GSOLAR
POWER

Date: 07th September 2021

The Registrar
National Electric Power Regulatory Authority
2nd Floor, OPF Building, Sector G-5/2
Islamabad.

Subject: Application for Generation License for 1,045.925 kWp

Dear Sir,

I, Murtazain Nasser, Director, being the duly authorized representative of GSolar Power (Private) Limited by virtue of Board Resolution dated 26 July, 2021 hereby apply to National Electric Power Authority forthe Grant of Generation License to GSolar Power (Private) Limited pursuant to section 14B 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, Modification & Cancellation Procedure) Regulations, 2021 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 attacheddocuments-in-support is true and correct to the best of my knowledge and belief.

A BANK DRAFT in sum of Rupees PKR. 186,944 Rs. One Hundred & Eighty-Six Thousand, Nine Hundred & Forty-Four being the non-refundable license application fee calculated in accordance with Schedule II to the National Electric Power Regulatory Authority Licensing (Application,Modification & Cancellation Procedure) Regulations, 2021 is also attached herewith.

The application is filed in triplicate with all annexure appended with each set of the application.

Sincerely,

Murtazain Nasser
Director, GSolar Power (Private) Limited

GSolar Power (Private) Limited

Tel: +92 21 35170711-22 Website: www.gsolar.pk Email: info@greenewables.co

THE GENERATION LICENSE APPLICATION

1. Applicant's Company Profile

1.1. GSolar Power (Private) Limited (the "Applicant Company"), is registered vide Registration No. 0181198 dated 06 August 2021 under the Companies Act, 2017. The copy of certificate of incorporationis attached herewith as **Annexure - A**. The copy of Memorandum & Articles of Association is attached herewith as **Annexure - B**.

1.2. The registered office of the Applicant Company is situated at "13 C, Ittehad Commercial, Lane 7, DHA Phase VI, Karachi".

1.3. The Applicant Company is required to submit the annual return to the Registrar of Companies pursuant to section 130(1) of the Companies Act, 2017 on the date of AGM. The first AGM of the applicant Company will be held by the end of August 2022 since 31st December 2021 is the first financial year end of the Applicant Company.

1.4. The Applicant Company has financial strength to meet with the requirements of the Project. The summarized audited financial statements for 2020 & unaudited financial statements of 2021 of the sister company GSolar (Private) Limited is presented as **Annexure - C**. The Cash & Balance Certificate of GSolar Power (Private) Limited is presented in **Annexure O**.

1.5. **Directors**

1.5.1. Mr. Murtazain Nasser

1.5.2. Mr. Maaz Mashkoor

1.6. **Auditors**

Yousuf Adil Chartered Accountants are the statutory auditors of the Applicant Company.

1.7. **Form 2**

Form 2 of the company is attached herewith as **Annexure – D**.

1.8. The list of the directors, senior management, key technical and professional staff of the Applicant Company is provided hereunder: -

Name	Designation
Murtazain Nasser	Director
Maaz Mashkoor	Director

1.9. Brief introduction of the above-named officials is as follows:

1.9.1. **Murtazain Nasser** - Experienced Managing Director with a demonstrated history of working in the real estate industry. He graduated from McGill University, Canada, and completed his MBA from The George Washington University School of Business. He is a strong business development professional skilled in Business Planning, Analytical Skills, Risk Management, Managerial Finance, and Entrepreneurship.

1.9.2. **Maaz Mashkoor** - Maaz currently works in business development at Vitol Group, based out of Dubai, and oversees the group's investments in the region. He was previously working as manager strategy at Engro Corp, one of the largest private sector business houses of the country. Before that he worked for large and prestigious business houses in the Middle East such as the National Investor as well as Abu Dhabi Capital Group. Maaz holds a Bachelor's degree from University of Toronto and an Executive Master in Finance from INSEAD.

1.10. The curriculum vitae of key personnel are given in **Annexure - E** while the profile showing experience of the Applicant Company and its sister concern is attached as **Annexure - F**.

2. Rationale & Business Model

2.1. Rationale

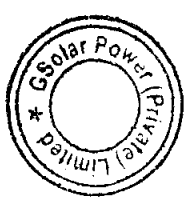
2.1.1. It is a common knowledge that availability of electricity in any country has direct effect on its economic and social factors and therefore, in order to measure the affluence of a society, the per capita energy consumption is used as an index to determine its energy sufficiency.

2.1.2. Pakistan is a country where more than 144 million people have unreliable power, and the rest have no electricity connection at all. Pakistan's cost of electricity is one of the highest in the region at 12.56 cents per unit as opposed to comparable nations such as Bangladesh and Vietnam where the rate is 5.49 or 6.89 cents per unit respectively.

2.1.3. Although Pakistan has set up natural gas plants recently, a large part of these are based on imported LNG which is expensive. In these circumstances, the use of solar power in Pakistan is quite an attractive alternative mode of generation of electric power. Further, its use does not require refining, transporting and conveying fuels and power over long distances. Moreover, solar power does not create pollution.

2.1.4. Naturally, Pakistan is located in the Sunny Belt and can take advantage of its ideal situation for utilization of solar energy. The country potential for solar generation is beyond doubt as it has high solar irradiation and enough space for installation of generation system those are ideal for PV and other solar energy applications.

2.1.5. Villages and other areas which are away from grid or distribution system of utilities can also benefit from solar power generation which will also save the extra cost of laying the system and the losses.



2.2. Business Model

2.2.1. The Applicant Company intends to sell electricity to residential, commercial, industrial and agricultural entities (Buyers) through its owned complete on-grid solution of electricity based on solar power (Generating Facilities) under the long-term Energy Purchase Agreements (EPAs)

2.2.2. In this regard, the Applicant Company has conducted financial analysis and found this model to be financially workable if there are long term contracts involved. The Company will therefore, plan, design, procure material, construct, install, operate and maintain Generating Facilities at sites of the Buyers.

2.2.3. The Applicant Company shall provide product of the Generation Facility to the Buyers on terms and conditions as agreed between the Parties so as to recover the cost of investment, working capital, operation and maintenance cost with reasonable rate of return on basis of actual delivery of electricity while taking the risk of shortfall in generation on account of reduction in solar irradiation at its own.

2.2.4. The Applicant Company shall install Generation Facility at the site of the Buyer and understands that the activity of generation and sale of electricity shall take place within the same premises without crossing any other property or requiring the use of transmission or distribution lines.

2.2.5. The electricity generated through the Generation Facility of the Applicant Company shall be fed directly into the Distribution Panel of the Buyer and in no case shall be fed or exported to the distribution system of a utility company.

2.2.6. The electricity generated through the Generation Facility of the Applicant Company shall be less than the total demand of the Buyer hence it will not be a replacement for the relevant utility company but only a partial augmentation.

3. Technical Overview

3.1. Technology

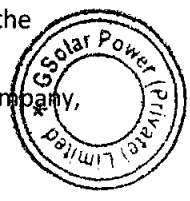
3.1.1. The electricity shall be generated by use of PV Panels to be installed at the premises of the Buyer and will be supplied directly to the Distribution Panel of the Buyer(s).

3.1.2. The Solar PV system will operate in grid interactive / grid tied mode. The grid-tie inverter will be used that will convert direct current (DC) electricity into alternating current (AC) with built in ability to synchronize with a utility line to supplement the electricity required by the buyer from the distribution company.

3.1.3. Grid-tie inverters are also designed to quickly disconnect from the grid if the utility grid will go down and it will ensure that in the event of interruption of electricity from utility, the grid tie inverter will shut down to prevent the energy flow back in the distribution system of the utility. Grid interactive system will supplement utility supplied energy to building or facility.

3.1.4. The PV System output will be designed in a manner that it will always be less than the premises load and there will be no export to the utility company's grid.

3.1.5. In case the Buyer, subject to NEPRA's permission and agreement with the utility company, opts to export excess electricity to the distribution system through net metering



arrangement, then the Applicant Company, on behalf of the Buyer, may provide requisite services.

3.1.6. The PV Panels shall convert the solar irradiation into DC electricity and by using inverters; DC supply will be converted into AC supply of 220/400 Volts. In the process, the Applicant will use equipment including:

- PV Modules including structure for their installation;
- Inverters
- Surge arrestors
- Junction Boxes
- PV / AC Electrical Board
- Main Distribution Panel
- Safety & Protection devices (Automatic with manual override)
- Wires
- Breakers
- Meters
- Online monitoring devices / data loggers for remote sensing and monitoring
- Internet access devices / connects
- Water taps for panels washing
- Aluminum Structure / Hot Dipped Galvanized Steel Structure
- Screws, Nuts/Bolts

List of Equipment with Technical details & the Single Line Diagram is attached herewith as **Annexure - G** & **Annexure - H**, as well as flow diagram is attached as **Annexure I**.

3.1.7. The configuration, technology, model, technical details and design of the Generation Facility to be acquired, constructed, developed and installed at the premises of Buyers shall be on a standard module but may have slight variations in installation on case to case basis. However, a general overview (on the basis of a model site) has been provided in **Annexure G** (Equipment and Technical Details) and supplemented by the **Annexure H** (Single Line Diagram). Grid interconnection and protections required for grid interconnection are in compliance with "NEPRA ARE (Alternative & Renewable Energy) Distributed Generation / Net Metering Rules".

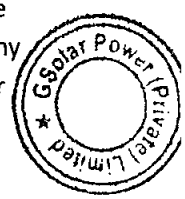
3.1.8. Before the Distribution Panel and after the PV AC Electrical Board there shall be installed the Meter for reading of the actual energy delivered through Generation Facility of the Applicant Company to the Buyer.

3.2. Capacity

3.1.1. The Applicant will deploy solar PV facilities totaling 1,045.925 kWp at Buyer premises – Nayyer Industries at Shadiwal, Gujrat, Punjab, Pakistan

3.3. Site(s)

3.1.1. The Generation Facility to be offered by the Applicant Company shall be at the premises of the Buyer and therefore the Applicant Company does not require purchasing or acquiring a particular site. Moreover, since the electricity generated by the Generation Facility of the Applicant will not be sold to any electricity utility i.e. DISCO hence it would not require any evacuation by the national grid company (NTDC) therefore the mentioning of a particular



site as required under the provisions of NEPRA Licensing (Application, Modification and Cancellation Procedure) Regulations, 2021 is not relevant in this case. However, the initial site (the Model Site) is at Shadiwal, Gujrat, Punjab, Pakistan.

3.1.2. Coordinates Latitude: 32°31'59.0"N Longitude: 74°05'25.1"E

3.4. Interconnection

Since the Generation Facility of the Applicant Company shall be installed at the site of the Buyer and shall provide electricity to that premises in order to supplement the electricity requirement of the Buyer. Therefore, the interconnection point shall also be within the premises of the Buyer at the point as identified by the Buyer. The Applicant Company shall deliver electricity to the Buyer's distribution box/panel at 400V level.

3.5. Commissioning & Expected Life

The terms as to commissioning shall be as per terms of EPA. However, the average expected life of the Generation Facility shall be 25 Years.

3.6. Operation & Maintenance

The Applicant Company shall also provide the operation and maintenance, including periodical washing of the PV modules of the Generation Facility Installed at the site of the Buyer.

3.7. Environmental

The Generation Facility by the Applicant, as visualized, will be without emissions and chemical usages; rather, shall be close to natural environment therefore may not involve environmental hazards. The Applicant Company shall use limited quantity of the tap water available at the premises of Buyer for the purposes of washing the PV modules and shall use the available sewerage for disposal to avoid any negative impact on the environment.

Our requested generation license is for small-scale solar (PV) generation on a single site of the consumer who will mainly be in Urban areas where there is little natural flora or fauna to be affected. Moreover, given the nature of the technology, there are no harmful emissions nor any natural fresh water sources are compromised. Only tap-water in small quantities is needed for cleaning on periodic basis. In fact, given the nature of the technology, it is actually beneficial for the environment since it replaces harmful fossil fuel-based power. Refer to **Annexure N** for Environmental & Social Soundness Assessment (ESSA).

3.8. Monitoring Facilities

The Applicant shall develop, install and maintain a remote monitoring facility at its premises for overall monitoring of the Generation Facility to be installed at site. The Applicant will hire trained staff to carry out maintenance activities on the installed facility at the Buyer's site. The Applicant also has a team of qualified engineers to plan and supervise the routine / regular maintenance needs. Detail of Monitoring Facilities is presented as **Annexure K**.

3.9. Eligible Site / Buyer

The Applicant Company declares the following eligibility criteria for the site/buyer for whom Generation License is required:

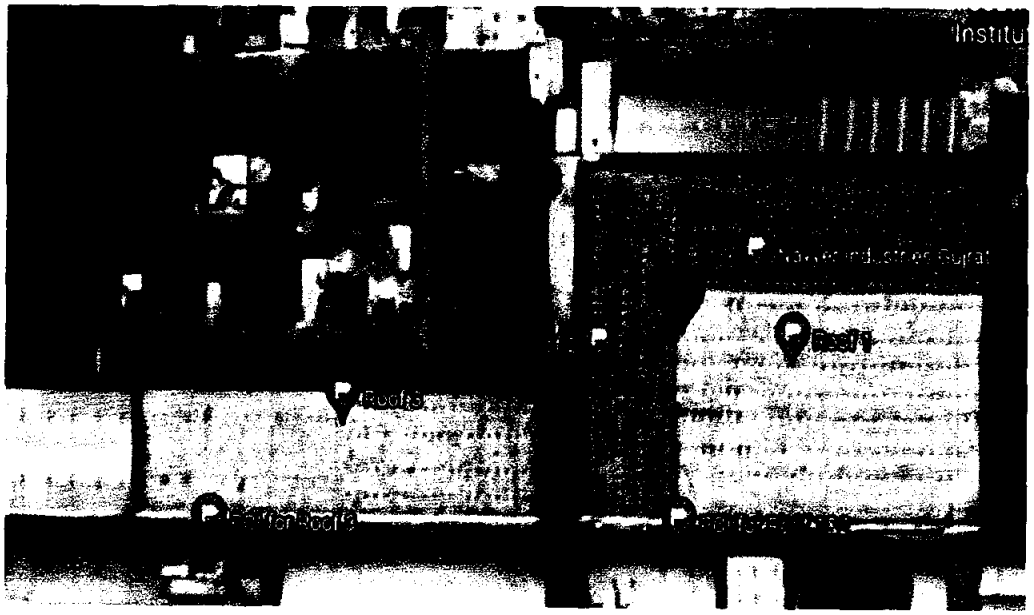
- Generation Facility to be setup should be within the site of the buyer

- Electricity generated through the Generation Facility should not be provided to any premises other than the buyer's premises/site where the Generation Facility is installed
- Electricity from the Generation Facility should be in addition and supplemental to the electricity being obtained from the electric utility company
- Interconnection point should be within the premises/site where the Generation Facility is installed
- Generation Facility installed should ensure no back flow of electricity to the distribution system of the utility
- The delivery of electricity from the PV Modules to the distribution box/panel of the buyer should not require crossing of any public road/area and the distribution network of the electric utility
- The buyer should not be a defaulter of dues of electricity obtained from electric utility company

3.10. Site Description

1	Name of Licensee	GSolar Power (Private) Limited
2	Registered/Business	13 C, Ittehad Commercial Lane 7, DHA, Phase VI, Karachi.
3	Plant Location	Shadiwal, Gujrat, Punjab, Pakistan
4	Type of Generation	Solar Photovoltaic (PV)
5	Type of Technology	Photovoltaic (PV) Cell
6	System Type	Rooftop Solar
7	Plant Capacity	1,045.925 kWp

3.11. Google Image of the Site



4. Financial Overview

4.1. Capital Cost

4.1.1. Detailed Feasibility Report of the Project is attached as **Annexure K.**

4.1.2. The Capital cost shall include the cost borne by the Applicant Company on feasibility studies, planning, designing, material, construction and installation of the Generation Facility.

4.1.3. The cost of land, step-up transformer, interconnection with distribution system of utility are not required in this case.

4.1.4. The Applicant Company aims to provide the Generation Facility of 1045.925 kWp in a period of about 12 months with an estimated cost on per Watt basis is worked out by the Applicant Company as below:

4.1.5. The expected cost of the installations under has been estimated to be US$0.545 / Wp (PKR/USD rate of 163.65). This cost does not include cost of land as facility shall be installed at the premises of the Buyers.

Description	USD/Wp
EPC Cost • Panels/Inverters/JBs/DC & AC Cables/Freight/Clearing Charge • HDG Steel/Aluminum Structure • Installation Cost	0.527
Insurance during construction	0.001
Lawyer Fees	0.005
Administrative and Development Costs	0.013
Total Costs	0.545

4.1.6. The applicant will deploy its projects in Single phase, with total of 1,045.925 kWp and will be completely equity financed.

5. Profile of Subcontractor

5.1. Reputed contractor has been selected for the construction of Nayyer Industries Private Limited. Their profile isattached as **Annexure L.**

6. Environmental

The Generation Facilities by the Applicant, as visualized, will be without emissions and chemical usages. The Applicant Company shall use limited quantity of the tap water available at the premises of Buyer for the purposes of washing the PV modules and shall use the available sewerage for disposal to avoid any negative impact on the environment.

Our requested generation license is for small-scale solar (PV) generation on site of the consumers who will mainly be in Urban areas where there is little natural flora or fauna to be affected. Moreover, given the nature of the technology, there are no harmful emissions nor any natural fresh water sources are compromised. Only tap-water in small quantities is needed for cleaning on periodic basis. In fact, given the nature of the technology, it is actually beneficial for the

GSolar Power (Private) Limited

environment since it replaces harmful fossil fuel-based power. Detailed Environmental Study of the project is attached as **Annexure M.**

7. Project Timelines

The project timelines are added in Gantt Chart form as **Annexure N.**

8. Proof of Funds

Cash and Balance Certificate of Company is attached as **Annexure O.**

9. Executive Summary & Prayer

9.1. To supplement the supply of electricity by utilities, the Applicant Company intends to set up small scale solar PV modules (Generation Facility) at Nayyer Industries Private Limited for which the Application for grant of Generation License is being submitted before the Authority in terms of Section 14B of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 read with the relevant Rules and Regulations.

9.2. For the reasons mentioned above, it is prayed that Application in hand may please be admitted and a Generation License be granted in name of GSolar Power (Private) Limited for generation of 1,045.925 kWp through Solar PV Modules, of the prospective buyer who are eligible in terms of the criteria and parameters mentioned above in this application.

GSolar Power (Private) Limited

Annexure A

Certificate of Incorporation

GSolar Power (Private) Limited

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

Company Registration Office

CERTIFICATE OF INCORPORATION

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

Corporate Unique Identification No. 0181198

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

Given at **Karachi** this **Sixth** day of **August,** Two **Thousand** and **Twenty One**

Muhammad Nasir Khan
Additional Joint Registrar

SEAL OF REGISTRAR OF COMPANIES
SECP

https://eservices.secp.gov.pk/eServices/ControllerServlet?request_id=VERIFY_ONLINE_INCORP_CERT&id=0181198

10/08/21

Company Registration Office Karachi Securities and Exchange Commission of Pakistan

GSolar Power (Private) Limited

Annexure B

Memorandum & Articles

GSolar Power (Private) Limited

THE COMPANIES ACT, 2017 (XIX of 2017)

(PRIVATE COMPANY LIMITED BY SHARES)

ARTICLE OF ASSOCIATION

OF

GSOLAR POWER (PRIVATE) LIMITED

1. The Regulations contained in Table 'A' to the First Schedule to the Companies Act, 2017 shall be the regulations of GSOLAR POWER (PRIVATE) LIMITED so far as these are applicable to a private company.

PRIVATE COMPANY

2. The Company is a "Private Company" within the meaning of Section 2(1)(49) of the Act and accordingly:

   (1) No invitation shall be made to the public to subscribe for the shares ordebentures of the Company.

   (2) The number of the members of the Company (exclusive of persons in the employment of the Company), shall be limited to fifty, provided that for the purpose of this provision, where two or more persons hold one or more shares in the company jointly, they shall be treated as single member and

   (3) The right to transfer shares of the Company is restricted in the manner and to the extent herein appearing.

TRANSFER OF SHARES

3. A member desirous to transfer any of his shares shall first offer such shares for sale or gift to the existing members and in case of their refusal to accept the offer, such shares may be transferred to any other person, as proposed by the transferor member, with the approval of the Board of Directors.

DIRECTORS

4. The number of directors shall not be less than two or a higher number as fixed under the provisions of the Act. The following persons shall be the first directors of the Company and shall hold the office upto the date of First Annual General Meeting:

   1 Murtazain Nasser

   2 Maaz Mashkoor

Company Registration Office Karachi Securities and Exchange Commission of Pakistan

GSolar Power (Private) Limited

We, the several persons whose names and addresses are subscribed below, are desirous of being formed into a company, in pursuance of this article 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 / Husband 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
Murtazain Nasser	4230107938371	Hussain Nasser	Pakistan	Businessman	House No. F-45, Block-5, Park Lane, Clifton, Karachi KARACHI SOUTH Sindh Pakistan	1	
Maaz Mashkoor	4220143895815	Mashkoor Ullah	Pakistan	Businessman	Flat No. K-504, Creek Vista Apartment, Phase-VIII, D.H.A., Karachi KARACHI SOUTH Sindh Pakistan	1	
GSOLAR HOLDING LIMITED through Murtazain Nasser	4230107938371	Hussain Nasser	UAE	Business	House No. F-45, Block-5, Park Lane, Clifton, Karachi KARACHI SOUTH Sindh Pakistan	14,998	
Total number of shares taken (in figures and words)						15,000 (Fifteen Thousand)	

Dated: the 6 day of Aug 20 21

Witness to above signatures: witness not required since the documents submitted electronically

Signature:

Address

Company Registration Office Karachi
Securities and Exchange Commission of Pakistan
SECP

GSolar Power (Private) Limited

THE COMPANIES ACT, 2017 (XIX of 2017)

(COMPANY LIMITED BY SHARES)
MEMORANDUM OF ASSOCIATION
OF

GSOLAR POWER (PRIVATE) LIMITED

1. The name of the Company is GSOLAR POWER (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 carry on businesses of solar energy system, its manufacturing through poly silicon and chemical technology, processing, casting, cell manufacturing, module manufacturing and installation thereof and also to install, run, own and manage biomass/waste-to-energy power plant, waste heat power plant, combined cycle power plant and to produce wind, biomass, wave and tidal energy and to deal in all other forms of energy and products or services associated therewith and of promoting the conservation and efficient use of energy and to perform all other acts which are necessary or incidental to the business of electricity generation, transmission, distribution and supply, subject to permission of relevant authorities.

(ii) Except for the businesses mentioned in sub-clause (iii) hereunder, the company shall engage in all the lawful businesses and shall be authorized to take all necessary steps and actions in connection therewith and ancillary thereto.

(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, managing agency, business of providing the services of security guards or any other business restricted under any law for the time being in force or as may be specified by the Commission.

(iv) It is hereby undertaken that the company shall not:
(a) engage in any of the business mentioned in sub-clause (iii) above or any unlawful operation;
(b) launch multi-level marketing (MLM), Pyramid and Ponzi Schemes, or other related activities/businesses or any lottery business;
(c) engage in any of the permissible business unless the requisite approval, permission, consent or licence is obtained from competent authority as may be required under any law for the time being in force.

4. The liability of the members is limited.

5. The authorized capital of the company is Rs. 5,000,000 (Five Million Rupees Only) divided into 50,000 (Fifty Thousand) Ordinary shares of Rs.100 (One Hundred Rupees Only) each.

Company Registration Office Karachi
Securities and Exchange Commission of Pakistan
GSolar Power (Private) Limited

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
Murtazain Nasser	4230107938371	Hussain Nasser	Pakistan	Businessman	House No. F-45, Block-5, Park Lane, Clifton, Karachi KARACHI SOUTH Sindh Pakistan	1	
Maaz Mashkoor	4220143695815	Mashkoor Ullah	Pakistan	Businessman	Flat No. K-504, Creek Vista Apartment, Phase-VIII, D.H.A., Karachi KARACHI SOUTH Sindh Pakistan	1	
GSOLAR HOLDING LIMITED through Murtazain Nasser	4230107938371	Hussain Nasser	UAE	Business	House No. F-45, Block-5, Park Lane, Clifton, Karachi KARACHI SOUTH Sindh Pakistan	14,998	
Total number of shares taken (in figures and words)						15,000 (Fifteen Thousand)	

Dated: the 6 day of Aug 20 21

Witness to above signatures: witness not required since the documents submitted electronically

Signature:

Address

Company Registration Office Karachi
Securities and Exchange Commission of Pakistan

GSolar Power (Private) Limited

Annexure K

Project Feasibility

GSolar Power (Private) Limited

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     - 4.2.2.Plant Characteristics
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1. Executive Summary

The feasibility study examines the costs, practicality, and likely outcome of a solar photovoltaic (PV) installation on the rooftop of Nayyer Industries.

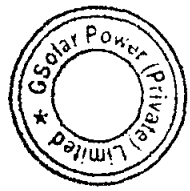
The main outcomes of the feasibility report are given below:

Technical Site Analysis: The project site is suitable for a solar PV energy system. For the purpose of estimation of power generation potential, solar specific production is assumed to be "good" (1,439kWh/kWp/year). As the project is distributed both rooftops are optimized at azimuth (1 degree), panel tilt (15 degrees) and satisfactory roof condition and structure are also assumed.

Anticipated System Information: The project will accommodate a 1,045.925 kWp solar PV system with a projected annual production of 1.506 GWh/year. Use of Longi Solar LR5-72HPH-535M Mono PERC Half cut (535 Watt) PV panel as a basis for design will result in an acceptable system weight density. The system will offset approximately 975 (not calculated) tons of carbon annually.

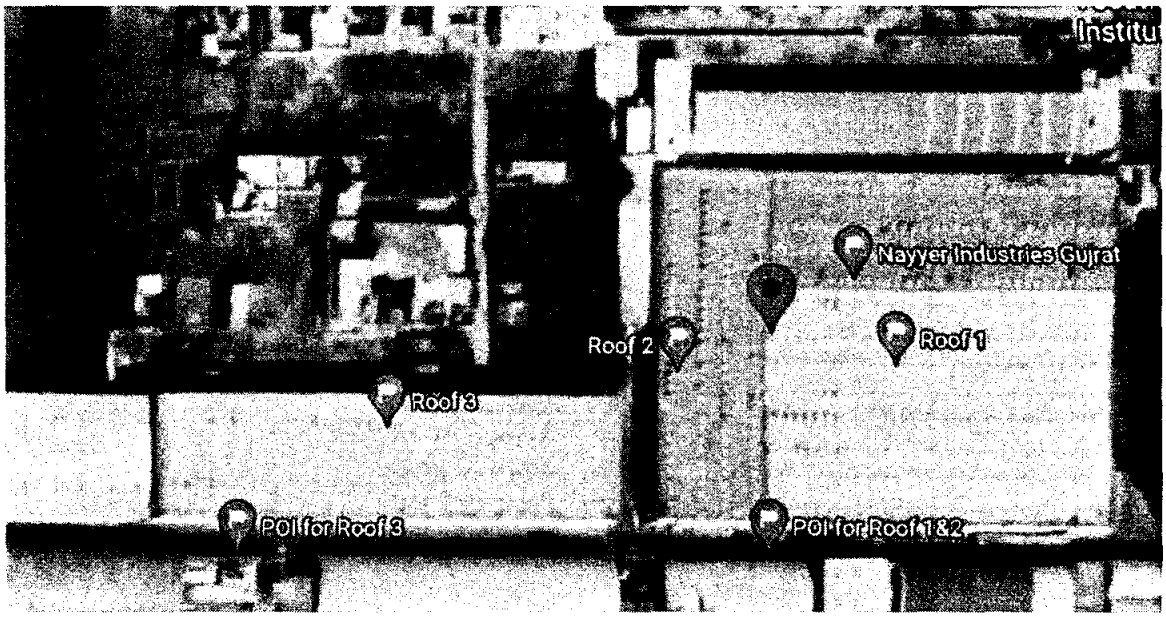
Financial Analysis: The project will be financed on a 100% equity model. The total estimated project cost is USD 570,342 (PKR/USD rate: 163.65).

Based on the technical and financial analysis, the installation of a 1,045.925 kWp Solar PV System on the rooftop of Nayyer Industries is deemed to be feasible.



Introduction

The project site is the rooftop of Nayyer Industries Gujrat. The exact coordinates of the project site are: Latitude: 32°31'59.0" N Longitude: 74°05'25.1" E. A bird's eye view of the project site is given in the figure below:



2. Current Energy Demand and Supply Situation

As per the historical consumption data, the total electricity consumption during last one-year Jul 2020 - Jun 2021 was 10.07 GWh from the grid (GEPCO).

3. Technical Analysis

4.1. Site Conditions

The following tasks were carried out:

- Global Horizontal Irradiation, annual and inter-annual variation was assessed.
- Near shading objects were taken into account for placement of PV modules.
- Area required for selected module technology was calculated. Keeping in view available area and minimum inter row shading, tilt angle and appropriate spacing was calculated from near shading objects.

Details of the finalized parameters are given under section 3.5.1.

4.2. Technology Review and Selection

4.2.1. Technology Selection

1	Type of Module	LR5-72HPH-535M
2	Type of Cell	Mono PERC
3	Dimensions of Each Module	2256*1133*35mm
4	Weight	27.2kg

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5	No. of Modules	1955
6	Total Land Area Used	Rooftop
7	Module Frame Anodized	Anodized Aluminum Alloy Frame
8	Nominal Max. Power (P Max)	535W
9	Opt. Operating Voltage (Vmp)	41.5V
10	Opt. Operating Current (Imp)	12.9A
11	Open Circuit Voltage (Voc)	49.35V
12	Short Circuit Current (ISC)	13.78A
13	Module Efficiency	20.9%
14	Operating Temperature	-40°C ~ +85°C
15	Max. System Voltage	DC1500V
16	Module Fire Performance	UL type 1 or 2 (Class II)

Panel wattage and brand may be changed to another equivalent Tier 1 brand depending upon availability.

S No.	Specification of Strings	Data
1	No. of Strings	113
2	Modules in Strings	15*7*5+20*6*5+15*8*1+20*6*1+15*9*2+20*5*2+20*6

PV Capacity

S No.	Specification	Data
1	Total Site	1045.925KW
2	Net Capacity Factor	16.43%

Inverters

S No.	Specification	Data	
1	Manufacturer	Huawei	Huawei

2	Capacity of each Unit	100KW	60KW
3	No. of Inverters	8	1
4	MPPT Input Voltage Range	200V – 1000V	200V – 1000V
5	Rated Input Voltage	1100V	1100V
6	Max Input Voltage	600V	600V
7	Total Power	100KW*8, 110000VA*8	60KW, 66000VA
8	Max Input Current for each MPPT	26A, 40A Isc	22A, 30A Isc
9	Max Output Current	160.4A @400Vac	95.3A @400V
10	Output Electrical System	3W+(N)+PE	3W+(N)+PE
11	AC Nominal Voltage	400V	400V
12	Rated Power Frequency	50Hz	50Hz
13	Efficiency	98.6%	98.7%
14	Relative Humidity (Non-Condensing)	0 ~ 100%	0 ~ 100%
15	Weight	90 kg	74 kg
16	Degree of Protection	IP66	IP65

Junction Boxes

S No.	Specification	Data
1	Number of J Boxes	9
2	Input Circuits in each box	6-14
3	Max. Input Current for each circuit	16A
4	Protection Level	IP54
5	Over Current Protection	Fuses (Builtin)
6	Surge Protection	1500V

PV Mounting Structure

S No.	Specification	Data
1	Structure 1	Aluminum 1x1 Portrait Wind speed = 35m/s
2	Tilt of Array Frame	15 Degrees

Foundation Pillars

S No.	Specification	Data
1	Foundation Structure	Chemical Anchoring

Data Collecting System

S No.	Specification	Data
1	System Data	Continuous on-line logging and monitoring over web portal
2	Weather Station	Collecting actual Weather Data for PR

Solar PV Yield Estimation and Simulation of Model Site

The aim of yield estimation is to predict the average annual energy output of the site. Helioscope Software is used for simulation and near shading analysis.

Model and Operation: No Export to Grid

The solar system will have export control device to make sure that PV power generated by the inverters is on par with power consumption of the site load. A device will measure load at injection point and the limit power of inverters by changing register values. AC output is implemented in reference to energy flow at grid connection point which will reduce inverter AC output of the inverter if site load will be less than the solar production.

4.2.2. Plant Characteristics

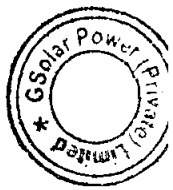
Generation Voltage: 230/400 V three phase four wire system

Power Factor at rated power: 1

Frequency: 50 Hz

Generation characteristic: Inverter has built-in features of controllable active power ramp following grid disturbance or normal connection, voltage regulation and frequency response. There are no additional control metering and instrumentations.

4.2.3. Design Parameters



The following tasks were carried out for PV layout and shading.

- Assessment of shading (horizon and nearby building)
- Outline layout of area suitable for PV development
- Designing row spacing to reduce inter-row shading and associated shading losses.
- Designing the layout to minimize cable runs and associated electrical losses.
- Creating access routes and sufficient space to allow movement for maintenance purposes.
- Choosing a tilt angle that optimizes the annual energy yield according to the latitude of the site and the annual distribution of solar resource.
- Module cleaning strategy.
- Simulating the annual energy losses associated with various configurations of tilt angle, orientation and row spacing. The optimized configuration and simulation results are given in section "Energy Yield Prediction".

4.3. Plant Layouts

PV layouts of the site are given in the following section.

Layout Figure 2: 2D Layout of rooftop of Nayyer Industries

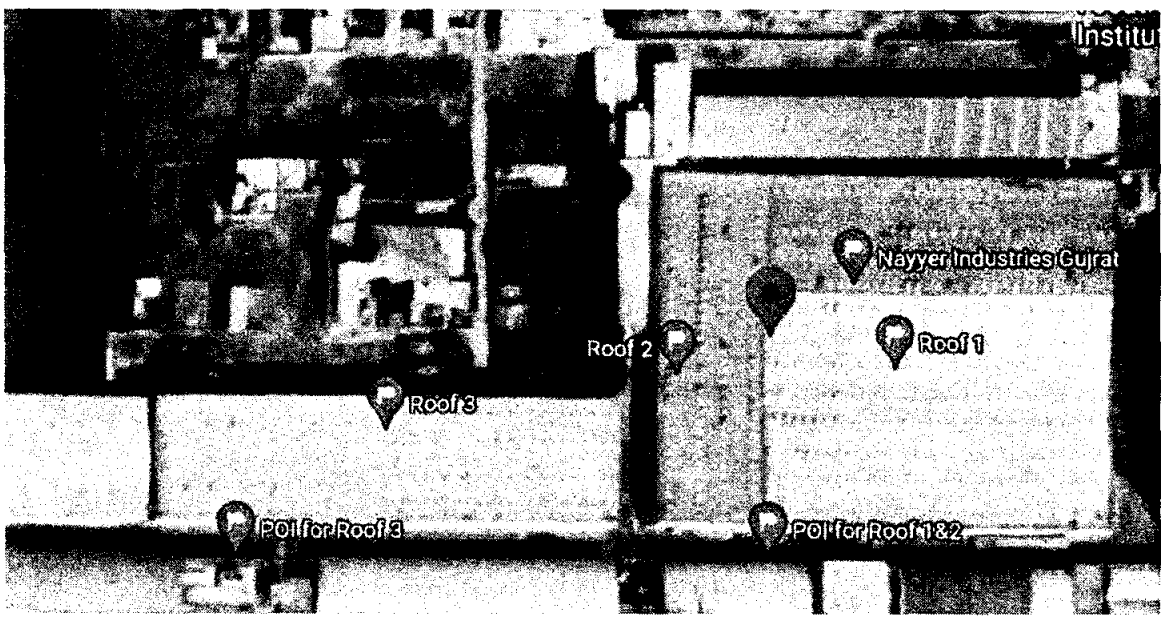


Figure 3: 2D Layout of rooftop of Nayyer Industries Gujrat showing solar panel locations.

4.4. Electrical Design

The electrical system comprises the following components:

- Array(s) of PV modules
- DC/AC cabling (module, string and main cable)
- DC connectors (plugs and sockets)
- Junction boxes and combiners
- Disconnects/switches
- Protection devices e.g. fuses, surge protective devices, beakers
- Energy Metering
- Earthing

The single line diagrams of DC and AC sides are given below. The single line diagram includes the protection devices that will be used for safe and smooth operation of the system.

Protections DC Side: String Fuses, Surge Protective Device (built-in)

AC Side: MCBs, Main Breaker

4.5. Energy Yield Estimation

The energy yield prediction provides the basis for calculating project revenues. The aim is to predict the average annual energy output for the lifetime of the proposed power plant.

To estimate accurately the energy produced from a PV power plant, information is needed on the solar resource and temperature conditions of the site. Also required are the layout and technical specifications of the plant components.

A number of solar energy yield prediction software packages are available in the market. These packages use time step simulation to model the performance of a project over the course of a year. PVsyst software has been used for energy yield prediction for this site and its results are given below.

5. Financial Analysis

Cost/watt: USD 0.545 (Capex)

Total Project Cost for 1,045.925 kWp Solar PV System: USD 570,342 (Capex)

Equity: 100%

Debt: 0%

PKR/USD rate: 163.65

6. Safety and Emergency Plans

- Only qualified and authorized electricians will be allowed to undertake servicing or maintenance tasks.
- The authorized personnel will wear appropriate equipment, including a safety harness to restrain from falling off the roof, sturdy shoes that will have thick rubber soles to provide electrical insulation and good grip and appropriate clothing for personal protection, including a hat, sunglasses, gloves and long pants and sleeves.
- Lock out and tag out procedures will be used before commencement of maintenance tasks.
- On-going operation and maintenance concerns for solar power systems will be addressed properly. These systems are exposed to outdoor weather conditions that enhance the aging process, and the infrastructure needs to be in place for the on-going maintenance of these systems to assure their safe operation.
- Properly grounded or double insulated power tools will be used for maintenance tasks. Tools will be maintained in good condition.
- Working on electrical equipment and circuits will be carried out in de-energized state.
- Proper pathways will be available for operation, maintenance and firefighting.
- Fire protection and suppression will be placed at site.

7. Training and Capacity Development

Trained and qualified personnel will be available at site 24/7 with proper safety and firefighting training. Training program will focus on but not limited to Solar Resource Assessment, Site Survey, Technology, Engineering Design, Regulation, Policy, Metering & Billing, and Project Management of Rooftop Solar System. The following components will include in training and development program.

- Collection of Resource Data
- Variability and uncertainty of resource data
- Site evaluation

- Crystalline and Thin film technology comparison
- Rooftop solar system components
- Module mounting structure selection
- Inverter selection
- Design of PV Array
- Shadow Analysis
- DC cable sizing
- DC cable layout
- Protection and Metering
- Installation and testing standards for solar PV plants
- Solar Module testing standards
- Economy of Rooftop Solar System
- Detailed Project Report
- Operation and maintenance of rooftop solar system
- Safety and fire-fighting training

8. Environmental Aspects

Every energy generation and transmission method affect the environment. Conventional generating options can damage air, climate, water, land and wildlife, landscape as well as raise the levels of harmful radiation. PV technology is substantially safer offering a solution to many environmental and social problems associated with fossil and nuclear fuels. Solar PV energy technology provides 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 C02 emissions and normally absence of any air emissions or waste products during their operation.

The use of solar power has additional positive implications such as:

- Reduction of the emissions of the greenhouse gases (mainly (02, NOx) and prevention of toxic gas emissions (502, particulates)
- Reduction of the required transmission lines of the electricity grids

9. Socio-Economic Aspects

In regard to the socio-economic viewpoint, the benefits of exploitation of solar PV system comprise of:

- Increase of the regional/national energy independency
- Provision of significant work opportunities
- Diversification and security of energy supply
- Support of the deregulation of energy markets

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10. Conclusion

This feasibility study is conducted to ascertain the technical feasibility and commercial viability of installation of 1045.925 kW rooftop PV system installation at Nayyer Industries. Installation of the PV system will result in annual power generation of 1.506 GWh. The results of the financial analysis indicate that the project is feasible. Based on the outcomes of both the technical and financial analysis, the project is deemed to be viable.

Annexure M

Environmental & Social Soundness Assessment (ESSA)

GSolar Power (Private) Limited

ESSA (Environmental and Social Soundness Assessment)

Executive Summary

GSolar Power (Private) Limited intends to develop a 1,045.925 kWp rooftop solar photovoltaic (PV) at Nayyer Industries Private Limited. This document presents the results of an initial environmental examination (IEE) analyzed for the construction and operation of the proposed Project.

The project will be developed as a rooftop solar plant, connected to the internal grid of Nayyer Industries Private Limited. Conversion of solar panel electrical output from direct current (DC) to alternating current (AC) will be achieved by means of string inverter stations called 'powerblocks'.

Description of Environment: Physical Environment

It is subtropical climate in Gujrat, rain, monsoon ravaging and hot in summer and autumn.

Temperature:

The month with the lowest average high temperature is January (32°C). The month withthe highest average low temperature is June (21°C). The coldest month (with the lowest average low temperature) is January (10°C).

Rainfall:

The wettest month (with the highest rainfall) is August (283.5mm). The driest month (with thelowest rainfall) is November (5.1mm).

Humidity:

The average annual relative humidity is 55.92% and average monthly relative humidity rangesfrom 29.5% in May to 71.3% in August.

Project Environmental Impacts and Mitigation Measures:

This section discusses the potential environmental impacts, assesses the significance, recommends mitigation measures to minimize adverse impacts, and identifies the residual impacts associated with the proposed activities of the project during the construction andoperation phase of the proposed project at the proposed site and of secondary actions likepotable, raw water and wastewater lines.

Identification of Potential Impacts

In the first step, potential impacts of the project are identified, using professional judgment, published literature on environmental impact of similar projects, environmental guidelines and checklists, and field visits.

- Impact on Occupational health and safety/ Public Health (of contractors, workers andnearby community. It includes safety at work, Fire, explosives, diseases etc.)

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- Ground water or surface water
- Impact on energy
- Impact on natural resources
- Impact on aesthetics
- Impact on land use
- Impact on land form
- Impact on soils
- Impact on traffic and transportation
- Noise or vibration
- Air quality (ambient air quality and indoor air quality).
- Solid Waste Management (including domestic waste, construction waste)
- Impact on population
- Impact on utilities and infrastructure
- Socio-economic impact (people, their social, cultural values, and aspirations)

Design Phase

Design phase is the phase that is meant for the preparations prior to the construction. During design phase, engineers (meant for construction) will come and visit the site. Necessary preparations will be started for construction. Gant chart will be prepared. Visits by the engineers and contractors to check the site and structure to be build but there will not be routine or regular visits to the site but once in aweek and design phase will last only for a month or so.

Impacts

Prediction

Impact on Air

During design phase, air emissions that exceed federal or provincial limits or standards, will not be exceeded because during design phase, there would be lesser visits to the site, lesser would be the atmospheric emissions. And the source of these emissions would be the motor vehicles only (for personal use). There would be no hazardous emissions (e.g. high amount of NOx, SOx and COx) and no objectionable odours as well as alternation of air temperature.

Impact on Ground water/ surface water

There would be no utilization or alteration to the course or flow of water during design phase so therewould be no impact on this component of environment.

Impact on Solid Waste

It may create only litter and trash waste (recyclables). Noise Impact

It will not increase significant amount of noise during design phase of the proposed project and will be within acceptable limits or NEQs.

Impact on Soils

There would be no change in soils and land forms i.e. the construction activity is not going to occur onground.

Impact on Land forms

Land forms will not change and this component is also having no impacts as there would be no change inground contours. There are no unique physical features at the site so land forms will not be changed.

Impact on Land use

The project will have a positive impact on land use but during design phase the land use is not going tobe altered, so this impact would be neglected in this phase.

Impact on energy

Design phase is not going to alter or use the energy like electricity, gas, petrol etc. in excessive amount as there will not be routine or regular visits to the site but once or twice in a week and design phase will last only for a month or so.

Impact on transportation and traffic circulation

There will be few additions to the movement of additional vehicles but these will also be for once or twice ina week during design phase. In this phase, there is no need for the additional parking facility. This wouldin turn lead to no traffic hazards.

Impact on natural resources

There won't be any increase in the rate of usage of any natural resource like any minerals, additional fuel for vehicles, oil, construction materials, and natural food products. But there would be increase inthe amount of usage of paper for map-making, enlisting items (e.g. types of construction materials to be used), letter writing and receipts (e.g. of billing & quotations), etc.

Impact mitigation

- Try to recycle the paper and prevent throwing it in the ordinary bin.
- Use of computer technology i.e. E-mails instead of focusing on paper
- Lessen the paper use and conserve the natural resources.

Impact on population

This project is not going to disturb or relocate the existing community, so there would be no change inpopulation.

Impact on utilities and infrastructures

There would be no alteration in the existing utilities like communication system, water courses, power transmission lines, electrical wirings, etc. due to the project's design phase. There would be no impact onnearby infrastructure e.g. nearby shops/malls, residences, institutes, mosques, communication offices, banks etc. during design phase.

Impact on economy

The economy is having no adverse effects on local or regional income levels, land values, or employment etc. but there will be regional beneficiary impacts on income during design phase of theproject in such a way that there will be hiring of consultants, engineers, contractors and labors etc.that will increase their income.

Impact on Public Health

The design phase will impart no adverse potential health effects to the people.

Impact on Flora/ Fauna

There will be no disturbance to the existing flora and fauna of the proposed design phase of theproject.

Impact on Aesthetics

No change would result in any scenic vista or aesthetics of the vicinity. No visual or temporary scenic blight during design phase.

Construction Phase

Construction phase is the phase that is meant for the construction. Contractor responsibility is to bringlabor, materials and equipment from suppliers. Then in the next step there will be commencement of the construction, construction vehicles & machines (concrete mixer machine and trolleys) and materials (course aggregate and fine aggregate, cement, bricks) and other equipment and tools (trolleys, cutters, hammers, saws, ladders, screwdrivers, wrenches, steel reinforcement, scaffolding etc.) will be assembled. This section is also focusing the potential impacts (both positive and negative) related to the construction phase along with the mitigation measures stepwise because it is likely that the new construction activities will surely affect the surrounding areas.

Impact on Air

The impact on air of this construction activity will be for short-term i.e. for construction phase only. Therefore, no high violation will be resulted.

Impact on Ground water/ surface water

There would be no drilling and boring holes in the groundwater for the construction activities. There would be no alteration to the course or flow of water during this phase so there would be less impacton this component of environment.

Noise Impact

The project site is located away from residential area. So, noise will not create any harmful impact.

Impact on Soils and landform

There will be change in soil condition. Soil erosion will decrease and it will positively impact by reducing carbon footprints.

Impact on Flora and Fauna

There will be no impact on Flora and Fauna because the construction is being done in an urban area.

Impact on Land use

This is a rooftop project so land use will not be impacted. Impact on energy

Construction phase is going to use the energy like electricity, petrol or diesel in excessive amount as there will be routine or regular visits to the site (i.e. energy will be used for transport in the form ofpetrol or diesel) and for moving machinery.

Impact Mitigation

There will be a minimal impact on the use of energy as this phase is for short term period say e.g. 5-6months and the only solution is to use these energy resources in conservation mode (i.e.

minimize theuse but do not misuse like for example, keep turning on the machine even when it is not required.)

Impact on transportation and traffic circulation

There will be additions to the movement of additional vehicles during construction phase but there are already existing alternating routes for traffic (street traffic) so no need to define alternating routesand parking facilities.

Impact mitigation

For transportation of the construction equipment, routes and duration must be defined. Impact

onpopulation

This project is not going to disturb or relocate the existing community, so there would be no change inpopulation during this phase as well.

Impact on utilities and infrastructures

There might be little disturbances to the existing utilities like communication system, water courses, power transmission lines, electrical wirings and nearby infrastructure e.g. nearby residences, mosques, communication offices, etc. during construction phase. But that is usually in terms of noise only and easily neglected.

Impact on economy

The economy is having positive impacts on local and regional income levels, land values, & employment in such a way that there will be hiring of consultants, engineers, contractors and laborsetc. that will increase their income. Therefore, this project will surely enhance socioeconomic welfare
e.g. health and employment (of labor, contractors, environmentalists, equipment/ materials suppliers, nearby hotels).

Accidental Risk

There may be accidental risks like falls or slips; cuts or injuries during hammering, sawing and drilling; and electric failure or sudden short circuit during electrocution works. There will be no handling of such chemical, drugs, radiations or explosives during construction phase that leads to catastrophic events or accidents.

Impact mitigation

Trained workers must be hired for construction by the contractors.

First aid team must be assigned by the hospital management to provide aid to the workers during time ofemergency.

Impact on Aesthetics

There will be visual, temporary scenic blight during construction phase due to the construction activity but as this will be temporary and only if there is no containment of the construction materials dumping and usage, so it is neglected and predicted that the current project will impart no negative impact on the aesthetics of the area.

Impact mitigation

Containment or enclosure must be provided around the storage of construction materials.

Impact of Solid Waste

Solid wastes generated from construction include abandoned construction materials. These solid wastes are usually harmless but will affect environmental sanitation of the construction site and causeenvironmental damage of improperly dumped offsite.

Impact Mitigation

- Implement Solid Waste Management procedure of GSolar Power (Private) Limited.
- Construction waste must be collected separately with segregation and routinely.
- Multi-compartment collection bins should be installed to facilitate reuse, recycle of this kind of waste i.e. if the construction material is in such form that can be reused or recycled so put separatebins for that and they can either be reused or recycled at the current project or if it is not needed then sell and transport it to the local market in sealed containment.
- The solid wastes must be collected regularly by the solid waste management authority andcleaned up by the contractors in a timely manner.
- The construction activity should be taken place in containment, boundary and limits so that it doesnot create harm to any person, place or property.