly separated from the residential area. The land is plain. Water supply to the project area is from the underground water supply network of tube wells that is already bored in the existing facility. Lower Chenab canal is flowing about four Kilo meter away from the project site. There is no worth mentioning fish life in the canal. The project site is an integral part of the urban and rural area of the city of Pindi Bhattian; therefore, presence of any water body in terms of environment is not applicable. This underground water is supplied to the plant area and residential colony of CBL. The water is quite fit for human consumption.

Agriculture is one among the major sources of income for the people of the area around. However, a little segment of the society works mostly as laborer in various industries of Faisalabad and Sheikhpura. Yet another part of the people runs their own shops in the villages around the project site.

Since the project is to operate under strict environmental control in compliance with the NEQS Pakistan and PEPA 1997, hence the environment will remain largely pollution free. Implementation of the proposed Environmental Management Plan (EMP) further guarantees protection of the environmental settings as they exist presently. Since all type of wastes are to be disposed off according to the requirements of the National Environment Quality Standards (NEQS) under the



Pakistan Environmental Protection Act-1997, therefore, this also provides safeguard against pollution from the project activity.

In case the project operates, it will provide job opportunities directly and indirectly, help poverty alleviation, and last but the least boost economy of the country on the overall basis.

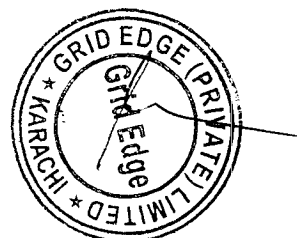
Obviously, in case the project does not proceed further, there will not be any change in the existing status of the environment or a status quo will be maintained with regard to all environmental, social and economic factors, education and basic infrastructure

### 3.4 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally sensitive areas of special or unique value (Physical resources of the project area: Topography and geology; Soils and Climate; water; Ecological resources: Fisheries and aquatic biology, Biodiversity, Forestry, Wildlife, scientific institutions, Socio-economic and Cultural and other heritage)

The project site is located in the agriculture area around. The area is flat. Upper Indus plain is the land of major tributaries of Indus River-Jhelum, Chenab, Ravi and Satluj. The Upper Plains start from foothills of the Himalayas and Potohar plateau and terminates near Mithan Kot where the Sulaiman Ranges approach the Indus River. The general slop of the plain towards the sea is gentle; with an average gradient of 1 meter to 5 km. the featureless plain has elements of micro relief, which possess great importance because of their relationship to irrigation and flooding. The only breaks in the monotony of this level plain are the Kirana Hills in the central Punjab. They constitute the low deeply weathered hills lying in four separate groups at Kirana, Chiniot, Sangala and Shorkot.

The site falls in Rechna Doab is located between Ravi and Chenab Rivers. The northern and central part of this doab has no high relief. Only southern central part named Sandal Bar is the actual bar area. It covers around 28 lac hectores of land in the districts of Sialkot, Naroval, Gujranwala, Hafizabad, Jhang, Faisalabad and Toba-Tek-Sing. Rice, Sugar cane, Wheat, Cotton and Maize are the major crops of the area. The oldest known Pre-Cambrian Rocks are about 3800 millions old. The Oxford dictionary old low relief hills near Chiniot, Sangala and Shah Kot are prominent orographic features of this Bar.





According to Anwaruddin Ahmad, Asmatullah and Russal Nazirullah, Geological Survey of Pakistan-Seismic Hazard Zones of Pakistan, 2006, the project site lies in the Minor to No damage zone, with intensity  $<6$  and g-factor  $<0.03$ .

### 3.5 SOILS

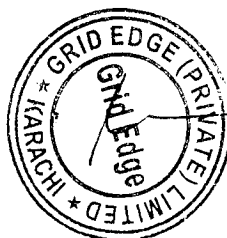
There is an important relation between soils and environment. Environment is greatly influenced by soils. Soils also provide food, clothes or housing population and lumber products, medicinal plants etc.

Soil is not a lifeless residual layer rather it is a very dynamic element of environment in which complicated physical, chemical and biological activities are constantly proceeding. It is dynamically developing and changing body. Soil scientists restrict the word soil or solum merely to the surface material, which has come to have distinct layers or horizon over the extended period of time.

Soils mean differently for different people. While for a soil scientist it means the upper a few layers created through weather effect in which plants are grown the solid portion of soil is both organic and inorganic. The organic part consists of both living and decayed plant and animal materials.

Geographically, Pakistan is highly diversified in environment and landscape. Lofty snow-clad mountains, extensive rivers, piedmont plains and vast sandy deserts have resulted in variations of soil forming elements. Accordingly, in order to have a generalized account of various kinds of soils which are available in Pakistan, the country has been divided into nine broad ecological zones. The project area falls in the Western Mountainous Region.

The soil of the project area is made up of river Alluvia brought down from the Himalayas and deposited during the Pleistocene epoch. The sediments generally are loamy in the northern reaches and become silty southwards. Finer materials settled in the digressional parts and coarse materials on higher undulations, intermediate level area received the particles-sized fractions in between. The sediments are characteristically calcareous and of mixed minerals makeup. The soils are typically deep calcareous, weakly structured, bright colored and with a zone of secondary lime accumulation at or near one meter depth.



### 3.6 CLIMATE

Pakistan extends from 240 N to about 370 N with its western border lies close to 620 E, north eastern border extends to about 74/120 E and lies on the western margin of one of the major climatic regions of the world. Therefore, her climate is more continental. Reversal of wind system and variable character of monsoon are quite complex. A major part of Pakistan is dominated by dry climate. Temperature and amount of rainfall determine type of natural vegetation in any area.

These physical features have great bearing on climatology of the area like the entire country; the project area has also four seasons distinctly:

- Cold weather season – December to March
- Hot weather season – April to June
- Monsoon season – June to September
- Post Monsoon season – October and November

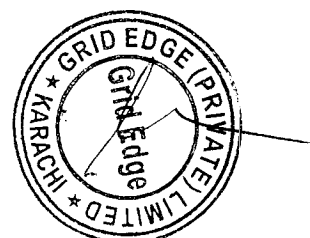
The mean monthly temperature (July) ranges between 30-35°C and above 15 °C during January, hottest month exhibits temperature observed 27.6 °C as minimum temperature and maximum 41.10°C. The average rain fall in July-December remains under 110 mm, while during December-March it ranges between 50-100 mm. The mean annual rain fall is 21.4 inches

Climate data of district hafizabad is shown below in Table No: 3.1

**Table No: 3.1 Climate Data of Hafizabad**

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	12.2	15.1	20.3	25.2	30.1	35.0	37.6	35.0	30.1	25.2	19.8	13.8
Min. Temperature (°C)	4.9	7.6	13.1	18.3	23.2	28.1	30.7	28.1	23.2	18.3	10.2	5.6
Max. Temperature (°C)	19.5	22.4	27.5	32.1	37.0	41.1	44.9	41.1	37.0	32.1	27.4	21.7
Avg. Temperature (°F)	54.0	59.2	68.5	77.4	86.2	95.0	100.0	95.0	86.2	77.4	68.8	56.8
Min. Temperature (°F)	40.8	46.0	55.6	64.9	73.8	82.6	87.3	82.6	73.8	64.9	50.4	42.1
Max. Temperature (°F)	67.1	72.3	81.5	90.0	98.8	105.9	112.8	105.9	98.8	90.0	81.3	71.1
Precipitation / Rainfall (mm)	23	25	22	17	16	35	105	114	44	7	4	11

The difference in precipitation between the driest month and the wettest month is 114 mm. throughout the year; temperatures vary by 21.9 °C.



## CLIMATE GRAPH BY MONTH

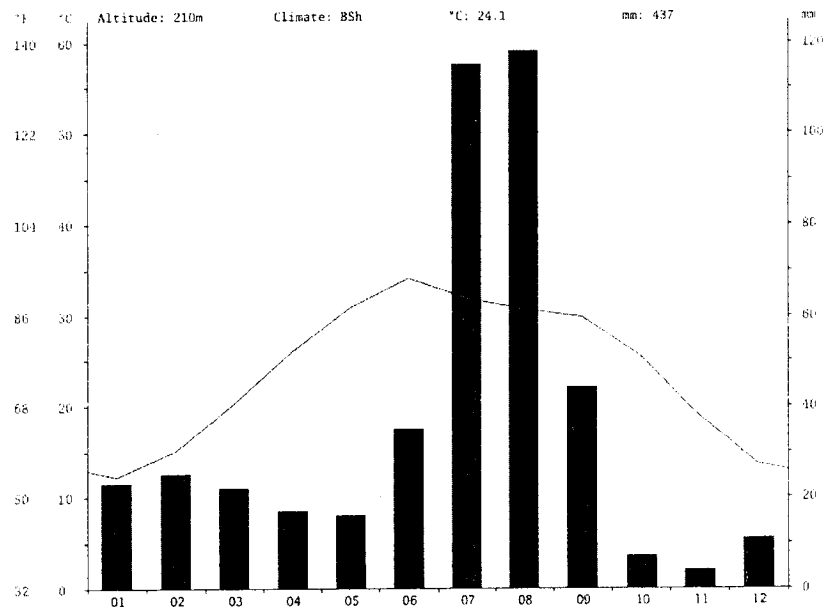


Figure No: 3.2 Climate Graph of Hafizabad

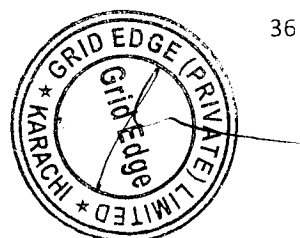
### 3.7 ECOLOGICAL RESOURCES

The project site falls in the rural area of Pindi Bhattian. There are no worth mentioning factors like ecological resources, fisheries, aquatic biology, wildlife, forests, rare or endangered species are not applicable.

### 3.8 SOCIOECONMIC

#### 3.8.1. Population and community

The project area is situated in the existing unit land of the Crescent Bahuman Limited (CBL) Lahore-Sheikhupura road, Pindi Bhattian, district Hafizabad. The area is purely rural area and there is no such commercial activities are being running already there. However; the project area is being enjoying the facilities like school and medical dispensary of CBL. There are some private shops and tea stalls in the near area of the project site. Most of the people are related to the agriculture and farming. The people of the area are accustomed to the social set up of the rural area. The people depend upon private medical clinics of the nearest area, CBL medical facility and the city of Pindi Bhattian.



### **3.8.2. Industries**

The area is purely agriculture area and there is no worth mentioning industries in the project area.

### **3.8.3. Infrastructure:**

Piped water from the civil water supply is not available to the area. Proper sewage, system is absent in the surroundings. Electricity is fed by the Water and Power Development Authority (WAPDA). Natural gas is also available and provided by the Sui Northern Gas Pipelines Limited. Roads network is available to the entire community.

### **3.8.4. Institutions:**

The project area lacks the well-reputed private and government institutes. However; the existing unit of CBL provides standard quality education to the nearest villagers through their school.

### **3.8.5. Transportation**

The project site being in the closest to the motorway (M-2) enjoys this road network. Being an old city of the area can claim to enjoy the availability of the main rail in Hafizabad. No airport in the area. The area is served by major road namely Lahore-Sargodha road besides a network of many other roads crossing the entire area around.

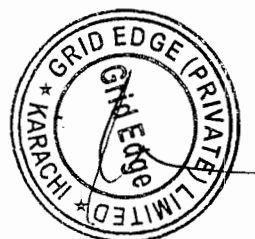
### **3.8.6. Land use planning**

The project site is situated in the rural category. Therefore, land use planning of the proposed site will be controlled by project proponent i.e. Messer CBL. All laws and by laws of the government are applicable to any land planning and use as well

### **3.8.7. Power sources and transmission**

CBL has its own power plant known as Crescent Bahuman Energy Ltd. It gives CBL the ability to control and maintain a continuous and uninterrupted power. This Wartsila, heavy fuel/diesel oil plant consist of two 5 MW engines with backup power supply by Mitsubishi. The plant also contains two waste heat recovery boilers, HFO separators, Lube oil separator, booster unit, and heat exchanger, compressor, and storage tanks.

The electricity is supplied to different departments of the facility through underground



transmission lines of 11 Kv via 8 different feeders. Where it is stepped down to 400 Kv through step-down transformers as per requirement of the equipment. The proposed power plant will add on to the supply of electricity.

### **3.8.8. Agricultural and mineral development**

The project site is situated in the rural city of Pindi Bhattian district Hafizabad. The land in the surrounding is agricultural land. Crops like wheat, rice, sugar cane and different vegetables are major products

## **3.9 QUALITY OF LIFE VALUES**

### **3.9.1 Socioeconomic values**

Majority of the residents of the area belong to middle class. Small proportions of people are among the affluent class. Some people earn their livelihood while performing private jobs, carrying out business on small and large scale and even running very small shops etc.

Importance of educational values is highly found. Consequently, the people send their children to educational institutions and try to get them educated to the extent their financial means permit them. The people share with each other the social, cultural and economic values of life. To a greater extent there is harmony towards collective interests among the people

### **3.9.2 Public health**

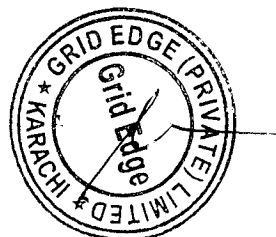
As far as medical facilities are concerned, CBL provides the medical facilities not only to its workers but also to the people of area. Area have no proper medical facility, most of the people travel in the surrounding cities for medical treatment.

### **3.9.3 Recreational resources and development**

The project area has not private recreational facilities. Yet they can enjoy the local recreational event like melaas.

### **3.9.4 Aesthetic values**

Like the general trend among the citizens of area, most of the people have low awareness about environment. Even then, some people take cleanliness and neatness of the environment lightly. Some people throw municipal solid wastes (MSWs) on the streets. Sense of personal responsibility to keep the environment clean as good citizens is even now lacking among a few people.



### **3.9.5 Archaeological and historical treasures**

Archaeological or historical treasures within the project area are not available.

### **3.9.6 Cultural values**

There is blend of poor and elite class among the residents of the project site. One can see a mixture of modern and old cultural values. Younger generation is vastly adopting modern cultural values of the affluent society of Pindi Bhattian and Hafizabad. Elderly people are well respected and they even now play a decisive role in decision making in family matters. The liberal independence is also dominating now a day

### **3.10 LAB REPORTS OF ENVIRONMENTAL ANALYSIS**

Environmental analysis is a strategic tool. It is a process to identify all the external and internal elements, which can affect the organization's performance. The analysis entails assessing the level of threat or opportunity the factors might present. These evaluations are later translated into the decision-making process. The analysis helps align strategies with the firm's environment.

Wastewater, drinking water quality and ambient air parameters were analyzed at the proposed project site. Results obtained from the analysis are mentioned below in Table No: 3.2, 3.3 and 3.4.

#### **3.10.1 Results of Wastewater Parameters**

Different parameters of wastewater including pH, TDS, TSS, temperature, COD, BOD and different heavy metal analysis was analyzed at proposed project site. Results obtained from the analysis s given below in Table No: 3.2

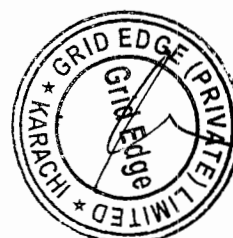
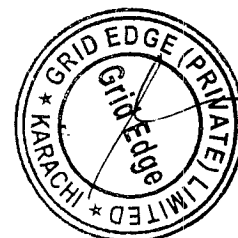


Table No: 3.2 Wastewater Analyses

SR. NO.	PARAMETERS	PARAMETERS	RESULTS	PEQS
1	Temperature	0°C	27.0	40
2	pH	----	8.42	6-9
3	Chemical Oxygen Demand (COD)	mg/l	234	150
4	Biochemical Oxygen Demand (BOD)	mg/l	122	80
5	Total Dissolved Solids (TDS)	mg/l	836	3500
6	Total Suspended Solids (TSS)	mg/l	138	200
7	Oil & Grease	mg/l	6.5	10
8	Chromium (Hexa & Trivalent)	mg/l	0.58	1.0
9	Sulphate (SO <sub>4</sub> )	mg/l	149	600
10	Iron (Fe -2)	mg/l	3.1	8
11	Chlorine (Cl <sub>2</sub> ) Free	mg/l	BDL	10
12	Fluoride (F )	mg/l	6.2	1.0
13	Chloride	mg/l	294	1000
14	Ammonia (NH <sub>3</sub> )	mg/l	BDL	40
15	Cadmium	mg/l	0.03	0.1
16	Lead	mg/l	BDL	0.5
17	Arsenic	mg/l	0.35	1.0
18	Copper	mg/l	1.52	1.0
19	Barium	mg/l	BDL	1.5
20	Selenium	mg/l	0.01	0.5
21	Silver	mg/l	BDL	1.0



SR. NO.	PARAMETERS	PARAMETERS	RESULTS	PEQS
22	Manganese	mg/l	BDL	1.5
23	Zinc	mg/l	0.3	5.0
24	Nickel	mg/l	BDL	1.0
25	Boron	mg/l	BDL	6.9
26	Mercury	mg/l	BDL	0.01
27	Total toxic metals	mg/l	1.85	2.0
28	Sulphide	mg/l	BDL	1.0
29	An ionic detergent as MBAS	mg/l	BDL	20
30	Phenolic compounds	mg/l	BDL	0.1
31	Cyanide	mg/l	0.1	10



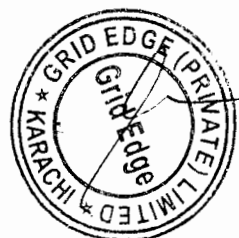


**3.10.2 Results of Drinking Water Parameters**

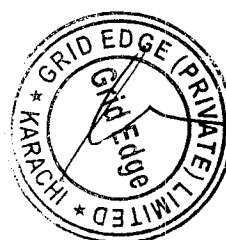
Different parameters of drinking water including pH, TDS, TSS, temperature, taste, color, odor, sodium, total hardness, COD, BOD and different heavy metal analysis was analyzed at proposed project site. Results obtained from the analysis s given below in Table No: 3.3

**Table No: 3.3 Drinking Water Analyses**

SR. NO.	PARAMETERS	UNIT	RESULTS	PEQS
1	Temperature	°C	18.0	---
2	pH	----	7.52	6.5-8.5
3	Total Dissolved Solids (TDS)	mg/l	672	1000
4	Total Suspended Solids (TSS)	mg/l	05	---
5	Chloride	mg/l	132	250
6	Fluoride	mg/l	0.16	1.5
7	Taste	Object/unobj	Unobject	Unobject
8	Odor	Object/unobj	Unobject	Unobject
9	Color	TCU	0	15
10	Iron	mg/l	0.06	0.3
11	Sodium	mg/l	75	200
12	Nitrate	mg/l	5.8	50
13	Nitrite	mg/l	BDL	3
14	Ammonia	mg/l	0	1.5
15	Hydrogen sulphide	mg/l	BDL	0.05
16	Sulphate	mg/l	0.4	250
17	Lead	mg/l	BDL	0.10
18	Total hardness as CaCO <sub>3</sub>	mg/l	236	500



SR. NO.	PARAMETERS	UNIT	RESULTS	PEQS
19	Turbidity	NTU	0	5
20	Zinc	mg/l	0.42	3
21	Manganese	mg/l	BDL	0.1
22	Benzene	mg/l	BDL	10-120
23	Aluminum	mg/l	BDL	0.2
24	Molybdenum	mg/l	BDL	0.070
25	Chromium	mg/l	0.01	0.050
26	Cadmium	mg/l	BDL	0.003
27	Boron	mg/l	BDL	0.300
28	Barium	mg/l	BDL	0.700
29	Antimony	mg/l	BDL	0.005
30	Arsenic	mg/l	0.05	0.010
31	Cyanide	mg/l	BDL	0.070
32	Mercury	mg/l	BDL	0.001
33	Nickel	mg/l	BDL	0.020
34	Total Coliform	Number/100ml	03	0/100ml
35	E. Coli	Number/100ml	0	0/100ml



**3.10.3 Results of Ambient Air Parameters (PM)**

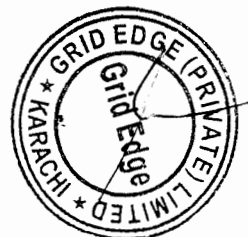
For ambient air quality different parameters of particulate matter (PM10 & PM2.5) from North, South, East and West location of project site were analyzed. Results obtained from analysis is shown below in Table No: 3.4

**Table No: 3.4 Ambient Air Analyses (PM10)**

Sr. No.	Parameters	Location	Method	Unit	Result	PEQS
1	PM10	North	Integrated Sampling Technique	( $\mu\text{g}/\text{m}^3$ )	411	150
2	PM10	South	Integrated Sampling Technique	( $\mu\text{g}/\text{m}^3$ )	236	150
3	PM10	East	Integrated Sampling Technique	( $\mu\text{g}/\text{m}^3$ )	49	150
4	PM10	West	Integrated Sampling Technique	( $\mu\text{g}/\text{m}^3$ )	39	150

**Table No: 3.5 Ambient Air Analyses (PM2.5)**

Sr. No.	Parameters	Location	Method	Unit	Result	PEQS
1	PM2.5	North	Gravimetric Method	( $\mu\text{g}/\text{m}^3$ )	20	35
2	PM2.5	South	Gravimetric Method	( $\mu\text{g}/\text{m}^3$ )	13	35
3	PM2.5	East	Gravimetric Method	( $\mu\text{g}/\text{m}^3$ )	21	35
4	PM2.5	West	Gravimetric Method	( $\mu\text{g}/\text{m}^3$ )	16	35



#### **4. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

This section identifies the potential impacts; related with design, construction and operation of the Project on the physical, ecological and socio-economic domains of the environment. Accordingly, mitigation measures have also been proposed to manage the environment and for sustainable development.

Strict environmental management will be observed during the project construction and regular operation phases. Legal requirements of the PEPA and the PEQS will be the rating standard for the activities. Compliance with the EMP and EMtP, as per recommendations in this IEE report will be adhered to with full spirit.

The project proponent is filing with the EPA Punjab, written Affidavit and Undertaking on judicial papers, that the project throughout its life will operate under Environmental Management Order. Under these conditions the project at its all stages including from construction to regular operation will go in compliance with the PEQS. The project activities will, therefore, neither adversely affects the population nor the environment around the project site. Evaluation of the anticipated impacts from the project activity and their mitigation measures are described below.

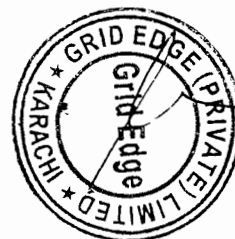
##### **4.1 PROJECT LOCATION**

Environmental problems related to location of the project are mostly in the areas of physical setting, socioeconomic setting, ecological setting and special areas. Field survey revealed that the impacts of the project due to its location are mostly insignificant in nature. Location of this on-grid solar power plant station is the existing textile unit of Crescent Bahuman Limited at Sarghoda Road, Pindibhattian, Hafizabad, and Punjab Pakistan.

##### **4.2 DESIGN**

Solar energy technologies offer a clean, renewable, and domestic energy source, and are essential components of a sustainable energy future. Solar energy systems (i.e., photovoltaic's, solar thermal) provide significant environmental benefits in comparison to the conventional energy sources.

Solar energy technologies (SETs) provide obvious environmental advantages in comparison to the conventional energy sources, thus contributing to the sustainable



development of human activities. Not counting the depletion of the exhausted natural resources, their main advantage is related to the reduced CO<sub>2</sub> emissions and normally absence of any air emissions or waste products during their operation. Concerning the environment, the use of SETs has additional positive implications such as:

- reduction of the emissions of the greenhouse gases (mainly CO<sub>2</sub>, NO<sub>x</sub>) and prevention of toxic gas emissions (SO<sub>2</sub>, particulates)
- reclamation of degraded land;
- reduction of the required transmission lines of the electricity grids; and
- improvement of the quality of water resources

#### **4.3 DURING CONSTRUCTION PHASE**

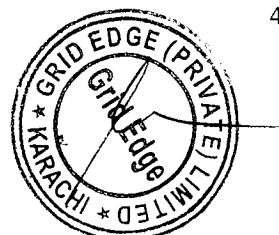
Installation of 3MW solar power plant at existing premises of textile unit of crescent Bahuman limited is not required any construction because this unit is already constructed and in operation stage, this project is about the installation of on-grid solar power plant at the roof top of unit. The only impacts this project have related to the installation of solar power plates at the roof top of unit. No or minor impacts are anticipated during construction phase that are discussed in the table no 4.1

#### **4.4 DURING OPERATIONAL PHASE**

Solar energy technologies are essential components of a sustainable energy future. Nevertheless, solar energy systems have some certain negative impacts on the environment just like any other energy system. Some of these impacts are summarized in this section below:

##### **4.4.1 Land Use and Thermal Pollution**

Solar cells (photovoltaics) have miscellaneous impacts on the natural ecosystem. These impacts are related to some specific factors, like the area and the topography of land that would be covered, sensitive ecosystems, and biodiversity. The application of the solar cells in cultivable land can cause possible harm on the land's productive areas. Large-scale utilization of the land also effects thermal balance of the area by absorbing more energy by the earth than otherwise would be reflected by the surface back to space. A serious solar power application needs to utilize square kilometers of desert area. Thermal balance of this land space can certainly be effected by such an application. Also, additional heat might destroy a few species living in this kind of



harsh environment.

#### 4.4.2 Discharge of Pollutants

Solar cells do not emit any pollutants during their operations. But solar cell modules contain some toxic substances, and there is a potential risk of releasing these chemicals to the environment during a fire. The possibility of an accidental release of the chemicals of the solar cell modules to soil and groundwater poses a great threat for the environment. Necessary precautions will be taken for emergency situations like fire.

#### 4.4.3 Impacts on Natural Resources

Solar cells have some negative impacts on the environment during their production phase like many other systems. But the current project involves only the installation of solar power plant, which will **not harm the natural resources**

#### 4.4.4 Air Pollution

Solar cells **do not emit** any substances to the air during operation.

#### 4.4.5 Water Pollution

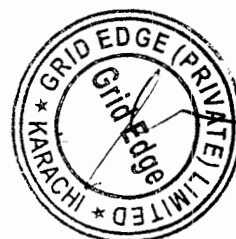
Solar reduces water pollution. This one is a little less obvious, but **certainly** one of the biggest environmental advantages of solar. While all manufacturing processes require some water, including those used to make solar panels, the total amount of water needed to generate solar electricity is dramatically less than more traditional electricity sources. Older technologies such as nuclear, natural gas and coal-fired facilities, all require massive amounts of water for cooling purposes. With solar energy, there's almost no risk to local water resources, nor does their operation strain local supplies by competing with agriculture, drinking systems, and **other** vital water needs.

#### 4.4.6 Noise

Intrusion Solar cells **do not make a noise** during operation. But during the construction phase, there will be a little noise as usual in other construction activities.

#### 4.4.7 Strain On Finite Resource

Global population will continue to grow, but our Earth only has a finite amount of oil, coal and natural gas to give up. The sun is Earth's most abundant energy source, producing a staggering 173,000 terawatts of solar energy every second! That's more than 10,000 times the world's total combined energy use, and it's **available** again and again. In contrast, fossil fuels are dirty and totally non-renewable. At some point, they will simply be gone, or the cost of finding and extracting them will be way too



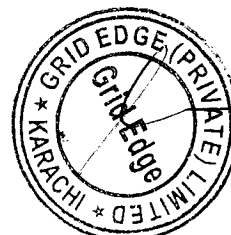
expensive for our strained population. If we don't change, the resulting damage to our environment and strain to our financial infrastructure may simply be un-repairable. Going solar is the best way to hedge against the reality of dwindling resources.

**4.4.8 Solid Waste Disposal:**

During operation there will **no significant** amount of solid waste generated.

**4.5 LIFE CYCLE ENVIRONMENTAL PERFORMANCE OF SILICON SOLAR PANELS**

Life cycle environmental performance of silicon solar panels related to material input, manufacturing and production, use and its disposal and reuse related to the impacts of energy use and greenhouse gas emissions, habitat, local air and occupational health and safety. Details of these parameters are discussed in Table No 4.1 below which show the comparison of impacts during the material input, its manufacturing, use and disposal. Impact described in the use section is related to this project.



	MATERIAL INPUTS	MANUFACTURING AND PRODUCTION	USE	DISPOSAL AND/OR REUSE
ENERGY USE & GREENHOUSE GAS EMISSIONS	<p><b><u>Major Impact</u></b></p> <p>4.1 Fossil fuels (diesel) are used for material extraction and for transporting those materials to manufacturing plants.</p> <p>4.2 Energy from the electrical grid is also used for refining those materials</p>	<p><b><u>Major Impact</u></b></p> <p>4.3 Life-cycle greenhouse gas emissions are 40-55 grams per kilowatt-hour of generation capacity for standard silicon panels and 25-32 grams per kilowatt-hour for the newer thin-film technologies</p>	<p><b><u>No Impact</u></b></p> <p>4.4 Solar panel systems do not cause emissions of carbon dioxide or other greenhouse gases during their use</p>	<p><b><u>Minimal Impact</u></b></p> <p>4.5 It takes 1/3 of the energy to make a solar panel from a recycled one rather than using new materials</p>





	MATERIAL INPUTS	MANUFACTURING AND PRODUCTION	USE	DISPOSAL AND/OR REUSE
HABITAT IMPACTS	<p><b><u>Major Impact</u></b></p> <p>4.6 Extraction of natural resources, such as quartz, silicon carbide, glass and aluminum can cause habitat disturbance analogous to sand and gravel pit mining but there is no leaching or precipitation process involving acids</p>	<p><b><u>Major Impact</u></b></p> <p>4.7 Solid waste production is minimal</p> <p>4.8 The fabrication of silicon solar cells requires large volume of high purity water for silicon wafer cleaning.</p> <p>4.9 Many plants are designed to minimize water consumption through recycling</p> <p>4.10 All wastewater is treated and monitored prior to discharge under water permit.</p>	<p><b><u>Minimal Impact</u></b></p> <p>4.11 Solar panel arrays should be sited to have the latest impact on the land and wildlife.</p>	<p><b><u>Major Impact</u></b></p> <p>4.12 The amount of waste generated by retired panels are very small</p> <p>4.13 PV products are mostly safe for landfills, because PV materials are usually encased in glass or plastic and many are insoluble</p>

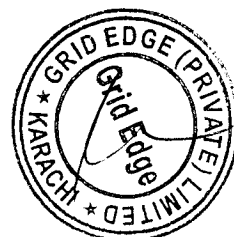


	MATERIAL INPUTS	MANUFACTURING AND PRODUCTION	USE	DISPOSAL AND/OR REUSE
LOCAL AIR IMPACTS	<p><b><u>Minimal Impact</u></b></p> <p>4.14 Emissions of solvents contribute to direct (and indirect) respiratory problems. All air emissions can be routed to pollution control equipment and covered under air permit.</p>	<p><b><u>Minimal Impact</u></b></p> <p>4.15 Fluorine and chlorine may be emitted to air as a component of dust particle during manufacturing but it could be routed to pollution control equipment and covered under air permit.</p>	<p><b><u>No Impact</u></b></p> <p>4.16 Unlike fossil fuels, PV systems produce no air pollution (sulfur dioxide, nitrous oxides, particulate matter) while operating.</p>	<p><b><u>No Impact</u></b></p> <p>4.17 Do not release particles to the air.</p>
OCCUPATIONAL HEALTH & SAFETY IMPACTS	<p><b><u>Minimal Impact</u></b></p> <p>4.18 Silica particles may be released during mining but it can be controlled through safety equipment</p>	<p><b><u>Minimal Impact</u></b></p> <p>4.19 By following SOPs (Standard Operating Protocols) hazards can be controlled through production of product.</p>	<p><b><u>Minimal Impact</u></b></p> <ul style="list-style-type: none"> <li>Solar cells require very little maintenance.</li> </ul>	<p><b><u>No Impact</u></b></p> <p>Disposal or reuse has no impact.</p>



#### 4.6 POTENTIAL ENVIRONMENTAL ENHANCEMENT MEASURES

This project is itself a sustainable development, and environmental friendly project. Among all the benefits of solar panels, the most important thing is that solar energy is a truly renewable energy source. It can be harnessed in all areas of the world and is available every day. We cannot run out of solar energy, unlike some of the other sources of energy. Solar energy will be accessible as long as we have the sun; therefore sunlight will be available to us for at least 5 billion years when according to scientists the sun is going to die. It will also save the electricity bills.



## **5. ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM**

### **5.1 ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM**

This section provides brief description of environmental issues, mitigation measures to eliminate and/or reduce environmental and social impacts to an acceptable level, institutional arrangement for the implementation of the mitigation measures and also carrying out environmental monitoring for air quality, water quality and noise pollution related parameters.

### **5.2 ENVIRONMENTAL MANAGEMENT PLAN**

This EMP describes the mitigation and management measures to address the environmental issues during construction, its regular operation and decommissioning phases of the proposed project

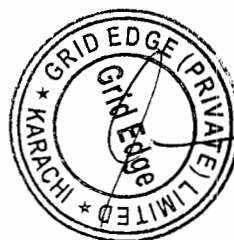
### **5.3 OBJECTIVES OF ENVIRONMENTAL MANAGEMENT PLAN**

The objectives of the EMP are as follow:

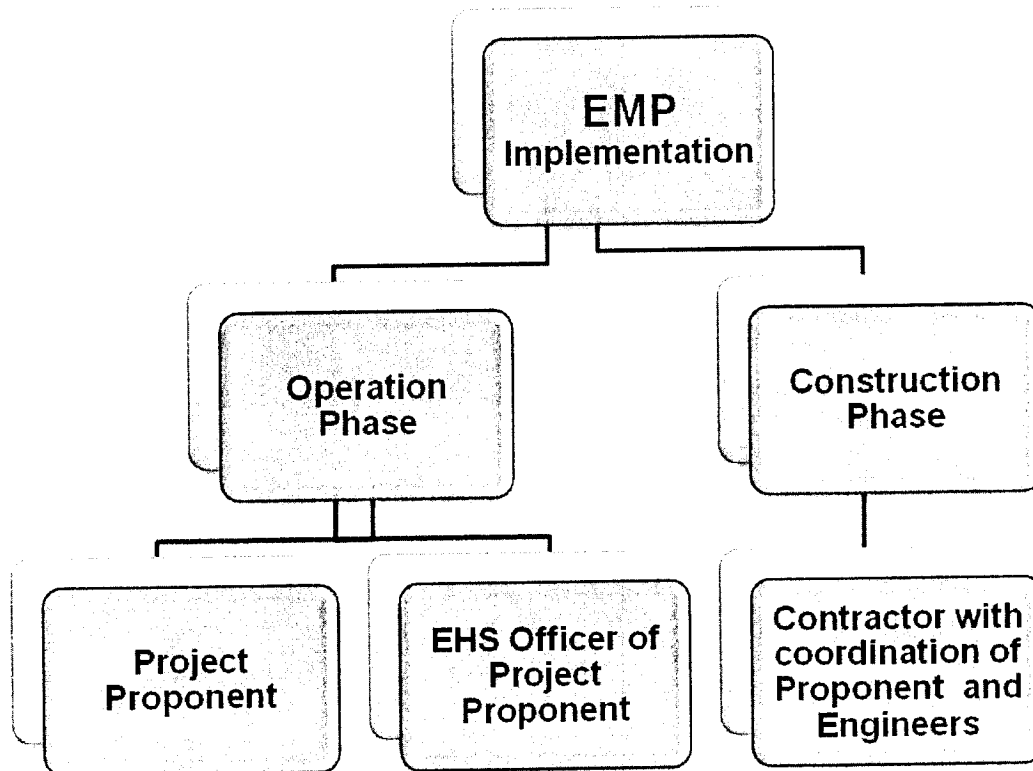
- To outline functions and responsibilities of responsible persons.
- To state standards and guidelines, which are required to be achieved in term of environmental legislation
- To outline mitigation measures and environmental specifications which are required to be implementation for all phase of the project in order to minimize the extant of environmental impacts and to manage environmental impact associated with the proposed project.
- To prevent long term or permanent environmental degradation
- To identify training requirement at various levels

### **5.4 INSTITUTIONAL CAPACITY**

Project Proponent will be responsible for Monitoring and Evaluation, but Environment consultant (of the proponent) will responsible to monitor EMP implementation in the field and reporting to the Project Proponent. The Project Proponent will integrate monitoring reports in the main monthly reports of the project. The Environment Specialist of Supervision Consultant will carry out a final evaluation at the end of the Project. District Office of the EPA at the project area will monitor the overall activity at the site



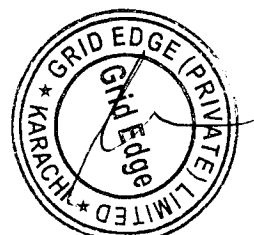
## 5.5 ORGANOGRAM FOR IMPLEMENTATION ENVIRONMENTAL MANAGEMENT PLAN (EMP)



## 5.6 TRAINING SCHEDULE

In order to effectively operate the EMP all the staff to be engaged in this activity will be trained extensively.

The person to monitor gaseous emissions, PM and noise levels will be extensively trained to handle his job capably. Training program will include use of monitoring instruments, data generation, processing, interpretation, recording and presentation.



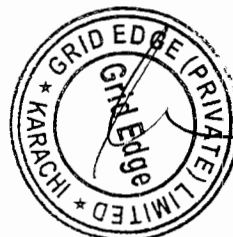
Training of the workers will be done on quarterly basis. Proponent will also be conducting the Personal Training Program at different level to address different responsible persons which involved in project. Table 5.1 explains the information about Personal Training Program.

**Table 5.1 - Personnel Training Program**

PROVIDED BY	CONTENTS	TRAINEES/EVENTS	DURATION
Organizations specializing in environmental management and monitoring	Short seminars and courses Environmental laws and regulations daily monitoring and supervision	Three seminars for Project staff	3 days
Organizations specializing in social management and monitoring	Short seminars and courses on social awareness	Three seminars for Project staff dealing in social matters	3 days
Organizations specializing in occupational health and safety issues	Short lectures relating to occupational health and safety	Two seminars for workers	2 days

#### 5.7 MITIGATION/COMPENSATION MEASURES DURING OPERATION PHASE

These are presented in **Table- 5.2** below



**TABLE 5.2: ENVIRONMENTAL MANAGEMENT PLAN**

SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
Construction phase					
1	Land Use	Land acquisition	<ul style="list-style-type: none"><li>Development of the project and installing the panels only on the specified rooftops area, no installation of any panels besides the facilities' premise</li><li>There is no direct land use associated with the project; the solar panels will be installed on the rooftops. Thus, there is no “Community displacement” and “land acquisition”</li></ul>	Proponent	Proponent
2	Air Quality	Compliance with	<ul style="list-style-type: none"><li>Installing construction</li></ul>	During Construction	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
		prescribed PEQs to control air pollution	<p>sheets on the site to prevent dust propagation where it may occur</p> <ul style="list-style-type: none"> <li>• Maintenance and management of all the construction machinery and vehicles</li> <li>• Waste burning will not be allowed.</li> </ul>	Phase by Contractor with coordination of Proponent staff	
3	Water Quality	Control of groundwater or surface water pollution from construction activities	<ul style="list-style-type: none"> <li>• Use of spill prevention trays and impermeable sheets to avoid contamination of the groundwater/surface water</li> <li>• Furthermore, septic tanks will need to be constructed which will be cemented to prevent the groundwater</li> </ul>	During Construction Phase by Contractor with coordination of Proponent staff	Proponent







SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			contamination <ul style="list-style-type: none"> <li>• Proper disposal of waste material on dumping sites to avoid leachate generation and contamination of groundwater/surface water</li> <li>• Prohibit illegal dumping of waste</li> <li>• The contractor will repair / replace / compensate for any damages caused by the Construction activities to the drinking water sources.</li> </ul>		
4	Waste	Proper & safe handling and disposal of construction related waste	<ul style="list-style-type: none"> <li>• Ensure prevention of inappropriate disposal of waste material.</li> <li>• Conduct separate collection</li> </ul>	During Construction Phase by Contractor with coordination of Proponent staff	Proponent

SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			<p>contamination</p> <ul style="list-style-type: none"> <li>• Proper disposal of waste material on dumping sites to avoid leachate generation and contamination of groundwater/surface water</li> <li>• Prohibit illegal dumping of waste</li> <li>• The contractor will repair / replace / compensate for any damages caused by the Construction activities to the drinking water sources.</li> </ul>		
4	Waste	Proper & safe handling and disposal of construction related waste	<ul style="list-style-type: none"> <li>• Ensure prevention of inappropriate disposal of waste material.</li> <li>• Conduct separate collection</li> </ul>	During Construction Phase by Contractor with coordination of Proponent staff	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
		Compliance with applicable waste management rules for hazardous and non-hazardous waste disposal Implementation of waste management plan	<p>of construction and domestic waste to promote recycling and re-use.</p> <ul style="list-style-type: none"> <li>• Dispose non-recyclable and hazardous waste material properly according to waste management rules</li> <li>• Proper disposal of waste on agreed site as per agreed method.</li> <li>• Contractor will prepare waste management plan related to construction activities; get its approval from site engineer and ensure its full implementation.</li> </ul>		



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
5	Noise	Compliance with prescribed PEQS to control Noise pollution	<ul style="list-style-type: none"> <li>The contractor will strictly follow the PEQS for ambient noise</li> <li>Control noise through control of working hours and selection of less noisy equipment.</li> <li>Prohibit use of pressure horns</li> <li>Provision of acoustic enclosures (hood and shrouds) on generator</li> <li>Proper maintenance of vehicles and construction equipment.</li> <li>Minimize/avoid unnecessary use of pneumatic drills and</li> </ul>	During Construction Phase by Contractor with coordination of Proponent staff	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			<p>other noisy machinery</p> <ul style="list-style-type: none"> <li>The personal protective equipment (PPE) will be provided to the construction workers and its usage will be made mandatory</li> </ul>		
6	Workers Health & Safety	Prevention of any possibility of work site accident /impact on worker's health	<ul style="list-style-type: none"> <li>Provision of Personal Protective Equipment to the workers</li> <li>Provision of first aid box at work site to cope with emergency situation</li> <li>Safety training to the workers</li> <li>Safe driving training to the drivers</li> <li>Adequate safety signs on</li> </ul>	During Construction Phase by Contractor with coordination of Proponent staff	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			<p>site</p> <ul style="list-style-type: none"> <li>• Provide training regarding proper handling and use of chemicals/ paints</li> <li>• Install fire extinguishers at fire handling places</li> <li>• Inspect and ensure that any lifting devices, such as cranes, are appropriate for expected loads</li> <li>• Any loss of public/ private property will be compensated by the contractor</li> <li>• Regular checks should be carried out to ensure a contractor's is following</li> </ul>		



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			safe working procedures and practices.		
7	Socio-economic Impacts	Prevention of conflicts among locals and make the project socially acceptable Empowerment of locals to possible extent Increase in employment and business opportunities for locals.	<ul style="list-style-type: none"> <li>Contractor's activities and movement of staff to be restricted to designated construction areas</li> <li>The conduct of the construction staff when dealing with the public or other stakeholders shall be in a manner that is polite and courteous all the time</li> <li>Lighting on the construction site shall be pointed downwards and away from oncoming traffic.</li> <li>The site must be kept clean</li> </ul>	During Construction Phase by Contractor with coordination of Proponent staff	Proponent/ EPA



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			<p>to minimize the visual impact of site</p> <ul style="list-style-type: none"> <li>• Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbors</li> <li>• Noisy activities must be restricted to the times given in the Project Specification or General Conditions of contract</li> <li>• The Contractor are responsible for ongoing communication with those people that are interested in / affected by the projects</li> </ul>		





SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			<ul style="list-style-type: none"> <li>• Employ local residents as much as possible</li> <li>• Promote communication between external workers and local people (e.g. join local events).</li> </ul>		
8	Clearance of site from extra / surplus material and construction equipment	Restoration of site to a similar condition prior to the commencement of the work or to a condition agreed with the project management and landscaping of the site	<ul style="list-style-type: none"> <li>• Timely removal of waste from the site to avoid congestion at work place.</li> <li>• Construction waste should be collected and disposed separately from other waste.</li> <li>• Care will be taken during handling and disposal of waste.</li> <li>• Contaminated soil (if generated) due to accidental</li> </ul>	During Construction Phase by Contractor with coordination of Proponent staff	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			<p>spills will be removed and transported to suitable site for disposal.</p> <ul style="list-style-type: none"> <li>• Avoid mixing of hazardous waste with non-hazardous waste.</li> <li>• Safe transportation of construction equipment from the site.</li> <li>• The contractor must ensure that all structure, equipment, materials and facilities used or created on site for/or during construction activities are removed.</li> <li>• Empty/available space will be covered with grassy</li> </ul>		



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			lawns. • Use of native vegetation as a part of landscape. Ornamental plant species like roses, jasmine, and seasonal flowers can be used in proposed landscaping, which is a common practice in this part.		
Operations Phase					
1	Visual Impact	Ensure Visibility criteria	<ul style="list-style-type: none"> <li>In case it was determined that there is light reflection, signs have to be installed in the areas where it causes a constraint, as well as on roads where this effect is determined</li> <li>Solar Power Plant also</li> </ul>	EHS officer of Project Proponent	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			installed on building, therefore it will have minimal visual impacts.		
2	Solid Waste	Handling and proper dispose of batteries.	<ul style="list-style-type: none"> <li>• If recycling is a possibility, then it shall be the most favorable action to dispose the PV panels.</li> <li>• Also, coordinate with the municipality whether they will be able to dispose and deal with the large quantity of waste that may be generated.</li> <li>• If not, then a private contractor has to be hired.</li> <li>• The amount of waste generated from retired solar panels is currently very</li> </ul>	EHS officer of Project Proponent	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			<p>small</p> <ul style="list-style-type: none"> <li>Solar products are mostly safe for landfill disposal because PV material are usually encased in glass or plastic and many are insoluble</li> </ul>		
3	Hazardous Waste	Handling and proper dispose of batteries	<ul style="list-style-type: none"> <li>Separate hazardous waste containers at site shall be used for hazardous waste generated by the solar energy project, and it shall be stored according to defined procedures (Cracked solar plates)</li> </ul>	EHS officer of Project Proponent	Proponent
4	Air Quality	Ambient air quality (PEQs) standards,	<ul style="list-style-type: none"> <li>Solar panel systems do not cause carbon dioxide gas</li> </ul>	EHS officer of Project Proponent	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
		Comparison of air quality of project site with surrounding area	emission or emissions of other greenhouse gasses • Solar Panel have positive impacts on air quality • PV material are usually encased in glass or plastic and do not release particles into air		
5	Health and Safety	Prevention measures against labor accidents and health problems	• Protective gear must be supplied and worn all the time. • Explanatory and preventive signs must be available around the solar power plant; barriers for sites that are only to be entered by authorized and skilled	EHS officer of Project Proponent	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			<p>workers should be implemented.</p> <ul style="list-style-type: none"> <li>Workers shall be given orientation regarding the works they are to be indulged in.</li> <li>The Emergency Response Plan is a part of the OHS procedures</li> </ul>		
6	<b>Biodiversity</b>	Prevention measures against biodiversity accidents and problems	<ul style="list-style-type: none"> <li>There are no registered protected or rare animal species in the project area. Moreover, there are no bird migration activities or any habitats around project site.</li> <li>As the panels are located on the rooftops, monitoring</li> </ul>	EHS officer of Project Proponent	Proponent



SR. NO.	PROJECT COMPONENT/ IMPACT	TARGETS TO BE ACHIEVED	MITIGATION/ PREVENTIVE ACTION	RESPONSIBILITY	
				IMPLEMENTATION	MONITORING
			activities need to be implemented to record avian species fatalities and injuries. If the numbers are high, then mitigation measures need to be carried out such as habitat restoration in nearby areas.		
7	Wastewater	Compliance with waste management rules Prevention of inappropriate waste disposal	• The project operators will be using existing wastewater facilities,	EHS officer of Project Proponent	Proponent





## 5.8 EQUIPMENT MAINTENANCE DETAIL

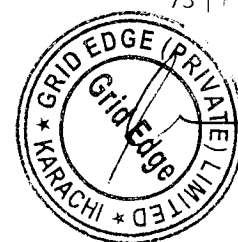
Equipment should only be inspected, tested and maintained by qualified trained personnel. If any equipment is not in good operating condition, it should be repaired immediately. Authorized dealers will be responsible for maintenance of equipments. Equipment procedures and maintenance guidelines should be kept in a central location for quick reference when needed

## 5.9 ENVIRONMENT MANAGEMENT COST

Although solar power plant project itself is an eco-friendly project however instead of project eco friendly development, separate environmental management cost also added in project. The total cost for the environmental management is estimated as 600,000.0 Pak Rupees. Details are given below in table 5.3

**Table 5.3: Environment Management Cost**

Environmental Component	Quantity	Amount PKR
(i) Tree Plantation	800	100,000.0
(ii) Health and Safety Measures and Provision of PPEs	L.S.	250,000.0
(iii) Air and Water Quality & Noise Monitoring	L.S.	250,000.0
Total Environmental Management and Monitoring Cost		600,000.0



## **6. STAKEHOLDERS/ PUBLIC CONSULTATION**

Stakeholder consultation is a means of involving all primary and secondary stakeholders in the project's decision-making process in order to address their concerns, improve project design, and give the project legitimacy. Stakeholder consultation, if conducted in a participatory and objective manner, is a means of enhancing project sustainability. Community input (both of knowledge and values) on socioeconomic and environmental issues can greatly enhance the quality of decision-making. Stakeholder consultation was therefore conducted in the project area not only to satisfy the legal requirements of the IEE process in Punjab province but also to improve and enhance the social and environmental design of the project

### **6.1 OBJECTIVES OF STAKEHOLDERS CONSULTATION**

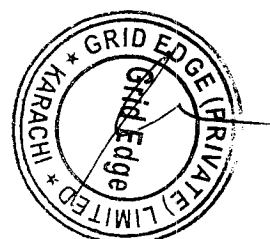
The process of public participation and consultation was endorsed in the United Nations Conference on the Environment and Development (UNCED) in 1992 through one of the key documents of the conference named as Agenda 21.

Agenda 21 is a comprehensive strategy for global action on sustainable development and deals with issues regarding human interaction with the environment. It emphasizes the role of public participation in environmental decision-making for the achievement of sustainable development.

A study was carried out with the broad objective to evaluate the impact of the project on the local population through public consultation process. The specific impact assessment aims were:

- Promote better understanding of the project, its objective, and its likely impact
- Identify and address concerns of all interested and affected parties of project area.
- Provide a means to identify and resolve issues before plans are finalized and potentially costly delays development commences, thus avoiding public anger and resentment.
- Encourage transparency and inculcate trust among various stakeholders to promote cooperation and partnership with the communities and local leadership

### **6.2 PUNJAB ENVIRONMENTAL PROTECTION ACT 2012 (AMENDED ACT)**



Public consultation is mandated under Punjab's environmental law. The Provincial Agency, under Regulation 6 of the IEE-EIA Regulations 2000, has issued a set of guidelines of general applicability and sectoral guidelines indicating specific assessment requirements. This includes Guidelines for Public Consultation, 1997 (the 'Guidelines'), that are summarized below:

#### **6.2.1 Objectives of Public Involvement**

To inform stakeholders about the project, to provide an opportunity for those otherwise unrepresented to present their views and values, providing better transparency and accountability in decision making, creating a sense of ownership with the stakeholders

#### **6.2.2 Stakeholders**

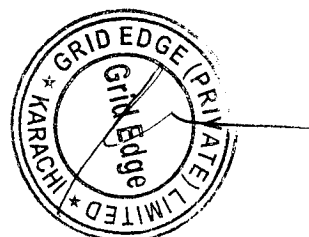
People who may be directly or indirectly affected by the project will clearly be the focus of public involvement. Those who are directly affected may be project beneficiaries, those likely to be adversely affected, or other stakeholders. The identification of those indirectly affected is more difficult, and to some extent it will be a subjective judgment. For this reason it is good practice to have a very wide definition of who should be involved and to include any person or group who thinks that they have an interest. Sometimes it may be necessary to consult with a representative from a particular interest group. In such cases the choice of representative should be left to the group itself. Consultation should include not only those likely to be affected, positively or negatively, by the outcome of proposed project, but should also include those who can affect the outcome of a proposal

#### **6.2.3 Mechanism**

Provide sufficient relevant information in a form that is easily understood by non-experts (without being simplistic or insulting), allow sufficient time for stakeholders to read, discuss, consider the information and its implications and to present their views, responses should be provided to issues and problems raised or comments made by stakeholders, selection of venues and timings of events should encourage maximum attendance.

#### **6.2.4 Timing and Frequency**

Planning for the public consultation program needs to begin at a very early stage; ideally it should commence at the screening stage of the proposal and continue



throughout the IEE process. In particular for present project the consultation was carried for six consecutive days.

#### **6.2.5 Consultation Tools**

Some specific consultation tools that can be used for conducting consultations include; focus group meetings, needs assessment, semi-structured interviews; community meetings and workshops.

#### **6.2.6 Important Considerations**

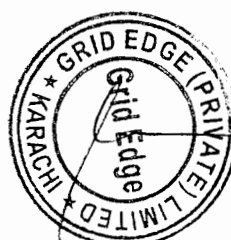
The development of a public involvement program would typically involve consideration of the following issues:

Objectives of the proposal and the study;

- Identification of stakeholders;
- Identification of appropriate techniques to consult with the stakeholders
- Identification of approaches to ensure feedback to involved stakeholders; and
- Mechanisms to ensure stakeholders consideration are taken into account

### **6.3 CONSULTATION PROCESS**

Primary stakeholders were consulted during informal and formal meetings held in the project area. The consultation process was carried out in the Punjabi and Urdu languages. During these meetings a simple, non-technical, description of the project was given, with an overview of the project's likely human and environmental impact. This was followed by an open discussion allowing participants to voice their concerns and opinions. In addition to providing communities with information on the proposed project, their feedback was documented during the primary stakeholder consultation. The issues and suggestions raised were recorded in field notes for analysis, and interpretation. By reaching out to a wider segment of the population and using various communication tools such as participatory needs assessment, community consultation meetings, focus group discussions, in-depth interviews, and participatory rural appraisal; present IEE involved the community in active decision-making. This process will continue even after this IEE has been submitted, as well as during future IEEs in which similar tools will be used to create consensus among stakeholders on specific environmental and social issues.



In the Secondary stakeholder consultations were more formal as they involved government representatives and local welfare organizations, NGO's consulted during face-to-face meetings and through telephonic conversations. They were briefed on the IEE process, the project design, and the potential negative and positive impact of the project on the area's environment and communities. It was important not to raise community expectations unnecessarily or unrealistically during the stakeholder consultation meetings in order to avoid undue conflict with community's leaders or local administrators. The issues recorded in the consultation process were examined, validated, and addressed in the IEE report.

#### **6.4 POINTS DISCUSSED**

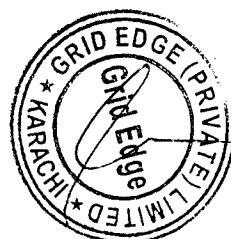
Following points were discussed during the public consultations

- Project components, its activities and impacts.
- Needs, priorities and reactions of the affected population regarding the Project.
- Grievances redress procedures.
- Entitlement checklist development for the affects of the Project.
- Evaluation criteria of the buildings.
- Basis for determining the rates of the land, houses, and other infrastructures.
- Compensation framework for the Project affects.
- Compensation criteria to be followed for the payment to the affects.
- Role of the affects in implementation of the project

#### **6.5 STAKEHOLDER CONSULTATION TECHNIQUE**

In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders and to analyze their capacity and willingness to be involved in some or all of the project and its planning process. It is important to be aware of how different power relations can distort participation. It is also important to examine how community skills, resources, and 'local knowledge' can be applied to improve project design and implementation. All of this can be achieved by careful use of the various tools of Stakeholder Consultation. Therefore, the following participatory techniques were employed during stakeholder consultations

- Informal meetings with communities.
- Focus Groups with participants in communities.



- In the consultation process for IEE, following key stakeholders were consulted:
- Local communities,
- Men
- Women and
- Community's elders attended meetings

Meetings with stakeholders consisted of community consultation meetings, focus group discussions, and in-depth interviews with men and limited focus-group discussions with women

#### **6.5.1 Proponent**

All possible impacts and mitigation measure related to the project were discussed with the proponent and management. They assured to take all suggested mitigation measures to control any discrepancy arose by the project and to make the protect environment friendly

#### **6.5.2 The responsible Authority**

Proponent shall be the responsible authority to take all measures prior to start the project and during operation

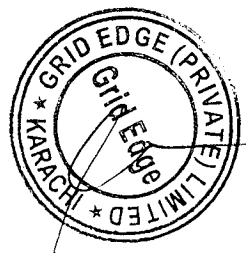
#### **6.5.3 Other departments and agencies**

For the impact analysis detailed with the management, local community, educational institutes, health institutes, hospitals and NGOs. All issues were discussed related to implementation of the project. Scoping sessions, focused group discussion and way side consultations were held with the relevant stakeholders in the area

#### **6.5.4 Environmental practitioners and experts**

Team of Integrated Environment Consultants visited the project site, had discussion with stakeholders and consulted with the local people of nearby and other villages to evaluate the project socio-economic impacts. People of the area belong to different professions like mostly belong to employment, own businesses, doctors, some in abroad, in Army, teaching, in agriculture etc. women were also consulted for their point of view regarding the betterment of the area by this project, some of them communicated but according to social value of the area they mostly hesitate to communicate comfortably and get pictured. People provide the massive information about the project and have positive remarks regarding the project development

#### **6.5.5 Government Representatives**



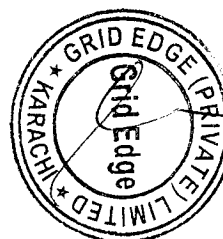
The consultations were carried out with the local government officials and officials of the following departments:

- Forestry
- Fisheries
- Irrigation
- Wild Life

The officials of Wildlife and Forest department perceived that the employment opportunities and business development would be the positive impacts on the community and people during the construction phase of the proposed project. Among the perceived negative impacts during construction phase of the project include especially road blockage, dust emissions, noise and nuisance due to heavy traffic. All officials of project study area were in favor of the project. They expect many positive, conducive and constructive impacts on socio-economic life of local community regarding jobs, business opportunity and social structure development. They were in opinion that project would improve area development through development of existing infrastructure etc. The project will also raise their level of awareness, initiate cultural diffusion, activate social mobility and bring social change regarding various aspects of their life. The officials from Fisheries and Irrigation departments appreciated the activity. They also expressed that the jobs and business opportunities for the local community will be increased due to project activities and that the infrastructure will developed that automatically lead to the development of the project area. They also expressed the concern that most of the unskilled and skill jobs should be provided for the local communities

#### **6.5.6 Affected and wider community**

There is no affected community present in the area of project. Consultant's team has consulted with the inhabitants of different villages. The remarks of people are positive regarding the project and people foresee positive impacts like employment opportunities, business, development of the area etc.



## 7. MITIGATION AND IMPACT ASSESSMENT

### 7.1 PROBLEM AND ITS OCCURRENCE

On the basis of the findings of the IEE, it is concluded that the project will not pose any adverse impact on the local population and the environment. A proper management plan shall be prepared in case of an accident like;

- Any health hazard to workers/other persons during construction or operation phase.
- Gaseous emissions to the environment.
- Inappropriate waste handling.

As mention above that, the project will not pose any adverse impacts to the environment. An assessment of impact during construction and operation phase is given in Table 7.1 - which indicates the impact and their magnitude

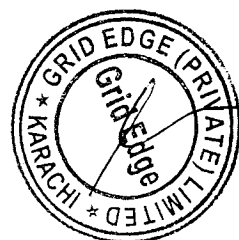




Table - 7.1: Anticipated Impacts and their magnitude of the Proposed Project

Environmental Components	Physical Environment											Biological Environment							Social Environment								
	Agricultural Lands	Soil (Erosion/Stability)	Housing	Cultural/Religious Properties	Infrastructure	Mineral Resources	Downstream River Flows	Flooding	Surface water quality	Groundwater quality	Air quality	Noise	Aquatic Ecosystem	Wetland Ecosystem	Terrestrial Ecosystem	Endangered Species	Natural Flora	Wildlife	Disease Vectors	Public Health/Safety	Land Use	Communication System	Employment	Community Stability	Cultural and Religious Value		
Components/ Activities	Construction Phase																										
	Construction Camp site	N	L	O	O	O	O	O	O	N	N	N	O	L	LA	LA		O	O	O	O	O	L	O	LB	O	O
	E&M of Equipments	N	L	O	O	O	N	N	O	O	N	N	O	O	LA	LA		O	O	O	O	O	LA	O	M	O	O
	Vehicular Movement	N	L	O	O	O	N	N	O	L	LA	M	O	O	O	O	O	O	O	LA	L	O	O	LA	O	O	
	Machinery and Equipments work	N	L	O	O	O	N	N	N	O	LA	M	O	O	O	O	O	O	O	LA	L	O	LB		O	O	



Environmental Components	Physical Environment												Biological Environment								Social Environment						
	Agricultural Lands	Soil (Erosion/Stability)	Housing	Cultural/Religious Properties	Infrastructure	Mineral Resources	Downstream River Flows	Flooding	Surface water quality	Groundwater quality	Air quality	Noise		Aquatic Ecosystem	Wetland Ecosystem	Terrestrial Ecosystem	Endangered Species	Natural Flora	Wildlife	Disease Vectors		Public Health/Safety	Land Use	Communication System	Employment	Community Stability	Cultural and Religious Values
Components/ Activities																											
Operation Phase																											
Solid Waste	N A	N A	O	O	O	N A	N A	N A	O	N A	O	O		O	O	O	O	O	O	O		NA	O	O	O	O	O
Noise	N A	O	N A	O	O	N A	N A	N A	O	O	O	O		O	O	O	O	O	O	O		NA	O	N A	NA	NA	O
Waste water	N A	N A	O	O	O	N A	N A	N A	O	N A	O	O		O	O	O	O	O	O	O		O	O	O	O	O	O

LA: Low Adverse

MA: Medium Adverse

HA: High Adverse

NA: Not Applicable

O: None or Insignificant

LB: Low Beneficial

MB: Medium Beneficial

HB: High Beneficial

ND: Not Determinable



## **7.2 WAYS OF ACHIEVING MITIGATION MEASURES**

### **7.2.1 CHANGING IN PLANNING AND DESIGN**

No such change is required in the planning and design of the project as it does not have any significant impact.

### **7.2.2 IMPROVED MONITORING AND MANAGEMENT PRACTICES**

There shall be a suitable program of monitoring and maintenance. There will be proper firefighting and health and safety plan. Any improvement in monitoring and management practices shall be addressed to concerned authorities.

### **7.2.3 COMPENSATION IN MONEY TERMS**

There is no compensation in money terms as the land is already owned by the Project Proponent. Land documents are submitted for the same.

### **7.2.4 REPLACEMENT, RELOCATION, AND REHABILITATION**

There will be no any matter of replacement, relocation, and rehabilitation as the proposed site is already owned by the project proponent. There will not be any let regarding safety factors as applicable from time to time for such buildings on all accounts



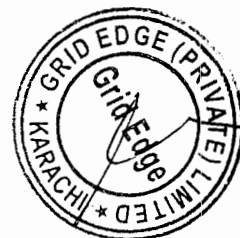
## 8. CONCLUSION AND RECOMMENDATIONS

Based on the study conducted for Initial Environmental Examination (IEE) of the project, the following recommendations are made:

- Plantation as far as permissible and within the scope of the project is carried out.
- Sustainable development approach through conservation of the natural environment is followed.
- Environmental aspects of the project should be well-taken care through implementation of the Environmental Management Plan as recommended in this report.

Quarterly monitoring of all-out environmental pollution sources by a third party would be required who will also certify that the project is running in accordance with legal requirements

On the basis of the findings of the IEE, it is concluded that the construction of the project will not pose any adverse impact on the local population and the environment. Therefore, it is recommended that the competent authority may please be issues Environmental Approval for the construction and operation of this project



## REFERENCES

Listed below are some of the documents, reports and other references consulted during the preparation of this report:

1. Information and data provided by project proponents;
2. Project Pre-feasibility Study Report;
3. Technical Design Data related to the project.
4. Information gathered through discussions with the project related persons of the project proponent;
5. Information collected from the Technical documents of various suppliers of machinery/equipment.
6. Punjab Environment Quality Standards for Ambient Air November 2010;
7. Punjab Environment Quality Standards Noise Levels November 2010;
8. Punjab Environment Quality Standards for Drinking Water November 2010;
9. Pakistan Environmental Protection Act, 1997;
10. The Punjab Environmental Protection (Amendment) Act 2012 covers aspects related to:
  - The protection, conservation, rehabilitation and improvement of the environment and the prevention, control of pollution and promotion of sustainable development;
  - Establishing complete regulatory and monitoring bodies, policies, rules, regulations and punjab environmental quality standards; and
  - To ensure enforcement, the act establishes regulating bodies i.e. Punjab Environmental Protection Council (PEPC) and responsible bodies i.e. Punjab Environmental Protection Agency (Punjab EPA) at Provincial level.
11. Environment-related Laws in Pakistan and the Province of Punjab;
12. Government of Pakistan, Pakistan Environmental Protection Agency, Policy and Procedures for Filing, Review, and Approval of Environmental Assessment, 2000;
13. Guidelines for Public Consultations –



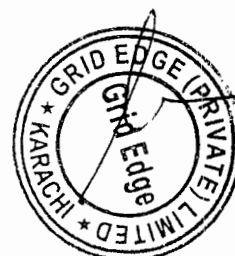
These guidelines cover:

- Consultation, involvement, and participation of Stakeholders
- Techniques for public consultation (principles, levels of involvements, tools, building trust)
- Effective public consultation (planning, stages of IEE where consultation is appropriate)

14. Workplace safety and health act 2011

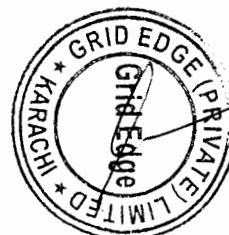
15. Land Acquisition Act (LAA) of 1894

16. Pakistan Penal Code, 1860

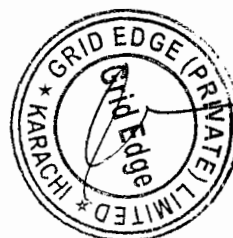


### Term of References

1. The Consultant is required to carry out an Environment Assessment Study of the Project as required under section 12 of Pakistan Environmental Protection Act 1997/ Punjab Environmental Protection (Amendment) Act 2012.
2. The Study should be comprehensive and should cover all aspects which are envisaged under the relevant national and provincials laws & regulations including but not limited to:
  - Identification and recommendation for suitable solution/treatment/mitigation measures of emissions and effluents such as wastewater and sludge etc in accordance with Punjab Environmental Quality Standards (PEQS).
  - Identification and recommendation for suitable solution/treatment/mitigation measures of solvents, oils (tar), hazardous waste, organic compounds, steam, flue gases, particulate matter and chemical compounds harmful for the environment and other substances leading to air, noise, water and soil pollution in accordance with PEQS.
3. The Study should be acceptable to the relevant national and/or provincial authorities (relevant authorities) in Punjab

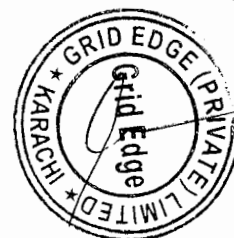


<b>GLOSSARY</b>	
<b>Air Quality</b>	Measurement of the pollutants in the air; a description of healthiness and safety of the atmosphere.
<b>Alternating Current</b>	Alternating current (AC) is an electric current which periodically reverses direction, in contrast to direct current (DC) which flows only in one direction.
<b>Consultation</b>	Consultation refers to two-way transfer of information or joint discussion between project staff and the affected population. Systematic consultation implies a sustained and rigorous sharing of ideas. Bank experience shows that consultation often yields the best resettlement alternatives, fruitful procedures for continued participation, and independent information on actual conditions for implementation.
<b>Coordinates</b> <b>Contaminate</b>	Each of a group of numbers used to indicate the position of a point, line, or plane to make impure, pollute
<b>Direct Current</b>	Direct current (DC) is the unidirectional flow of electric charge.
<b>Disclosure</b>	The action of making new or secret information known
<b>Electric Current</b>	An electric current is a flow of electric charge.
<b>Environmental Management</b>	Attempt to control human impact on and interaction with the environment in order to preserve natural resources
<b>Evaluation</b>	The making of a judgment about the amount, number, or value of something; assessment.
<b>Fossil Fuel</b>	A fossil fuel is a fuel formed by natural processes, such





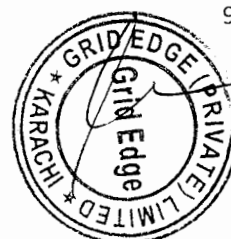
	as anaerobic decomposition of buried dead organisms, containing energy originating in ancient photosynthesis
<b>Geology</b>	A science that studies rocks, layers of soil, etc., in order to learn about the history of the Earth and its life
<b>Greenhouse Gas</b>	A greenhouse gas is a gas that absorbs and emits radiant energy within the thermal infrared range
<b>Ground Water</b>	Aquifers currently being used as a source of drinking water or those capable of supplying a public water system. They have a total dissolved solid content of 10,000 milligrams per liter or less, and are not "exempted aquifers."
<b>Hazardous</b>	Substance or material, which could adversely affect the safety of the public, handlers or carriers during transportation
<b>Household</b>	People residing under one roof, using the same hearth and operating as a single economic unit.
<b>Impact</b>	Effect on someone or something
<b>Inventor</b>	Inventor is an electronic device or circuitry that changes direct current (DC) to alternating current
<b>Jurisdiction</b>	The extent of the power to make legal decisions and judgments.
<b>Land Acquisition</b>	The process whereby a person is compelled by a public agency to cede all or part of the land a person owns or possesses, to the ownership and possession of that agency, for public purpose in return for compensation.
<b>Light</b>	Light is electromagnetic radiation within a certain portion of the electromagnetic spectrum. The word usually refers



	to visible light, which is the visible spectrum that is visible to the human eye and is responsible for the sense of sight.
<b>Mitigation</b>	The action of reducing the severity, seriousness, or painfulness of something
<b>Monitoring</b>	Supervising activities in progress to ensure they are on-course and on-schedule in meeting the objectives and performance targets
<b>Occupational Health</b>	Maintenance of the highest degree of physical, mental and social well-being of workers in all occupations by preventing departures from health, controlling risks and the adaptation of work to people, and people to their jobs
<b>pH</b>	pH is a measure of how acidic/basic water is.
<b>Photovoltaic's</b>	Photovoltaic's (PV) is the conversion of light into electricity using semiconducting materials that exhibit the photovoltaic effect,
<b>Project Area</b>	The area specified by the funding and/or implementing agency according to the Official Gazette Notification and includes the areas within the administrative limits of the Federal or a Provincial Government.
<b>Proponent</b>	A person who advocates a theory, proposal, or course of action.
<b>Proposed project</b>	It is a document that is used to convince a sponsor that a project needs to be kicked-off to solve a particular business problem or opportunity. It describes in depth, how the project is going to be commenced so that the sponsor understands what is involved early.



<b>Rehabilitation</b>	Include all compensatory measures to re-establish; at least lost incomes, livelihoods, living and social systems. It does not include the payment of compensation for required assets.
<b>Renewable Energy</b>	Renewable energy is energy that is collected from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat
<b>Resettlement</b>	Means all measures taken to mitigate any and all adverse impacts, resulting due to execution of a project on the livelihood of the project affected persons, their property, and includes compensation, relocation and rehabilitation.
<b>Scope</b>	The extent of the area or subject matter that something deals with or to which it is relevant
<b>Social Environment</b>	It includes the culture that the individual was educated or lives in, and the people and institutions with whom they interact.
<b>Solar Cell</b>	A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon
<b>Solar Power</b>	Solar power is the conversion of energy from sunlight into electricity, either directly using photovoltaic's (PV), indirectly using concentrated solar power, or a combination
<b>Solar Panel</b>	Solar panels absorb sunlight as a source of energy to generate electricity
<b>Stakeholders</b>	Include affected persons and communities, proponents,



	private and public businesses, NGOs, host communities and EPA.
<b>Topography</b>	Details of the surface features of land. It includes the mountains, hills, creeks, and other bumps and lumps on a particular hunk of earth.
<b>Turbidity</b>	Turbidity is the amount of particulate matter that is suspended in water.
<b>Voltage</b>	Voltage is the difference in electric potential between two points. The difference in electric potential between two points (i.e., voltage) is defined as the work needed per unit of charge against a static electric field to move a test charge between the two points.
<b>Watt</b>	The watt (symbol: W) is a unit of power. In the International System of Units (SI) it is defined as a derived unit of 1 joule per second, and is used to quantify the rate of energy transfer

