Ref.: BSPPL/GLA/EFLC-SAH/23-001 **Date:** September 04, 2023.

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

Subject: **Application for Generation License/Concurrence Application for 3 MWp PV Solar Plant at FrieslandCampina Engro Pakistan Limited, Sahiwal.**

Dear Sir,

I, **Saleem uz Zaman, Director,** being the duly authorized representative of **Burj Solar Energy (Private) Limited** by virtue of Board Resolution dated July 17th, 2023 hereby apply to National Electric Power Regulatory Authority for the Grant of Generation License/Concurrence to **Burj Solar Energy (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 bank draft in sum of Rupees Four Hundred Eighty-Five Thousand, Eight Hundred and Seventy-Nine Only Rs. 485,879 /- 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.

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

Sincerely,

Saleem uz Zaman
(Director)

BURJ SOLAR ENERGY (PVT) LTD.

Ref.: BSPPL/GLA/EFLC-SAH/23-002 **Date:** December 20, 2023.

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

Subject: Addendum to Application for Generation License/Concurrence Application for 3 MWp PV Solar Plant at Engro Friesland Campina, Sahiwal.

Ref: Our GL application BSPPL/GLA/EFLC-SAH/23-001 dated 04.09.2023

Dear Sir,

With respect to our GL application for the subject location and plant, we would like to make an addendum to the same requesting to replace "National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999" and should instead be read as "National Electric Power Regulatory Authority Licensing (Application, Modification, Extension and Cancellation) Procedure Regulations 2021" in all sections of the GL application.

Sincerely,

Saleem uz Zaman
CEO
Burj Solar Pvt. Ltd.

BURJ SOLAR ENERGY (PVT) LTD.

Extracts from the Resolution passed by the Board of Directors of Burj Solar Energy Pvt. Ltd. On 17th July 2023

RESOLVED that an application for the Generation License (**"the GL Application"**) be filed by and on behalf of Burj Solar Energy Pvt. Ltd. **("the Company")** with the National Electric Power Regulatory Authority (**"NEPRA"**), in connection with the GL Application for the Company in respect of the Company's 3.006 MWp Solar power Project at Friesland Campina Engro Pakistan Limited, Sahiwal (**"the Project"**).

Further Resolved that Mr. Saleem uz Zaman, holding CNIC 42301-10948355-5, Director of the Company, be and is hereby authorised to sign the GL Application, and any documentation ancillary thereto, pay all filing fees, and provide any information required by NEPRA in respect of the Project, and do all acts and things necessary for the processing, completion and finalization of the GL application.

CERTIFICATION

CERTIFIED that, the above resolution by circulation was duly passed by the Board of Directors of Burj Solar Energy Pvt. Limited on 17th July 2023 for which quorum of directors was present.

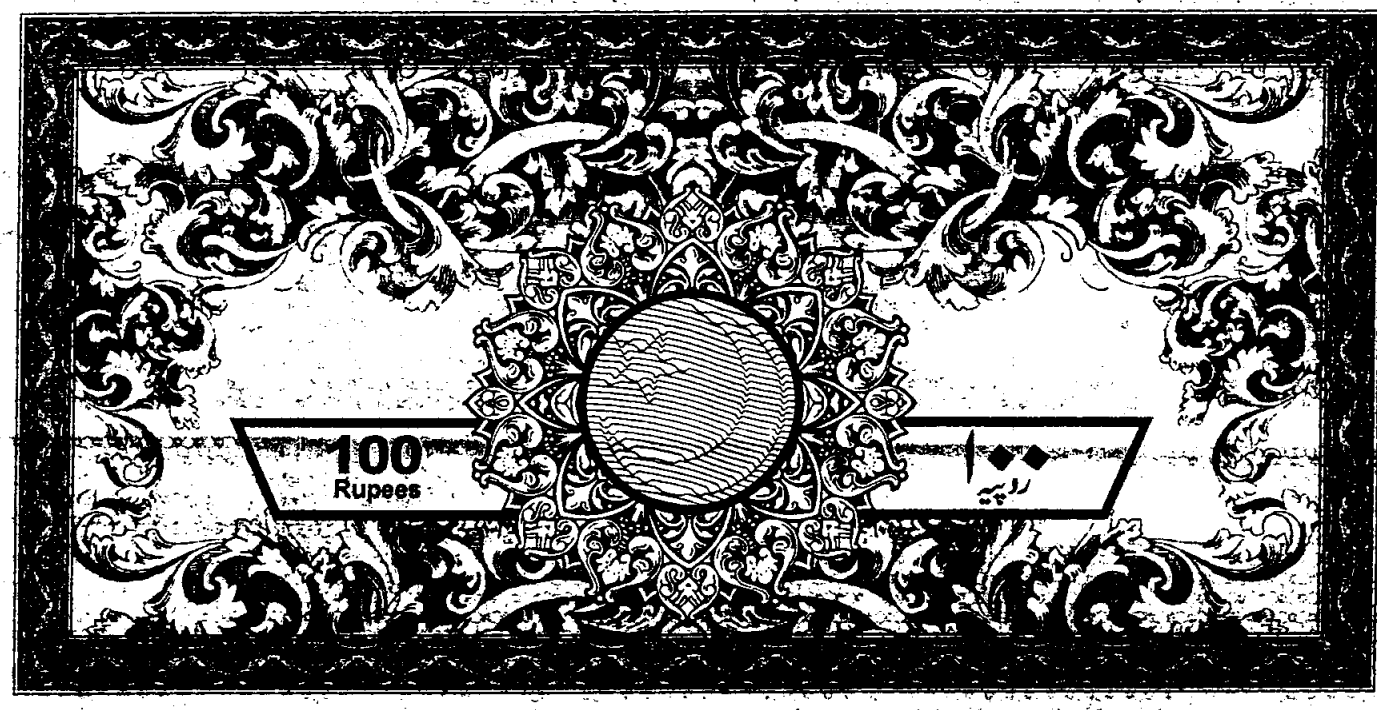
FURTHER CERTIFIED, that the said resolution has not been rescinded and is in operation and that this is a true copy thereof.

Saleem uz Zaman
Director

BURJ SOLAR ENERGY (PVT) LTD.

Saad uz Zaman
Director

AA229873



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AFFIDAVIT

I, Saleem uz Zaman S/O Qamar uz Zaman, Chief Executive Officer of Burj Solar Energy (Private) Limited, Office # 202, 11-C Al Murtaza Commercial Lane-2, DHA Phase-VIII, Karachi, the duly authorized representative of the Applicant Company depose on oath that the contents of the accompanying Application for Grant of Generation License and the supporting documents thereto are true and correct to the best of my knowledge and belief, and that nothing, material and relevant, has been kept concealed by design.

BURJ SOLAR ENERGY (PVT) LTD.

Deponent

Saleem uz Zaman
CEO
Burj Solar Energy (Private) Ltd.
20th July, 2023

APPLICATION DETAILS

THE GENERATION LICENSE APPLICATION

1. APPLICANT COMPANY'S PROFILE

1.1. Burj Solar Energy (Private) Limited (the "Applicant Company"), is registered vide Registration No. 0083734 dated 08th July 2015 under the Companies Ordinance, 1984. The certified true copy of certificate of incorporation is attached herewith as **Annexure — I in Section-2.** The certified true copy of Memorandum & Articles of Association is attached herewith as **Annexure — II in Section-2.**

1.2. The registered office of the Applicant Company is situated at "Office # 202, 11-C, Al-Murtaza Lane-2 , DHA Phase-VIII, Karachi".

1.3. The Applicant Company is since not required to submit the annual return to the Registrar of Companies pursuant to Section 156 of the Companies Ordinance, 1984, therefore the information, in as close a form and content as possible, laid down in the third schedule to the Ordinance is being provided. The information, in lieu of annual return, is **Annexure — III in Section-2.**

1.4. The Applicant Company has financial strength to meet with the requirements of the Project. The summarized last year audited report of the sponsor company Burj Capital is presented as **Annexure – IV in Section-2.** The latest audited balance sheet and income statement for 2018 are also presented in the same annexure.

1.5. **Directors**

1.5.1. Saleem Zaman

1.5.2. Saad Zaman

1.6. **Auditors**

The company is newly incorporated so an auditor has not been appointed as of yet. However, the company has received proposals for appointing auditor and will be appointing one shortly.

1.7. **Form 1**

Form 1 of the company is attached herewith as **Annexure — I in Section-2**

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

Name	Designation
Saleem Zaman	Director
Saad Zaman	Director
Talha Ameer	Dy. CEO
Wahab Ali	Technical Head
Noman Naseem Awan	Plant Manager
Usama Ahmed	Sr. Project Engineer
Ali Sheharyar Barlas	Commercial Lead

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

1.9.1. Saleem Zaman

Mr. Saleem Zaman as Director of Burj Energy, has more than 30 years of experience having expertise in legal and law affairs in Energy field.

1.9.2. Saad Zaman

Mr. Saad Zaman as Director of Burj Energy, has more than 25 years of experience and has held leadership positions in organizations like Citibank, where in his last role, he led the Islamic Investment Banking Business for the Middle East and Levant. Subsequent to Citi, he served as CEO for the Investment Banking Business and International Operations of Dubai Islamic Bank. He was the founder CEO of DIB Pakistan, and led DIB's international expansion into other regional markets. Saad has held various Board and Advisory positions with leading businesses like Citi, DIB, Etisalat International and DP WORLD Group.

1.9.3. Wahab Ali

Mr. Wahab Ali has been a part of the local PV market of Pakistan since 2016. Having almost 7 years of technical and commercial experience he has managed and developed several PV projects for both the industrial and commercial sector of Pakistan.

1.9.4. Ali Sheheryar

Ali Sheheryar is a versatile and result-driven power project developer with an Electrical Engineering and Business background along with an in-depth understanding of the power sector. Nine years of project cycle exposure in project development and execution of industrial and utility-scale renewal and thermal power projects. Associated with a number of local companies in Pakistan for project development and execution of utility-scale and industrial power projects. His expertise extends beyond project execution as was part of the teams involved in pre-financial close and post-financial close activities of projects exceeding $500 million in value.

1.9.5. Noman Naseem Awan

Mr. Noman Naseem Awan has been a part of the local PV market of Pakistan since 2016. Having almost 7 years of O&M and installation experience, he has managed and developed several PV projects for both the industrial and commercial sector of Pakistan and KSA.

1.9.6. Usama Ahmed

Mr. Usama has been a part of the energy and manufacturing market of Pakistan since 2010. Having almost 07 years of particular experience of design, estimation and project management, he has managed and developed several PV projects for both the industrial and commercial sector of Pakistan.

1.10. The curriculum vitae of key personnel are given in **Annexure — V** in **Section-2.**

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 220 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 Facilities 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 various Generation Facilities at the sites of the Buyers 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 Facilities 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 Facilities 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 3-Phase AC supply of 400V/11,000 Volts. In the process, the Applicant will use equipment including:

- PV Modules;
- Mounting structure;
- Invertors;
- Surge arrestors;
- Junction Boxes;
- Transformer;
- LV, MV Switchgear
- DC , AC Cables
- Meters;
- Data loggers for Monitoring;
- Internet devices;
- Water Network;
- Steel Structure;
- Screws, Nuts/Bolts;

List of Equipment with Technical details & the Single Line Diagram and flow diagram is attached herewith as **Section-3(Schedule-I)**.

The configuration, technology, model, technical details and design of the Generation Facilities 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) , Equipment and Technical Details and Single Line Diagram has been provided in **Section-3(Schedule-I)**. Grid interconnection and protections required for grid interconnection are in compliance with "NEPRA ARE (Alternative & Renewable Energy) Distributed Generation / Net Metering Rules"

3.1.7. 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 Facilities of the Applicant Company to the Buyer.

3.1.8. DC PV Generation from Modules will be converted to both Single and three Phase AC supply(220V and 400V) by specified inverters. Single and Three phase AC supply will further be transformed to MV system(11KV) by using specified Transformer.

3.1.9. The whole capacity of PV plant will fully be utilized by the facility, so there is no need of Net-Metering and export of power to national grid studies and regulations.

3.1.10. Standardized PV-DG operational technology along with IEC standardized protection schemes will be adopted to control the flow of power towards the national grid system.

3.2. Capacity

The Applicant will deploy solar PV facilities totaling 3MWp at Buyer premises – Friesland Campina Engro Pakistan Limited, Sahiwal, Punjab, Pakistan.

3.3. Site

The Generation Facilities 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 Facilities 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 and Modification Procedure) Regulations, 1999 is not relevant in this case. However, the initial site (the Model Site) is at Friesland Campina Engro Pakistan Limited, Sahiwal, Punjab, Pakistan. Coordinates are:

Latitude: 30°36'31.34"N **Longitude:** 73° 7'47.85"E

3.4. Interconnection

Since the Generation Facilities 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 11,000V 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 Facilities 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 Facilities Installed at the site of the Buyer.

3.7. Environmental

The Generation Facilities 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 various sites 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 environment since it replaces harmful fossil fuel-based power. In view of the same we request that the environmental study requirement for the GL be waived.

3.8. Monitoring Facilities

The Applicant shall develop, install and maintain a remote monitoring facility at its premises for overall monitoring of the Generation Facilities to be installed at various sites. The Applicant will hire trained staff to carry out maintenance activities on the installed facilities at the Buyer's sites. 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**.(Plant General Diagram).

3.9. Eligible Site/Buyer

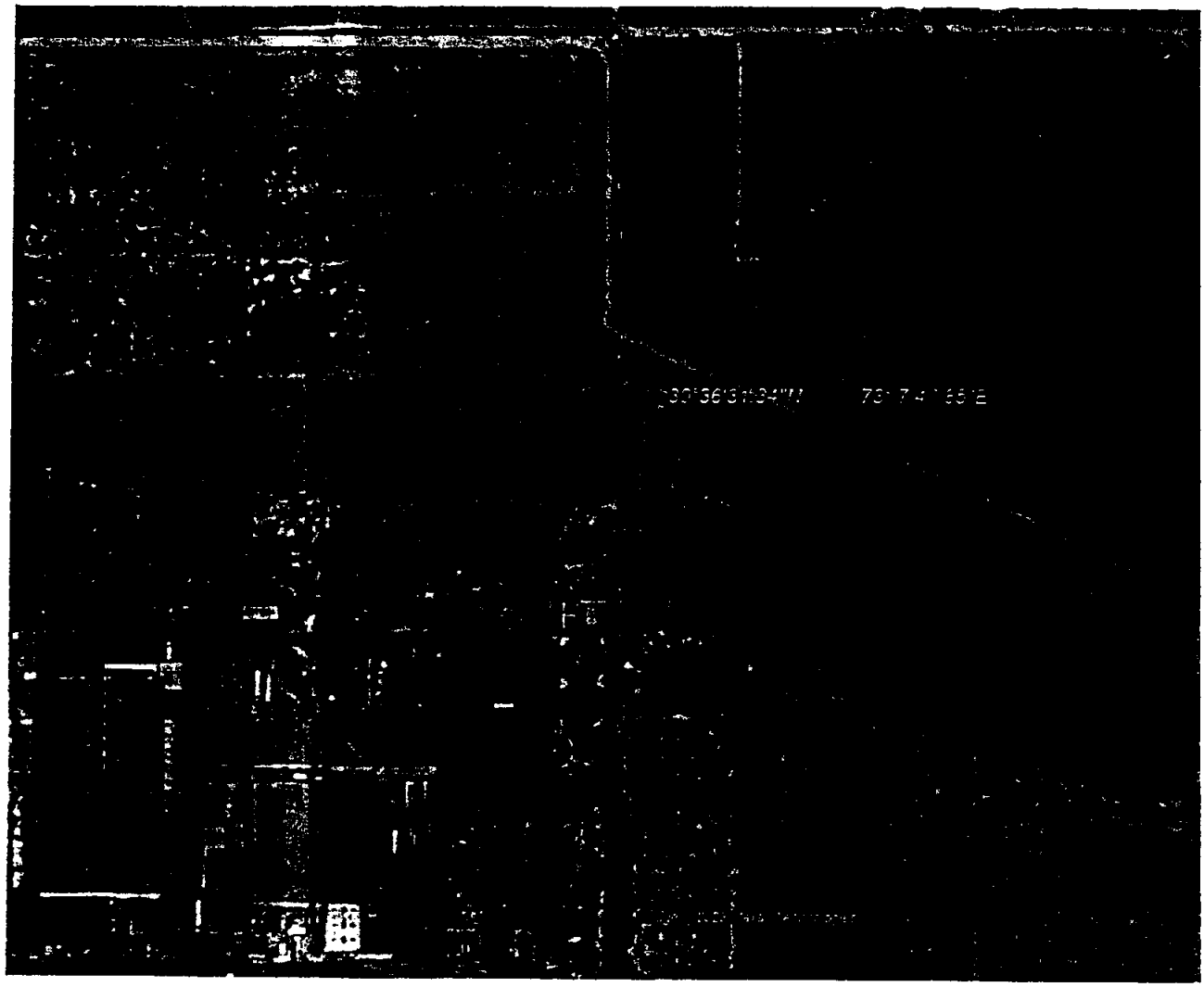
The Applicant Company declares the following eligibility criteria for the site/buyer for whom Generation License is required:

i. Generation Facility to be setup should be within the site of the buyer;
ii. 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;
iii. Electricity from the Generation Facility should be in addition and supplemental to the electricity being obtained from the electric utility company;
iv. Interconnection point should be within the premises/site where the Generation Facility is installed;
v. Generation Facility installed should ensure no back flow of electricity to the distribution system of the utility;
vi. The delivery of electricity from the PV Modules to the distribution Switchgears of the buyer should not require crossing of any public road/area and the distribution network of the electric utility;
vii. The buyer should not be a defaulter of dues of electricity obtained from electric utility company.

3.10. Site Description

1.	**Name of Licensee**	Burj Sola Energy (Private) Limited.
2.	**Registered/Business**	Office # 202 , 11-C Al-Murtaza Commercial Lane-2, DHA Phase-VIII, Karachi.
3.	**Plant Location**	Friesland Campina Engro Pakistan Limited, Sahiwal, Punjab, Pakistan. 30°36'31.34"N 73° 7'47.85"E
4.	**Type of Generation**	Solar Photovoltaic (PV)
5.	**Type of Technology**	Photovoltaic (PV) Cell
6.	**System Type**	Ground Mounted
7.	**Plant Capacity**	3MWp

3.11. Site Satellite Image:



4. FINANCIAL OVERVIEW

4.1. Capital Cost

4.1.1. Detailed Feasibility Report of the Project is attached as **Section-5.**

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

4.1.3. The cost of land, step-up transformer with switchgear protection, interconnection with distribution system of utility is included in this case.

4.1.4. The Applicant Company aims to provide the Generation Facilities up to 3 MWp in a period of about 06 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$ 0.655/Wp. This cost does not include cost of land as facility shall be installed at the premises of the Buyers.

Description	USD/Wp
EPC Cost: ▪ PV Modules. ▪ Inverters ▪ Mounting Structure ▪ DC , AC Cables ▪ Transformer & Switchgear ▪ Other accessories	0.595
Insurance during construction	0.030
Administrative and Development Costs.	0.010
Total Costs	**0.655**

4.2. Source of funding

4.2.1. The applicant will deploy its projects in Single phase, with total of 3MWp and will be equity financed with 80:20 ratio.

5. Profile of Subcontractor

5.1. Reputed contractor has been selected for the construction of one phase, that is Zero Carbon. Their profile is attached as **Section-2.**

6. Executive Summary & Prayer

6.1. To supplement the supply of electricity by utilities, the Applicant Company intends to set up large scale solar PV modules (Generation Facilities) at Engro Friesland Campina, Sahiwal, for which the Application for grant of Generation License is being submitted before the Authority in terms of Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 read with the relevant Rules and Regulations.

6.2. 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 **Burj Solar Energy (Private) Limited** for generation of in maximum of 3 MWp through Solar PV Modules, of the prospective buyer who are eligible in terms of the criteria and parameters mentioned above in this application.

SECTION 2
COMPANY PROFILE

LIST OF ANNEXURES

ANNEXURE I

CERTIFICATE OF INCORPORATION, ACCOUNT MAINTENANCE CERTIFICATE, FORM-1 & FORM-29.

B004772

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

SECP

CERTIFICATE OF INCORPORATION ON CHANGE OF NAME

[Under section 40 of the Companies Ordinance, 1984 (XLVII of 1984)]

Company Registration No. 0083734

I hereby certify that pursuant to the provisions of section 39 of the Companies Ordinance, 1984 (XLVII of 1984), the name of BURJ COAL POWER (PVT.) LIMITED has been changed to BURJ SOLAR ENERGY (PVT.) LIMITED and that the said company has been duly incorporated as a company limited by shares as a private company under the provisions of the said Ordinance.

This change is subject to the condition that for period of one year from the date of issue of this certificate, the company shall continue to mention its former name along with its new name on the outside of every office or place in which its business is carried on and in every document or notice referred to in clauses (a) and (c) of section 143.

Given under my hand at Karachi this 8th day of July Two Thousand and Fifteen.

(Sidney C. Pereira)
JOINT REGISTRAR / INCHARGE
Company Registration Office, Karachi

Fee Rs.5,000/-

No/ 1247 Date 2x/7/xx

001582

SECP

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

COMPANY REGISTRATION OFFICE KARACHI

CERTIFICATE OF INCORPORATION

[Under section 32 of the Companies Ordinance, 1984 (XLVII of 1984)]

Corporate Universal Identification No. 0083734

I hereby certify that BURJ COAL POWER (PVT.) LIMITED is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is limited by shares.

Given under my hand at Karachi this Eighth day of May, Two Thousand and Thirteen.

Incorporation fee Rs. 5,000/= only

(Sidney Custodio Pereira)
Joint Registrar of Companies
Karachi

Received
9/5/13.

Meezan Bank
The Premier Islamic Bank

Best Bank in Pakistan 2020
Recognized by Pakistan Banking Awards

Dated: **July 19, 2023**

Burj Solar Energy (Private) Limited

Account Maintenance Certificate

السلام علیکم ورحمۃ اللہ وبرکاتہ

This is to certify that M/s. **BURJ SOLAR ENERGY (PRIVATE) LIMITED** are maintaining PKR **MEEZAN RUPEE CURRENT ACCOUNT** No. **0101-0105968513** (IBAN No. **PK72MEZN0001010105968513**) with us since **09 DEC 2021.**

The above information is provided at the specific request of our customer without any risk, obligation and responsibility on the part of Meezan Bank Ltd. Pakistan, its authorized signatories or employees.

MUNEER AHMED KHOWAJA
PA # C-2491

Syed Manzoor Hussain Shah
A.S. No. C-2620

387264

FORM 1

THE COMPANIES ORDINANCE, 1984
(Section 30(2) and rule 4)

DECLARATION OF APPLICANT FOR INCORPORATION

Securities & Exchange Commission of Pakistan
Diary No.....
03 MAY 2013
CRO KARACHI.

Please complete in typescript or in bold block capitals.

1. Name of the Company: BURJ COAL POWER (PVT) LIMITED
2. Presented by: SAAD UZ ZAMAN
3. Fee Paid (Rs.): Name & Branch of the Bank:
4. Receipt No.: Date: Day Month Year
   (Bank Challan to be attached in original)
5. Declarant's Name & Designation: SAAD UZ ZAMAN (DIRECTOR)
6. Declarant's Father Name: QAMAR UZ ZAMAN
7. Profession/ Designation (delete the portion not applicable): A person named in the articles as Director/ Officer of the proposed company.
8. Declaration:
   I do hereby solemnly and sincerely declare that:
   a) I am the above named declarant;
   b) all the requirements of the Companies Ordinance, 1984, and the rules made there under in respect of matters precedent to the registration of the said Company and incidental thereto have been complied with and
   c) I make this solemn declaration conscientiously believing the same to be true.
9. Signature of Declarant
10. N.I.C No. of Declarant: 42301-8489997-7
11. Signature of Witness
12. Name and Father's Name of the witness: MUHAMMAD HAFEEZ | MUAMMAD BASHIR
13. N.I.C No. of the witness: 42201-4755117-3
14. Address of the witness: HOUSE NO. B-13, BLOCK 1, GULSHAN-E-IQBAL, KARACHI
15. Date: Day 19 Month 03 Year 2013

ANNEXURE II

MEMORANDUM/ARTICLES OF ASSOCIATION

The Companies Ordinance, 1984

COMPANY LIMITED BY SHARES

Memorandum of Association

of

BURJ SOLAR ENERGY (PVT) LIMITED

I. The name of the Company is BURJ SOLAR ENERGY (PVT) LIMITED

II. The Registered Office of the Company will be situated in the Province of Sindh.

III. The objects for which the Company is established are to do all or any of the following: -

1. To design, insure, build, establish, own, operate, maintain, manage electric power generating plants for the generation, supply & transmission of electric power and in relation hereto, to establish, fix, carry out and maintain without limitation, any ancillary works, cables, wires, meter, lines, interconnect facilities, grid stations, transmission facilities, civil, electrical and mechanical works.

2. To carry out feasibility study for and to carry on the business of power generation and in relation thereto, to generate, accumulate, transmit, distribute and sell electric power to the public sector, including but not limited to KESC, Water and Power Development Authority, National Transmission and Dispatch Company, Government and Government bodies, and the private sector and any other energy off taker whosoever it may be.

3. To manufacture, purchase, import or otherwise acquire, construct, own, process, lease, operate and maintain buildings, apparatus, fixtures, fittings, plants, machinery, materials, and thing as may be necessary, incidental to or convenient in connection with power generating plants for the generation of electric power and or in connection with supply, transmission and distribution of electric power.

4. To buy, sell, manufacture, repair, alter, improve, exchange or let out, import, export and deal in all works, plant, machinery, engines, tanks, cylinders, valves, regulators, testing equipment, tools, utensils, appliances, cookers, stoves, heaters, apparatus, products materials, substances, raw materials, chemicals, natural gas, liquefied petroleum gas, fuel and coal, lubricants, articles and things and to manufacture, experiment with, render marketable and deal in all products, incidental to or obtained in the business carried on by the Company.

5. To purchase, take on lease or tenancy or in exchange, hire, take options over or otherwise acquire for any estate or interest whatsoever and to hold, develop, work, cultivate, deal with and turn to account concessions, grants, decrees, licenses, privileges, claims, options, leases, property, real or personal or rights or powers of any kind which may appear to be necessary or convenient for the business of the Company but not to act as a leasing company or property developer.

6. To sell, exchange, mortgage, let on royalty or tribute, grant licenses, easements, options and other rights over and in any manner deal with or dispose of the Company's property or any part thereof for such consideration as may be thought fit and in particular for stocks, shares or securities of any company but in any event not to act as an investment company or leasing company.

7. To establish laboratories and to employ and promote scientific research and invention, patronize such invention and enter into manufacture in collaboration with outside parties for transfer of technology from abroad and to promote transfer of technology from Pakistan abroad, and to carry on business in all other allied fields permissible by law.

8. To invest and deal with any surplus moneys of the Company not immediately for the time being required for any of the Purposes of the Company in such investments as may be thought proper and to hold, sell or otherwise deal with such investments but in any event not to act as an investment company.

9. For the purposes of the business of the Company only, to advance money upon such terms as the Company may approve, and to guarantee the obligations and contracts of customers and others but not to act as a banking company. Pakistan or elsewhere any patents, patent rights, brevets, inventions, trademarks, design licenses, protections, concessions and the like conferring any exclusive or non-exclusive or limited right to use any secret or other information as to any invention, process or privilege which may seem capable of being used for any of the purposes of the Company or the acquisition of which may seem calculated directly or indirectly to benefit the Company and to use, exercise, develop, manufacture under grant, licenses, privileges in respect of, or otherwise turn to account the property, rights and information so acquired and to carry on any business in any way connected therewith.

10. To get insured against losses, damages, risks, accidents and liabilities of all kinds which may affect the Company whether in respect of its contracts, agreements advances or securities or in respect of servants or employees or directors of the Company, or in respect of property belonging to or leased to or hired by the company either by setting apart funds of the Company or by effecting such insurance and in later case to pay the premium thereon.

11. To train personnel and workers, in Pakistan and/or abroad, to obtain technical proficiency in various specialties connected with the business of the Company.

12. To undertake and execute any project the undertaking whereof may seem desirable, and either gratuitously or otherwise,

13. To Procure the Company to be registered or recognized in any foreign country or place.

14. To acquire and undertake all or any part of the business, property, goodwill and liabilities of any person or company carrying on any business which the Company is authorized to carry on or possessed of property suitable for the purposes of the Company.

15. To adopt such means of making known the business and/ or services of the Company as seem expedient and in particular by advertising in the press, or in the other media or by way of participation in exhibitions.

16. For, the purposes of the Company, to purchase, mortgage of, sell, exchange, turn to account any part of the property and rights of the Company to employ or appoint any person, experts, consultants, advisers, contractors (including O&M contractors), brokers in connection with the business of the Company.

17. To pay for any property or rights acquired by the Company, either in cash or fully paid shares or by the issue of securities, or partly in one mode and partly in another and generally on such terms as may be determined banking or finance company.

18. Only in connection with the business of the Company to open and operate any current, overdraft, loan, fixed or savings bank accounts for the Company, and draw make, accept, discount, endorse, execute and issue promissory notes, bills of exchange, bills of lading and other negotiable or transferable instruments or securities and to deposit money, securities or property with any persons firm or company and on any terms with or without security and to advance money to Company's executives, officers and employees/agents/customers and others having dealings with the company but in any event not to act as an investment, banking or finance company.

19. In connection with the business of the Company only, to give guarantees and indemnities for the payment of money or the performance of contracts or obligations by this Company but in any event not to act as an investment banking or finance company.

20. In connection with the business of the Company only, to borrow and where required, to secure the payment of money in such manner as the Company shall think fit and in particular by the creation of mortgages and charges over the (present and future) property, assets and/or undertaking of the Company and/or by issue of debentures, participation term certificates, term finance certificates and other securities charged upon all or any of the Company's property both present and future, and to purchase, redeem and payoff any such securities.

21. To take, or otherwise acquire, and hold shares in any other company having objects altogether or in part similar to those of this Company or carrying on any business capable of being conducted so as directly or indirectly to benefit this Company but in any event not to act as an investment company.

22. To Enter into partnership or into any agreement or agreements for sharing profits, union of interests, cooperation, joint venture, reciprocal concession and/or facilities with any person or company whether or not-having objects similar to those of this- Company but in any event not to act as Managing Agent.

23. So far as is permissible in law, to offer stock option schemes to employees, to grant funds, donations, annuities, pensions, allowances, gratuities, bonuses to any employees or Directors or employees of the Company or any dependent thereof or to any charitable, religious, social, scientific, educational, industrial institutions or organization and to establish provident, gratuity and/or superannuation funds for the benefit of present or ex-employees or Directors or former directors of the Company.

24. To enter into any agreement or agreements with any government or other authority, supreme, municipal, local or otherwise, that may seem conducive to all or any of the: objects

of the Company and/or to obtain from such government or authority including the State Bank of Pakistan or National Electric Power Regulatory Authority (NEPRA) any rights, concessions or privileges, licenses which the Company may think desirable to obtain and to carry out, exercise and comply with any such, arrangements, rights, privileges, concessions and licenses.

25. To pay all or any costs charges and expenses preliminary and incidental to the promotion, formation, establishment, and registration of the Company and to pay any development costs incurred (whether before or after the incorporation of the Company) by the sponsors of the Company in connection with any project of the Company.

26. To pay brokerage or commission to any person or persons in consideration of his/their subscribing, or agreeing to subscribe, whether absolutely or conditionally, for any shares or debentures of the Company, or for procuring or agreeing to procure subscriptions whether absolute or conditional for the same which brokerage or commission may be paid either cash or shares of the Company, credited as fully paid up.

27. To distribute any of the Company's property among the members in specie in the event of winding up of the Company.

28. To amalgamate, consolidate, or merge, either in whole or in part with or into any other companies, associations, firms or persons carrying on any trade or business of a similar nature to that which this Company is authorized to carry on.

29. To resolve, settle disputes by negotiation, conciliation, mediation, arbitration litigation or other means, judicial or extra judicial, and to enter in compromise agreement with creditors, members and any other persons in respect of a difference or dispute with them and to exercise the power to sue, and be sued and to initial or oppose all actions, steps, proceedings or application which may seem calculated directly or indirectly to benefit or prejudice, as the case may be, the interest of the or of its members.

30. To do all or any of the things herein in any part of the world either as principals, agents, contractors or otherwise, and either alone or in conjunction with others but in any event not.

31. To provide engineering, construction, consultancy and design services and radio and other communication systems and services, and any facilities, equipment and installations whether related to such services and systems or otherwise.

32. To carry on any other business whether manufacturing or otherwise that may seem to the Company capable of being conveniently carried on in connection with the above objects or calculated directly or indirectly to enhance the value of or render profitable any of the Company's property or rights or which it may be advisable to undertake with a view to improving, developing, rendering or turning to account any property real or personal belonging to the Company or in which the Company may interested and to do all or any of the above things either as principals, agents, contractors or otherwise, and either alone or in conjunction with others and either by or through agents, sub-contractors, trustees or otherwise, and to do all such things as are incidental or conducive to the attainment of the above objects but in any event not to act as managing agents.

33. To do all and everything necessary, suitable or proper or incidental or conducive to the accomplishment of any of the purposes or the attainment of any of the objects on the furtherance of any of the powers hereinbefore set forth, either alone or in association with other corporate bodies, firms or individuals or with any Government authority or public or quasi-public authority or any other authority, and to do every not or thing incidental or pertinent to or arising out of or connected with the business or powers of the Company or part thereof, provided the same be lawful."

34. It is expressly declared that the several sub-clauses of this clause and all the powers expressed therein are to be cumulative but in no case unless the context expressly so requires is the generality of anyone sub-clause to be narrowed or restricted by the name of the Company or by the particularity of expression in the same sub-clause or by the application of any rule of construction such as the ejusdem generis rule, and accordingly none of such sub-clauses or the objects therein specified or the power thereby conferred shall be deemed subsidiary or auxiliary merely to the objects mentioned in any other sub-clause of this clause, and the Company shall have full power to exercise all or any of the powers conferred by any part of this clause in any part of the world.

35. IT IS HEREBY UNDERTAKEN that the Company shall not engage in the banking business, business of a finance, investment, leasing or insurance company, or as a Modaraba management company, or the business of land development or a managing agent or any unlawful business and that nothing in the objects clause shall be construed to entitle it to engage in such business.

36. AND it is hereby declared that the word "COMPANY" when used herein and when by the context it appears that it does not refer to the above-named Company shall be deemed to include any Government body, authority, or other body of persons incorporated and registered or domiciled in Pakistan or elsewhere, and that the objects set forth in any sub clauses of this clause shall both except when the same be in any way limited or restricted by reference to or inference from the terms of any other sub clause or by the name of the Company or by the nature or description property hereinafter stated to be acquired or by the juxtaposition of any two or more or by any objects being or being deemed a main or dominant object but each shall be deemed to be an independent object.

37. AND that none of such-clauses or the objects therein specified or the power conferred shall be or be deemed to be subsidiary or ancillary or ancillary merely to the object mentioned in any of the other sub clause of this clause or any of them out, the Company have full power to exercise all or any of the power conferred by any part of this clause in any part of the world, notwithstanding that the business undertaking property rights or acts proposed to be transacted, acquired, dealt with or performed do not fall within the objects of the earlier or any other sub-clauses of this clause or any of them.

38. Notwithstanding anything stated in any object clause, the Company shall obtain such other approval or license from the competent authority, as may be required under any law for the time being in force, to undertake a particular business.

39. It is undertaken that the Company shall not by advertising, pamphlets, other mean or other negotiation offer for sale or take advance money, for the further sale of plots, houses, flats

etc. to the general public or individuals unless such plots, houses or flats etc. are acquired and have been developed by the Company and shall not indulge in any sort of housing finance company business as mentioned in NBFC Rules 2003.

40. The Company shall not launch multilevel marketing (MLM), Pyramid and Ponzi Schemes.

IV. The liability of the Members is limited.

V. The authorized capital of the Company is PKR 300,000,000/- (Pak Rupees Three Hundred Million) divided into 30,000,000 (Thirty Million) ordinary shares of PKR 10/- (Pak Rupees Ten) each, with power of the Company, specifically to increase the Authorized share capital to include a further issue including of preference shares and generally, to increase or reduce the capital and to divide the shares in the capital for the time being into several classes in accordance with the provisions of the Companies Ordinance, 1984 and any rules made there under, and to attach thereto respectively such preferential, deferred, qualified or special rights, privileges or conditions as may be determined by or in accordance with the Articles of Association of the Company for the time being and to vary, modify or abrogate any such rights, privileges or conditions in such manner as may for the time being be provided by the Articles of Association of the Company in accordance with the law

We the several persons whose names, addresses and deceptions are subscribed below , are desirous of being formed into a company, in pursuance of the Memorandum of Association and we respectively agree to take the number of shares in capital of the Company set opposite to our respective names.

S.No.	Name and Surname (present and Former) in full Block Letters	Father's/Husband's Name in full	Nationality with any former Nationality	Occupation	Residential Address in Full	No. of Shares Taken	Signature
1	SAAD UZ ZAMAN (42301-8489997-7)	QAMAR UZ ZAMAN	PAKISTANI	BUSINESS	HOUSE NO. F252/2, MOHALLA BATH ISLAND, KEHKASHAN 7 CLIFTON 6 KARACHI.	01 (ONE SHARE ONLY)	
2	SHAHZAD SYED QASIM (42301-0900036-1)	SYED SHAH ABDUL QASIM	PAKISTANI	BUSINESS	HOUSE NO. 32/2 A. KHAYABAN E-MOMIN, D.H.A, PHASE 5, KARACHI	01 (ONE SHARE ONLY)	

DATED THE 19th DAY OF March 2013.

Witness:

Muhammad Hafeez
S/o Muhammad Bashir
CNIC 42201-4755117-3
House No B-13, Block No 1, Gulshan-e-Iqbal, Karachi

THE COMPANIES ORDINANCE 1984

(Company Limited by Shares)

ARTICLES OF ASSOCIATION

OF

BURJ SOLAR ENERGY (PVT) LIMITED

PRELIMINARY

1. Interpretation:

In these Articles, unless there is anything repugnant in the subject or context:

a) "Articles" means these Articles of Association as originally framed or as may be amended from time to time;

b) "Board" means the board of directors of the Company for the time being;

c) "Chief Executive" means the Chief Executive for the time being of the Company;

d) "Directors" means the directors of the Company for the time being:

e) "General Meeting" means a general meeting of the Company;

f) "Member" means a member of the Company as defined in Section 2(1)(21) of the Ordinance;

g) "Ordinance" means the Companies Ordinance, 1984, or any statutory modification or reinactment thereof for the time being in force;

h) "Ordinary Resolution" means a resolution passed at a general meeting when the votes cast (whether on a show of hands or poll, as the case may be) in favour of the resolution (including the casting vote, if any, of the Chairman) by members who, being entitled to vote in person or by proxy, do so vote, exceed the votes, if any, cast against the resolution by members entitled and voting;

i) "Register" means the register of Members to be kept pursuant to Section 147 of the Ordinance; and

j) "Special Resolution" means the special resolution of the Company as defined in Section 2(1)(36) of the Ordinance.

2. The 'regulations contained in Table 'A' in the First Schedule to the Ordinance ("Table 'A') shall not apply to the Company except to the extent and as hereinafter expressly incorporated.

3. In the interpretation of these Articles words importing the singular shall include the plural, and vice versa and words importing the masculine gender shall include the feminine gender and words Importing persons shall also include corporate bodies.

BUSINESS

4. (1) The business of the Company shall include the several objects in the Memorandum of Association or any of them.

(2) The Company shall have its Registered office at Karachi along with its branches at such places as may be decided by the Board.

(3) The business of the Company may be commenced as soon after the Incorporation of the Company as the Directors shall think fit.

PRIVATE COMPANY

5. The Company is a private company within the meaning of section 2(1)(28) of the Ordinance and accordingly (i) no invitation shall be issued to the public to subscribe for any shares, debenture or debenture stock of the Company (ii) the number of members of the Company (exclusive of the persons in the employment of the Company) shall be limited to fifty, provided that for the purpose of these provisions where two or more persons held one or more shares jointly in the Company, they shall be treated as a single member and (iii) the right to transfer shares in the Company is restricted in the manner and to the extent hereinafter provided.

SHARES

6. The authorized share capital of the Company is PKR 300,000,000/- (Pak Rupees Three Hundred Million) divided into 30,000,000 (Thirty Million) ordinary shares of PKR 10/- (Pak Rupees Ten) each but the Company may from time to time by Special Resolution increase, consolidate, sub-divide or otherwise reorganize its share capital.

7. The shares shall be under the control of the Directors who may allot or otherwise dispose of the same or any of them to such persons on such terms and conditions and at such times as the Directors think fit and with full powers to give to any persons the call of any shares at a premium or at par or (subject to the provisions of the Ordinance) at a discount and for such time and for such considerations as the Directors think fit.

8. No shares shall be offered for subscription except upon the term that the amount payable on application shall be the full amount of the nominal amount of the shares.

9. Regulations 4 to 7 in Table 'A' shall apply to the extent applicable to private limited companies.

TRANSFER AND TRANSMISSION OF SHARES

10. No transfer of any share shall be made or registered in the Register without the previous sanction of the majority of the Directors who may without assigning reason decline to give any such sanction.

11. Regulations 8 to 13 in Table 'A' shall apply to the Company.

ALTERATION OF CAPITAL

12. Regulations 14 to 18 in Table 'A' shall apply to the Company.

GENERAL MEETING & NOTICES

13. (i) Regulations 20 to 22 in Table 'A' shall apply to the Company for general meetings and

(ii) Regulations 23 to 33 in the Table A shall apply to notice and proceedings of

(iii) A resolution (including a Special Resolution) in writing (in one or more counterparts) signed by all Members for the time being entitled to receive notice of and to attend and vote at general meetings (or, being corporations, signed by their duly authorized representatives) shall be as valid and effective as if the resolution had been passed at a general meeting of the Company duly convened and held."

(iv) A person may participate at a general meeting by conference telephone or other communications equipment by means of which all the persons participating in the meeting can communicate with each other. Participation by a person in a general meeting in this manner is treated as presence in person at that meeting. Meetings will be treated as taking place where the Chairman of the meeting is situated.

VOTES OF MEMBERS

14. (i) Regulations 34,35,36,37,39 & 40 in Table 'A' shall apply to the Company.

(ii) The instrument appointing a proxy shall be in writing under the hand of the appointer or of his attorney duly authorized in writing. A proxy need not be a member.

DIRECTORS

15. (i) The number of Directors shall not be less than two.
(ii) The first Directors of the Company shall be:

a) Mr. SAAD UZ ZAMAN
b) Mr. SHAHZAD SYED QASIM

16. The First Directors of the Company shall retire from office at the first Annual General Meeting of the Company. The Board will consist of at least two Directors A Director, Including the Chief Executive, shall hold office for not more than three years unless he resigns earlier, becomes disqualified for being a Director or otherwise ceases to hold office.

INELIGIBILITY OF CERTAIN PERSONS TO BECOME DIRECTOR

17. No person shall be appointed as a director of the Company if he

a) is a minor, b) is of unsound mind, c) has applied to be adjudicated as an insolvent and his application is pending, d) is an un-discharged insolvent, e) has been convicted by a court of law for an offence involving moral turpitude, f) has been debarred from holding such office under any provision of the Ordinance, g) has betrayed lack of fiduciary behavior and a declaration to this effect has been made by the Court under section 217 of the Ordinance at any time during the preceding five years, h) is not a member Provided that clause (h) shall not apply in the case of: i) a person representing the Government or an institution authority which is a member, ii) a whole time director who is an employee of the Company, iii) a chief executive, or iv) a person representing a creditor.

VACATION OF OFFICE BY A DIRECTOR

18. A Director shall ipso facto cease to hold office if: a) he becomes ineligible to be appointed a director on any one or more of the grounds enumerated in clauses(s) (a) to (h) of article 17, b) he absents himself from three consecutive meetings of Directors or from all the meetings of the Directors for a continuous period of three months, whichever is the longer, without leave of absence from the Directors; c) he or any firm of which he is partner or any private company of which he is a director: i) without the sanction of the Company In General Meeting accepts or holds an office of profit under the Company other than that of chief executive or legal or technical adviser or a banker, or (ii) accepts a loan or guarantee from the Company in contravention of Section 195 of the Ordinance.

19. The Directors shall be elected in a General Meeting by the Members for three years in the following manner: a) A member shall have such number of votes as is equal to the product of the number of voting shares or securities held by him and the number of Directors to be elected, b) A member may give all his votes to a single candidate or divide them between more than one of the candidates in such manner as he may choose, c) The candidate who gets the highest number of votes shall be declared elected a Director and then the candidate who gets the next highest number of votes shall be so declared until the number of Directors to be elected have been so elected.

20. If any Director shall be called upon to perform any extra service or to make special exertion or to go or reside out of Islamabad for any purpose of the Company or to give special attention to the business of the Company, the Company may remunerate the Director for so doing either by fixed sum or by percentage of profit or otherwise as may be determined by the shareholders in a General Meeting.

ALTERNATE DIRECTOR

21. A Director who is about to leave or is absent from Pakistan may with the approval of the Directors appoint any person to be his alternate director during his absence from the country provided such absence shall not be less than for a period of three months and such appointee whilst he holds office as an alternate shall be entitled to notice of the meetings of the Directors and to attend and vote thereat accordingly but shall ipso facto vacate office on the return of his appointing Director to Pakistan. Any appointment or removal under this article shall be affected by notice in writing under the hand of the Director making the same.

REMOVAL OF DIRECTOR

22. The Company may by resolution in General Meeting remove a Director appointed under section 176 or section 180 of the Ordinance or elected in the manner provided for in section 178 of the Ordinance, provided that a resolution for removing a Director shall not be deemed to have been passed unless the number of votes cast in favor of such a resolution is not less than:

    i) The minimum number of votes that were cast for the election of a director at the immediately preceding election of directors, if the resolution relates to removal of a director elected in the manner provided in sub-section (5) of section 178 of the Ordinance; or (ii) the total number of votes for the time being computed in the manner laid down in subsection (5)

of section 178 of the Ordinance divided by the number of directors for the time being, if the resolution related to removal of a director appointed under section 176 or section 180 of the Ordinance.

POWER AND DUTIES OF DIRECTORS

23. The regulations 44 and 45 in Table 'A' shall apply to the Company.

POWER AND DUTIES OF CHIEF EXECUTIVE

24. (a) Subject to the provisions of the Ordinance, the management of the business of the Company shall be carried on by the Chief Executive or any one of the Directors. Such Director or Chief Executive shall, subject to the supervision of the Board, have powers for engagement and dismissal of managers, technicians, assistants, accountants, clerks, labors, and the general direction and management of the business of the Company with full power to do all acts matters and things deemed necessary, proper or expedient for carrying on the business of the Company as he shall think fit and to make and sign all contracts and draw, sign accept endorse, and negotiate on behalf of the Company all bills of exchange, promissory notes, cheques drafts and other securities and instruments and to negotiate with bankers to obtain loan and overdraft facilities for the Company: subject to the provisions of sub-section (2) of section 196 of the Ordinance.

(b) The Chief Executive may, with the consent of the other Directors delegate his powers to any other person or persons so authorized in his behalf to make, sign and execute any contract and agreement as may be necessary and to draw, sign, accept, endorse and negotiate on behalf of the Company, all bills of exchange, promissory notes, cheques, drafts, securities and other instruments.

THE SEAL

25. The Board shall provide a common seal for the purposes of the Company, and shall have power from time to time to destroy the same and substitute a new seal in lieu thereof and they shall also provide for the safe custody of the seal and the seal shall never be affixed except by the authority of the Chief Executive or the Board previously given. And every deed or other instrument to which the seal of the company is required to be affixed shall be sealed in the presence of and be signed by at least one of the Directors.

PROCEEDINGS OF DIRECTORS

26. Regulations 51 to 53 and 55 and 56 in Table 'A' shall apply to the Company.

26(a) A resolution in writing signed by seventy five percent majority of Directors for the time being entitled to receive notice of a meeting of the Directors shall be as valid and effectual as if it had been passed at a meeting of Directors duly convened and held.

26 (b) Directors may participate in a meeting of the Directors by means of any communication equipment whereby all persons participating in the meeting can speak to and hear each other. Participation in a meeting in this manner shall be deemed to constitute presence of

such Director at such meetings for the purposes of constituting a quorum. Meetings will be treated as taking place where the Chairman of the meeting is situated,

FILLING OF VACANCIES

27. Regulations 57, 58 to 62 in Table 'A' shall apply to the Company.

DIVIDEND AND RESERVE

28. (i) Regulations 63 to 70, in Table 'A' shall apply to the Company

(ii) No dividend or bonus shall bear interest as against the Company:

(iii) Any General Meeting declaring a dividend may direct payment of such dividend wholly or partly by the distribution of specific assets and, in particular, of paid-up shares or debentures of any other Company or in any one or more of such ways and the board shall give effect such resolution, and

(iv) Notwithstanding anything contained in any other of these Articles the company may by Ordinary Resolution on the recommendation of the Board determine that any realized accretion of capital assets shall be divided amongst the members in proportion of the amounts paid up on the shares held by them respectively.

CAPITALISATION OF PROFITS

29. The Company in General Meeting may at any time and from time to time upon the recommendation of the Board by resolution declare that it is expedient to capitalize any sum or sums
(i) standing to the credit of any of the Company's reserve funds; or

(ii) being undivided profits in the hands of the Company and available for distribution and not required for the payment of any dividend which at the date of resolution is due to any shares of the Company and that the same be set free for distribution accordingly and may direct the appropriation of any such sum or sums among the members or any class of members who would be entitled to such profits if distributed as dividend and in the same proportion in which they would have been so entitled by applying the same in issuing fully paid shares or debentures of the Company for distribution among such members or towards payment of the uncalled liability on any issued shares or debentures or in any one or more of such ways and the Board shall give effect to such resolution.

ACCOUNTS AND AUDIT

30. Regulations 71 to 78 in Table 'A' shall apply to the Company.

AUDIT

31. Auditors shall be appointed and their duties regulated in accordance with section 252 to 255 of the Ordinance

NOTICE

32. Regulations 79 to 83 in Table 'A' shall apply to the Company.

BORROWING POWERS

33. The Board may from time to time at their discretion borrow or secure the payment of any sums of money for the purposes of the Company.

34. The Board may borrow or secure the payment or repayment of such sum or sums in such manner and on such terms and conditions in all respects in a manner they may think fit, and in particular, by the issue of bonds, perpetual or redeemable debentures or debenture stock, PTCs or any mortgage or charge or other security of or on the undertaking of the whole or any part of the property of the Company both present and future and such mortgage may contain a power of sale and such other powers and provisions as the Board may think fit.

WINDING UP

35. If the Company shall be wound up, the surplus assets shall be applied first in repayment of the capital paid upon the ordinary shares and the excess if any, shall be distributed among the Members holding ordinary shares in proportion to the number of ordinary shares held by them respectively at the commencement of the winding up.

36. Regulations 84 to 85 in Table 'A' shall apply 10 the Company.

SALE OF TOTAL UNDERTAKING

37. A special resolution sanctioning of sale of any other company, duly passed pursuant to the provisions contained in the Ordinance, may in like manner as aforesaid determine that any shares or other consideration recoverable by the liquidators be distributed amongst the members otherwise than in accordance with their existing rights and such distribution shall be binding upon all members subject to the right of dissent and consequential rights conferred by the said section.

SECRECY

38. No member shall be entitled to visit or inspect any works of the Company without the permission of the Managing Director or require discovery of any information respecting any detail of the Company's trading or any other matter which is or may be in the nature of a trade secret, mystery of trade or secret process or which may relate to the conduct of the business of the Company and which in the opinion of the Directors will be inexpedient in the interest of the members of the Company to communicate to the public.

Every Director, Manager, Auditor, Trustee, Members of a Committee, Officer, Servant, Agent Accountant or any other person employed in the business of the company shall, if so required by the Directors before entering upon his or their duties sign a declaration pledging himself or themselves to observe strict secrecy respecting all transaction of the Company with the customers and the state of account with individuals and in matters relating thereto and shall by such declaration pledge himself or themselves not to reveal any of the matters which may come to his or their knowledge in the discharge of his or their duties except when required to do so by the Directors or by any Meeting or by a Court of Law and except so far as may be necessary in order to comply with any of the provisions in these presents contained.

INDEMNITY

39. Every Officer or Agent for the time being of the Company may be indemnified out of the assets of the Company against any liability incurred by him in defending any proceedings whether civil or criminal arising out of his dealings in relation to the affairs of the Company, except those brought by the Company against him, in which judgment is given in his favour or in which he is acquitted or in connection with any application under section 488 of the Ordinance in which relief is granted to him by the Court.

ARBITRATION

40. Whenever any difference arises between the Company on the one hand and any of the members, their executors and administrators or assigns on the other hand, touching the true intent or construction, or the incidents or consequences of these Articles, or of the statutes, or touching anything then or there after done, executed, omitted or suffered in pursuance of these Articles, or of the statutes or touching any breach or alleged breach of these Articles, or any claim on account of any such breach or alleged breach or otherwise relating to the premises, or to these presents or to any statute affecting the Company, or to any of the affairs of the Company, every such difference shall be referred under the Arbitration Act, 1940, to the decision of an arbitrator to be appointed by the parties in difference, or if they cannot agree upon a single arbitrator, to the decision of two arbitrators, of whom one shall be appointed by each of the parties in difference, or an umpire to be appointed by the arbitrators.

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

S.NO	Name and Sur Name (present and Former) in full Block Letters	Father's/Husband's Name in full	Nationality with any former Nationality	Occupation	Residential: Address in Full	No. of Shares Taken	Signature
1	SAAD UZ ZAMAN (42301-8489997-7)	QAMAR UZ ZAMAN	PAKISTANI	BUSINESS	HOUSE NO. F252/2, MOHALLA BATH ISLAND. KEHKASHAN 7 CLIFTON 6 KARACHI.	01 (ONE SHARE ONLY)	
2	SHAHZAD SYED QASIM (42301-0900036-1)	SYED SHAH ABDUL QASIM	PAKISTANI	BUSINESS	HOUSE NO. 32/2 A. KHAYABAN E-MOMIN, D.H.A, PHASE 5, KARACHI	01 (ONE SHARE ONLY)	

DATED THE 19th DAY OF March, 2013.

Witness:

Muhammad Hafeez
S/o Muhammad Bashir
CNIC 42201-4755117-3
House No B-13, Block No 1, Gulshan e Iqbal

ANNEXURE IV

LAST YEAR AUDITED REPORT

BURJ SOLAR ENERGY (PVT) LTD
FINANCIAL STATEMENTS
FOR THE YEAR ENDED
JUNE 30, 2022

BURJ SOLAR ENERGY (PVT) LTD

UHY Hassan Naeem & Co.
Chartered Accountants

402 Progressive Center
Sharah-e-Faisal,
Karachi, Pakistan.

Phone +92 21 34322551-3
Web www.uhy-hnco.com

INDEPENDENT AUDITOR'S REPORT

To the members of BURJ SOLAR ENERGY (PRIVATE) LIMITED

Report on the Audit of the Financial Statements

Opinion

We have audited the annexed financial statement of BURJ SOLAR ENERGY (PRIVATE) LIMITED, which comprise the statement of financial position as at June 30, 2022 and the statement of profit or loss, the statement of changes in equity, the statement of cash flows for the year then ended, and notes to the financial statements, including a summary of significant accounting policies and other explanatory information, and we state that we have obtained all the information and explanations which, to the best of our knowledge and belief, were necessary for the purposes of the audit.

In our opinion and to the best of our information and according to the explanations given to us, the statement of financial position, statement of profit or loss, the statement of changes in equity and statement of cash flows together with the notes forming part thereof conform with the accounting and reporting standards as applicable in Pakistan and give the information required by the Companies Act, 2017 (XIX of 2017), in the manner so required and respectively give a true and fair view of the state of the Company's affairs as at June 30, 2022 and of the loss for the year then ended, the changes in equity and its cash flows for the year then ended.

Basis for Opinion

We conducted our audit in accordance with International Standards on Auditing (ISAs) as applicable in Pakistan. Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of our report. We are independent of the Company in accordance with International Ethics Standards Board for Accountants' Code of Ethics for Professional Accountants as adopted by the Institute of Chartered Accountants of Pakistan / Institute of Cost and management Accountants (the Code) and we have fulfilled our other ethical responsibilities in accordance with the Code. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Responsibilities of Management and Board of Directors for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with the accounting and reporting standards as applicable in Pakistan and the requirement of Companies Act, 2017(XIX of 2017) and for such internal control as management determines is necessary to enables the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

BURJ SOLAR ENERGY (PVT) LTD

In preparing the financial statements, management is responsible for assessing the Company's ability to continue as a going concern, disclosing as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Company or to cease operation, or has no realistic alternative but to do so.

Board of directors are responsible for overseeing the Company's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with ISAs as applicable in Pakistan will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with ISAs as applicable in Pakistan, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.

- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Company's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Company to cease to continue as a going concern.

- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

We communicate with the board of directors regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

BURJ SOLAR ENERGY (PVT) LTD.

Report on Other Legal and Regulatory Requirements

Based on our audit, we further report that in our opinion:

a) proper books of account have been kept by the Company as required by the Companies Act, 2017 (XIX of 2017);

b) the statement of financial position, the statement of profit or loss, the statement of changes in equity and the statement of cash flows together with the notes thereon have been drawn up in conformity with the Companies Act, 2017 (XIX of 2017) and are in agreement with the books of account and returns;

c) investments made, expenditures incurred and guarantees extended during the year were for the purpose of the Company's business; and

d) no zakat was deductible at source under the Zakat and Ushr Ordinance, 1980 (XVIII of 1980).

The engagement partner on the audit resulting in this independent auditor's report is Arslan Ahmed

URJ SOLAR ENERGY (PVT) LTD.

UHY Hassan Naeem & Co.

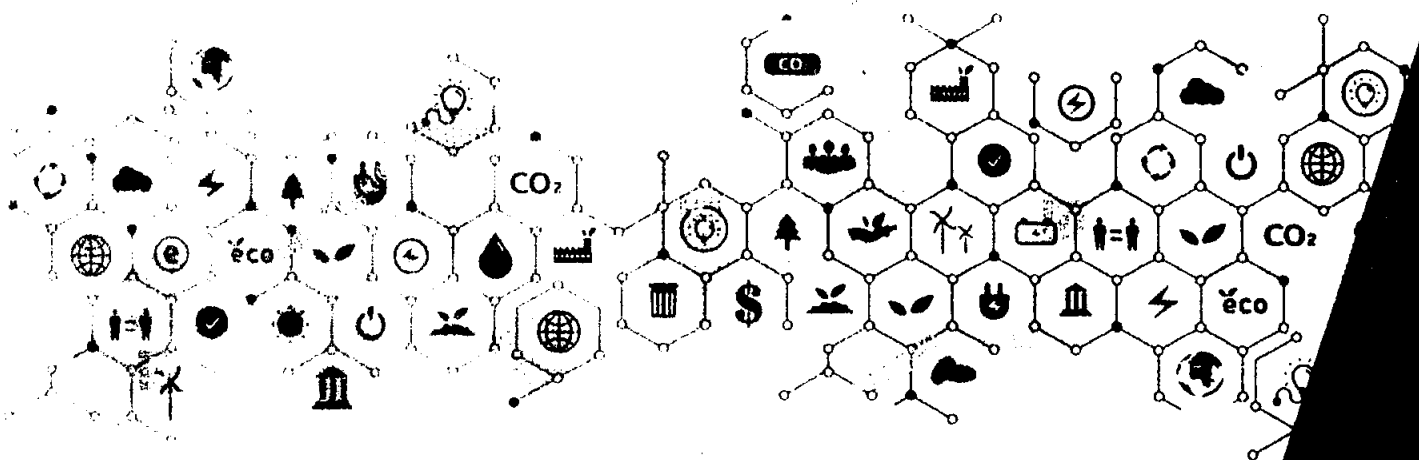
KARACHI
DATE: 27 January 2023
UDIN: AR202210311nLFUj81CT

ANNEXURE V

COMPANY PROFILE OF BURJ SOLAR ENERGY (PVT.) LTD.

BURJ Solar Energy

Strictly Private & Confidential



BURJ SOLAR ENERGY (PVT) LTD.

OFFICE # 202, 11-C, AL
MURTAZA LANE-2 , DHA PHASE-VIII, KARAC

CONTENTS

VISION & MISSION

VISION:

To be the preferred Alternative & Impact Investments firm, investing in high quality assets in Pakistan, the Middle East, Africa and South- and South-East Asia.

ORGANIZATION VALUES:

TRUST
gained from all stakeholders

EXCELLENCE
in achieving the highest professional standards in all our dealings

DEDICATION
in adopting Islamic values

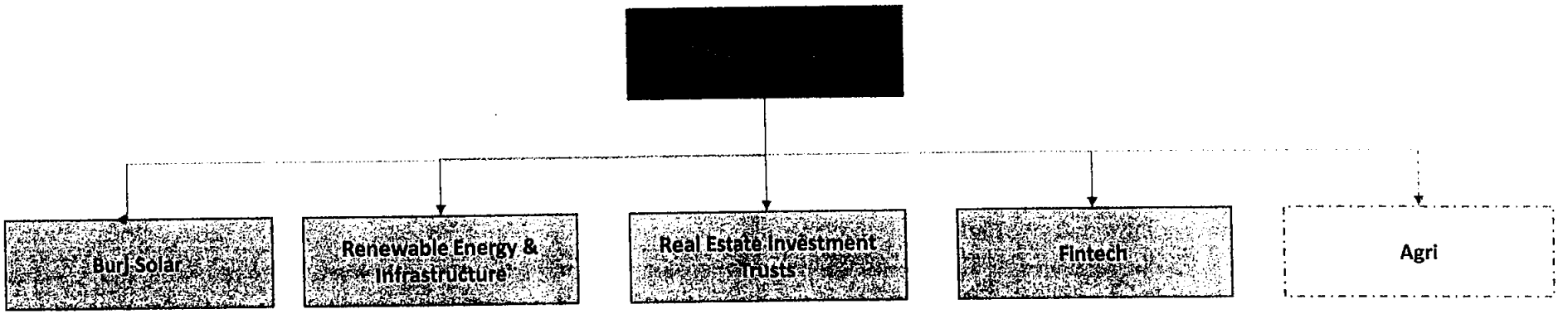
TRANSPARENCY
in all our dealings, contracts and results

IMPACT
in environmental, social and governance aspects underlying investments

MISSION:

To deliver long term sustainable returns to our investors through growth and value creation in our assets, backed by prudent capital management and adhering to principles of Islamic Shariah

BUSINESS VERTICALS



MANAGEMENT

Saad Zaman
Managing Partner

The Group and Management team is led by Saad Zaman, Founder and Chairman of Burj Capital.

Saad has more than 25 years of experience, he has held leadership positions in organizations like Citibank, where in his last role, he led the Investment Banking Business for the Middle East and Levant. He also served as the Managing Director and Global Islamic Finance Head for Citi. Subsequent to Citi, Saad was associated with Dubai Islamic Bank (Government of Dubai) where he served as CEO for the Investment Banking Business and International Operations. He was the founder CEO of DIB Pakistan, he led DIB's international expansion into a number of other regional markets. Saad has held various Board and Advisory positions with leading businesses like Citi, DIB, Etisalat International and DP WORLD Group.

Aamer Chishti
Chief Investment Officer

Mr. Aamer Chishti is the Chief Investments Officer at Burj Energy International Management Limited in Dubai, United Arab Emirates.

He has more than 25 years of experience. He has had leadership positions in organizations like World Call Broadbank limited, First Capital Securities Limited, ABN Ambro Asia Corporate Finance Limited, TransAsia Gas international LLC, Dubai.

He has served at senior positions in prestigious organizations. Mr. Aamer has done his masters in Business Administration from Lahore University of Management Sciences, Lahore, Pakistan.

RENEWABLE ENERGY

TECHNOLOGY PARTNERS

- **GE** is a leading technology and solutions provider in the renewable energy space. The company's turbines account for over 20% of global renewable energy capacity and GE has the largest wind portfolio with an installed based of >400GW. With presence in 80+ countries and a business model to support developers through innovative solutions and services, GE is driving the adoption and integration of renewable technologies like wind and solar globally.

- **Simple Watt Portugal**: SWP comprises solar power professionals with expertise in solar EPC and O&M. Based in Portugal and Dubai, the SWP team used to be part of Voltalia, a leading French IPP and renewable services company. They have constructed and operated plants across Latin America, Africa and Asia.

- **Power Construction Corporation of China** is a state-owned engineering company involved in heavy, civil and power plants construction globally.

- **Orient Energy Systems** is a multinational engineering company providing power generation and industrial power solutions.

PROJECT EQUITY & DEBT PARTNERS

These institutions have committed debt and / or equity for Burj projects.

- **JCM Power Canada:** In addition to being our partner in 50 MW JPL wind farm, JCM owns wind and solar utility scale projects in Asia and Africa
- **IFU – A Danish Development Finance Institution:** IFU and IFU-managed funds have invested in 1,300 projects in 100 countries. Investments produce positive results and have turned out to be good business for all parties involved - for the host country, the partners and for IFU.
- **FMO is the Dutch entrepreneurial development bank.** It was founded in 1970 and is a public-private partnership, with 51% of our shares held by the Dutch State and 49% held by commercial banks and other members of the private sector. FMO has a triple A rating from both Fitch and Standard & Poor's.
- **DFC** is American development finance institution. It partners with private sector in developing countries by providing debt and equity financing.
- **ICD** is part of Islamic Development Bank and provides finance for private sector projects in OIC member countries
- **Pak Kuwait Investment Company (PKIC)** is a development finance institution owned by Governments of Kuwait and Pakistan
- **Meezan Bank Limited, Pakistan** is the largest Islamic bank owned by IsDB, Noor Financial Investment Company, Kuwait and PKIC

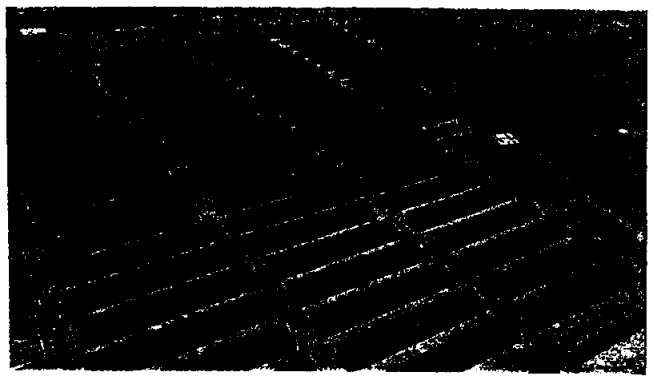
PROJECTS UNDER BURJ CAPITAL

Projects	Technology	MW	MW	MW	MW	MW
Utility Scale						
Operational	Wind	50.0	-	-	-	50.0
Under Development	Wind / Solar	500.0	-	-	-	500.0
Pipeline	Solar	-	-	-	-	-
Subtotal		550.0	-	-	-	550.0
Distributed Generation						
Operational	Solar	7.0	0.5			7.5
Under Construction	Solar	4.4	1.3			5.7
Under Development	Wind / Solar	11.0	-	0.2		11.2
Acquisition Target	Solar	45.0				45.0
Pipeline	Solar	35.0	15.0	25.0	500.0	575.0
Subtotal		102.4	16.8	25.2	500.0	644.4
Total		**652.40**	**16.80**	**25.22**	**500.00**	**1,194.42**

7 MW CAPTIVE SOLAR PLANT, NOORIABAD, PAKISTAN – BURJ SOLAR

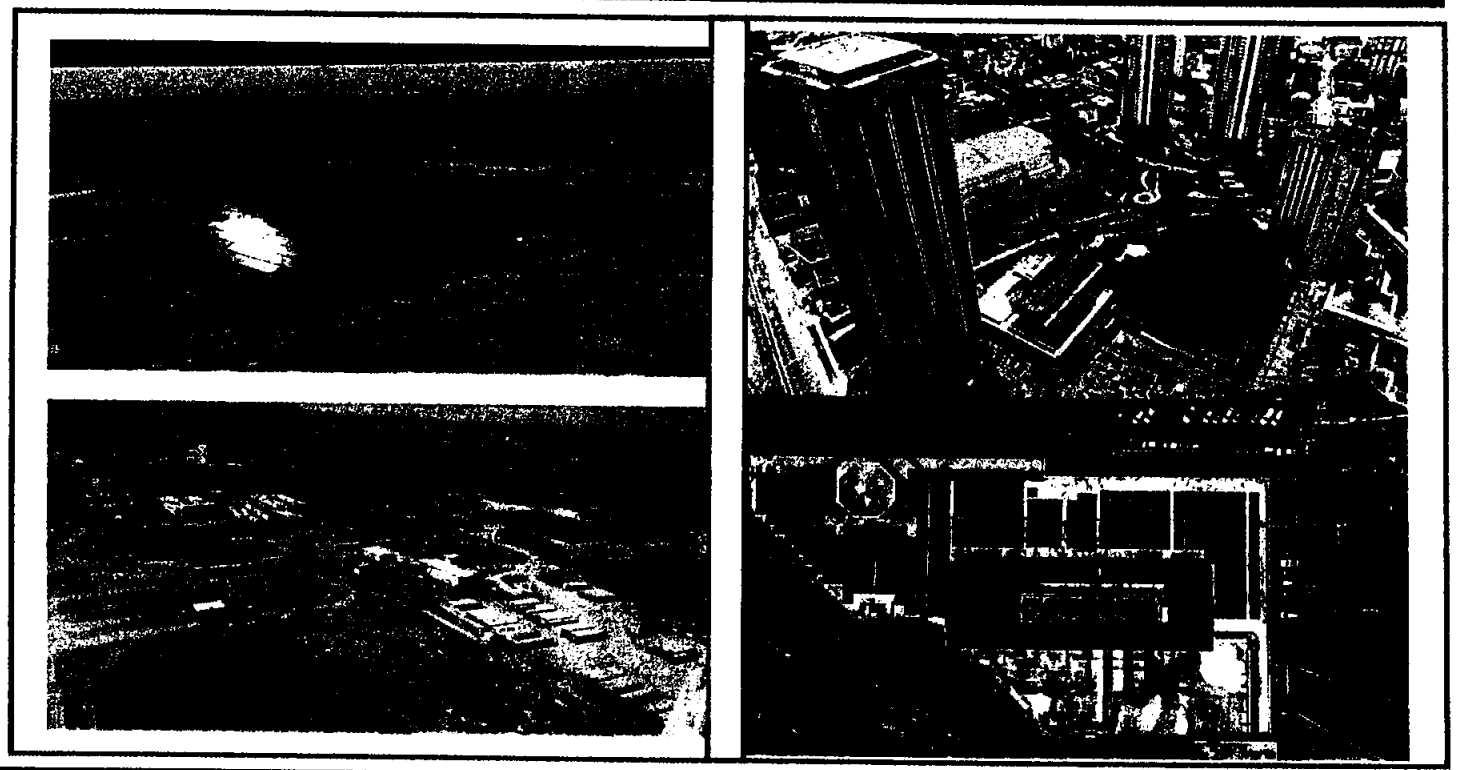
Project started commercial operations in Aug 2022 and completed its reliability run test at 99.92% availability. Burj completed this project with Orient as its EPC contractor]

Performance Indicators	
COD	Aug 31st, 2022
Availability to date	97.5%
Capacity Factor to date	17%
Net Energy Delivered since COD	10,000 MWh



SELECT SOLAR DG INSTALLATIONS

7MW Power Cement, Karachi Pakistan	0.5MW World Trade Centre, KL Malaysia



CORPORATE SOCIAL RESPONSIBILITY

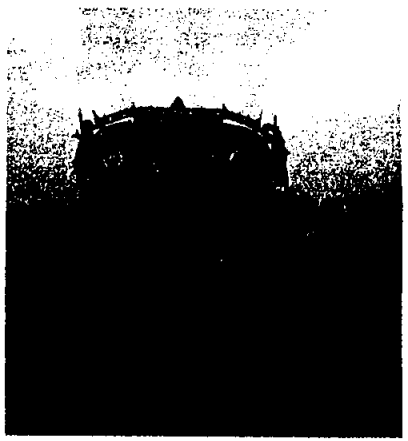
CSR TRACK RECORD

Partnerships for Humanitarian Causes

- Education: The Citizen's Foundation, Pakistan
- Blindness & Eyecare: Layton Rahmatullah Benevolent Trust (LRBT), Pakistan
- Vocational Training: The Hunar Foundation, Pakistan
- Healthcare: Patients' Aid Foundation, Pakistan
- Education: Dubai Cares, UAE

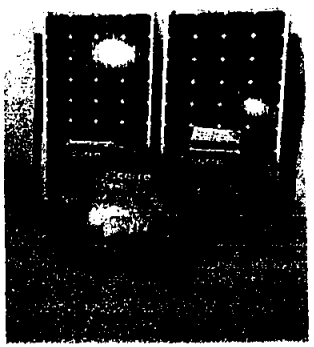
CSR Programs Executed Internally

- Uplift programs focused on 7 villages around our operating wind project
- Employment, Education, Vocational training, Health, Sanitation & social infrastructure



Building tanks and provision of water

Adoption, renovation and operation of 2 schools



Home lighting solutions

Vocational training for women

Sports

Regular Medical Camps

DISCLAIMER

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In considering any performance data contained herein, each recipient of this document should bear in mind that historic returns, projected returns or financial market scenarios are no reliable indicator for current or future performance and that past performance is not indicative of future results,. There can be no assurance that any future assets managed or sponsored by Burj will achieve comparable results or be able to avoid losses

Each recipient of this document should bear in mind that certain information contained in this document constitutes "forward-looking statements", which can be identified by the use of forward-looking terminology such as "may," "will," "should," "expect," "anticipate," "target," "project," "estimate," "intend," "continue," or "believe," or the negatives thereof or other variations thereon or comparable terminology. Nothing contained herein, however, should be deemed to be a prediction or projection of future performance. Due to various risks and uncertainties, including future operating results, the value of the assets and market conditions at the time of disposition, any related transaction costs and the timing and manner of sale, all of which may differ from the assumptions on which the information contained herein is based, actual events or results may materially differ from those reflected or contemplated in such forward looking statements.

Any projected returns reflected herein have been prepared based on various estimations and assumptions made by Burj, including estimations and assumptions about events that have not occurred, any of which may prove to be incorrect. Due to various risks, uncertainties and changes (including changes in economic, operational, political or other circumstances) beyond the control of Burj, the actual results of the referenced investments could differ materially from the results expressed or implied by the projected returns reflected herein in respect of such investments. Industry experts may disagree with the estimations and assumptions used in preparing the projected returns. No assurance, representation or warranty is made by any person that any of the projected returns are accurate or will be achieved, nor in respect of any other information in this document, and you should not place undue reliance on the projected returns nor any other information in this document. Additional information about the estimations and assumptions used in preparing the projected returns and the factors that could cause actual results to differ materially from the projected returns is available upon request.

The information contained in this document does not constitute investment, legal, tax or accounting advice. Recipients of this document should conduct their own due diligence and other enquiries in relation to such information and consult with their own professional advisors as to the accuracy and application of the information contained in this document and for advice relating to any legal, tax or accounting issues relating to a potential investment in the regions described. This document does not constitute a recommendation to invest. This document may include descriptions of selected portfolio investments, including details on the transaction and investment thesis. The selected portfolio investments are intended to be illustrative of the types of investments that may be entered into by Burj however Burj does not intend to invest in any company highlighted herein unless otherwise noted. Certain information contained in this document concerning economic trends and performance are based on or derived from information provided by independent third party sources. Burj cannot guarantee the accuracy of such information and has not independently verified the assumptions on which such information is based. Burj disclaims any responsibility for any errors or omissions in such information, including the financial calculations, projection, and forecasts in this document.

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This material is intended for Professional Clients only.

CONTACT US

BURJ Solar Energy Limited

Office # 202, 11-C, Al-Murtaza Lane-2 ,
DHA Phase-VIII, Karachi

ANNEXURE VI

CV OF MANAGEMENT AND TEAM OF BURJ SOLAR ENERGY (PVT.) LTD.

BIO-DATA

SAAD UZ ZAMAN

- Saad UZ Zaman is the founder and Chairman / CEO of Burj Capital with offices in UAE and Pakistan.

- Prior to establishing Burj Capital, Saad's work experience centered on banking and investments. He has held leading roles at global institutions like Citi, where he led Citi's Corporate Finance and Investment Banking. At Dubai Islamic Bank Group, he was responsible for international growth of the bank. Saad was also responsible for bank's investments and private equity platform which entailed management and turnaround of a USD 2 billion portfolio. This comprised of over 80 local and international investments in publicly listed equities, direct/strategic and joint venture stakes in industrial, financial services, land and incomegenerating real estate assets in UAE and internationally, as well as investments in special and general-purpose funds (e.g. aviation, shipping & power) managed by external managers. Through active management, and despite the unprecedented environment of the 2008 financial crisis, Saad was able to successfully manage key investments, helping DIB Group navigate the period.

- Saad started his career at ANZ Grindlays Bank in 1991. His achievement and career highlights include:

Dubai Islamic Bank Group, 2005 – 2010

Positions Held:

- CEO DIB Capital Limited, DFSA regulated entity
- Director on the Board of Dubai Islamic Bank Pakistan Limited
- CEO, Dubai Islamic Bank Pakistan Limited
- Director, Etisalat International Pakistan Limited (Strategic Shareholding in PTCL)
- Chairman, Millennium Finance Corporation, DFSA regulated Investment Advisory Company
- Director & Executive Committee member, Liquidity Management Center (LMC) Board of Directors
- Director & Executive Committee member, Bank of Khartoum (BOK) Board of Directors
- Head of International operations, Dubai Islamic Bank
- EVP and business manager; Treasury, Corporate Finance and Investment Bank
- Key Achievements:

- Established and ran DIB Pakistan, now a leading bank in the country with over 225 branches
- Established Emirates & Sudan Bank, at the time the largest capitalized bank in Sudan
- Established Bank of Khartoum, largest bank in Sudan, by way of acquisition of majority stake from the Government of Sudan and merged with Emirates & Sudan Bank
- Established and exited Millennium Finance Corporation that comprised DIB Group's investments
- Established DIB Capital, DIB Group's investment banking arm which comprised private equity and capital markets activities. Developed it into one of the leading investment banks in the region.
- Established Emirates REIT, the first REIT in UAE, now quoted on Nasdaq Dubai

Citigroup, 1994 - 2004

Appointments:

- Managing Director, Citi Islamic Investment Bank, Bahrain
- Head of Corporate Finance and Investment Banking, Middle East & Levant
- Head of Corporate Finance, Middle East
- Senior Securities Officer (SSO), Investment Banking
- Key Achievements:
- Charged with and repositioned Citi Islamic Investment Bank for global growth in line with the growing Islamic banking sector
- Positioned Middle East Corporate Finance & Investment Banking products to Citi's Global Corporate & Investment Banking practice into key relationships like Dubai Ports World, Dubai World, Emirates Airline, Family Offices etc
- Established the Middle East Corporate Finance unit to increase bank's focus on the growing corporate finance market across the region
- Completed over $5bn in corporate finance deals in Middle East
- Pakistan lead in London Club restructuring of Pakistan's commercial banking debt post 1997/98

ANZ Grindlays Bank, 1991 - 1993

- Relationship Manager, Corporate Branch, Karachi

- Management Assistant, ANZ Merchant Bank, London
- Education: Business & Finance, Bachelors in Commerce

SALEEM UZ ZAMAN
ADVOCATE AND LEGAL CONSULTANT

Advocate High Courts of Pakistan
B. Com., LLB (Karachi University)
LLM in Commercial Law (Cardiff University, Wales, U.K.)
Pg. Dip. in Islamic Banking & Insurance (London)

Father Name: (Late) Qamar uz Zaman

CNIC No.: 42301-0948355-5;

Date of Birth: 10 July 1964;

Address: F-52/2 Block 7 Clifton, Bath Island, Karachi;

Contact No.: 0092334 3077630;

Email Addresses: saleem.zaman@burjcap.com; saleem.zaman@gmail.com

PROFESSIONAL

Legal Adviser to Burj Group of Companies since 2012

I enrolled as an Advocate, on 27 November 1996, to practice law in the subordinate courts. On 22 January 2000, was enrolled as an Advocate High Court.

Memberships:

Karachi Bar Association (since 1996);

Sindh High Court Bar Association (since 2003);

Karachi Gymkhana Club.

ACADEMIC

Bachelors in Commerce the University of Karachi, Pakistan in 1986.

In 1991, completed chartered accountancy training program, prescribed under the byelaws of the Institute of Chartered Accountants of Pakistan, from M/s

A.F. Ferguson Co., Chartered Accountants, Karachi, Pakistan. I also worked as an internal auditor with a textile company in Karachi.

Bachelors of law from the University of Karachi, Pakistan in 1996.

LLM in Commercial law, from Cardiff University, Wales, U.K. in: Commercial Legal Practice, Comparative Corporate Governance, International Banking Law and World Trade Law. Dissertation was a comparative study and analysis on Islamic and conventional banking in 2007.

Post Graduate Diploma in Islamic Banking and Insurance from the Institute of Islamic Banking and Insurance London in 2008.

Completed QLTT (Qualified Lawyers Transfer Test) program of the Law Society of England and Wales in 2009 for enrolment as a solicitor.

RECENT AND PAST WORK EXPERIENCE

Having 35-year experience in legal and corporate sector, as private corporate legal practice, as CEO of Burj group companies and legal adviser to Burj Group of Companies.

Legal Adviser to Burj Group of Companies since 2012

Saleem uz Zaman & Co., Advocates & Legal Consultants, established in April 2011. Earlier worked with Surridge & Beecheno Advocates and Legal Consultants and Kabraji & Talibuddin Advocates and Legal Consultants.

Corporate Practice includes non-contentious matters relating to corporate, banking and commercial laws. Including but not limited to corporate restructuring, mergers and amalgamations.

Talha Ameer Khan, CFA, FMVA

talha.ameer@ymail.com | +92 343 2516699 | https://www.linkedin.com/in/talhaameer/

EDUCATION

2021 – 2022 **National University of Singapore**
Master of Business Administration | ADB Scholar | Focus: Finance & Strategy (CGPA: 4.5/5.0)

2022 – 2022 **London Business School**
Exchange Program - Spring 2022 | Focus: PE&VC, M&A, Corporate Finance, Global Economy

2011 – 2016 **CFA Institute, USA – CFA Charterholder**

2008 – 2012 **Institute of Business Administration, Karachi**
Bachelor of Business Administration, Finance (CGPA 3.47/4.0)

BUSINESS EXPERIENCE

2022 - Now **Burj Modaraba Management Company Private Limited, Karachi, Pakistan**
Deputy Chief Executive Office

- Promoted as 'Deputy CEO' from the position of 'Investment Director' within one year of joining
- Spearheading the IPO of 'Burj Clean Energy Modaraba' (worth Rs. 1,000mn), Pakistan's first green-listed fund capitalizing on investment opportunities in the growing renewable energy sector
- Heading the investment portfolio (valuing ~US$ 3mn) of Burj Capital in Pakistan; these investments include both utility-scale & distributed generated projects in Wind & Solar respectively
- Deal origination, development & execution of energy efficiency, battery storage, and renewable energy projects of ~25 MW (distributed generation) & ~200 MW (utility-scale) for Modaraba
- Investment Lead of Burj Capital's off-shore investments; destinations include Malaysia, Sri Lanka, Bangladesh, & Dubai

2017 - 2020 **MCB Bank Limited, Karachi, Pakistan**
Manager Investment Banking, Investment Banking Division

- Awarded Employee of the Month for Jun '18 and Mar '19, and Star Award in Jul '18
- Structured and closed debt financing deals for (a) asset acquisition by sugar mills valuing Rs. 8,000mn, (b) 22MW bagasse-based cogeneration power project valuing Rs. 2,200mn, and (c) 12MW solar power project valuing Rs. 1,215mn
- Led the execution of IPO of (a) Pakistan Stock Exchange valuing Rs. 4,488mn, (b) Matco Food Limited valuing Rs. 758mn
- Managed, and analyzed various debt and equity deals in sectors including sugar & food processing, cement, pharmaceuticals, renewables, shipbuilding, oil pipeline, OMC, and motorways construction

2015 - 2017 **Habib Bank Limited, Karachi, Pakistan**
Senior Credit Analyst, Corporate Risk Management Department

- Developed 'Obligor Risk Rating Scorecard' and template of 'Financial Spread for Insurance and Corporate entities', reducing turn-around time of proposal review by ~50%
- Presented numerous credit recommendations covering thorough financial and credit analysis with an acceptance rate of 90%; helping overall NPLs to reduce from 10.9% to 9.2%
- Analyzed credit portfolio covering sectors including an oil refinery, FMCG, and cement

2012 - 2015 **Meezan Bank Limited, Karachi, Pakistan**
Assistant Manager, Commercial Banking Department

- Received award for outstanding performance in "Developing Commercial Financing Portfolio '14"
- Managed the credit relationships with approved limits exceeding Rs. 5,500mn covering sectors namely Textile, Edible Oil, and Commodities (Wheat and Rice)
- Structured (shariah-complaint) and executed first-ever Import Istisna transaction of Rs. 330mn for procurement of wheat in a record time of 2 weeks

ADDITIONAL INFORMATION

- Financial Modelling & Valuation Analyst (FMVA) certification in 2021 by CFI
- Secured fully funded scholarship from ADB Japan Scholarship Program for NUS MBA program
- Awarded 'Islamic Banking Certificate' by 'The National Institute of Banking & Finance, SBP' in 2016

Languages: **Urdu (native), English (fluent)**
Nationality: **Pakistan**

WAHAB ALI

House # 604/C-4 Civic View Apartment, Block13-A Gulshan-e-Iqbal Karachi.
|Mobile; +92-346-3666733; +92-331-3156265
Email: abdulwahab_00@hotmail.com

Objective

A versatile and result-driven power projects developer with an Electrical Engineering and Business background along with an in-depth understanding of the power sector. 9 years of project cycle exposure in project development and execution of industrial and utility-scale Renewable power projects. Equipped with expertise in business development, project management, technical designing, budgeting, contract management, and execution of projects with skills in leadership, team management, problem-solving, strategy, and communication

Experience

TECHNICAL HEAD | BURJ CAPITAL | OCT, 2021 – PRESENT

Burj Capital is an all-rounded investment firm engaged in renewable power development focusing on both utility-scale IPPs and Distributed Generation solutions for Industrial and Commercial scale customers. We develop, finance, construct, operate and transfer renewable energy projects, thereby managing assets end-to-end and in the process ensuring project quality and delivering savings to our customers

RESPONSIBILITIES

As a Technical Head, I am responsible for leading the Technical Department for PV project to meet customer satisfaction in an economical manner. In addition, I am also responsible to deal technical quires of lenders, submission of RFP with negotiated quotations from different EPC contractors.

- Complete designing, installation, system integration and feasibility of Hybrid & Grid-Tied Solar plants of following prominent projects among others:
  - Power Cement (7 MW)
  - Hasho Groups & Hotels (2 MW)
  - Power Cement Wind (9 MW)
  - Aisha Steel (4.5 MW)
  - Instaplast (2MW)
- Designed & successfully commissioned large scale commercial & residential solar solution.
- Dealing with consultant, Client & Lenders for different PPA & ERA projects.
- Planning & Execution of designed projects under the estimated cost.
- Develop and finalize the proposal plan including proposal compliance matrix.
- Organize and holds the project Kick-off meetings.
- Finalize the technical points with Client and close all the Designing, Installation & O&M points with them.
- Selling the solar equipment's in local market also to companies including solar panels and inverters.
- Approves the scope of work of each party involves in the projects. (Contractors)
- Developed Operation & Maintenance work flow and SOPs to increase revenue and efficiency.
- Provided O&M and back-up support which included regular calibration equipment redundancy, system availability and capacity factor achievement.
- Provide full support during & after completion of projects.
- Developing of BOQ and manage to purchase it from local & International vendors (Structure, Controller etc)
- Selection and installation of controlling devices for Genset.

TECHNICAL MANAGER | ACT GROUP | MARCH, 2019 – OCT, 2021

ACT Group is a group comprising of three of the large conglomerates operating in Pakistan; Akhtar Group, Candyland (Ismail Group) and Tapal Group. The three groups have jointly invested in 80 MW wind power project in Pakistan. The project has achieved COD in 2016.The group further aims to invest in wind, Hydro & Solar power projects in Pakistan. Construction) company in Pakistan that delivers cost effective and environment friendly solutions.

RESPONSIBILITIES

As a Technical Manager, I am responsible for leading the installation and designing department for PV project to meet customer satisfaction in an economical manner. In addition, I am also responsible to plan and supervise the maintenance activities of all completed and under warranty/contract with coordination of Trina Solar (Consultant of ACT Group). Also responsible of sales of solar panels and customer care.

- Complete designing, installation, system integration and feasibility of Hybrid & Grid-Tied Solar plants of following prominent projects among others:
  - Ismail Industry (2 MW)
  - Snack City Lahore (680 Kw)
  - Connect Logistics (589kw)
  - Glaciers (700 kw)
- Designed & successfully commissioned large scale commercial & residential solar solution
- Manage the interface with EPC partners (Trina Solar) and Client.
- Develop and finalize the proposal plan including proposal compliance matrix.
- Organize and holds the project Kick-off meetings.
- Finalize the contractors with respect to Design & technical expertise.
- Finalize the technical points with Trina's Engineer and close all the Designing, Installation & O&M points with them.
- selling the solar equipment's in local market also to companies including solar panels and inverters.
- Approves the scope of work of each party involves in the projects. (Contractors)
- Developed Operation & Maintenance work flow and SOPs to increase revenue and efficiency.
- Provided O&M and back-up support for solar Grid-Tied & Hybrid solution which included regular calibration equipment redundancy, system availability and capacity factor achievement.
- Developing of BOQ and manage to purchase it from local & International vendors (Structure, Controller Breakers etc)
- Organize and holds the meetings with clients on their requirements.
- Follow-up the clients for new projects.
- Selection and installation of controlling devices for Genset.
- Installation & commissioning of Remote monitoring equipment's of different brands (Weather Station, Data logger etc)

ASSISTANT MANAGER O & M / EXECUTION | REON ENERGY | SEPTEMBER, 2016 – FEBRUARY, 2019

Reon Energy Limited was started in 2012 with a clear focus on providing solar energy solutions. Solar with its short set-up time and abundance has proven to be an effective solution for the country's economy.

RESPONSIBILITIES

As an O&M Engineer, I am responsible for leading the Operation and Maintenance of all installed Solar PV Projects to meet customer satisfaction in an economical manner and I am also responsible to plan and supervise the maintenance activities of all completed and under warranty/contract projects. In addition, my Responsibility included but not limited to installation of solar system, managing executing and commissioning of project.

- **Responsibilities:**
  - Preparing monthly reports on the Operational performance of the installed solar projects.
  - Ensuring performance deviations are promptly identified and rectified.
  - Ensuring prompt response to after sales service calls.
  - Managing databank for all operational data and maintenance logs.
  - Detail Audit of projects before closing.
  - Corrective & preventive maintenance of all projects.
  - Collaborate with Engineers and Leads on required changes during site operation.
  - Comply with Company health, safety and environmental policies.

- Data analysis of installed plants and Weather Station.
- Compile report on detailed analysis of Weather Station & Installed Plants.
- Research & Development of new products to enhance plants efficiency with cost effective solutions.
- Lead team for installation on different projects including Special structure, roof mount & ground mount.
- Calculation of powered Suppressed by Controlling devices (DEIF, Elgris).
- Hand on experience on controlling devices like (DEIF, Elgris, Seneca Data logger)
- Complete/partial designing and installation, system integration and feasibility of Grid-Tied Solar Plants of following prominent projects among others:
  - SECMC (5 Mw)., Islamkot
  - Matco Rice Mill (400 Kw)., Karachi,
  - Alucan Pvt Ltd (240.24 Kw)., Karachi
  - DP World (182Kw)., Karachi
  - Solex Chemical Pvt Ltd (170 Kw)., Multan
  - Rackiett Benckiser (107.28 Kw)., Karachi
  - Younis Textile Mill (100 Kw)., Karachi
- Designed and successfully commissioned large scale commercial and residential solar solutions (Grid-Tied, Off-Grid and Hybrid systems)
- Developed Operations and Maintenance workflow and SOPs to increase revenue and efficiency.
- Provided O&M and back-up support for solar Grid-Tied and Hybrid solutions which included regular calibration, equipment redundancy, system availability and capacity factor achievement.
- Experience in large scale system designing through internationally recognized and standardized PV softwares (PVsyst/PV*SOL/Helioscope)

APPLICATION ENGINEER | PAK OASIS | FEBERUARY, 2014 TO AUGUST 2016

PAK Oasis is an EPC, OEM and O&M Company, active in the fields of water filtration, desalination, wastewater management, Solar Energy and disaster relief. With interests across South Asia, the Middle East and North Africa, PAK Oasis now has a portfolio of more than 1,500 projects in these fields with a variety of sizes and applications composing its divers profile in domestic, industrial and agricultural, urban and rural projects. Project orchestrated by PAK Oasis have reached tens of millions of imperial gallons per day, more than 50,000 cubic meters as well as composite hub projects of individual plants with much smaller individual capacities.

RESPONSIBILITIES:

Responsibilities ranged from installation, O&M and R&D of Solar Reverse Osmosis and Solar Ultra Filtration water treatment plants, Solar tube wells for irrigation of land, UF 14 MIGD (Ultra Filtration plant), meetings, Documenting, managing, commissioning and O&M of projects.

Projects & Responsibilities

- **P-250 Solar Tube Well, P-500 UF (Ultra Filtration) & P-750 RO (Reverse Osmosis projects.**
  - Installation and commissioning of plants.
  - Designing of Solar bank mechanical structure for tube well.
  - Design and installation of protection and metering equipment's.
  - Lead complete team for troubleshooting in solar electrification and solar water pumping.
  - Monitoring troubleshoots error codes/alarm and controlling plant running parameters.
- **Ultra Filtration Water Treatment Plant (14 MIDG) 1st Mega Project in Pakistan**
  - Operation and Maintenance of Ultra Filtration Water Treatment Plant.
  - Supervision in the operation of wastewater treatment facility & inspect from time to time compliance of lessees to environmental regulation
  - Operate in a safe and efficient manner ensuring that all operations are carried out within the terms of the permit to work and local relevant standing orders.
  - Provides service report to the client after servicing and the related scope of work in the plant
  - Handles hazardous materials safely and implements operating procedures.

Education

BE.ENERGY | 2009 | HAMADARD UNIVERSTY KARACHI,

- CGPA:2.98/4.00
- Fest Merit Scholarship
- Student Member ASHRAE Pakistan
- Member National Youth Parliament

Soft Skills

- PVsol
- Helioscope
- AutoCAD & Link Software's
- PVsyst
- MS Office

Seminar/Certification

- Fundamentals of Air System Design – ASHRAE Pakistan
- NTS (National Testing Service) Pakistan – 52 Marks (72.65 Percentile) – 2013
- Ielts – 6.5 Bands (Nov 2016 to Nov 2018)
- 1st Youth National Energy Conference – National Youth Parliament.
- 5th International Conference on Power Generation – PowerGen Pak 2012
- 6th International Conference on Power Generation – PowerGen Pak 2013

Usama Ahmed.

House # H-22, Street # 7, Walton Officers Colony, Lahore, Pakistan.
Cell#: +92-321-7554011 **Email:** engr.osamaf06@hotmail.com **Skype ID:** engr.osama

Objectives:

With over 12 years of experience working as an Electrical Engineer, particularly working on energy projects, my goal is to utilize my Engineering license and background in the renewable and environmental friendly projects.

Highlights:

- ✓ PV Solar Expert.
- ✓ Energy Audits.
- ✓ Planning & Scheduling.
- ✓ PPA & EPC Expertise.
- ✓ Technical Report writing.
- ✓ LV & MV Expertise.
- ✓ Drawings, TDS Development.
- ✓ Testing, Commissioning.
- ✓ QHSE Audits.

Accomplishments:

- ➢ Developed Model of PV Solar Projects on PVSyst & Helioscope for renowned Industrial Projects up to 150MW for Power Purchase Agreement with NEPRA, Pakistan.
- ➢ Supervised teams for Commissioning of various EPC Projects with 100MW capacities.
- ➢ Techno-commercial closure of 12MW Wind & Solar Agreement with Cement Plant.
- ➢ Energy Auditing of Textile Firms in collaboration with World Bank & IFC.

Current Experience:

Sr. Project Engineer from December, 2021 to till Date
Burj Capital – UAE (Lahore, Pakistan Office).

BURJ Capital

Major Duties:

- ➢ Review and evaluate the RFPs of EPC proposals for PPA based projects in Pakistan, UAE, Bangladesh and Srilanka.
- ➢ Liaison role with consultants, EPC contractors, Suppliers, Clients & Lenders.
- ➢ Negotiations of agreements, procurement, EPC, O&M and Financing agreements.
- ➢ Coordinate with legal and financial team for agreement closures.
- ➢ To provide technical assistance in Lenders' technical due diligence processes.
- ➢ Assist Country Manager in achieving the corporate and strategic goals.
- ➢ Quality Assurance / Testing of plant meeting all grid code requirements for compliances.
- ➢ Technical Report writing for Client, Lender & Management.
- ➢ Supervise EPC projects as an Owner's Engineer.
- ➢ Monitor installation & O&M work streams within the projects allocated.
- ➢ Coordination and communication with internal and external parties and/or suppliers to resolve techno-commercial issues
- ➢ Managing site surveys and supervisions for Business Development queries.

Past Experience:

1) **Sr. Electrical Engineer** from October, 2019 to December,2021.
Shams Power (Private) Limited - Lahore, Pakistan.

Major Duties:

- Develop design the specifications and requirements commercial, or industrial PV solar systems.
- Create plans for solar energy system development, monitoring, and evaluation activities.
- Test or evaluate photovoltaic (PV) cells or modules.
- Provide technical direction or support to installation teams during installation, start-up, testing, system commissioning, or performance monitoring.
- Conduct engineering site audits to collect structural, electrical, and related site information for use in the design of residential or commercial solar power systems.
- BOQ Preparation of whole PV Solar Project with cost effective estimation.
- Developing SLDs and Technical Proposals for Commercial Bidding and offers.
- O&M of PV Solar Sites.
- Liaising with WAPDA/ NEPRA & Client for Net Metering & PPA Approvals.
- Conducting Office and Sites' QHSE Audits to maintain the safe working environment.

2) **Assistant Manager (Electrical)** from November, 2010 to September, 2019.
Transfopower Industries (Private) Limited - Lahore, Pakistan.

Major Duties:

- To perform quality checks and perform in process inspections during production processes.
- Schedule the Testing Inspections.
- Co-ordination with Client for Testing schedule and stage Inspections of Panels & Transformers.
- Preparation test and progress reports on weekly and monthly basis to ensure Quality.
- Performing FAT & SAT.
- Implementation of Quality & HSE Standards to enhance production.
- Supervision of Internal & External Quality Audits for ISO.
- Calibration of Testing Equipment.
- RCA for routine and special production Transformers and Panels.

Major Projects:

- ✓ Designing & Estimation of 100MWp PV Solar Plant for National Grid Wheeling Projects.
- ✓ 5 MWp PV Solar Plants Designing for Metro Cash & Carry Stores in Pakistan.
- ✓ Designing of 25MWp of PV Solar Plants on PVSyst for different RFPs of Private and Government Projects.
- ✓ Designed & Supervised 1 MW PV Solar System for HYUNDAI-NISHAT Motor Plant.
- ✓ Designed & Supervised 2 MW PV Solar System for Packages Mal PV Plant.
- ✓ Energy Audit for Carbon emission and diesel generator's cost reduction for World Bank.
- ✓ Testing & Commissioning of 5 MW Solar Power Equipment for Fauji Cement Industry.
- ✓ FAT, SAT of 10 MVA (Step-Up & Step-Down) Transformers for Sugar & Steel Mills Plants.
- ✓ Designed & Installed 03 X 2 MVA KIOSK Hut-Type Sub-Station in KANUPP with MV &LV Panels.
- ✓ FAT, SAT and maintenance of 2MVA KIOSK Hut-Type Sub-Station with RMUs for GIKI.
- ✓ Maintenance & SAT of 5 x 3MVA Step up Transformers for FIEDMC 132kV Grid Station.
- ✓ Commissioned 4.5 MVA Transformers for DESCON Chemical Plant.
- ✓ Designing & Testing of Auxiliary Panels with 1.5MVA Pad Mounted Transformers in 132KV Grids.
- ✓ Commissioned 20MVA Step-up Transformers with Gensets for Bahria Town Lahore.
- ✓ Designed & commissioned 2MVA KISOK S/S with RMUs & LV Panels for US Embassy.
- ✓ Commissioning & Maintenance of 4.5MVA Transformer installed at DESCON Power Project.

Instruments Experience

Having specialization in working with instruments and equipment's on-site works:

- ✓ Digital AVO, Clam-On Meters, Power Analyzers for Power Measurements ***(KYRUTSU, FLUKE).***
- ✓ Digital and Analog Transformer Turn Ratio Meter ***(BIDDLE, MEGGER, RAY-TECH).***
- ✓ Hi-Potential Transformers up to 95kV, Current Injection Sets up to 6000Amps.
- ✓ 11KV Digital High Voltage Insulation Testers ***(Megger, KYRUTSU).***
- ✓ MCBs, MCCBs, ACBs, VCBs & SF6 RMUs ***(ABB, SCHNIEDER, SIEMENS, TERASAKI).***

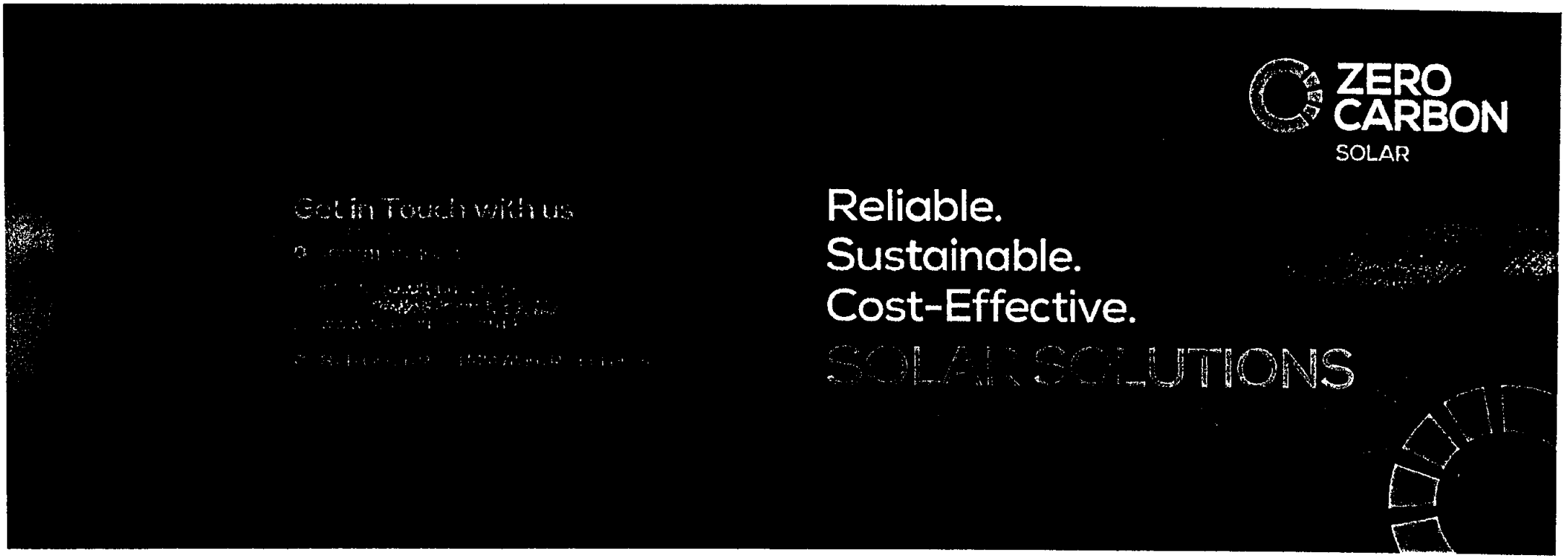
Academia

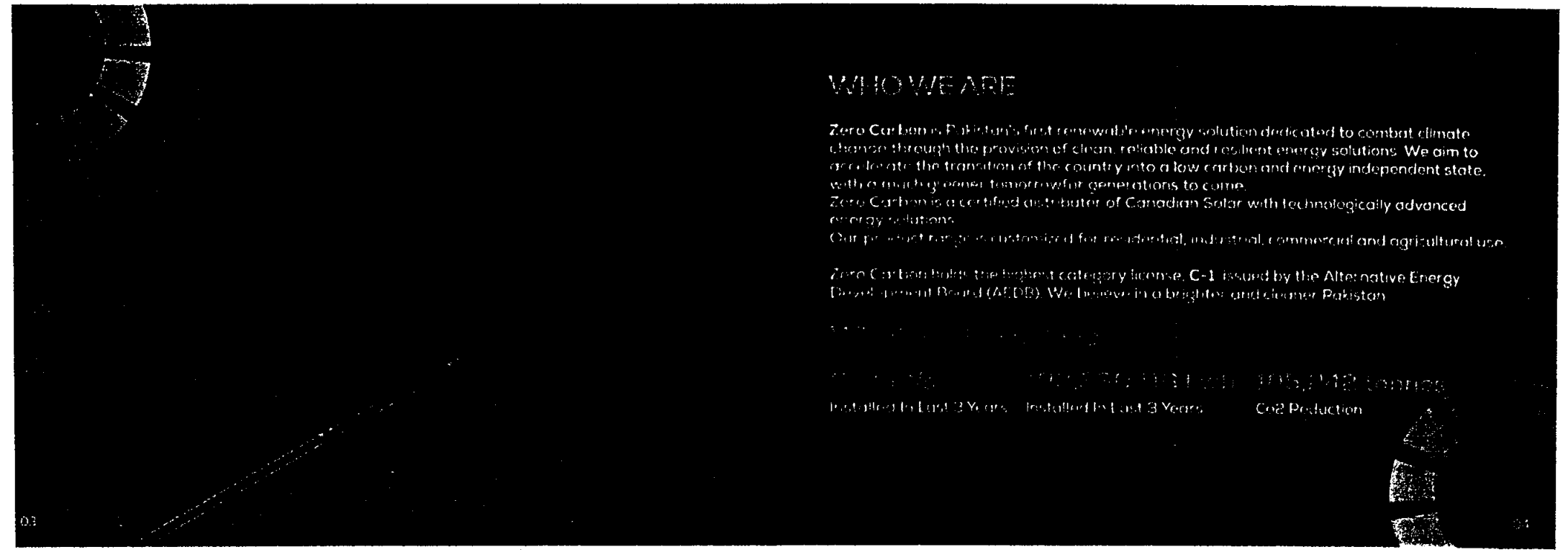
BSc. Electrical Engineering (2006-2010)
University of Central Punjab – Lahore, Punjab, Pakistan.

- ✓ Coursework in Electrical-technology, Machines, Protection and Designing.
- ✓ Coursework in Switchgear, Transformers and Power Distribution Units.
- ✓ Member of Pakistan Engineering Council with PEC #: ELECT/30233.

ANNEXURE VII

COMPANY PROFILE OF EPC CONTRACTOR


ZERO
CARBON
SOLAR
Get in Touch with us
Reliable.
Sustainable.
Cost-Effective.
SOLAR SOLUTIONS



WHO WE ARE

Zero Carbon is Pakistan's first renewable energy solution dedicated to combat climate change through the provision of clean, reliable and resilient energy solutions. We aim to accelerate the transition of the country into a low carbon and energy independent state, with a mighty power tomorrow for generations to come.
Zero Carbon is a certified distributer of Canadian Solar with technologically advanced energy solutions.
Our product range is customized for residential, industrial, commercial and agricultural use.

Zero Carbon holds the highest category license, **C-1** issued by the Alternative Energy Development Board (AEDB). We believe in a brighter and cleaner Pakistan.

Installed In Last 2 Years Installed In Last 3 Years Co2 Production

OUR TECHNOLOGY PARTNERS

We Partner With the Best

CanadianSolar
MAKE THE DIFFERENCE

HUAWEI

JA SOLAR

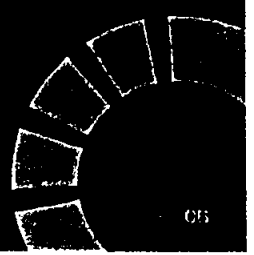
solis

Trinasolar

GOODWE

LONGi Solar

SUNGROW



Zero Carbon provides Turnkey Solar Solutions for all your Energy Problems

Site Audit → System Design → Permitting → Installation → Commissioning → Grid Mixing → Net Metering → Monitoring → Maintenance

Industrial Solar Solutions

Tailored Solutions for Sustainable & Reliable Electrification of Your Asset-Intensive Industrial Units.

Why Zero Carbon Solar Industrial Systems?

Amidst rapidly increasing electricity tariffs, it is becoming increasingly difficult for Pakistan's medium and large-scale businesses to compete in international market. For asset-intensive industries like petrochemicals, mining, cement & glass, and oil & gas industries, the pressure to slash operational costs while maintaining competitiveness & reducing environmental impact is ever-mounting. These complexities are further exacerbated by challenges in operating a complex asset infrastructure vis-à-vis high energy demands.

Zero Carbon Solar offers smart industrial solar solutions to 21st-century energy problems of industrial sector. We provide unrivaled industrial solar solutions for sustainable, reliable and cost-effective electrification of your asset-intensive businesses. Our smart industrial solar solutions are accompanied by proven digital technologies that help your organizations to become more energy-, data-driven, and efficient.

Commercial Solar Solutions

Reduce Your Business's Exposure to Rapidly-rising Electricity Tariffs by Switching to Commercial Solar System.

Why Switch to Solar for Commercial Systems?

Most businesses operate during 9-5 daylight hours. Therefore, installing a commercial solar system is the perfect energy solution. As power prices in Pakistan continue to rise rapidly due to the worldwide surge in energy prices and local currency devaluation, installing a commercial solar system provides much-needed protection to your business against fluctuating electricity tariffs.

As Pakistan's leading commercial solar system installers, we provide unrivaled expertise in slashing your business operational costs through customized solar systems. So, if you are looking to cut operational costs through sustainable business strategies, look no further as we have got your back. Book your free survey and start saving on energy bills NOW!

Our customized solar solutions are ideal for educational institutions, commercial buildings, and other units that operate during the day. Complementing this with Net Metered System, off-day production can be sold back to the grid or adjusted against the energy required during weekdays.

Smartest Residential Solar Solutions

Save up to 100% on Your Electricity Bills Through Our Tailored Residential Solutions

Why Zero Carbon Solar Residential Systems?

Zero Carbon Solar has partnered with the leading international technology companies to provide On-grid and Hybrid solar solutions. We provide the most efficient and advanced residential solar systems comprising solar panels, inverters, and cloud-connected 24/7 support. Our residential solar systems ensure the highest production of electricity units over their lifespan as compared to equivalent systems, providing the best value for your hard-earned money. Our residential solar solutions are net-metered allowing you to sell surplus units to the national grid and get your electricity bill reduced.

Our simple & trouble-free approach and post-sale maintenance services ensure you get the most reliable, cost-effective, and sustainable solar solutions for your unique residential

Net Metering

Sell Surplus Units to National Grid & Save Upto
100% on Your Electricity Bills

What is Zero Carbon Net Metering?

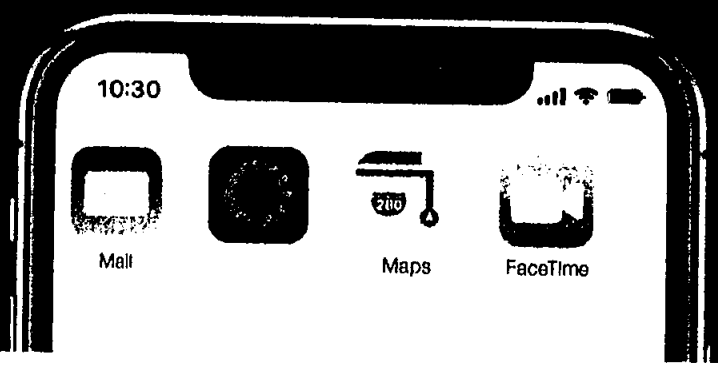
Zero Carbon is determined to help you at every step of the net-metered installation process. The process begins with the installation of a net-metered compliant solar power plant followed by an application submitted to the respective electricity company. The electricity company then runs an inspection and issues the NOC after a full examination. Finally, an agreement is signed with the electricity company and a license is issued which allows the activation of your net-metered solar system.

Zero Carbon is an Alternative Energy Development Board (AEDB) license holder under the category C-1.

This is the highest level of the license provided to a company.

Zero App

Access & Control Your Solar System from Anywhwere in the World

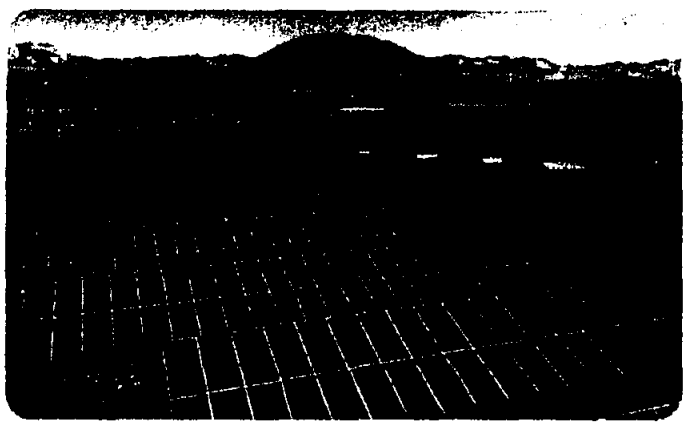


Zero App Features

- Moniter Your Solar System
- Monitor Status & Performance of Inverters
- Keep Track of your Savings
- User-Friendly Interface
- Impact on Environment

Our Flagship Projects

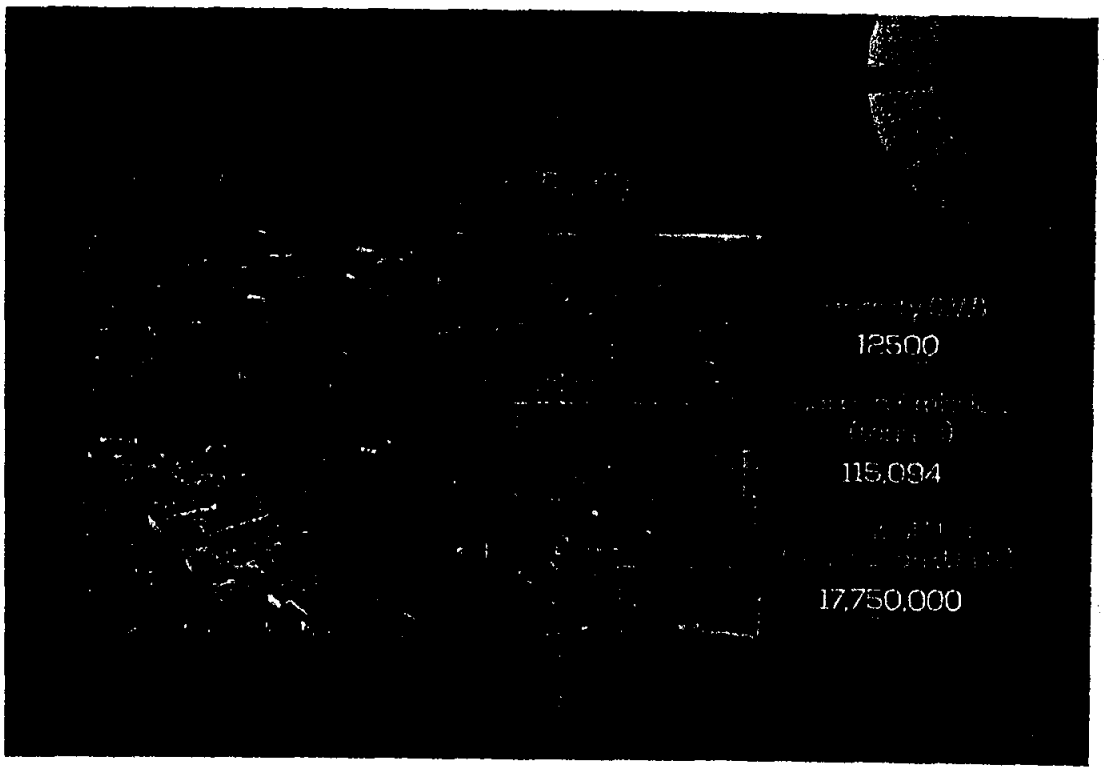
Maple Leaf Cement



Capacity (MW)
12.5

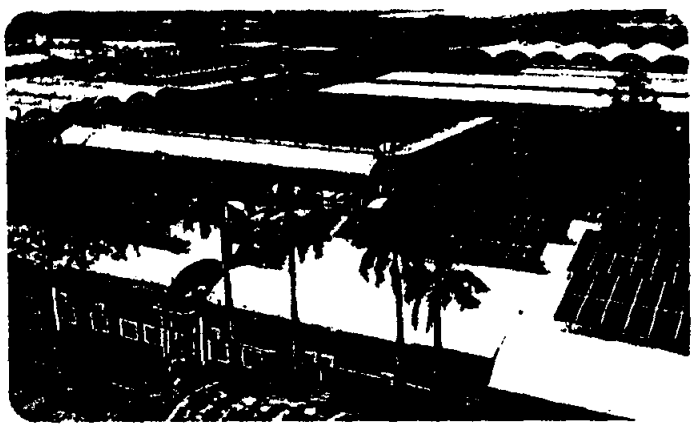
Carbon Emission (tonnes)
115,094

Annual Unit Generation (Units)
17,750,000



Our Flagship Projects

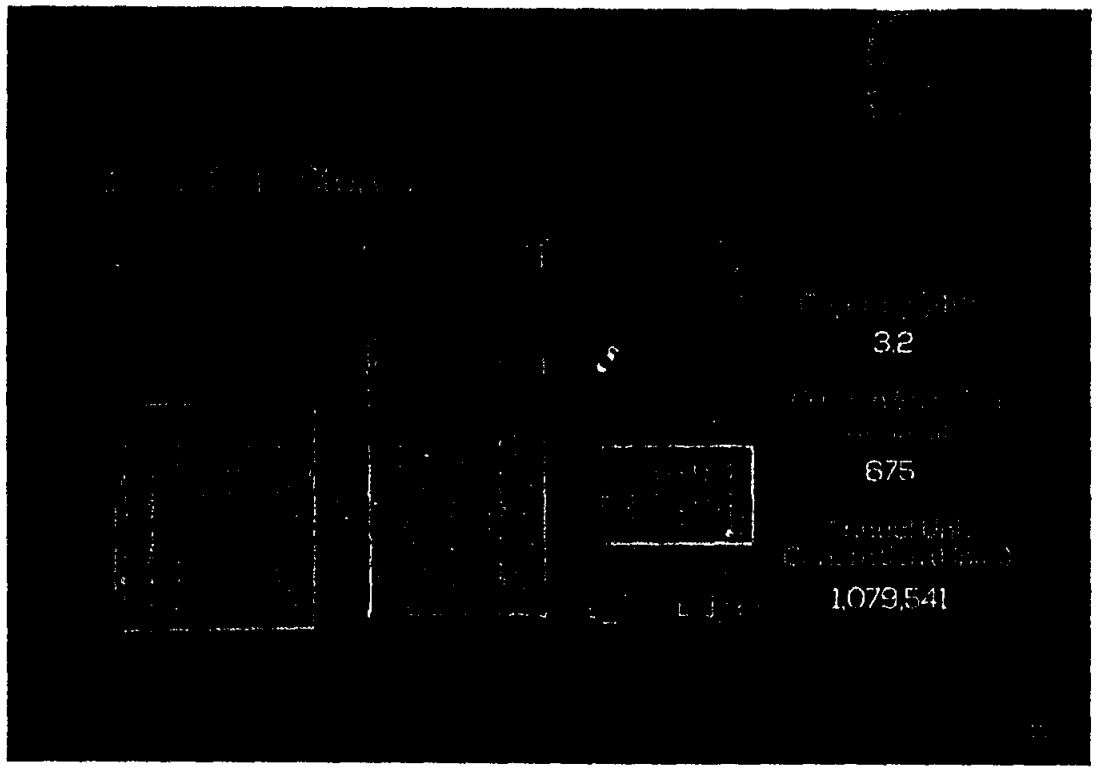
Packages Private Limited



Capacity (kW)
3120

Carbon Emission (tonnes)
2,769

Annual Unit Generation (Units)
4,430,400



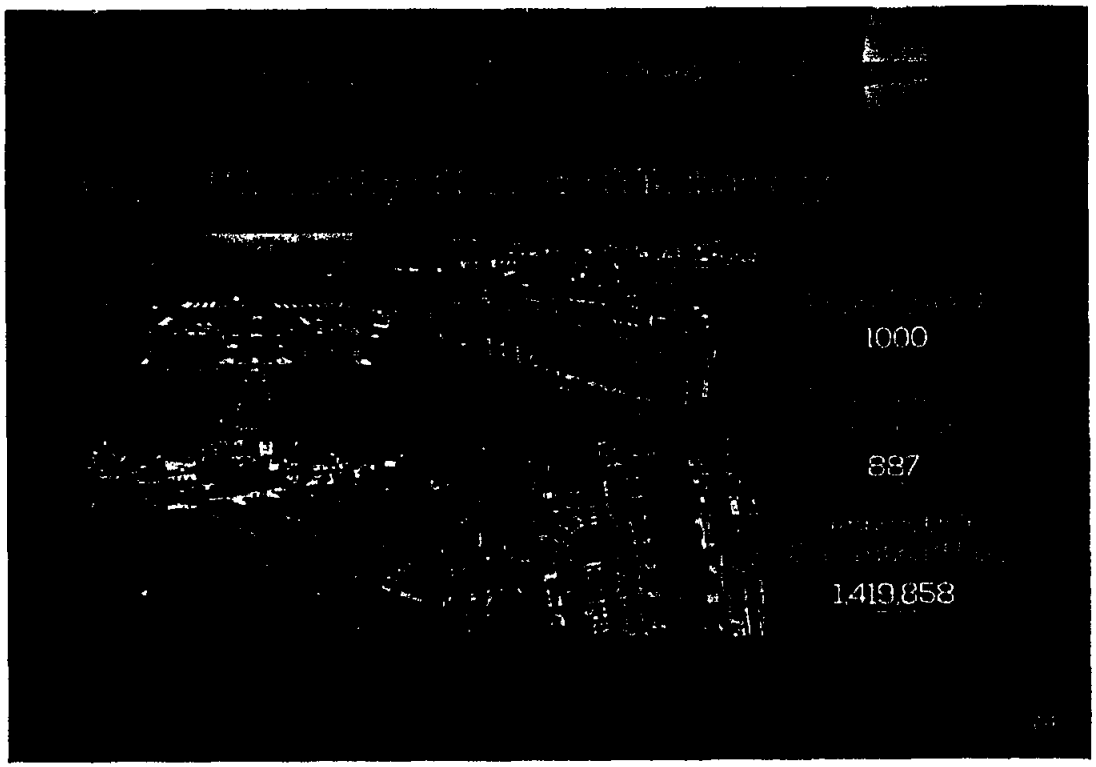
Our Flagship Projects

Hoor Oil Mills

Capacity (kW)
1000

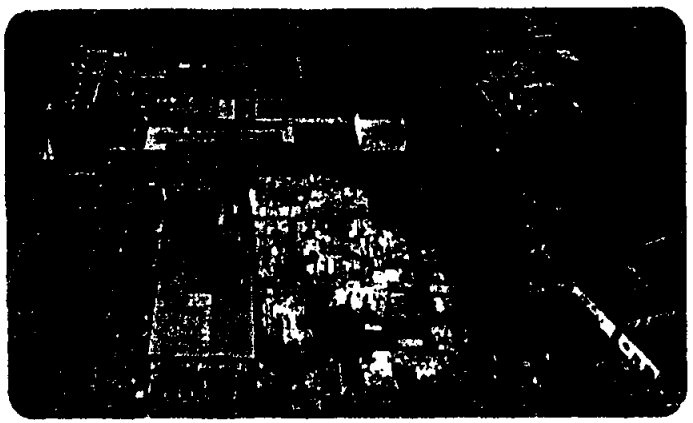
Carbon Emission (tonnes)
887

Annual Unit Generation (Units)
1,419,879



Our Flagship Projects

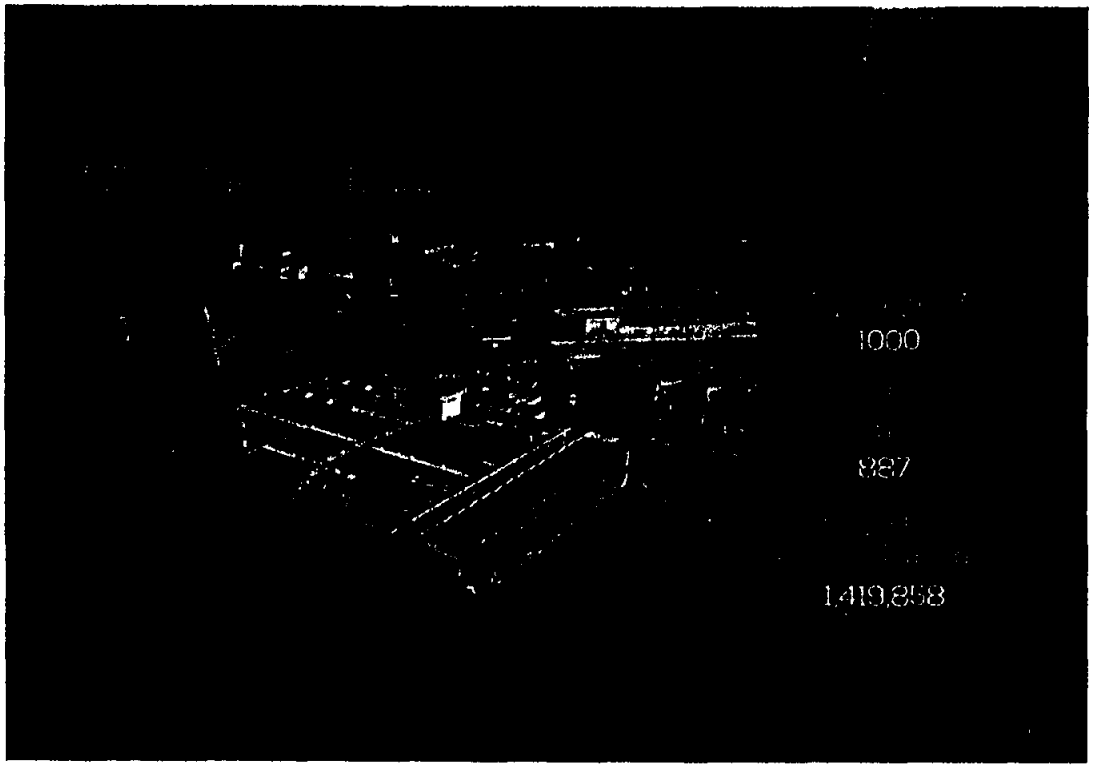
Khalis Fiber



Capacity (kW)
760

Carbon Emission (tonnes)
675

Annual Unit Generation (Units)
1,079,541



Our Flagship Projects

Roots Ivy

Capacity (kW)	Carbon Emission (tonnes)	Annual Unit Generation (Units)
688	610	976,392

Waresa Industry Pvt Ltd

Capacity (kW)	Carbon Emission (tonnes)	Annual Unit Generation (Units)
650	577	923,036

Kohinoor Textile Mills

Capacity (kW)	Carbon Emission (tonnes)	Annual Unit Generation (Units)
2653	2,003	3,679,711

Our Flagship Projects

Happy Cattle Farm

Capacity (kW)	Carbon Emission (tonnes)	Annual Unit Generation (Units)
658	508	932,437

Arsalan Cold Store

Capacity (kW)	Carbon Emission (tonnes)	Annual Unit Generation (Units)
243	215	344,350

Ghani Foods

Capacity (kW)	Carbon Emission (tonnes)	Annual Unit Generation (Units)
200	178	284,128

Jauharabad Sugar Mills

Capacity (kW)	Carbon Emission (tonnes)	Annual Unit Generation (Units)
260	201	368,440

Yuksel Seeds Asia (Private) Limited

1548	175	280,649

Punjab Rice Mills

193	171	273,492

Pak Fans

161	143	228,478

Our Flagship Projects

Toyota Motors Sialkot

Capacity (kW)	Carbon Emission (tonnes)	Annual Unit Generation (Units)
100	89	142,568

Toyota Central Motors

Capacity (kW)	Carbon Emission (tonnes)	Annual Unit Generation (Units)
75	67	106,500

Solar Financing

Power Your Residential, Commercial & Industrial Units
Through Solar Financing

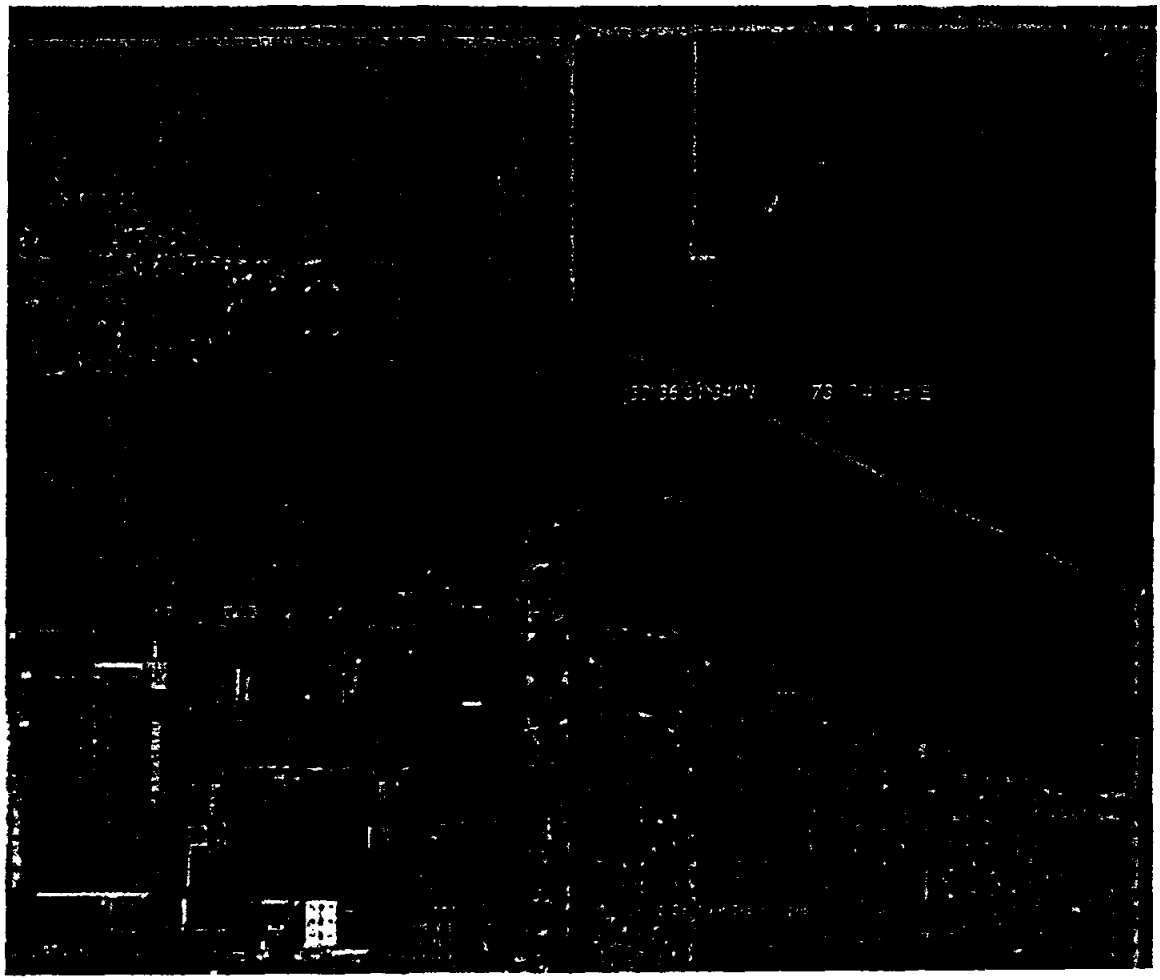
SECTION 3
TECHNICAL DETAILS
(SCHEDULE-I)

Contents of Section-3(Schedule-I)

1. Satellite Image of Site with Coordinates.
2. Flow Diagram of PV Plant and Facility's System.
3. Single Line Diagram of Propose 3MWp PV Plant.
4. Interconnection & Arrangement for Power.
5. Detail of Generation Facility & Solar Power Plant.
    i) General Information
    ii) Equipment Details, Technology & Capacity.
6. I-V Curve.
7. Information Regarding Distribution Network for Supply of Electric Power Consumer in the name of Friesland Campina Engro Pakistan Limited

SATELLITE IMAGE OF SITE WITH COORDINATES:

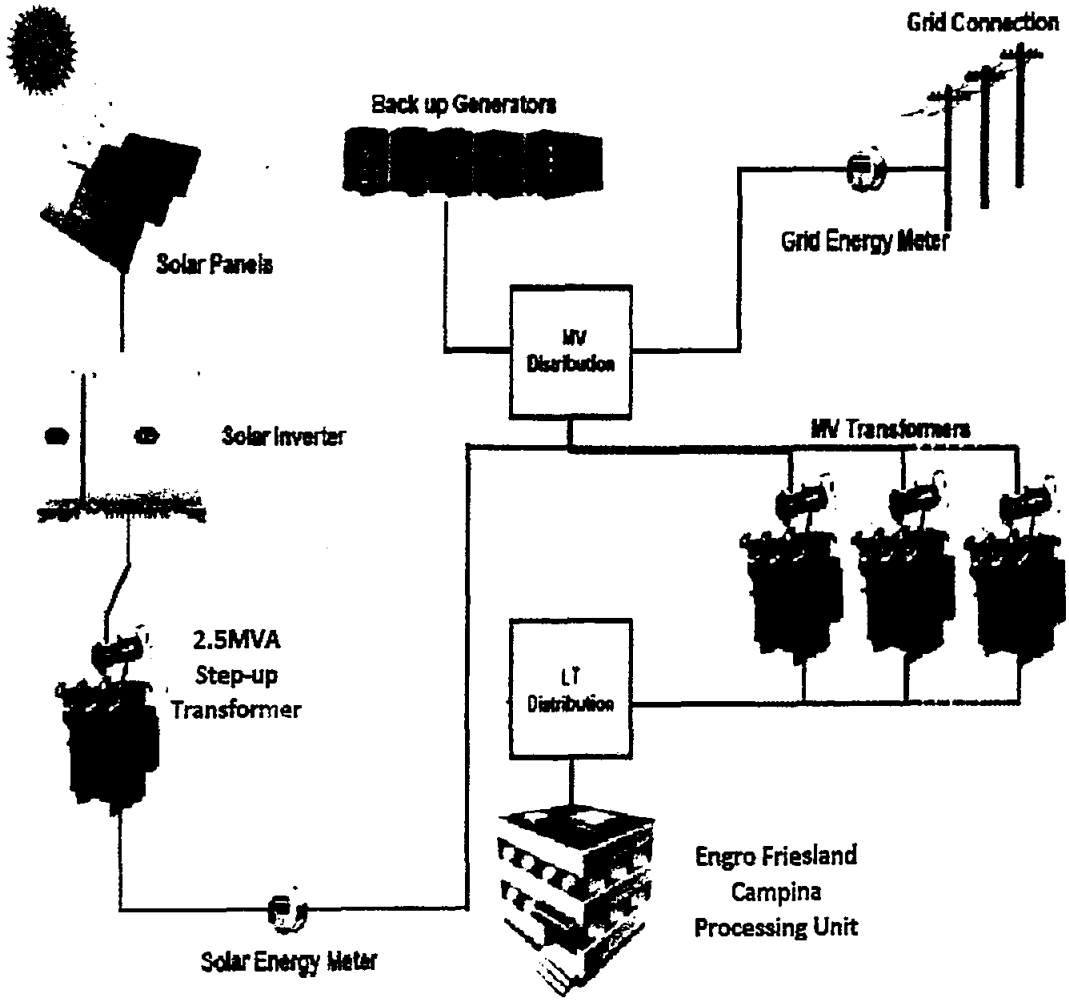
1. **Satellite Image of Site with Coordinates:**



Latitude (North)	Longitude (East)
30°36'31.34"N	*73° 7'47.85"E*

FLOW DIAGRAM OF PV PLANT AND FACILITY'S SYSTEM.

2. Flow Diagram of PV Plant and Facility's System.

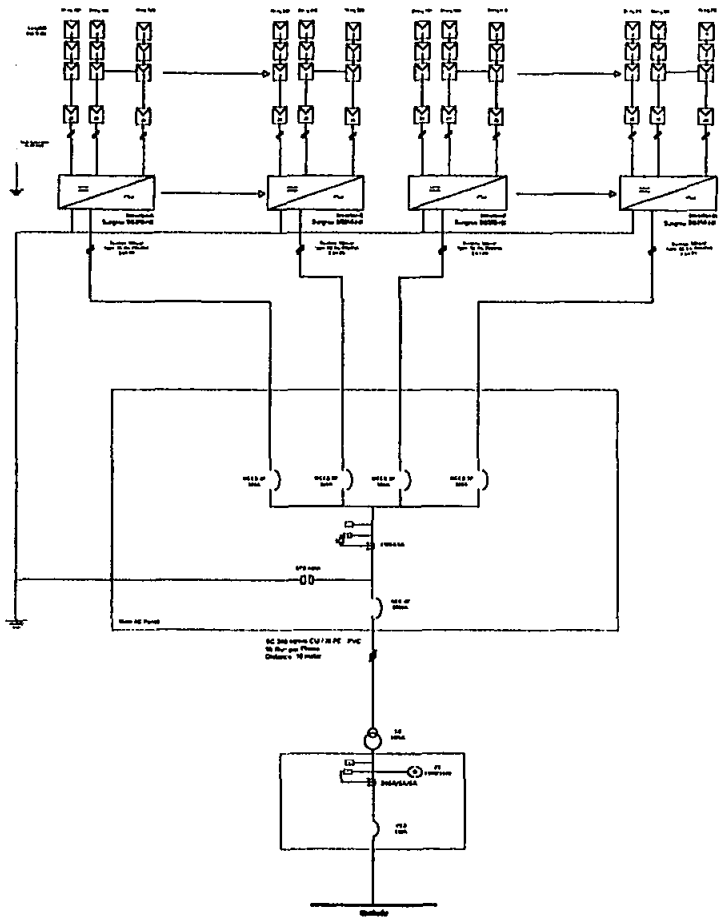


SINGLE LINE DIAGRAM OF PV PLANT:

3. Single Line Diagram of Propose 3MWp PV Plant:

SIngle Line Diagram - 3 MWp Solar PV Plant FrieslandCampina Engro Sahiwal

Ground Mount



SR NO	DESCRIPTION	DOC/DRAWING NO

REFERENCE DOCUMENT/ DRAWING

Legends

Navigation :

Notes:

1-Sungrow Inverter SG350-HX
2-JA/Longi 545W PV Module.
3-Protection Equipment

REV	DATED	DESCRIPTION
A	00-00-00	PROPOSAL DRAWINGS

87-Block B1 MM Alam Road
Gulberg, III Lahore.
info@zerocarbon.com.pk

DATE 26-09-2022

PROJECT
3 MWp PV System - FrieslandCampina Engro Sahiwal, Pakistan

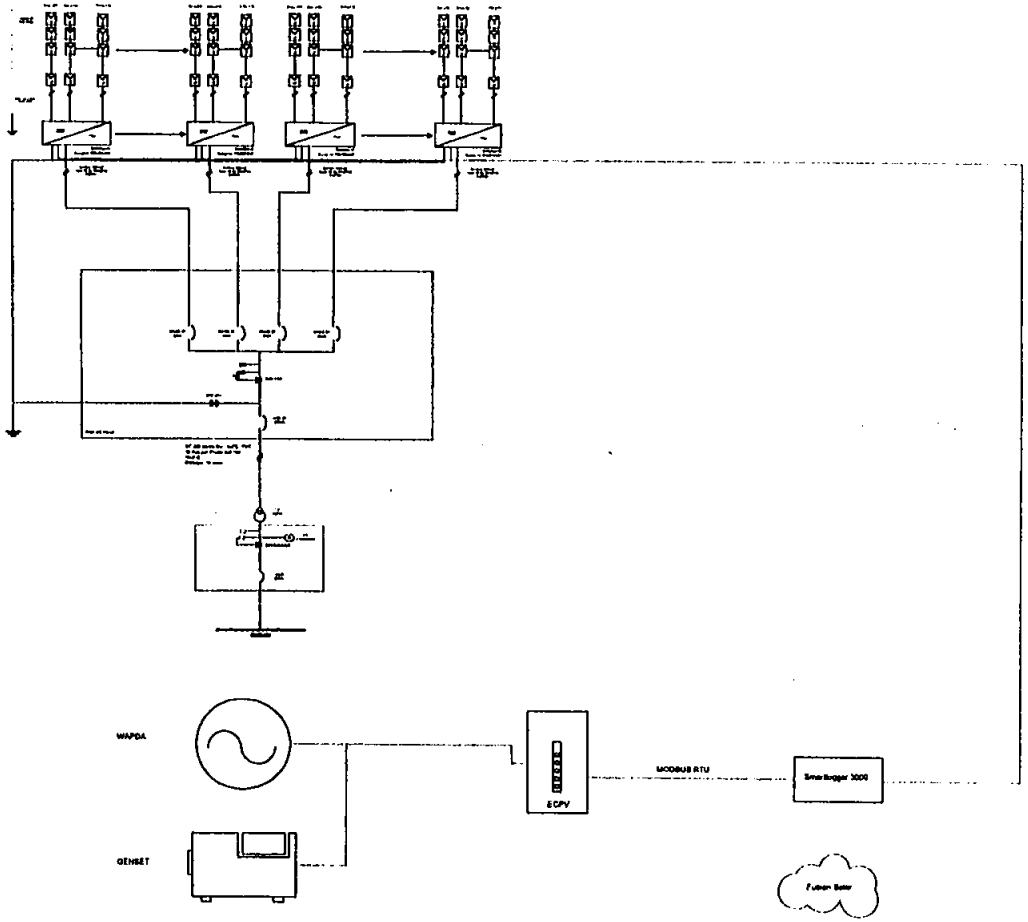
TITLE SINGLE LINE DIAGRAM

SCALE	SHEET SIZE	REV
-	A3	

SHEET: 01

Communication Diagram - 3 MWp Solar PV Plant FrieslandCampina Engro Sahiwal

Ground Mount



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Gulberg, III Lahore.
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DATE 26-09-2022

PROJECT 3 MWp PV System - FrieslandCampina Engro Sahiwal, Pakistan

TITLE SINGLE LINE DIAGRAM

SCALE	SHEET SIZE	REV
-	A3	

SHEET: 01

INTERCONNECTION & ARRANGEMENT FOR POWER.

4. Interconnection & Arrangement for Power:

The power generated from the PV Plant will be dispersed for in-house utilization only. The proposed Interconnection Arrangement for dispersal of electric power for the Generation Facility/Solar Power Plant will be as under:-

(1) 3-Phase 400V Power generated by PV Plant will be stepped-up by installing a 2.5MVA Transformer and will be transmitted to client's MV room for a distance of approximately 150 Meters.

(2) A sperate MV Switchgear will be installed with 2.5MVA step-up transformer ensuring all the necessary protections and control.

(3) Whole power generated by 3MWp PV Plant will be utilized by facility, as facility has sanctioned and running load of over 4MW.

(4) Any change in the above Interconnection Arrangement duly agreed by **Burj Solar Energy (Private) Limited** and **Friesland Campina Engro Pakistan Limited** shall be communicated to the Authority in due course of time.

DETAIL OF GENERATION FACILITY & PV PLANT.

5. **Detail of Generation Facility & Solar Power Plant.**

I. **General Information**

(i).	**Name of the Company/ Licensee**	Burj Solar Energy (Private) Limited
(ii).	**Registered/Business Office of the Company**	Office # 202, 11-C Al-Murtaza Commercial Lane-2, DHA Phase-VIII, Karachi.
(iii).	**Principal Office**	Office # 202, 11-C Al-Murtaza Commercial Lane-2, DHA Phase-VIII, Karachi.
(iv).	**Plant's Name & Location**	Friesland Campina Engro Pakistan Limited, 8-km, Pakpattan Road, Sahiwal, Pakpattan Sahiwal Road, Sahiwal, Sahiwal District, Punjab
(v).	**Field Type**	Fixed Tilted Plane
(vi)	**Field Parameters**	Tilt 20°
(vii).	**Type of Generation Facility**	Solar Photovoltaic (PV)

II. **Equipment Details, Technology & Capacity.**

(a).	**Solar Panels-PV Modules**		
(i).	Type of Module	Mono Perc - crystalline PV Module JAM72S30-545/MR	
(ii).	Surface Area of Module	1.4268 m²	
(iii).	Dimension of each Module	2279 mm x 1134 mm x 35mm	
(iv).	No. of Modules	5,516	
(v).	Frame of Module	Anodized Aluminum Alloy	
(vi).	Weight of one Module	28.6 kg	
(vii).	Module Output Warranty	For 1st Year	For 2nd Year to 25th Year

		97.5% or above	Not more than 0.6% output reduction each year
(viii).	Number of Solar Cells in each Module	144 Cells	
(ix).	Efficiency of Module	21.1 %	
(x).	Environment Protection System	Encapsulation and sealing arrangements for protection from environment.	
(xi).	Maximum Power (Pmax)	545 WP	
(xii).	Power Tolerance at STC	0 ~ +5W	
(xiii).	Operating Voltage @ (Pmax)	41.8 V	
(xiv).	Operating Current @ (Pmax)	13.4 A	
(xv).	Open circuit voltage (Voc)	49.75 V	
(xvi).	Maximum system open Circuit Voltage	1000V(IEC) or 1500V (UL)	
	PV Array		
(i).	No. of Arrays	28	
(ii).	Total No. of Strings	197	
	PV Capacity		
(i).	Total Capacity	3.006 MWP DC	
(ii).	Net Capacity Factor	16.01 %	
(b).	**Inverters**		
(i).	Maximum AC Power Input	2.560 MWac	
(ii).	Inverter Model	Sungrow 350HX	

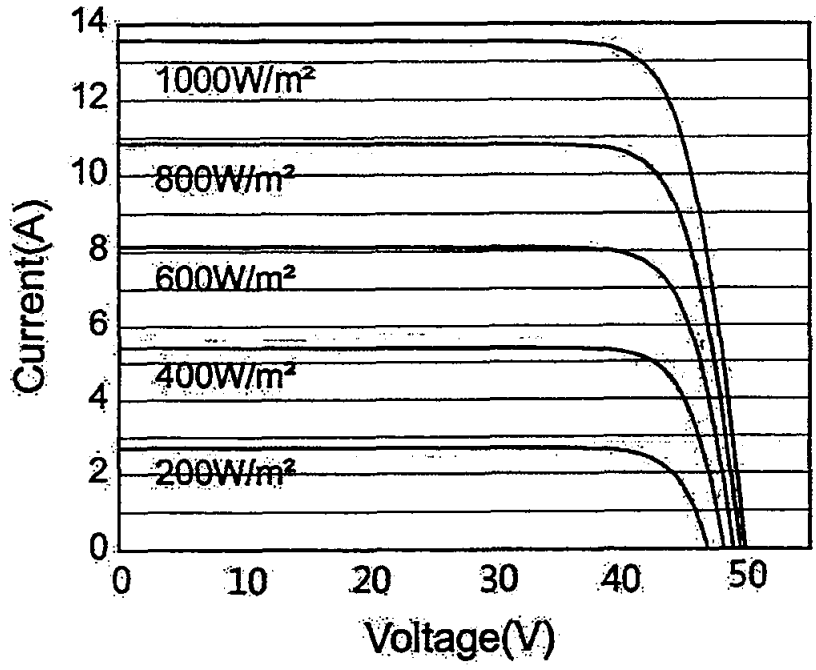
(iii).	Manufacturer	Sungrow	
(iv).	Maximum DC Input Voltage	DC 1500 V	
(v).	Start Voltage	DC 500 V	
(vi).	Number of Inverters	8	
(vii).	Efficiency	98.8%	
(viii).	Max. Input Current	DC 480 A	
(ix).	MPP Voltage Range	500 V- 1500 V DC	
(x).	Output electrical system	3-Phase, 4-Wire	
(xi).	Rated Output Voltage	AC 230/400 V	
(xii).	Rated Frequency	50 Hz	
(xiii).	Power Factor	Adjustable – 0.8 lag to 0.8 lead	
(xiv).	Power Control	MPP Tracker (12 MPPT/Inverter)	
(xv).	Environmental Enclosures	Operating Temperature Range	-30° C to 60° C
		Relative Humidity	100% non-condensing
		Protection Class	IP66
		Audible Noise	
		Operating Elevation	<4000m
(xvi)	Protection Devices	(a).	DC Disconnect Switch
		(b).	Anti-Islanding
		(c).	DC SPD
		(d).	DC Reverse Polarity Protection
		(e).	AC SPD

		(f).	Residual Current Monitoring Unit
	Junction Boxes		
	N/A	Strings directly connected to Inverters	
(c)	**Data Collecting System**		
(i).	Weather Data	(a).	Meteo Control WS501-UMB Irradiation, Temperature, Air pressure, Wind speed, Rel. Humidity
(ii).	System Data	(a).	DC input voltage (V) & current (A) of each Inverter (Phase, Line)
		(b).	Total DC power (kW) generated by PV array.
		(c).	AC output voltage(V) and current (A) of each Inverter (Phase, Total)
		(d).	AC output power (kW) and energy (kWh) of each Inverter
		(e).	Frequency (Hz)
		(f).	Power Factor (PF)
(d)	**Data Collecting System**		
(i)	Expected COD of the generation facility Solar Power Plant		December 31, 2023
(ii).	Expected useful Life of the generation facility Solar Power Plant/ Roof Top Solar from the COD		25 years

6. I-V Curve:

I-V CURVE

Current-Voltage Curve JAM72S30-540/MR



7. **Information Regarding Distribution Network for Supply of Electric Power Consumer in the name of Friesland Campina Engro Pakistan Limited:**

Information Regarding Distribution Network for Supply of Electric Power Consumer in the name of Friesland Campina Engro Pakistan Limited

(i).	No. of Consumers		1 (One)
(ii).	Location of consumers (distance and/or identity of premises)		Friesland Campina Engro Pakistan Limited, 8 km, Pakpattan Road, Sahiwal, Pakpattan Sahiwal Rd, Sahiwal, Sahiwal District, Punjab.
(iii).	Contracted Capacity and Load Factor for consumer		3MWp / 10 - 15%
(iv).	Specify Whether		
	(a).	The consumer is an Associate undertaking of the Licensee -If yes, specify percentage ownership of equity;	No
	(b).	There are common directorships:	No
	(c).	Either can exercise influence or control over the other.	No
(v).	Specify nature of contractual Relationship		
	(a).	Between each consumer and the Licensee	Burj Solar Energy (Private), Limited will construct and operate solar plant and provide electricity to Friesland Campina Engro Pakistan Limited, Sahiwal for its operations.
	(b).	Consumer and DISCO.	Yes Existing Consumer of MEPCO with Sanctioned Load of 4.55 MW
(vi)	Any other network information deemed relevant for disclosure to or consideration of the Authority.		NA
(i).	No. of Feeders		01

(ii).	Length of Each Feeder (Meter)		650m
(iii).	Length of Each Feeder to each Consumer		650m
(iv).	In respect of all the Feeders, describe the property (streets, farms, Agri land, etc.) through, under or over which they pass right up to the premises of customer, whether they cross-over.		N/A
(v).	Whether owned by Burj Solar Energy (Private) Limited, Consumer or DISCO-(deal with each Feeder Separately)		N/A.
	(a).	If owned by DISCO, particulars of contractual arrangement	N/A.
	(b).	Operation and maintenance responsibility for each feeder	DISCO
(vi).	Whether connection with network of DISCO exists (whether active or not)- If yes, provide details of connection arrangements (both technical and contractual)		B3(14)T consumer of MEPCO
(vii).	Any other network information deemed relevant for disclosure to or consideration of the Authority.		N/A.

SECTION 4

SCHEDULE-III

Contents of Section-4(Schedule-II)

1. Installed Gross ISO Capacity Detail.
2. Technical Data Sheet of PV Modules.
3. Technical Data Sheet of PV Inverters.
4. PVSyst Simulation Report.

INSTALLED GROSS ISO CAPACITY DETAIL.

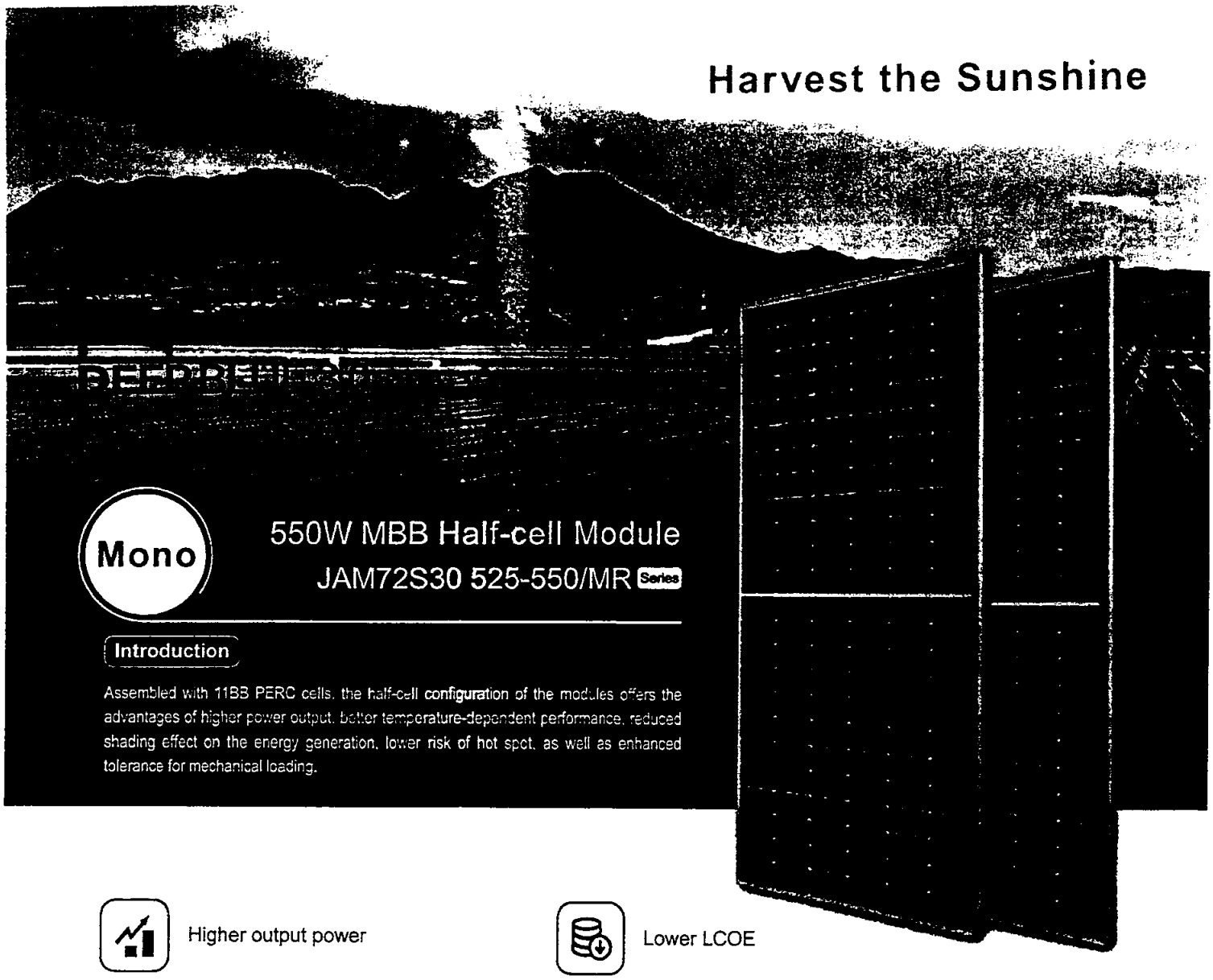
1. **Installed Gross ISO Capacity Detail:**

(1).	Total PV Installed Capacity of Generation Facility	3.006 MWp DC 2.560 MWp (Inverter Output)
(2).	Average Sun Hour Availability/Day (Irradiation on Inclined Surface)	5.18 Hrs
(3).	Days per Year	365
(4).	PV Plant Generating Capacity Annually (As Per Simulation)	4,217 MWh
(5).	Expected Total Generation in 25 years Life Span	98,172 MWh
(6).	Generation per Year from plant keeping 24 Hours Working	2.56 x 24 x 365 = 22,425.6 MWh
(7).	Net Capacity Factor (4/6)	16.01%

All the above figures are indicative as provided by the Licensee. The Net energy available to the Power Purchaser for dispatch will be determined through procedures contained in the Energy Purchase Agreement.

TECHNICAL DATA SHEET OF PV MODULES

Harvest the Sunshine



Mono

550W MBB Half-cell Module
JAM72S30 525-550/MR Series

Introduction

Assembled with 11BB PERC cells, the half-cell configuration of the modules offers the advantages of higher power output, better temperature-dependent performance, reduced shading effect on the energy generation, lower risk of hot spot, as well as enhanced tolerance for mechanical loading.

- Higher output power
- Lower LCOE
- Less shading and lower resistive loss
- Better mechanical loading tolerance

Superior Warranty

- 12-year product warranty
- 25-year linear power output warranty

0.55% Annual Degradation Over 25 years

■ New linear power warranty ■ Standard module linear power warranty

Comprehensive Certificates

- IEC 61215, IEC 61730,UL 61215, UL 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- ISO 45001: 2018 Occupational health and safety management systems
- IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules – Guidelines for increased confidence in PV module design qualification and type approval

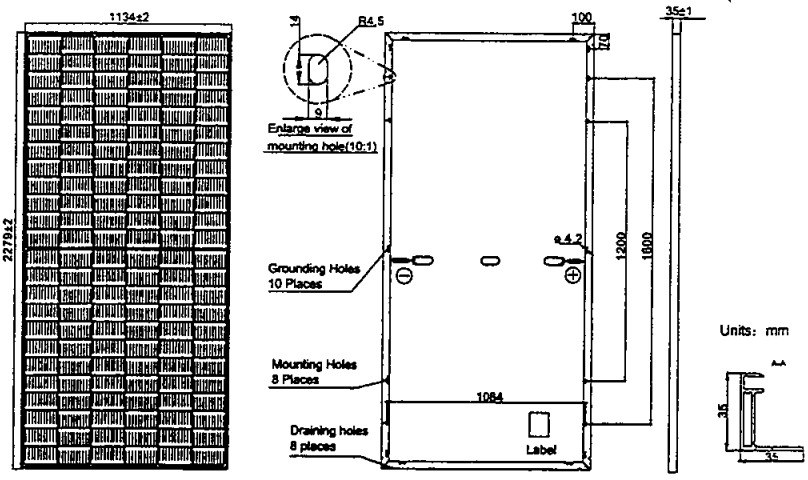
JA SOLAR

www.jasolar.com

JA SOLAR

JAM72S30 525-550/MR

MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request.

SPECIFICATIONS

Cell	Mono
Weight	28.6kg±3%
Dimensions	2279±2mm×1134±2mm×35±1mm
Cable Cross Section Size	4mm² (IEC) , 12 AWG(UL)
No. of cells	144(6×24)
Junction Box	IP68, 3 diodes
Connector	QC 4.10(1000V) QC 4.10-35(1500V)
Cable Length (including Connector)	Portrait: 300mm(+)/400mm(-); Landscape: 1300mm(+)/1300mm(-)
Packaging Configuration	31pcs/Pallet, 620pcs/40ft Container

ELECTRICAL PARAMETERS AT STC

TYPE	JAM72S30 -525/MR	JAM72S30 -530/MR	JAM72S30 -535/MR	JAM72S30 -540/MR	JAM72S30 -545/MR	JAM72S30 -550/MR
Rated Maximum Power(Pmax) [W]	525	530	535	540	545	550
Open Circuit Voltage(Voc) [V]	49.15	49.30	49.45	49.60	49.75	49.90
Maximum Power Voltage(Vmp) [V]	41.15	41.31	41.47	41.64	41.80	41.96
Short Circuit Current(Isc) [A]	13.65	13.72	13.79	13.86	13.93	14.00
Maximum Power Current(Imp) [A]	12.76	12.83	12.90	12.97	13.04	13.11
Module Efficiency [%]	20.3	20.5	20.7	20.9	21.1	21.3
Power Tolerance	0~+5W					
Temperature Coefficient of Isc(α_Isc)	+0.045%/°C					
Temperature Coefficient of Voc(β_Voc)	-0.275%/°C					
Temperature Coefficient of Pmax(γ_Pmp)	-0.350%/°C					
STC	Irradiance 1000W/m², cell temperature 25°C, AM1.5G					

Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer.They only serve for comparison among different module types.

ELECTRICAL PARAMETERS AT NOCT

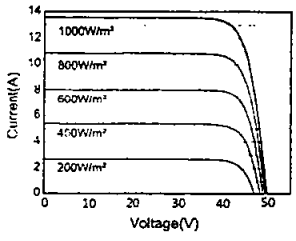
TYPE	JAM72S30 -525/MR	JAM72S30 -530/MR	JAM72S30 -535/MR	JAM72S30 -540/MR	JAM72S30 -545/MR	JAM72S30 -550/MR
Rated Max Power(Pmax) [W]	397	401	405	408	412	416
Open Circuit Voltage(Voc) [V]	46.05	46.18	46.31	46.43	46.55	46.68
Max Power Voltage(Vmp) [V]	38.36	38.57	38.78	38.99	39.20	39.43
Short Circuit Current(Isc) [A]	10.97	11.01	11.05	11.09	11.13	11.17
Max Power Current(Imp) [A]	10.35	10.39	10.43	10.47	10.51	10.55
NOCT	Irradiance 800W/m², ambient temperature 20°C,wind speed 1m/s, AM1.5G					

OPERATING CONDITIONS

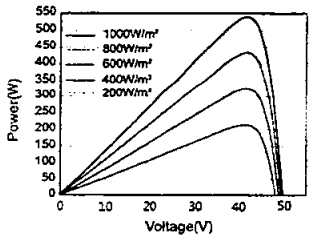
Maximum System Voltage	1000V/1500V DC
Operating Temperature	-40°C~+85°C
Maximum Series Fuse Rating	25A
Maximum Static Load,Front* Maximum Static Load,Back*	5400Pa(112lb/ft²) 2400Pa(50lb/ft²)
NOCT	45±2°C
Safety Class	Class II
Fire Performance	UL Type 1

CHARACTERISTICS

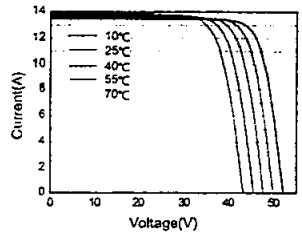
Current-Voltage Curve JAM72S30-540/MR

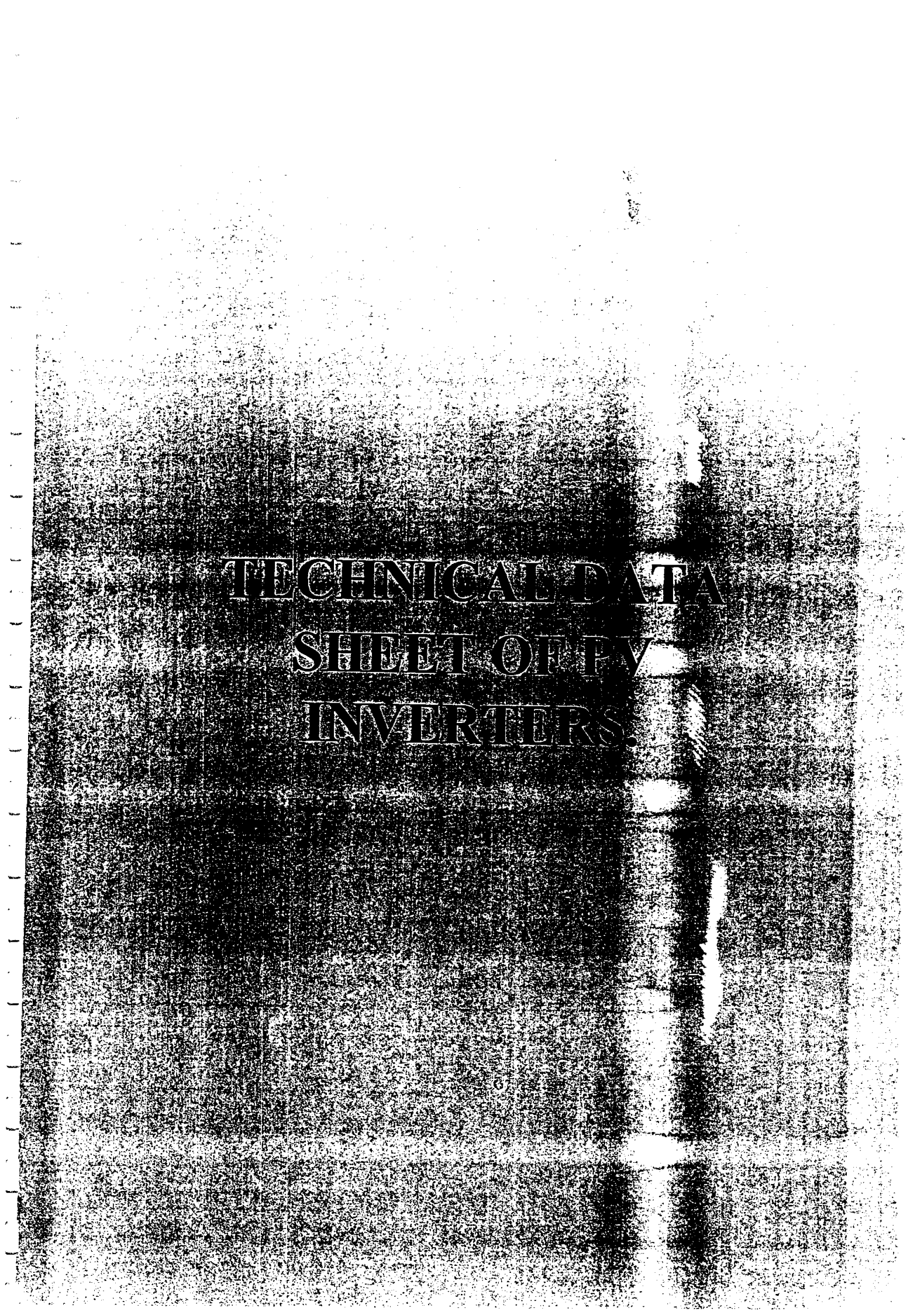


Power-Voltage Curve JAM72S30-540/MR



Current-Voltage Curve JAM72S30-540/MR

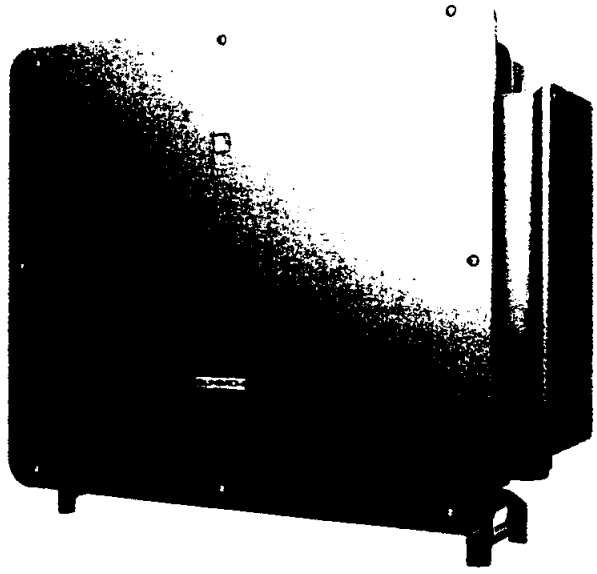



TECHNICAL DATA
SHEET OF PV
INVERTERS

SG350HX

Multi-MPPT String Inverter for 1500 Vdc System

NEW



HIGH YIELD

- Up to 16 MPPTs with max. efficiency 99%
- 20A per string, compatible with 500Wp+ module
- Data exchange with tracker system, improving yield

LOW COST

- Q at night function, save investment
- Power line communication (PLC)
- Smart IV Curve diagnosis*,active O&M

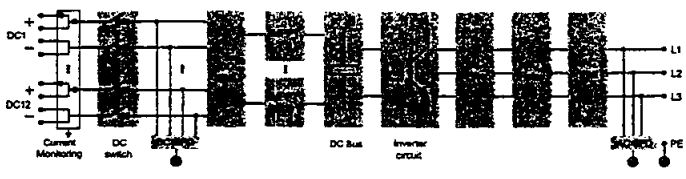
GRID SUPPORT

- SCR≥1.16 stable operation in extremely weak grid
- Reactive power response time <30ms
- Compliant with global grid code

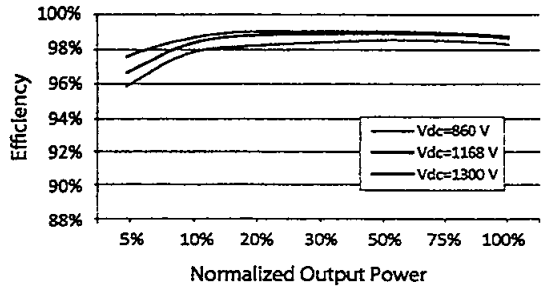
PROVEN SAFETY

- 2 strings per MPPT, no fear of string reverse connection
- Integrated DC switch, automatically cut off the fault
- 24h real-time AC and DC insulation monitoring

CIRCUIT DIAGRAM



EFFICIENCY CURVE



SUNGROW
Clean power for all

Type designation	SG350HX
Input (DC)	
Max. PV input voltage	1500 V
Min. PV input voltage / Startup input voltage	500 V / 550 V
Nominal PV input voltage	1080 V
MPP voltage range	500 V – 1500 V
MPP voltage range for nominal power	860 V – 1300 V
No. of independent MPP inputs	12 (optional: 14/16)
Max. number of input connector per MPPT	2
Max. PV input current	12 * 40 A (Optional: 14 * 30 A / 16 * 30 A)
Max. DC short-circuit current per MPPT	60 A
Output (AC)	
AC output power	352 kVA @ 30°C/ 320 kVA @40 °C / 295 kVA @50°C
Max. AC output current	254 A
Nominal AC voltage	3 / PE, 800 V
AC voltage range	640 – 920V
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
Efficiency	
Max. efficiency / European efficiency/CEC efficiency	99.01 % / 98.8 % / 98.5%
Protection	
DC reverse connection protection	Yes
AC short circuit protection	Yes
Leakage current protection	Yes
Grid monitoring	Yes
Ground fault monitoring	Yes
DC switch / AC switch	Yes / No
PV string current monitoring	Yes
Q at night function	Yes
Anti-PID and PID recovery function	Optional
Overvoltage protection	DC Type II / AC Type II
General Data	
Dimensions (W*H*D)	1136*870*361 mm (44.7" * 34.3" * 14.2")
Weight	≤116 kg(≤255.7 lbs)
Isolation method	Transformerless
Ingress protection rating	IP66 (NEMA 4X)
Night power consumption	< 6 W
Operating ambient temperature range	-30 to 60°C(-22 to 140 °F)
Allowable relative humidity range (non-condensing)	0 – 100 %
Cooling method	Smart forced air cooling
Max. operating altitude	4000 m (> 3000 m derating) / 13123 ft (> 9843 ft derating)
Display	LED, Bluetooth+APP
Communication	RS485 / PLC
DC connection type	MC4-Evo2 (Max. 6 mm², optional 10mm² /Max. 10AWG, optional 8AWG)
AC connection type	Support OT/DT terminal (Max. 400 mm²/ 789 Kcmil)
Compliance	IEC 62109, IEC 61727, IEC 62116, IEC 60068, IEC 61683, VDE-AR-N 4110:2018, VDE-AR-N 4120:2018, EN 50549-1/2, UNE 206007-1:2013, P.O.12.3, UTE C15-712-1:2013, UL1741, UL1741SA, IEEE1547, IEEE1547.1, CSA C22.2 107.1-01-2001, California Rule 21, UL1699B
Grid Support	Q at night function, LVRT, HVRT,active & reactive power control and power ramp rate control, Q-U control, P-f control

*: Only compatible with Sungrow logger and iSolarCloud

SUNGROW
Clean power for a

Logger4000

SMART AND FLEXIBLE

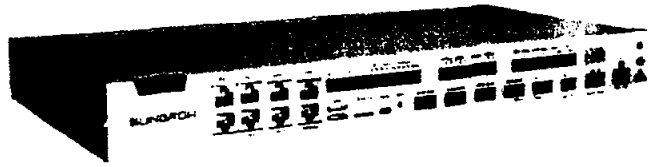
- Intelligent communication and control of the data collection
- Communication with up to 300 devices
- 30ms fast dispatch via Goose protocol
- Built-in Web for commissioning and O&M

SIMPLE AND EFFICIENT

- Automatically distributing Modbus addresses
- Remote parameter setting and control of active & reactive power
- Local maintenance via WLAN access
- Rack-mounted, wall mounting

SAFE AND RELIABLE

- Built-in anti-surge protection for communicaton ports, and support isolation voltage up to 2500V
- Dual power supply, automatic switch



Type designation	Logger4000
Communication	
Max. number of devices	300
RS485	7
Fiber port	2*100 / 1000 Mbps
Ethernet port	4*10 / 100 Mbps
Fast dispatch port	1*10 / 100 Mbps
Digital inputs	16, max. 24 Vdc
Digital outputs	4
Built-in MPLC	1
PT100 / PT1000	2
Analog Input	4 (1 Analog Input: 0 – 10 Vdc, 3 Analog Input: 4 – 20 mA)
Power Supply	
AC input	100 – 277 Vac, 50 / 60 Hz
DC input	24 Vdc, 1.25 A
Power consumption	Typ. 18 W, max. 30 W
Ambient conditions	
Operating Temperature	-30 ℃ to 60 ℃
Storage Temperature	-40 ℃ to 70 ℃
Relative air humidity	≤ 95% (non-condensing)
Elevation	≤ 4000 m
Protection class	IP20
Mechanical parameters	
Dimensions (W*H*D)	440*44*224 mm
Weight	3 kg
Installation	Rack-mounting, wall mounting

PVSYST SIMULATION REPORT.

PVSYST
PHOTOVOLTAIC SOFTWARE

Version 7.2.14

PVsyst - Simulation report

Grid-Connected System

Project: Engro Sahiwal

Variant: 3MWp- Sungrow 350HX - 20220921

Sheds on ground

System power: 3006 kWp

Engro fries - Lakanwala Mor - Pakistan

Author

Zero Carbon Pvt Ltd (Pakistan)

PVsyst V7.2.14
VC0, Simulation date:
23/09/22 12:12
with v7.2.14

Project summary

Geographical Site
Engro fries - Lakanwala Mor
Pakistan

Situation

Latitude	30.61 °N
Longitude	73.13 °E
Altitude	156 m
Time zone	UTC+5

Project settings
Albedo 0.20

Meteo data
Engro fries - Lakanwala Mor
Meteonorm 8.0, Sat=100% - Synthetic

System summary

Grid-Connected System
Sheds on ground

PV Field Orientation
Fixed plane
Tilt/Azimuth 20 / 0 °

Near Shadings
According to strings
Electrical effect 100 %

Shadings of thin objects
According to strings
Electrical effect 40 %

System information

PV Array

Nb. of modules	5516 units
Pnom total	3006 kWp

Inverters

Nb. of units	8 units
Pnom total	2560 kWac
Pnom ratio	1.174

User's needs
Unlimited load (grid)

Results summary

Produced Energy	4506 MWh/year	Specific production	1499 kWh/kWp/year	Perf. Ratio PR	80.87 %

Table of contents

General parameters

Grid-Connected System

Sheds on ground

PV Field Orientation

Orientation		Sheds configuration		Models used	
Fixed plane		Nb. of sheds	122 units	Transposition	Perez
Tilt/Azimuth	20 / 0 °	Sizes		Diffuse	Perez, Meteonorm
		Sheds spacing	7.80 m	Circumsolar	separate
		Collector width	4.58 m		
		Ground Cov. Ratio (GCR)	58.7 %		
		Shading limit angle			
		Limit profile angle	24.1 °		

Horizon	Near Shadings		Shadings of thin objects	
Free Horizon	According to strings		According to strings	
	Electrical effect	100 %	Electrical effect	40 %

User's needs
Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	JA Solar
Model	JAM72S30-545/MR
(Custom parameters definition)	
Unit Nom. Power	545 Wp
Number of PV modules	5516 units
Nominal (STC)	3006 kWp
Modules	197 Strings x 28 In series
At operating cond. (50°C)	
Pmpp	2744 kWp
U mpp	1068 V
I mpp	2570 A

Inverter

Manufacturer	Sungrow
Model	SG350HX-20A-Preliminary
(Custom parameters definition)	
Unit Nom. Power	320 kWac
Number of inverters	8 units
Total power	2560 kWac
Operating voltage	500-1500 V
Max. power (=>30°C)	352 kWac
Pnom ratio (DC:AC)	1.17

Total PV power

Nominal (STC)	3006 kWp
Total	5516 modules
Module area	14268 m²
Cell area	13122 m²

Total inverter power

Total power	2560 kWac
Number of inverters	8 units
Pnom ratio	1.17

Array losses

Array Soiling Losses
Loss Fraction 3.0 %

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 6.9 mΩ
Loss Fraction 1.5 % at STC

LID - Light Induced Degradation
Loss Fraction 2.0 %

Module Quality Loss
Loss Fraction -0.5 %

Module mismatch losses
Loss Fraction 0.6 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

IAM loss factor
Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	1.000	1.000	0.985	0.943	0.840	0.000

System losses

Unavailability of the system

Time fraction	0.8 %
	3.0 days,
	5 periods

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage	800 Vac tri
Loss Fraction	0.50 % at STC
Inverter: SG350HX-20A-Preliminary	
Wire section (8 Inv.)	Copper 8 x 3 x 120 mm²
Average wires length	55 m

MV line up to Injection

MV Voltage	11 kV
Wires	Alu 3 x 185 mm²
Length	380 m
Loss Fraction	0.16 % at STC

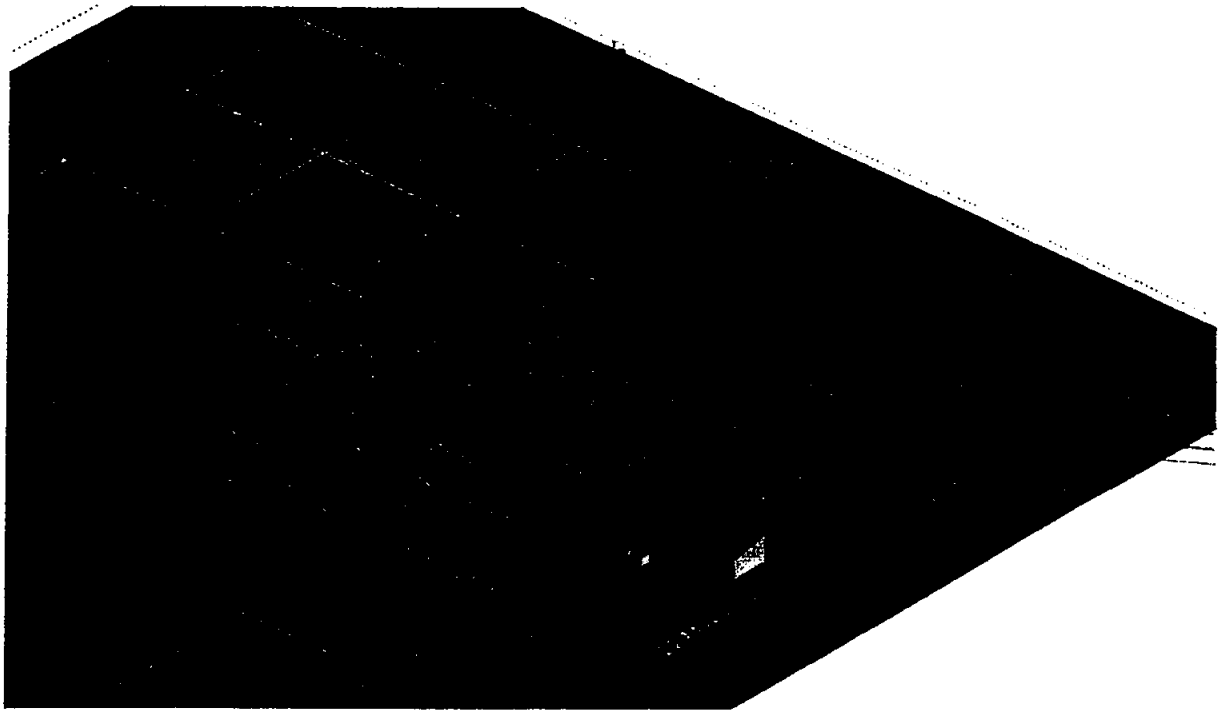
AC losses in transformers

MV transfo

Grid voltage	11 kV
Operating losses at STC	
Nominal power at STC	2962 kVA
Iron loss (24/24 Connexion)	2.96 kW
Loss Fraction	0.10 % at STC
Coils equivalent resistance	*3 x 2.16 mΩ*
Loss Fraction	1.00 % at STC

Near shadings parameter

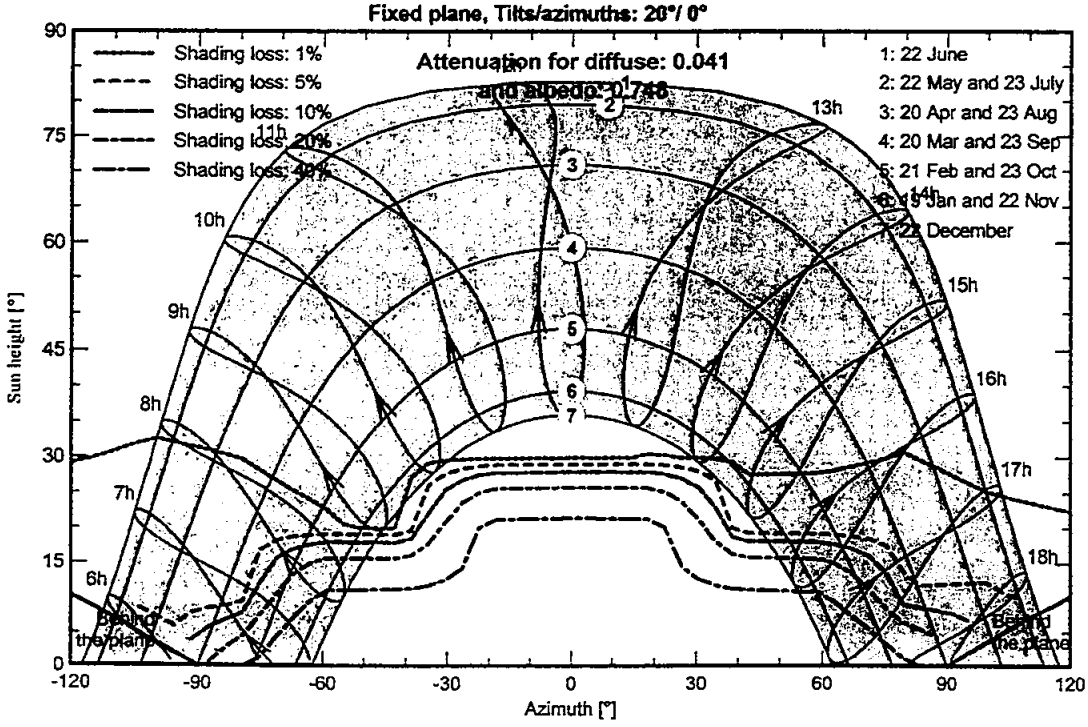
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 20°/ 0°



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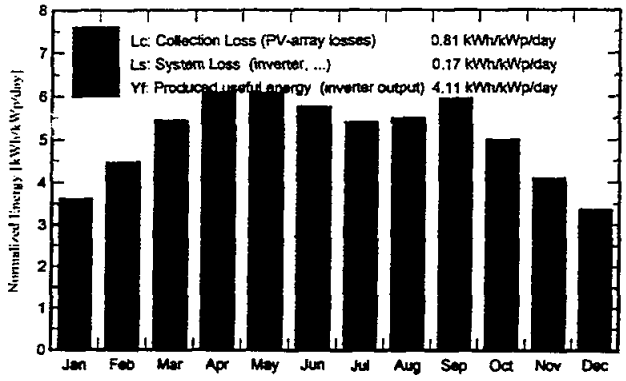
Main results

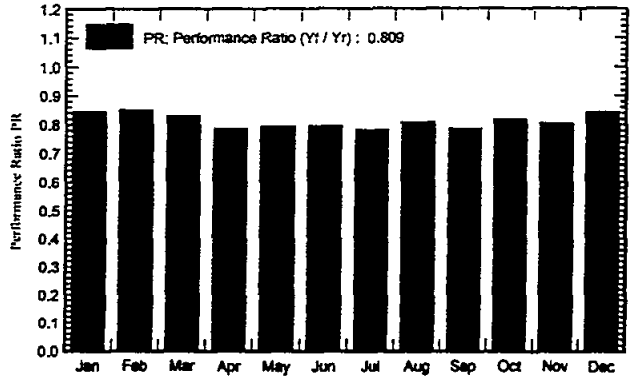
System Production

Produced Energy	4506 MWh/year	Specific production	1499 kWh/kWp/year
		Performance Ratio PR	80.87 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m²	kWh/m²	°C	kWh/m²	kWh/m²	MWh	MWh	ratio
January	87.0	41.3	12.57	112.4	106.2	297.0	286.1	0.847
February	103.9	52.0	16.67	125.2	118.8	329.3	320.4	0.851
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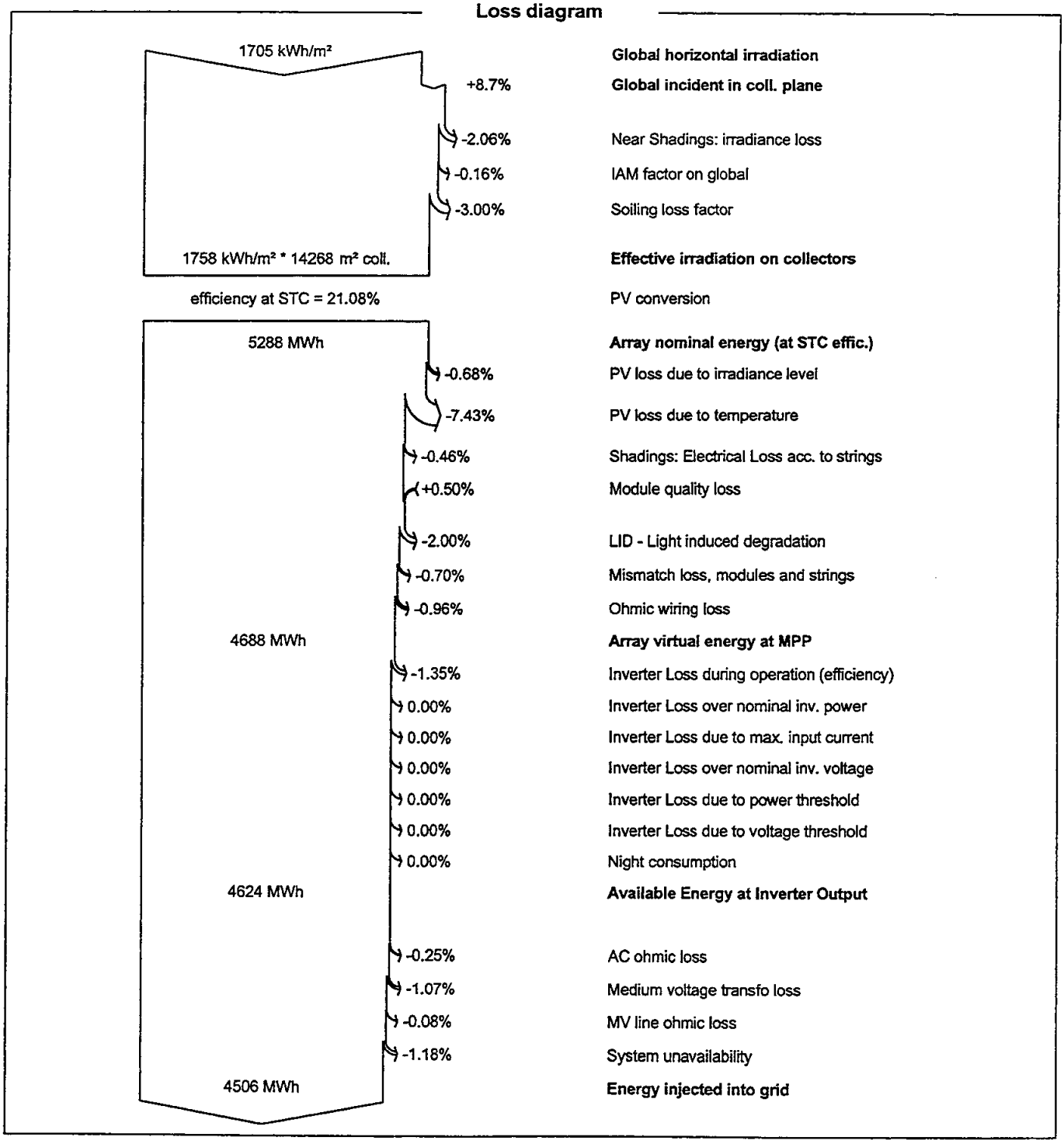
December	81.5	47.7	14.94	104.5	97.8	272.5	265.1	0.843
Year	1705.4	910.6	25.94	1853.4	1757.8	4687.9	4505.7	0.809

Legends

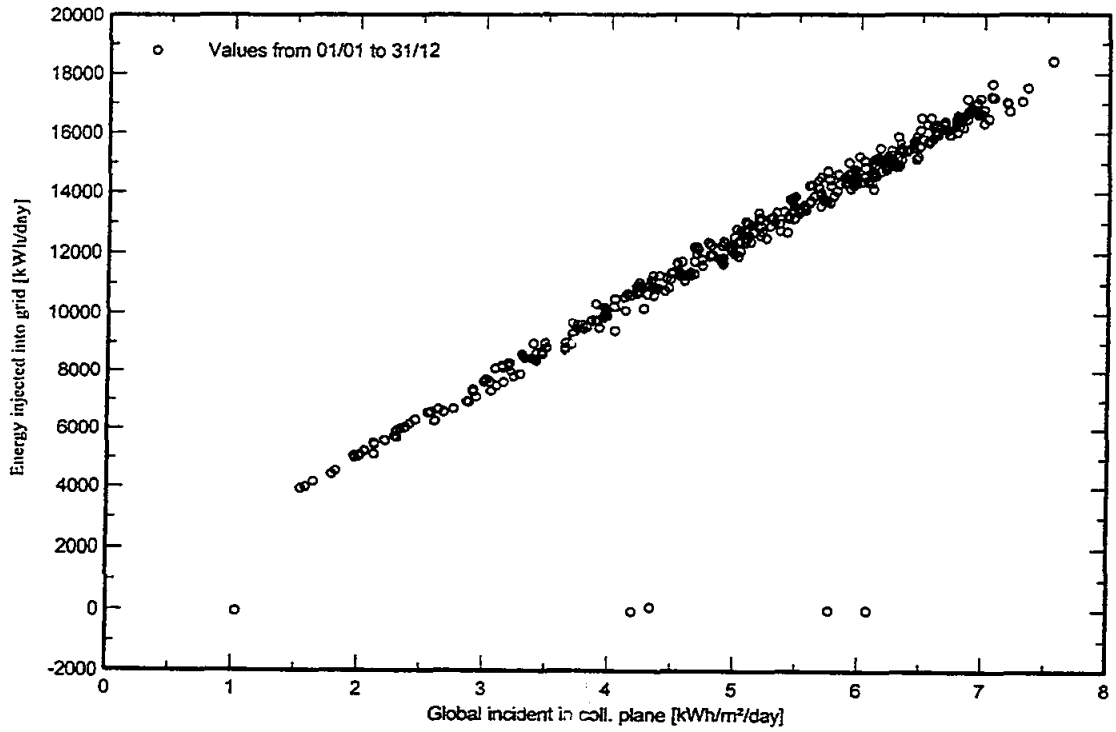
GlobHor	Global horizontal irradiation
DiffHor	Horizontal diffuse irradiation
T_Amb	Ambient Temperature
GlobInc	Global incident in coll. plane
GlobEff	Effective Global, corr. for IAM and shadings
EArray	Effective energy at the output of the array
E_Grid	Energy injected into grid
PR	Performance Ratio

Loss diagram

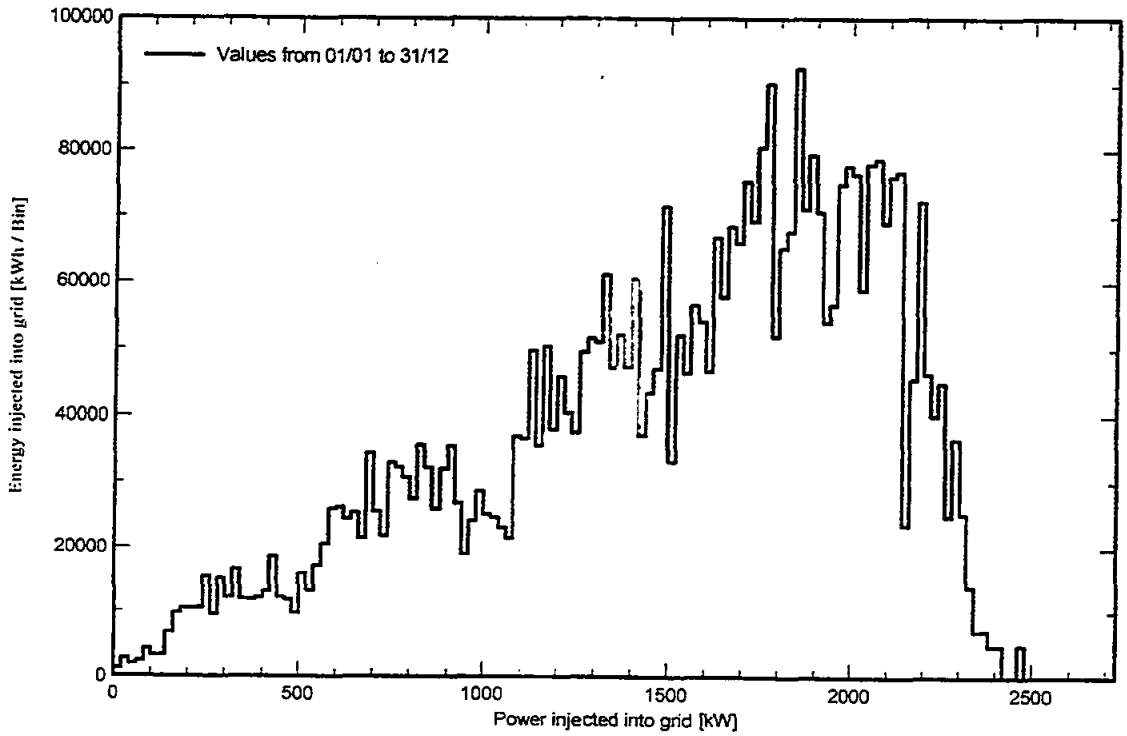


Special graphs

Daily Input/Output diagram



System Output Power Distribution



P50 - P90 evaluation

Meteo data

Source	Meteonorm 8.0, Sat=100%
Kind	Monthly averages
Synthetic - Multi-year average	
Year-to-year variability(Variance)	4.6 %
Specified Deviation	
Climate change	0.0 %

Global variability (meteo + system)

Variability (Quadratic sum)	5.0 %

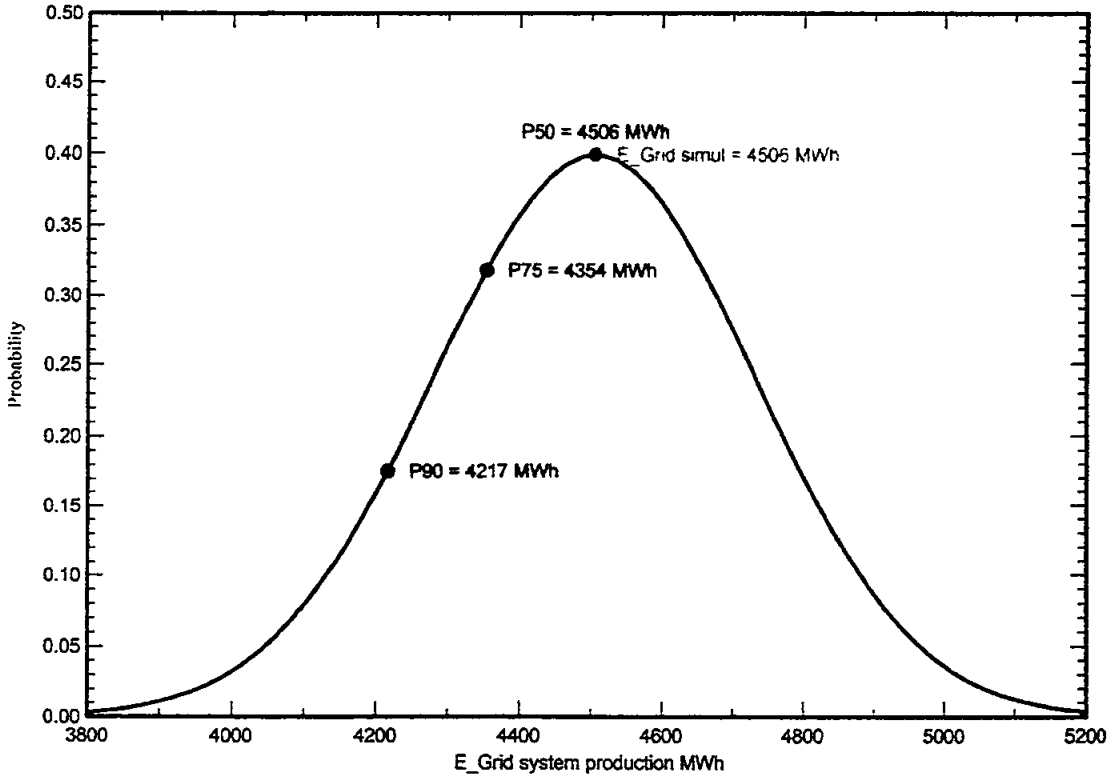
Simulation and parameters uncertainties

PV module modelling/parameters	1.0 %
Inverter efficiency uncertainty	0.5 %
Soiling and mismatch uncertainties	1.0 %
Degradation uncertainty	1.0 %
Custom variability	0.8 %

Annual production probability

Variability	226 MWh
P50	4506 MWh
P75	4354 MWh
P90	4217 MWh

Probability distribution



SECTION 5

FEASIBILITY OF PROJECT

FEASIBILITY REPORT FOR 3MWp PV SOLAR PLANT INSTALLATION

AT

Friesland Campina Engro Pakistan Limited, Sahiwal.

by

Burj Solar Energy (Private) Limited.

EXECUTIVE SUMMARY

The feasibility examines the costs, practicality, and likely outcome of a solar photovoltaic (PV) installation in Engro Friesland Campina, Sahiwal.

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 insolation is assumed to be "good" (1,705 kWh/ square meter/ year). Panel azimuths (0 degrees), panel tilt (20 degrees) and satisfactory roof condition and structure are also assumed.

Anticipated System Information: The project will accommodate a 3MWo(DC) solar PV system with a projected annual production of 4,217 MWh/ year. Use of a JA Solar JAM72S30-545/MR (545Watt) PV Modules, the system will offset approximately 2,489 tons of carbon dioxide annually.

Financial Analysis: The total estimated project cost is estimated **USD 1,968,930** The sponsors of Burj Solar Energy (Private) Limited have agreed to finance the project on 80:20% equity.

Based on the technical and financial analysis, the installation of a 3MWp Solar PV System at the Friesland Campina Engro Pakistan Limited, Sahiwal is deemed to be feasible.

Introduction

The project site is rooftops and rooftop space of Friesland Campina Engro Pakistan Limited, Sahiwal. The site is a commercial area. The exact coordinates of the project site are:

TIME	*Longitude (East)*
30°36'31.34"N	*73° 7'47.85"E*

A bird's eye view of the project site is given in the figure below:

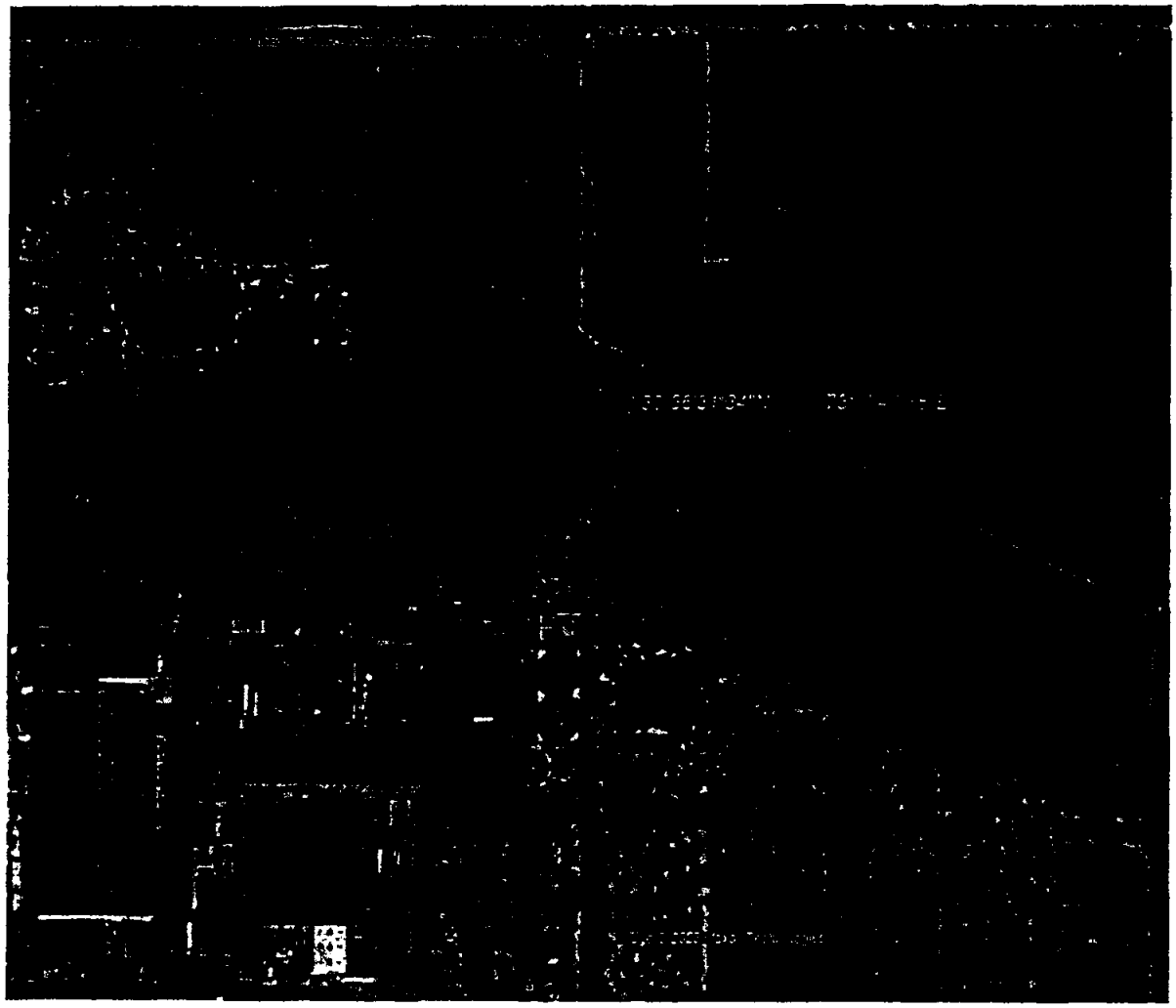


Figure 1: Overview of Project Site

Technical Analysis

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.

Solar PV Yield Estimation and Simulation

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

Working Conditions

The solar system will have automatic mechanism to ensure that PV power currently generated by the inverters always matches the current power consumption of the site load. A closed loop control system of inverter 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 in case of Load shedding.

Plant Characteristics

Generation Voltage: 800 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.

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"
- PV layouts of the site are given in 3D and 2D view in the following section.

Layout

The detailed layout (2D and 3D) of the solar panels is given below; PV layout may change depending upon site constraints before or during installation. PvSyst simulation is also performed as per following layout:

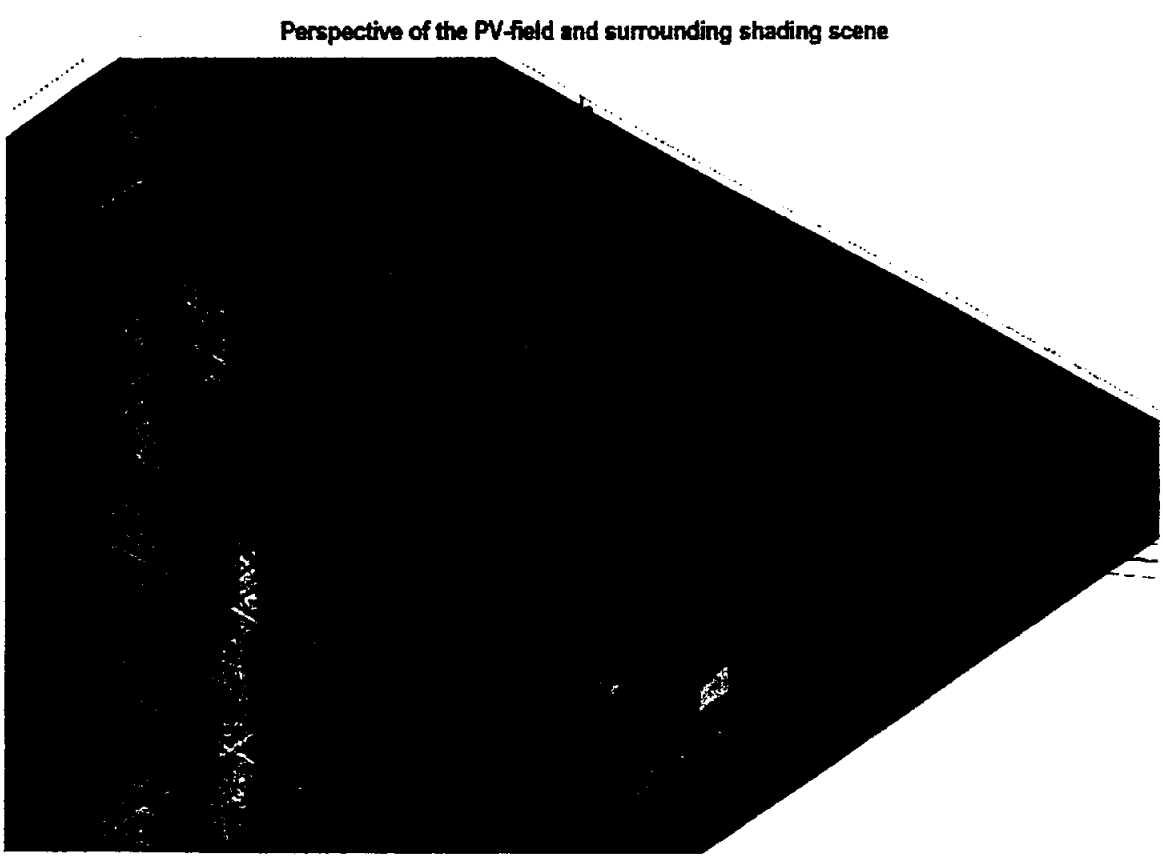


Figure 2: 3D Layout of PV Panels

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)
- Disconnects/switches
- Protection devices e.g., VCBs, fuses, surge protective devices, beakers
- Energy Meters
- Smart Loggers for Online Monitoring
- Earthing

Control, metering, instrumentation and protection:

Reverse Feed in Protection:

In PV Plants with 100 % self-consumption all the generated power has to be consumed by the connected site/load. In case the load is less and more PV Power is being generated, the excess power will go to the grid. In order to avoid feed-in to the grid a special control system is needed to be installed.

The feedback control loop to limit the active power feed-in to grid is implemented by using Sungrow's smart loggers. They will actively sense the electrical parameters at interconnection points and curtail inverter's output to restrict feed-in to the grid.

Metering and Protection:

The distance of interconnection point to the PV plant is approximately 120 - 150 meters. The metering of PV plant will be performed at the main MV busbar. Sensitivity Class for meters will be at least 1 with bidirectional 4 quadrant calculations algorithm. Metering parameters, including total import and export units TOD Calculations, MDI, active and reactive power calculations etc. can be extracted over the period, Solar power plant is designed to have the following protections for the line and load side;

- Over and under voltage/frequency protections
- Phase Failure, Unbalance and Phase reversal protection
- Short Circuit protections
- Earth Fault detection
- Over current protection
- Surge Protection
- Transformer Protections

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.

Details of the simulation steps are presented in the following sections:

PVSYST SIMULATION REPORT

PVSYST
PHOTOVOLTAIC SOFTWARE

Version 7.2.14

PVsyst - Simulation report

Grid-Connected System

Project: Engro Sahiwal

Variant: 3MWp- Sungrow 350HX - 20220921

Sheds on ground

System power: 3006 kWp

Engro fries - Lakanwala Mor - Pakistan

Author
Zero Carbon Pvt Ltd (Pakistan)

PVsyst V7.2.14
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Project summary

Geographical Site
Engro fries - Lakanwala Mor
Pakistan

Situation

Latitude	30.61 °N
Longitude	73.13 °E
Altitude	156 m
Time zone	UTC+5

Project settings

Albedo	0.20

Meteo data
Engro fries - Lakanwala Mor
Meteonorm 8.0, Sat=100% - Synthetic

System summary

Grid-Connected System

Sheds on ground

PV Field Orientation

Fixed plane	
Tilt/Azimuth	20 / 0 °

Near Shadings

According to strings	
Electrical effect	100 %

Shadings of thin objects

According to strings	
Electrical effect	40 %

System information

PV Array

Nb. of modules	5516 units
Pnom total	3006 kWp

Inverters

Nb. of units	8 units
Pnom total	2560 kWac
Pnom ratio	1.174

User's needs
Unlimited load (grid)

Results summary

Produced Energy	4506 MWh/year	Specific production	1499 kWh/kWp/year	Perf. Ratio PR	80.87 %

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Free Horizon

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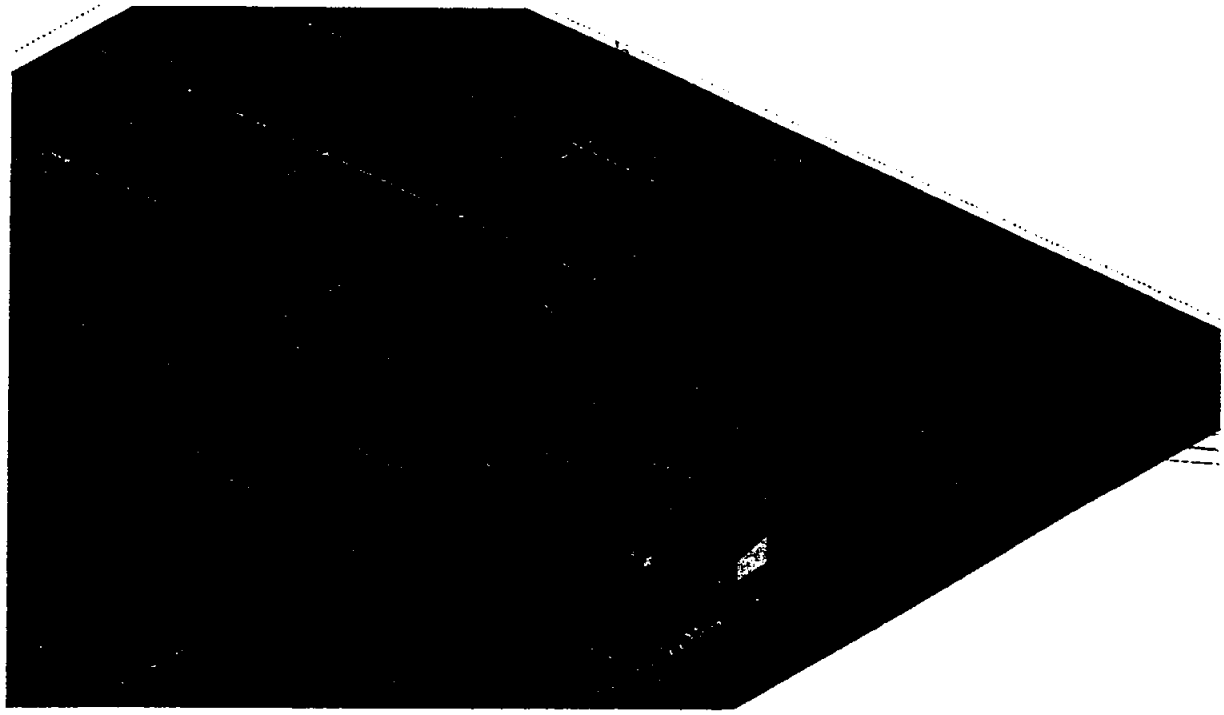
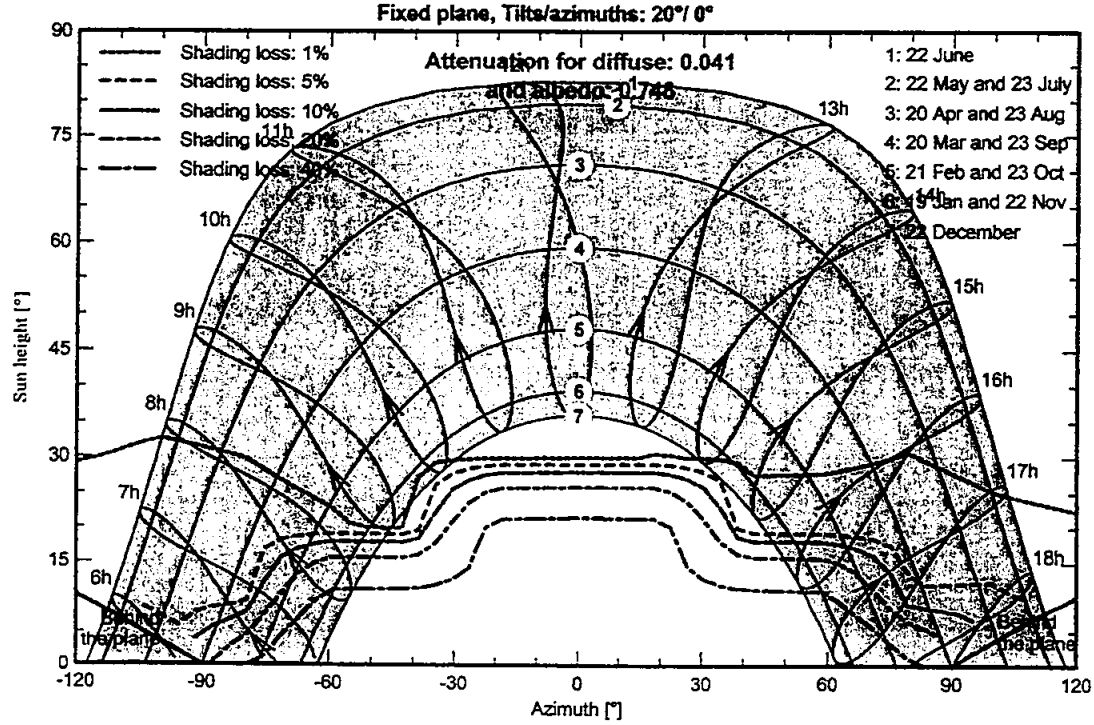
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 20°/ 0°



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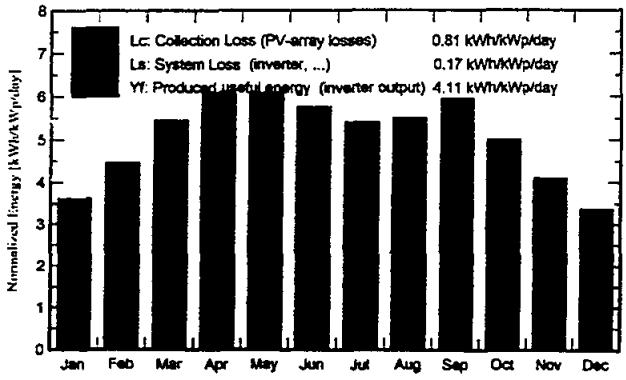
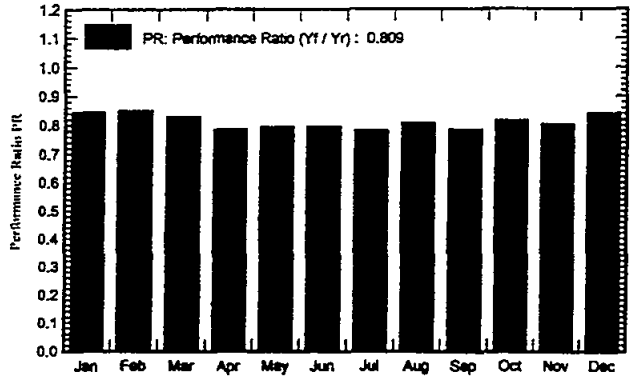


Performance Ratio PR



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Legends

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PVsyst V7.2.14
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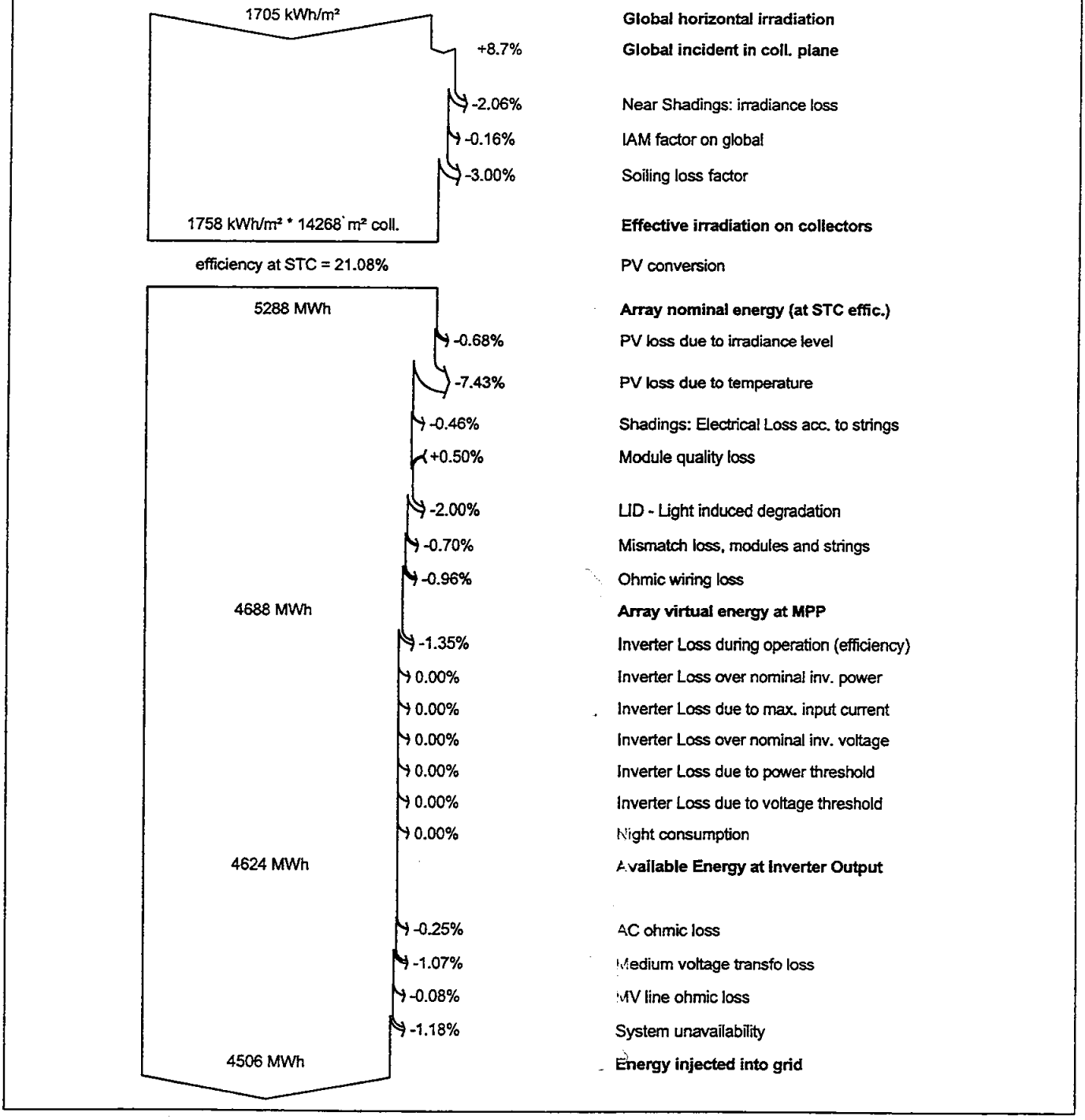
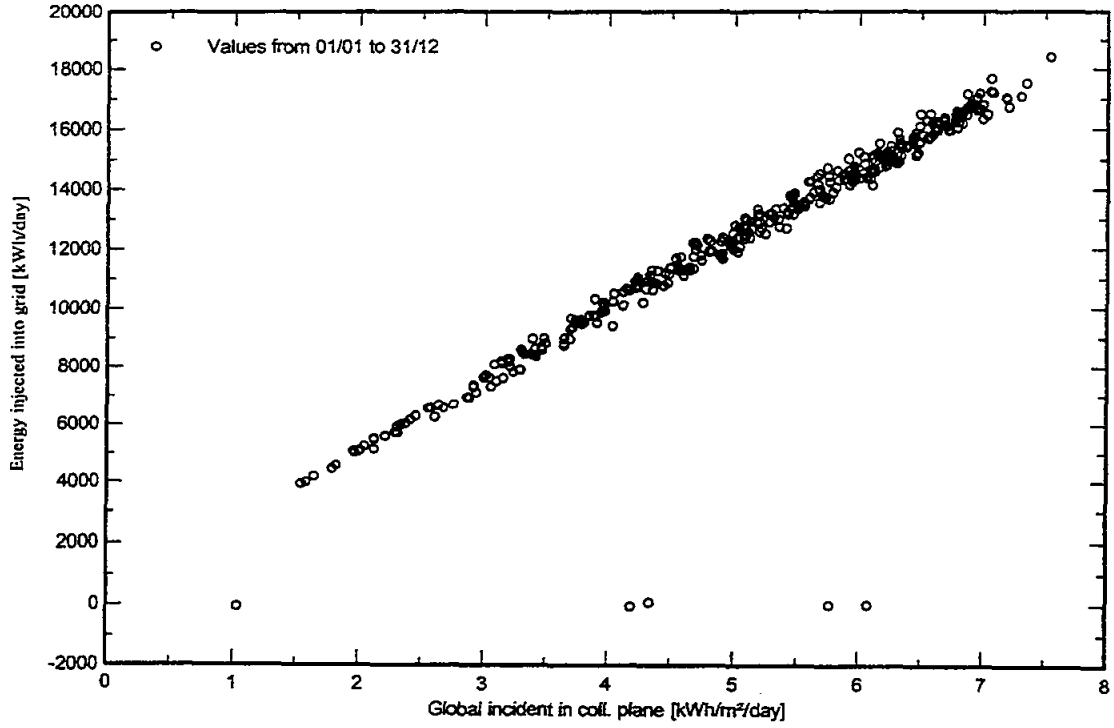
Loss diagram

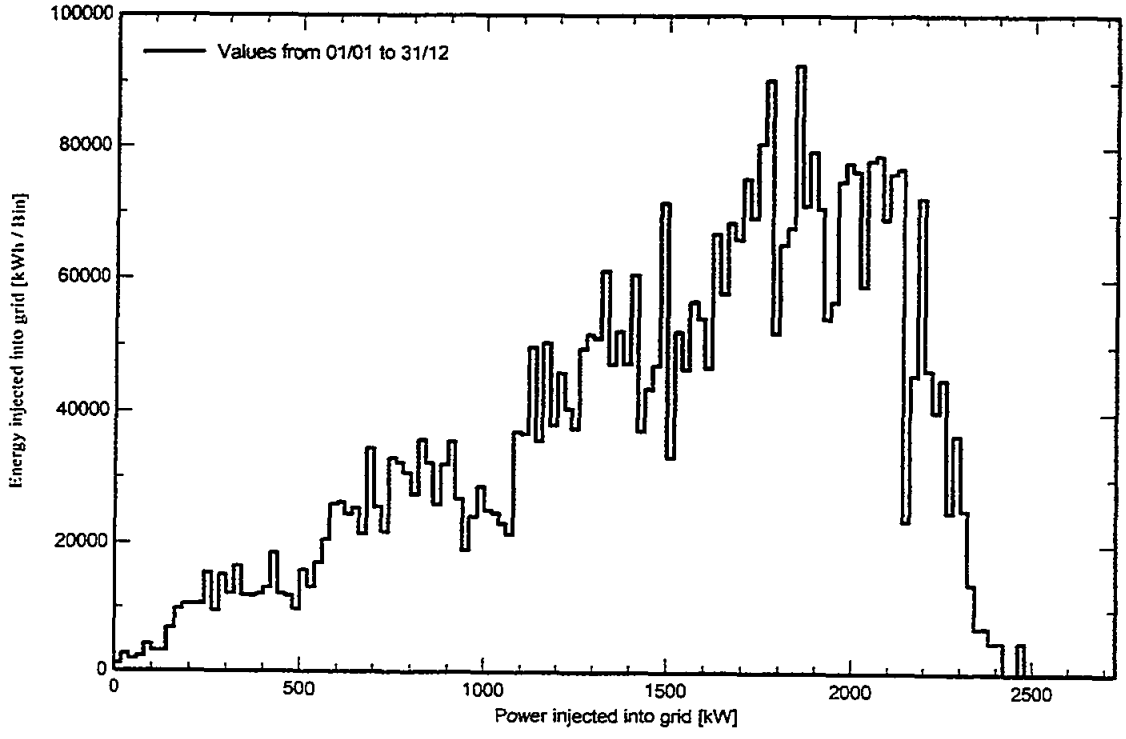


Special graphs

Daily Input/Output diagram



System Output Power Distribution



P50 - P90 evaluation

Meteo data

Source	Meteonorm 8.0, Sat=100%
Kind	Monthly averages
Synthetic - Multi-year average	
Year-to-year variability(Variance)	4.6 %
Specified Deviation	
Climate change	0.0 %

Global variability (meteo + system)

Variability (Quadratic sum)	5.0 %

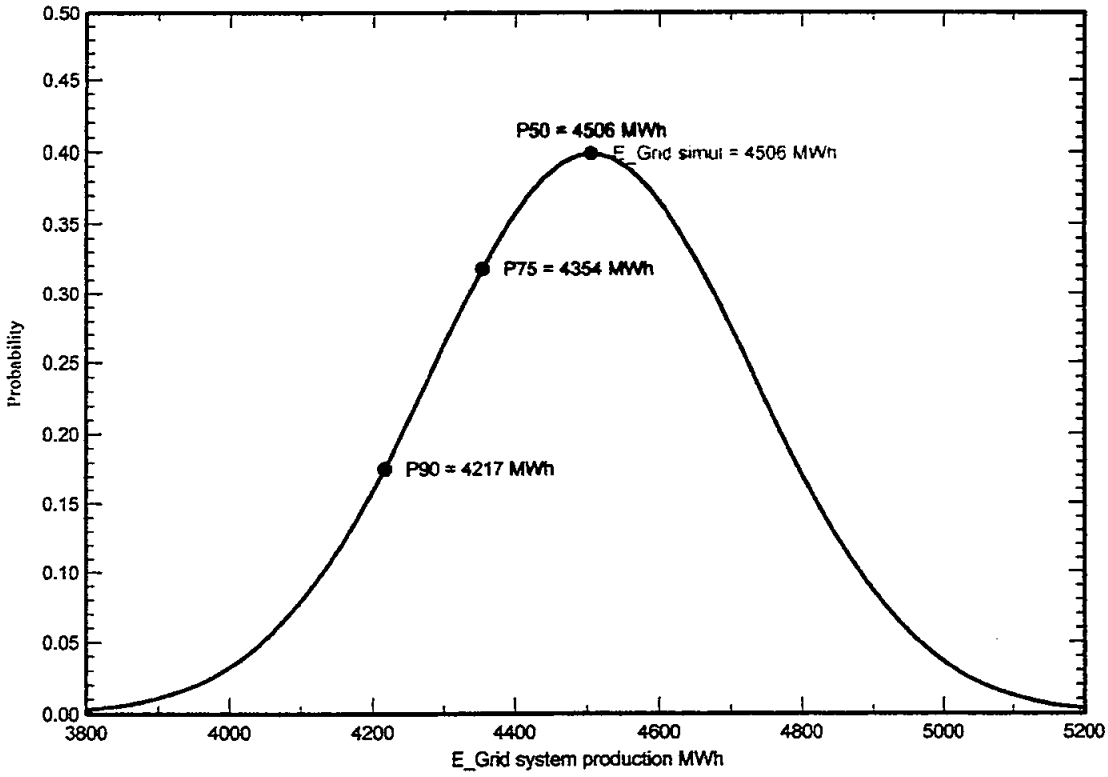
Simulation and parameters uncertainties

PV module modelling/parameters	1.0 %
Inverter efficiency uncertainty	0.5 %
Soiling and mismatch uncertainties	1.0 %
Degradation uncertainty	1.0 %
Custom variability	0.8 %

Annual production probability

Variability	226 MWh
P50	4506 MWh
P75	4354 MWh
P90	4217 MWh

Probability distribution



Financial Analysis

Cost/watt: **USD 0.655**

Total Project Cost for 3MWp(DC) Solar PV System: **USD 1,968,930**

Equity: **20%**

Debt: **80%**

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
- HSE PPEs will be provided and followed by team.
- Safety Trainings will be conducted at site.

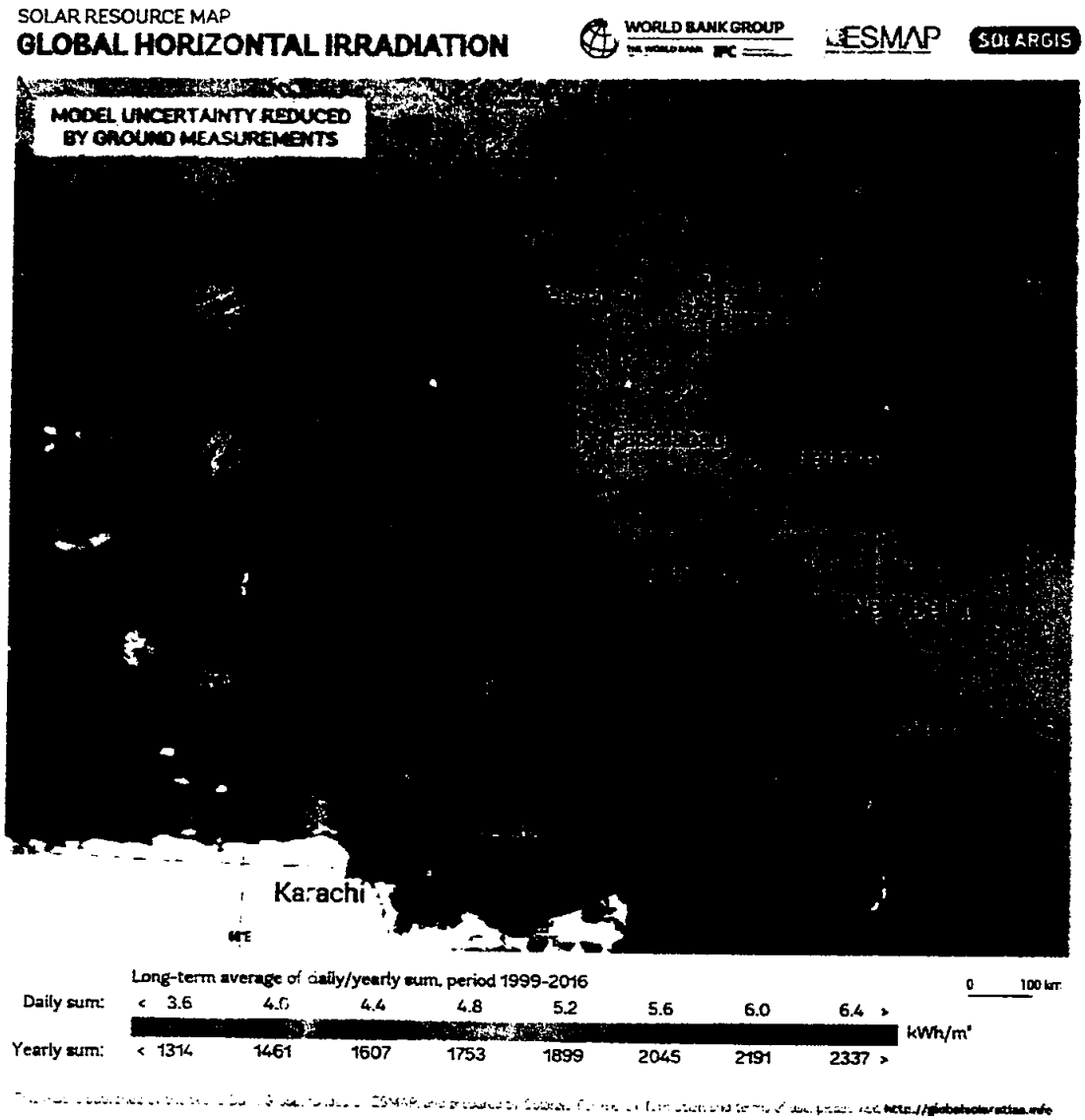
Training and Capacity Development

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.

WEATHER CONDITIONS IN SAHIWAL.

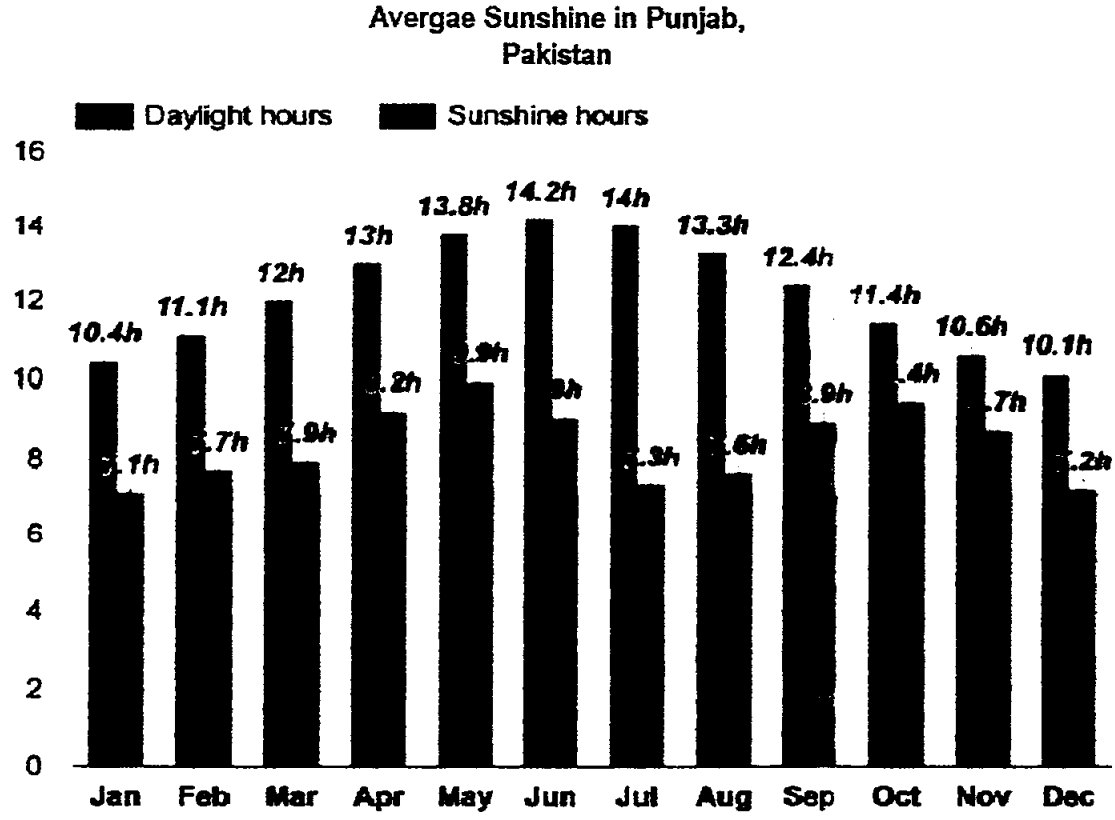
Sahiwal has a semi-arid climate, with extremely hot summers and cool winters. There is a monsoon season between July and September. Spring season is between February and April. Daily highs in February begin at a pleasant 25°C, with overnight temperatures of 10°C being a little on the chilly side. The summer season lasts from the month of May to October for almost six months, while the weather is cold from November to February. May and June are the hottest months. The monsoon rains hit Sahiwal in July, August and September, with July being the wettest month. The temperatures are still very high, averaging 40°C during the day and 29°C at night, so the rains come as some relief from the burning heat. October and November are the autumn months in Sahiwal, and this is a popular season for tourists. The heat dissipates a little, with average daily highs of around 31°C and the nights are considerably cooler, reaching as low as 11°C by the end of November. In winters, average daily highs are in the region of 23°C in December, January and February, and nights can feel cold at around 8°C. It can be very foggy - and the fog can linger for days or even weeks at a time. The highest rainfall records only in June is about 5,000 millimeters, which is highly seasonal since approximately half of the yearly rainfall takes place also in July and August during the monsoon season.

Following Figure-2 shows the Global Horizontal Irradiation details of Pakistan, recorded and published by World Bank



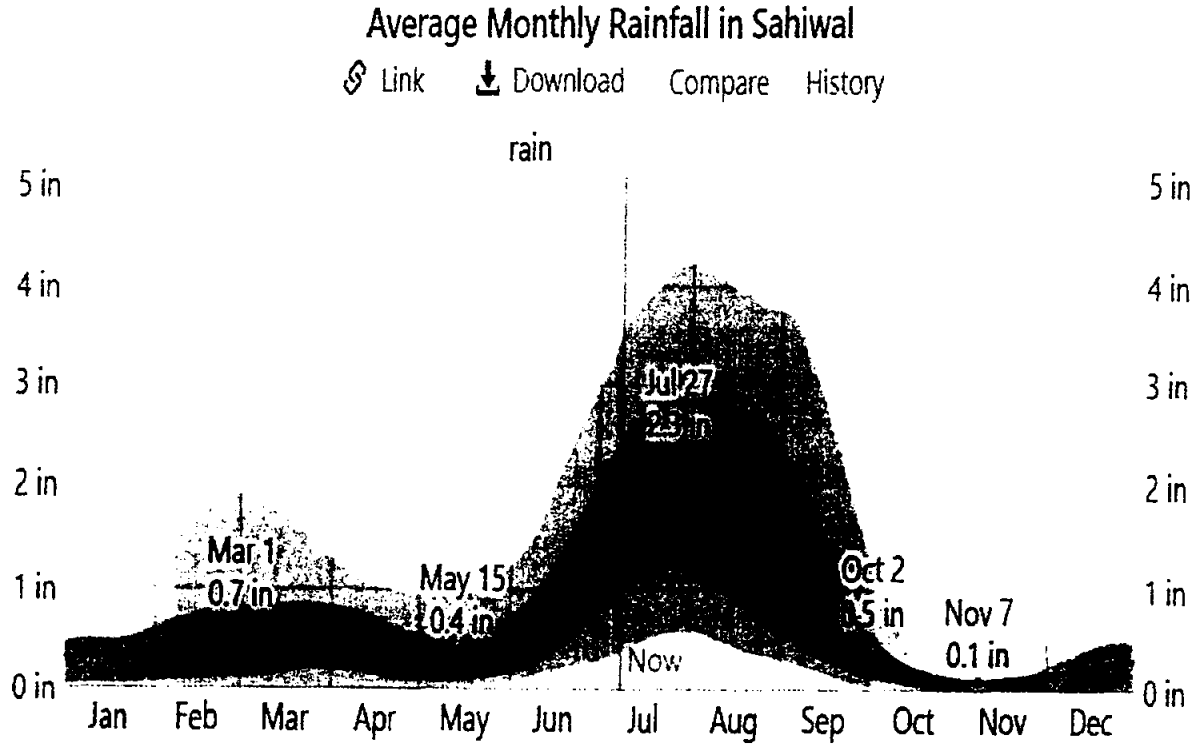
(Global Horizontal Irradiation, Pakistan).

The annual day light and sunshine recorded values of each month, shows that the least sunshine in Sahiwal, Pakistan, is January, with 7.1 hours. With an average of 9 hours of sunshine, May & June have the most sunshine of the year.



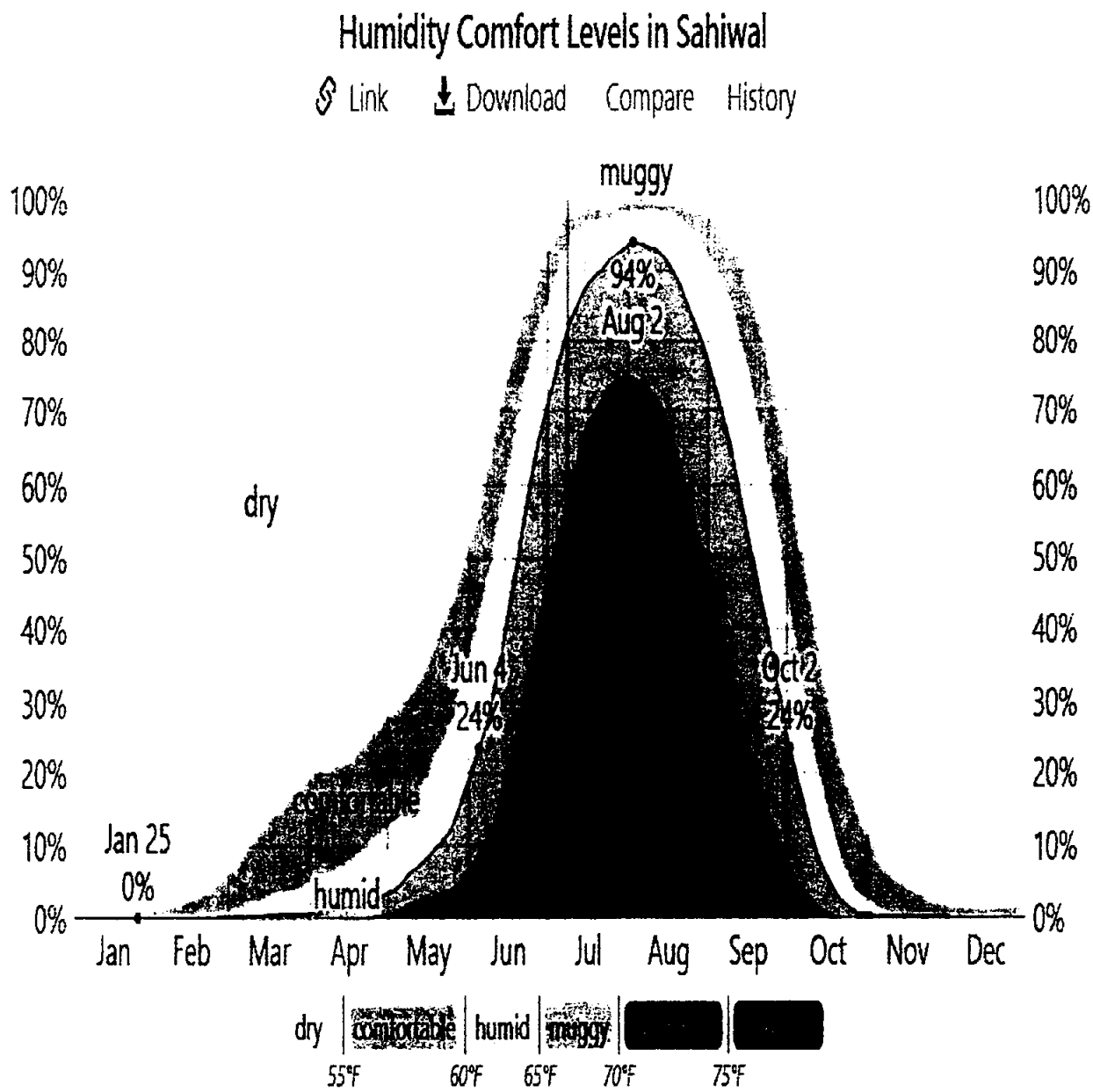
(Average Daylight/Sunshine Statistics of Sahiwal, Pakistan).

According to https://www.weatherspark.com , below figure presents the annual average rainfall recorded values of each month, shows that the least rainfall in Sahiwal, Pakistan,



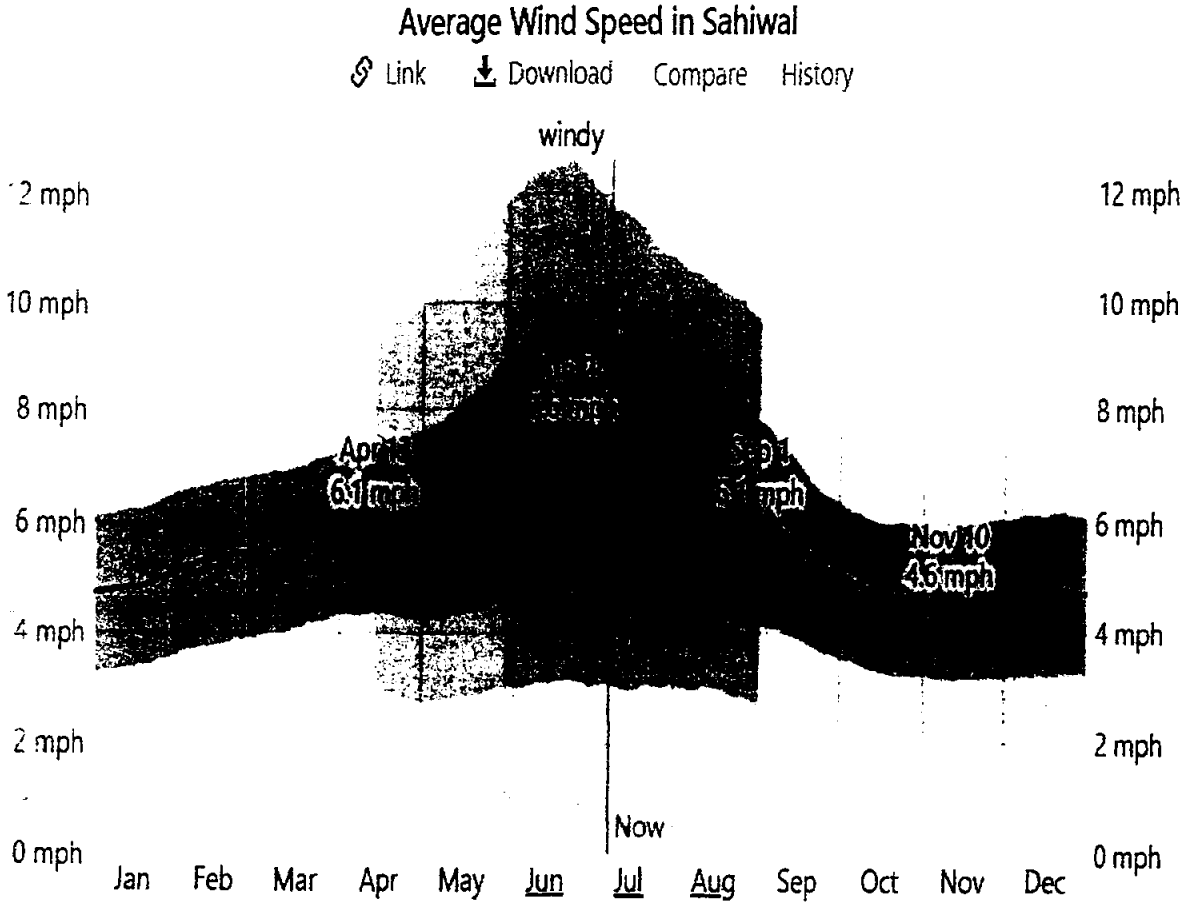
(Average Rainfall Statistics of Sahiwal, Pakistan).

The average annual relative humidity is illustrated in below Figure:



(Average Humidity Statistics of Sahiwal, Pakistan).

The below summarized, Figure represents the day per month during which the wind reaches a certain speed in Sahiwal:



(Average Wind Speed Statistics of Sahiwal, Pakistan).

Environmental and Social Soundness Assessment (ESSA)

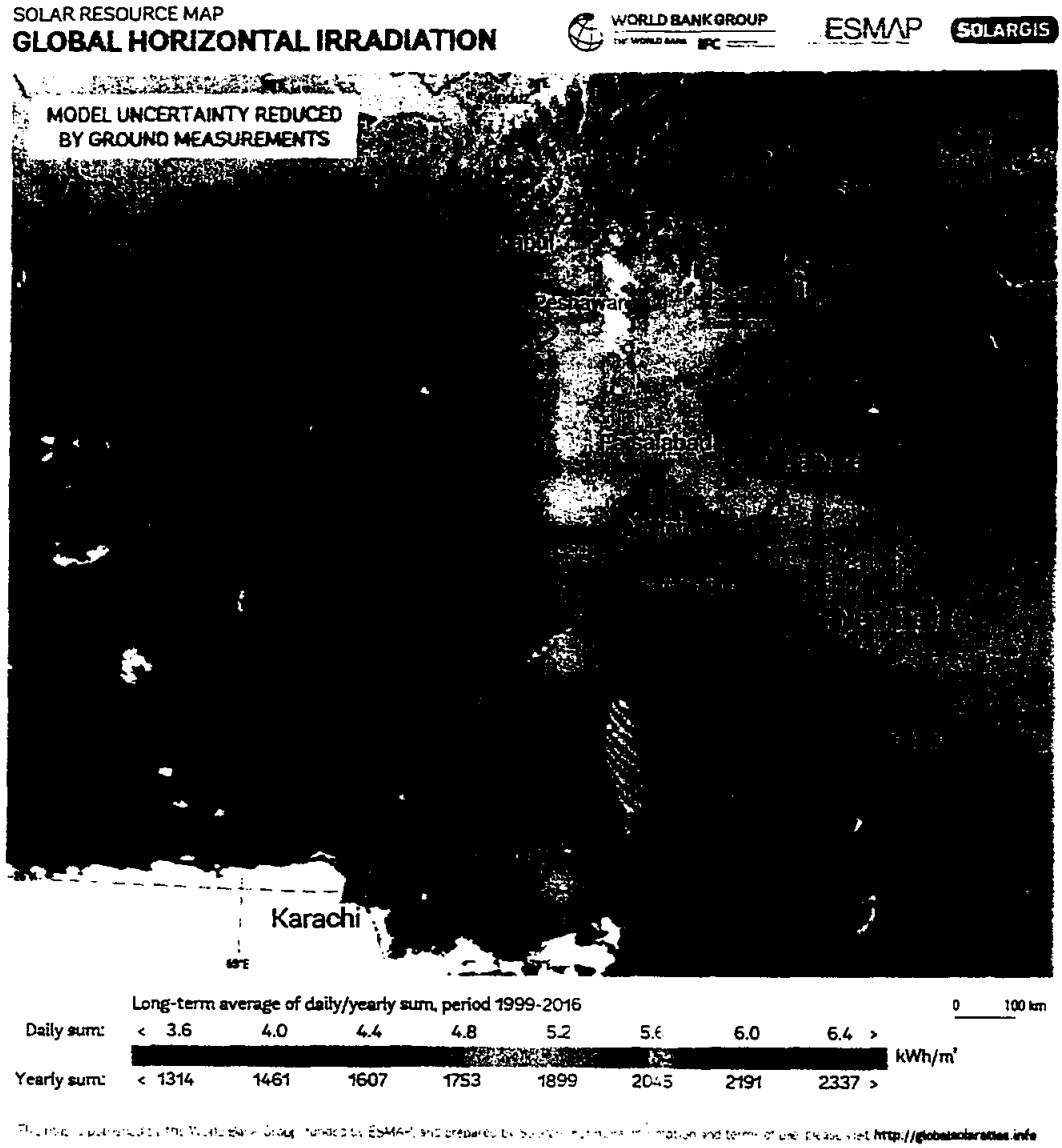
As there is no emission of any harmful Gas in Generation of Electricity from Sun's Radiation and Solar Power Plants are a source of clean energy, it can be safely assumed that the plant will not have any negative impact on the environment. ESSA (Environmental and Social Soundness Assessment) As there is no emission of any harmful Gas in Generation of Electricity from Sun's Radiation and Solar Power Plants are a source of clean energy, it can be safely assumed that the plant will not have any negative impact on the environment. ESSA (Environmental and Social Soundness Assessment).

Environmental Conditions

Solar energy has excellent potential in areas of Pakistan that receive high levels of solar radiation throughout the year. Every day, for example, the country receives an average of about 19 Mega Joules per square meter of solar energy.

Pakistan being in the Sun Belt is ideally located to take advantage of solar energy technologies. This energy source is widely distributed and abundantly available in the country. The mean global irradiation falling on horizontal surface is about 200-250 watt per sq.m in a day. This amounts to about 2500-3000 sun shine hours and 1.9 - 2.3 MWh per sq.met in a year. It has an average daily global insolation of 19 to 20 MJ/sq.met per day with annual mean sunshine duration of 8 to 8.5 hours (6-7hrs in cold and 10-12 hrs in hot season) and these values are among the highest in the world. For daily global radiation up to 23MJ/m2, 24 (80%) consecutive days are available in this area for solar energy. Such conditions are ideal for solar thermal applications.

Sahiwal is also among cities that have good solar radiation as can be seen in the diagram below, prepared by World Bank Group:



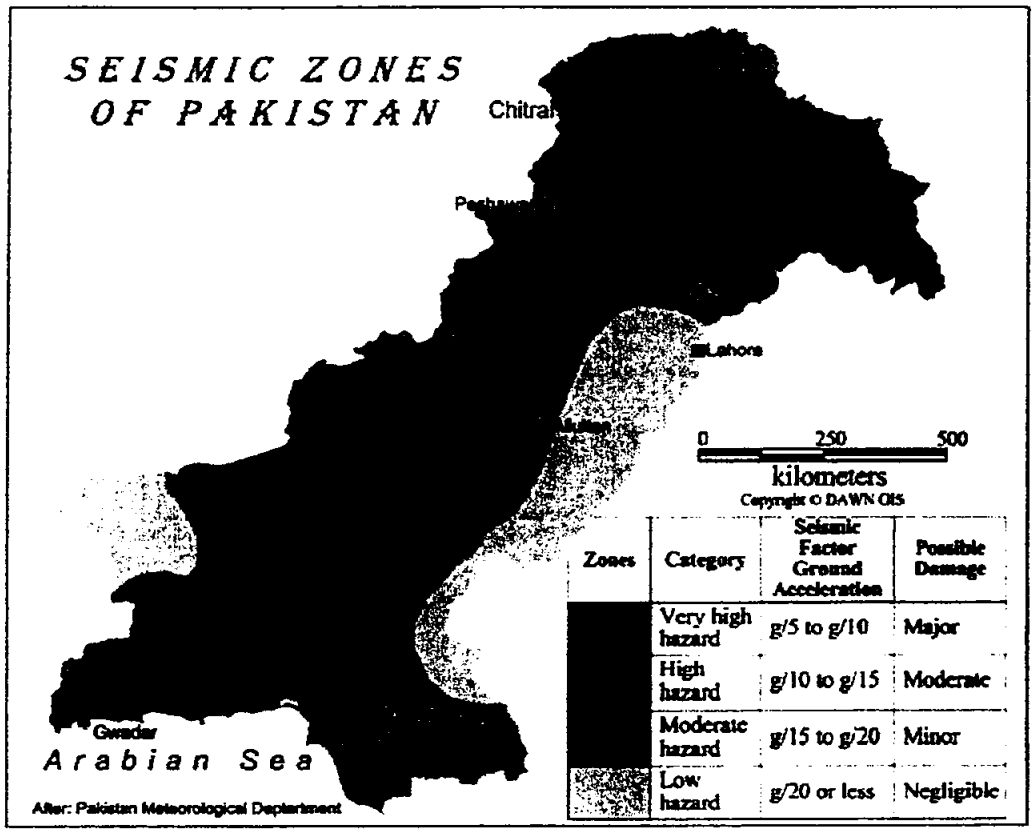
Climate

Climate of Sahiwal is Semi-Arid, with five seasons:

- foggy winter (Nov - Feb).
- pleasant spring (Feb - April).
- summer (April - June) with dust, rain storms and heat wave periods.
- rainy monsoon (July - September) and dry autumn (September - November)

Seismic Intensity:

According to Regional Seismic Monitoring Centre, the city falls under Moderate Hazard Category.



Pakistan Seismic Zones

ENVIROMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

This section discusses potential impact of the 3MWp solar power plant on different environmental parameters throughout the project's life.

Impact on different factors of environment and society are identified using professional judgment, published literature on similar projects, environmental guidelines and checklists. Following are the major factors affected by Solar Power Plant

- Occupational health and safety/ Public Health (of contractors, workers and nearby community including safety at work, Fire, explosives, diseases etc.
- Ground/surface water
- Energy
- Natural Resources
- Land Usage
- Soil
- Traffic and Transportation
- Noise 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

In the following paragraphs we have assessed each of these impacts and suggested possible mitigation actions that would be taken to avoid any adverse effect.

The proposed project may have impacts on the environment during construction & operation phases. During the construction phase, the impacts may be regarded as temporary or short-term; while long term impacts may be observed during the operation stage. Spatially the impacts have been assessed over the study area of 1 km radius of the project site.

Project Activities, Possible Impacts and Mitigation Actions			
Activity	**Affected Environmental Attribute**	**Possible Impacts**	**Mitigation**
Land	Usage	No Impact since Roof top and Parking is used only	Not Required
	Socio economic	No Impact due to Rehabilitation & Resettlement issues is expected	Not Required
Site clearing and Levelling (cutting, stripping, excavation, earth movement, compaction)	Air	Air Emission from Construction machinery and transportation	Efficient use of Machines and Vehicles
	Water	For Plant construction minimum water is required hence no wastage	Not Required
	Noise	Noise Pollution will be generated during construction phase	Use of heavy machinery is very limited, hence generated noise is well within acceptable range
	Soil	No affect since installation is at site.	Not Required
	Ecology	No loss of vegetation/ habitat as the site is roof top and car parking	Not Required
Transport and Storage of	Air	Air Pollution due to Transportation	This is temporary effect and cannot be avoided. We can minimize by

Construction Material			efficient use of Transportation
	Public Utilities	Increased traffic on Public Road	This is temporary effect and can be minimized by limiting movement of heavy traffic in late night hours only
Civil Construction Activities	Air and Water	Since there will be significant civil activities (due to roof top and parking structure nature of installation), there will be some impact.	This is temporary effect and can be minimized by limiting the usage of water.
Mechanical and Electrical Activities	Air	Minor emission from machines and activities	Not Required
Human Resource used in Project Activities	Socio-Economic	Requirement of Skill Labor for project activities will increase employment opportunities in the area	Positive Impact- No Mitigation Required
Transportation and Disposal of Construction Debris	Pollution	Air pollution due to transportation Pollution caused by construction debris	Air pollution can be controlled by efficient usage of transport Pollution can be mitigated by categorizing the debris in recyclable and non-recyclable wastage and recycle the as much as possible

Drilling and construction activities	Noise	Drilling will cause some noise; similarly different construction activities will generate noise	Since only small machines will be used for major part of the project, the generated noise will have no impact on the environment
Operations and Maintenance	Water	Washing of Panel consumes water	Water usage can be minimized using optimal cleaning strategy including dry cleaning procedures and further water usage can be optimized by using pressurized water

From the above assessment it is clear that the project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of Solar PV power. It will certainly meet the ever-increasing Demand of Power and bridge the Gap between Demand and Supply of Power.

The environmental impact during construction phase is localized and of short-term magnitude. However, as this project is installed at Roof Top of the mall, the changes in land use will be zero.

Conclusion

Impacts are manageable and can be managed cost effectively. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for project activities have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of access routes etc.

The proposed project will have positive social impacts like improvement in the economic activities in the surrounding areas due to generation of direct and indirect employment opportunities.

Most impacts are expected to occur during the construction phase and are considered to be of a temporary nature. No endangered or protected species of flora or fauna are affected at all.

From this perspective, the project is expected to have a negligible "environmental footprint".

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

Annexure-2 (Techno-Commercial Proposal)

ENGRO FRIESLAND CAMPINA, SAHIWAL.

BURJ Solar Energy

TEHNO-COMMERCIAL PROPOSAL

Solar PV Project

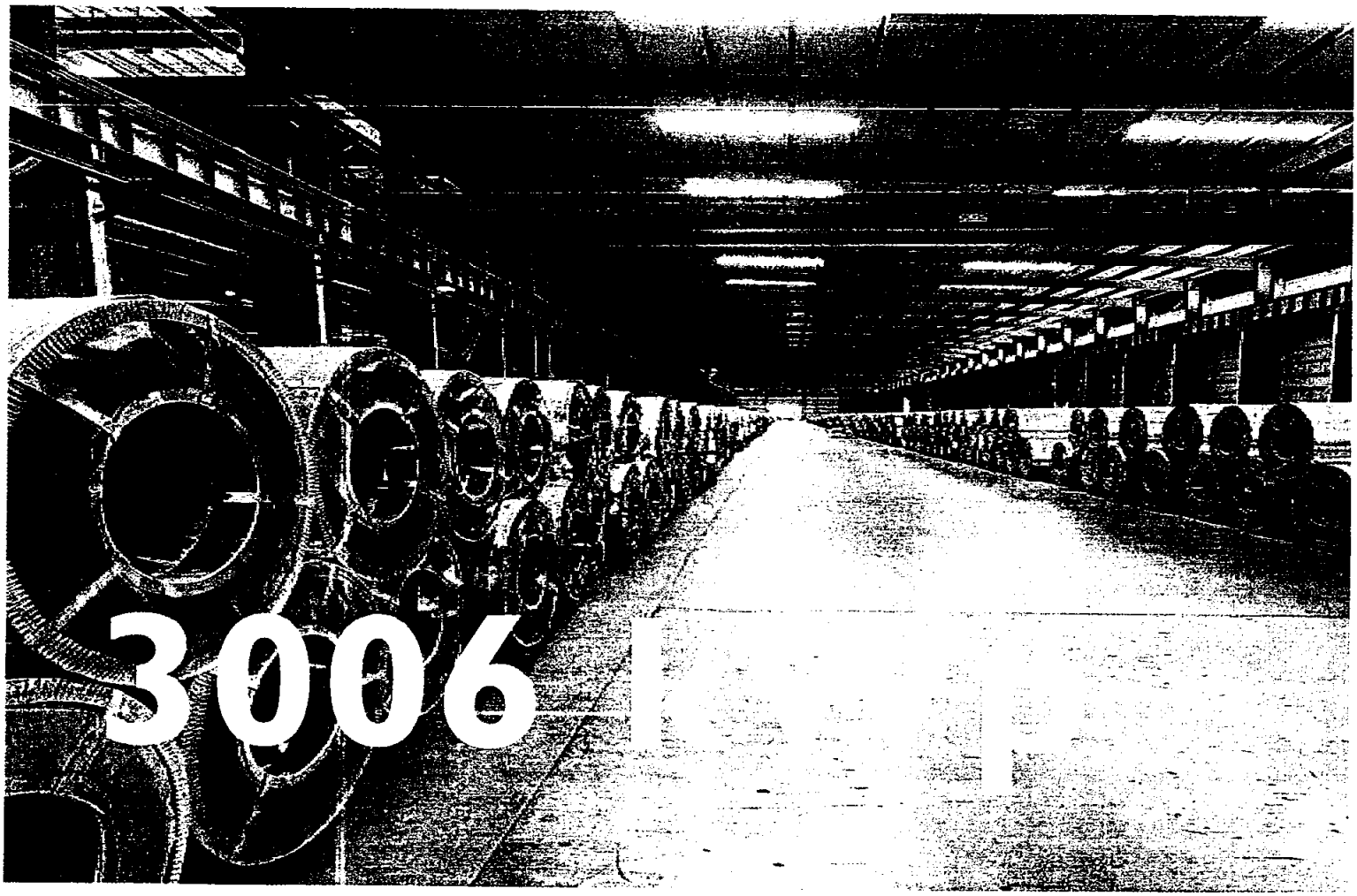


Table of Content

Annexure-A2.1

PVSYST
PHOTOVOLTAIC SOFTWARE

Version 7.2.14

PVsyst - Simulation report

Grid-Connected System

Project: Engro Sahiwal

Variant: 3MWp- Sungrow 350HX - 20220921

Sheds on ground

System power: 3006 kWp

Engro fries - Lakanwala Mor - Pakistan

Author

Zero Carbon Pvt Ltd (Pakistan)

PVsyst V7.2.14
VC0, Simulation date:
23/09/22 12:12
with v7.2.14

Project summary

Geographical Site
Engro fries - Lakanwala Mor
Pakistan

Situation

Latitude	30.61 °N
Longitude	73.13 °E
Altitude	156 m
Time zone	UTC+5

Project settings

Albedo	0.20

Meteo data
Engro fries - Lakanwala Mor
Meteonorm 8.0, Sat=100% - Synthetic

System summary

Grid-Connected System
Sheds on ground

PV Field Orientation

Fixed plane	
Tilt/Azimuth	20 / 0 °

Near Shadings

According to strings	
Electrical effect	100 %

Shadings of thin objects

According to strings	
Electrical effect	40 %

System information

PV Array

Nb. of modules	5516 units
Pnom total	3006 kWp

Inverters

Nb. of units	8 units
Pnom total	2560 kWac
Pnom ratio	1.174

User's needs
Unlimited load (grid)

Results summary

Produced Energy	4506 MWh/year	Specific production	1499 kWh/kWp/year	Perf. Ratio PR	80.87 %

Table of contents

PVsyst V7.2.14
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23/09/22 12:12
with v7.2.14

General parameters

Grid-Connected System

Sheds on ground

PV Field Orientation

Orientation	
Fixed plane	
Tilt/Azimuth	20 / 0 °

Sheds configuration	
Nb. of sheds	122 units
Sizes	
Sheds spacing	7.80 m
Collector width	4.58 m
Ground Cov. Ratio (GCR)	58.7 %
Shading limit angle	
Limit profile angle	24.1 °

Models used	
Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon
Free Horizon

Near Shadings
According to strings
Electrical effect 100 %

Shadings of thin objects
According to strings
Electrical effect 40 %

User's needs
Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	JA Solar
Model	JAM72S30-545/MR
(Custom parameters definition)	
Unit Nom. Power	545 Wp
Number of PV modules	5516 units
Nominal (STC)	3006 kWp
Modules	197 Strings x 28 In series
At operating cond. (50°C)	
Pmpp	2744 kWp
U mpp	1068 V
I mpp	2570 A

Inverter

Manufacturer	Sungrow
Model	SG350HX-20A-Preliminary
(Custom parameters definition)	
Unit Nom. Power	320 kWac
Number of inverters	8 units
Total power	2560 kWac
Operating voltage	500-1500 V
Max. power (=>30°C)	352 kWac
Pnom ratio (DC:AC)	1.17

Total PV power

Nominal (STC)	3006 kWp
Total	5516 modules
Module area	14268 m²
Cell area	13122 m²

Total inverter power

Total power	2560 kWac
Number of inverters	8 units
Pnom ratio	1.17

Array losses

Array Soiling Losses
Loss Fraction 3.0 %

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 6.9 mΩ
Loss Fraction 1.5 % at STC

LID - Light Induced Degradation
Loss Fraction 2.0 %

Module Quality Loss
Loss Fraction -0.5 %

Module mismatch losses
Loss Fraction 0.6 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

IAM loss factor
Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	1.000	1.000	0.985	0.943	0.840	0.000

PVsyst V7.2.14
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System losses

Unavailability of the system

Time fraction	0.8 %
	3.0 days,
	5 periods

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage	800 Vac tri
Loss Fraction	0.50 % at STC
Inverter: SG350HX-20A-Preliminary	
Wire section (8 Inv.)	Copper 8 x 3 x 120 mm²
Average wires length	55 m

MV line up to Injection

MV Voltage	11 kV
Wires	Alu 3 x 185 mm²
Length	380 m
Loss Fraction	0.16 % at STC

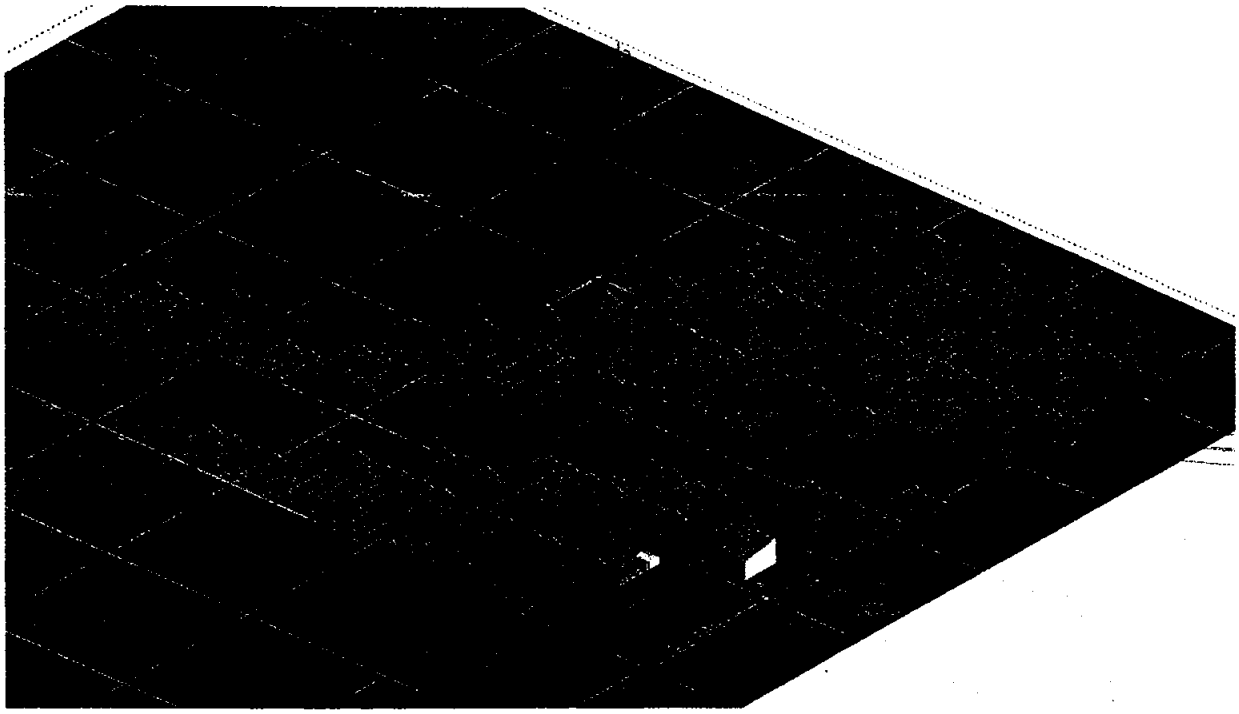
AC losses in transformers

MV transfo

Grid voltage	11 kV
Operating losses at STC	
Nominal power at STC	2962 kVA
Iron loss (24/24 Connexion)	2.96 kW
Loss Fraction	0.10 % at STC
Coils equivalent resistance	3 x 2.16 mΩ
Loss Fraction	1.00 % at STC

Near shadings parameter

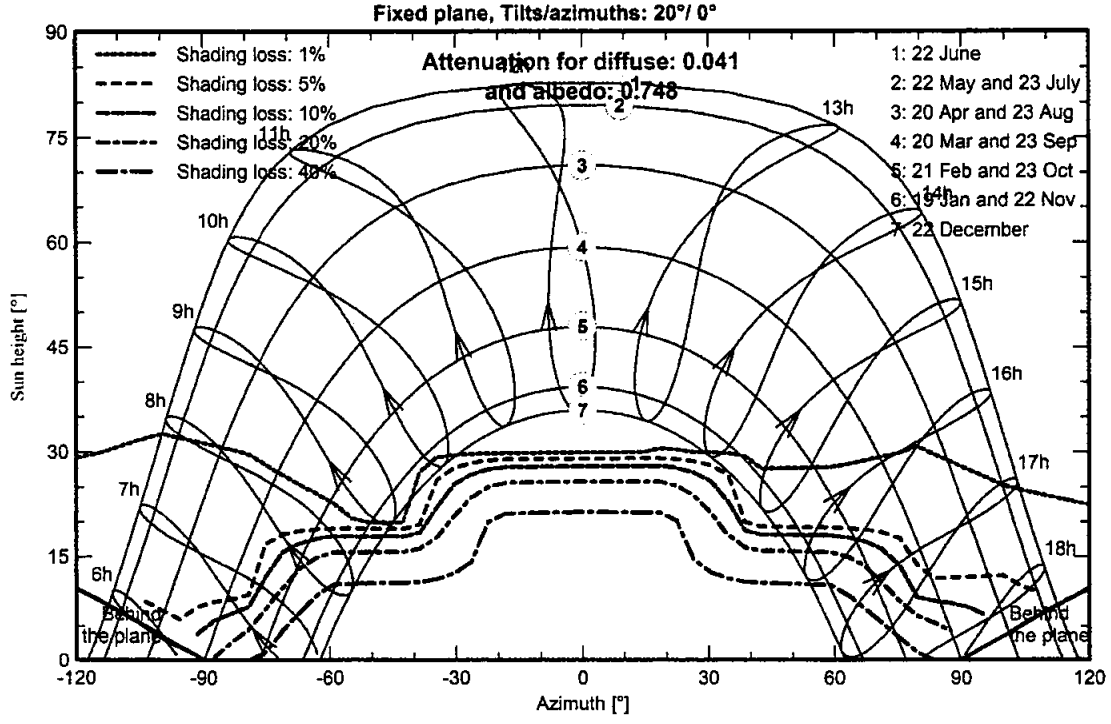
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 20°/ 0°



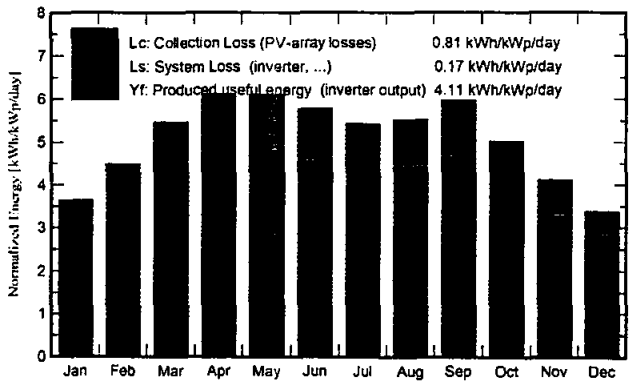
PVsyst V7.2.14
VC0, Simulation date:
23/09/22 12:12
with v7.2.14

Main results

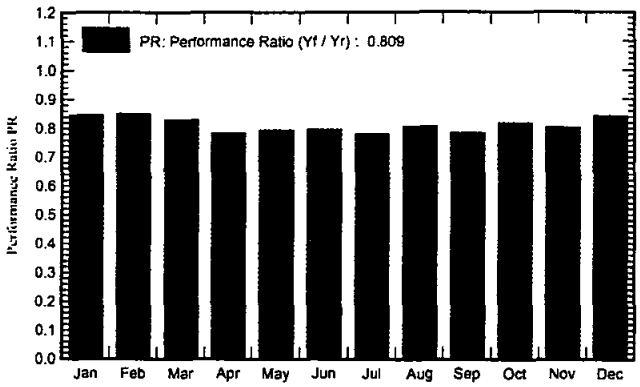
System Production

Produced Energy	4506 MWh/year	Specific production	1499 kWh/kWp/year
		Performance Ratio PR	80.87 %

Normalized productions (per installed kWp)



Performance Ratio PR



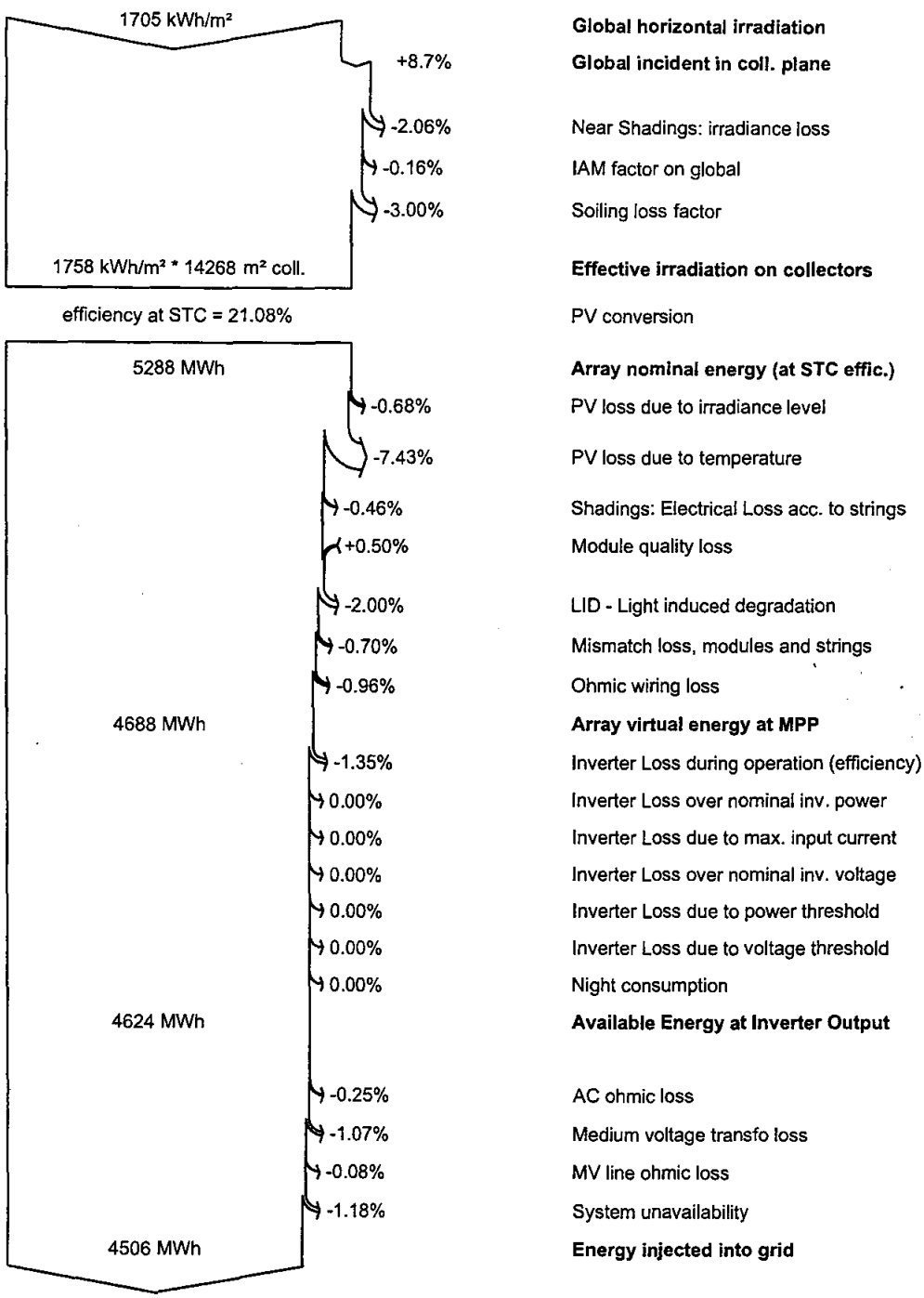
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	87.0	41.3	12.57	112.4	106.2	297.0	286.1	0.847
February	103.9	52.0	16.67	125.2	118.8	329.3	320.4	0.851
March	151.0	71.8	23.12	169.3	161.0	434.4	422.7	0.831
April	175.5	86.4	28.84	183.0	174.2	459.9	432.1	0.785
May	191.4	100.8	34.42	189.1	179.7	464.7	451.6	0.794
June	178.9	105.4	34.98	173.1	164.2	426.0	414.0	0.796
July	172.6	104.9	33.85	168.2	159.4	417.2	395.3	0.782
August	169.0	102.3	32.59	171.0	162.1	426.8	415.1	0.808
September	163.4	75.6	30.56	178.8	170.2	448.6	422.1	0.785
October	133.6	71.1	27.49	155.5	147.7	393.6	382.7	0.819
November	98.0	51.2	20.73	123.4	116.5	317.8	298.6	0.805
December	81.5	47.7	14.94	104.5	97.8	272.5	265.1	0.843
Year	1705.4	910.6	25.94	1853.4	1757.8	4687.9	4505.7	0.809

Legends

GlobHor	Global horizontal irradiation	EArray	Effective energy at the output of the array
DiffHor	Horizontal diffuse irradiation	E_Grid	Energy injected into grid
T_Amb	Ambient Temperature	PR	Performance Ratio
GlobInc	Global incident in coll. plane		
GlobEff	Effective Global, corr. for IAM and shadings		

Loss diagram



PVsyst V7.2.14
VC0, Simulation date:
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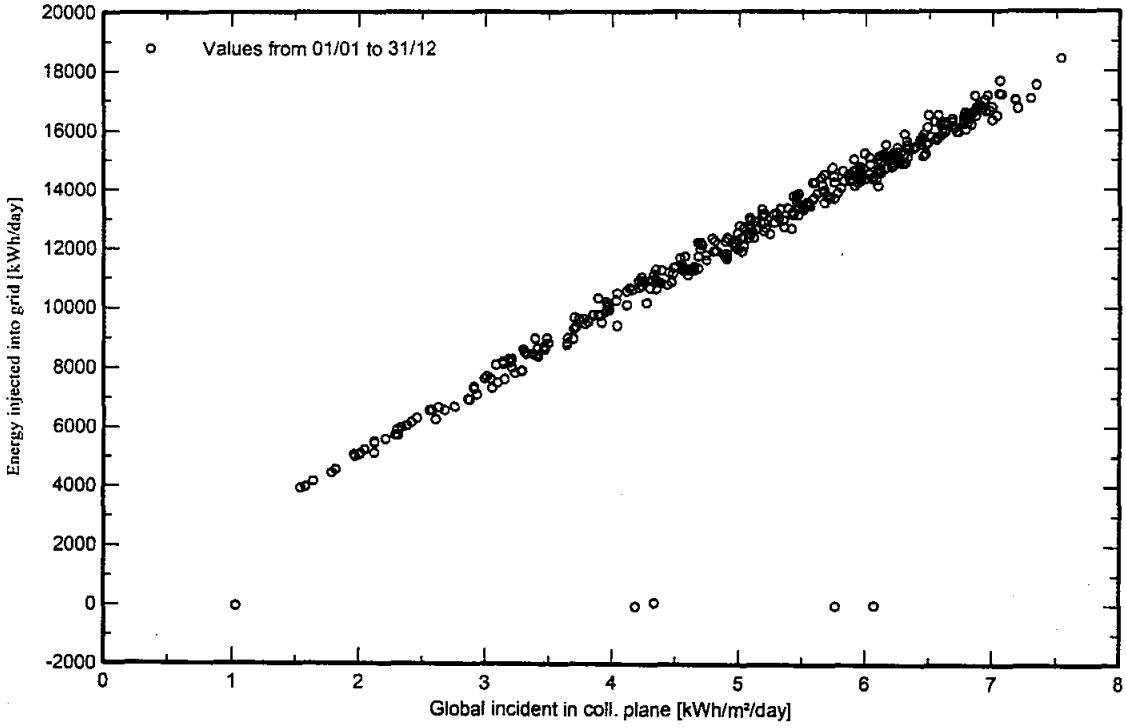
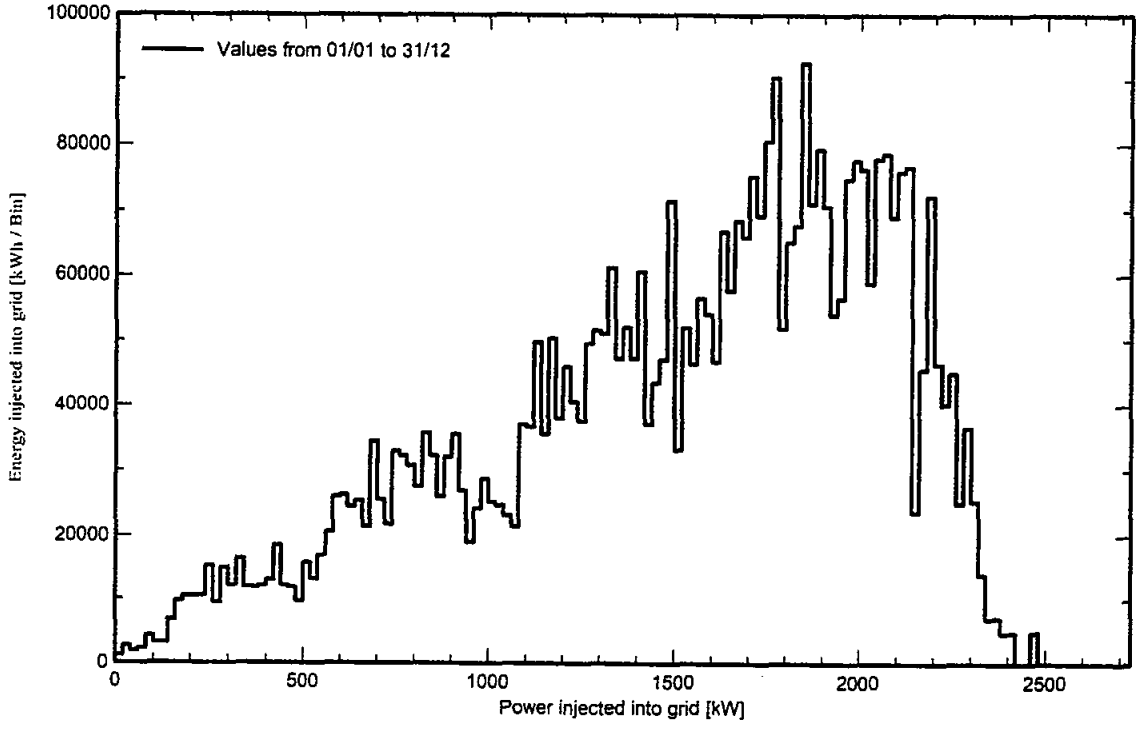
with v7.2.14

Special graphs

Daily Input/Output diagram



System Output Power Distribution



PVsyst V7.2.14
VC0, Simulation date:
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P50 - P90 evaluation

Meteo data

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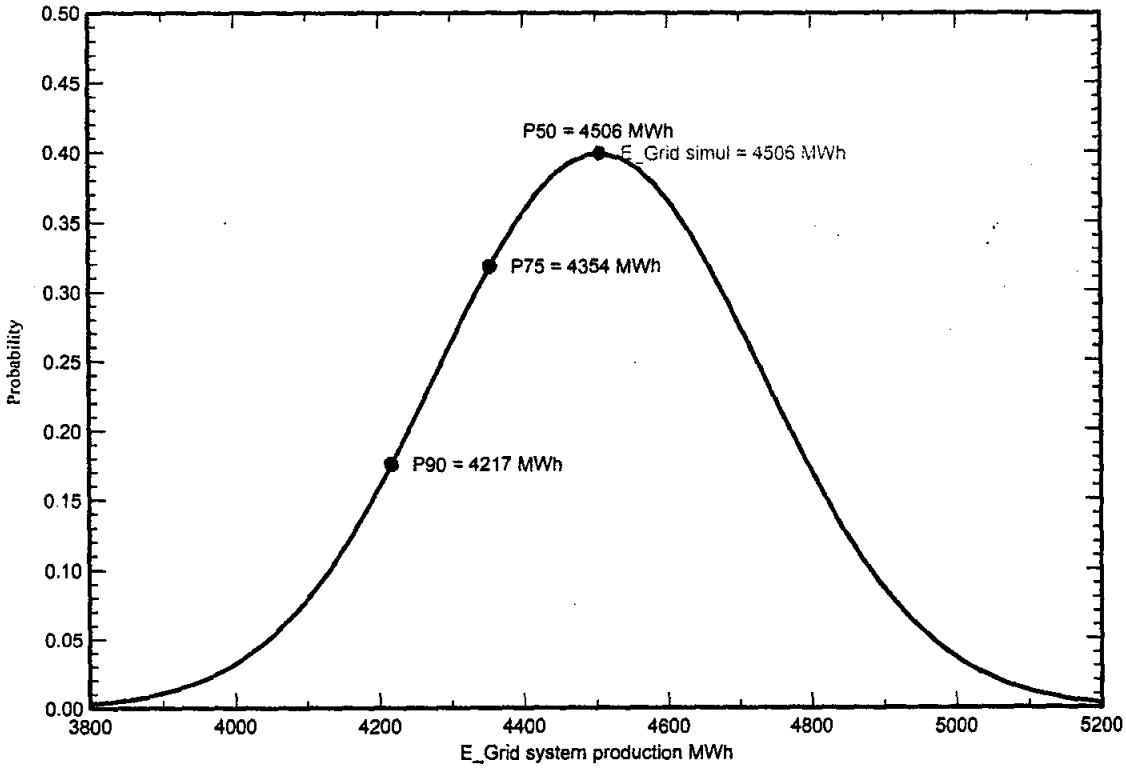
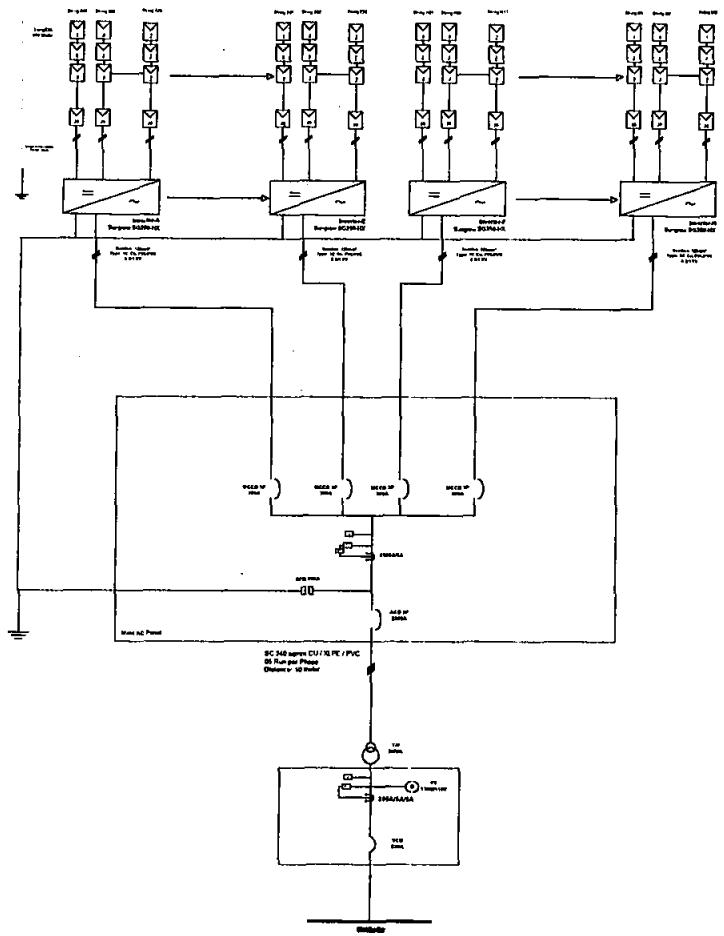


Annexure-A2.2

SIngle Line Diagram - 3 MWp Solar PV Plant FrieslandCampina Engro Sahiwal

Ground Mount



SR NO	DESCRIPTION	DOC/DRAWING NO

REFERENCE DOCUMENT/ DRAWING

Legends

Navigation :

Notes:

1-Sungrow Inverter SG350-HX
2-JA/Longi 545W PV Module.
3-Protection Equipment

REV	DATED	DESCRIPTION
A	00-00-00	PROPOSAL DRAWINGS

87-Block B1 MM Alam Road
Gulberg, III Lahore.
info@zerocarbon.com.pk

DATE 26-09-2022

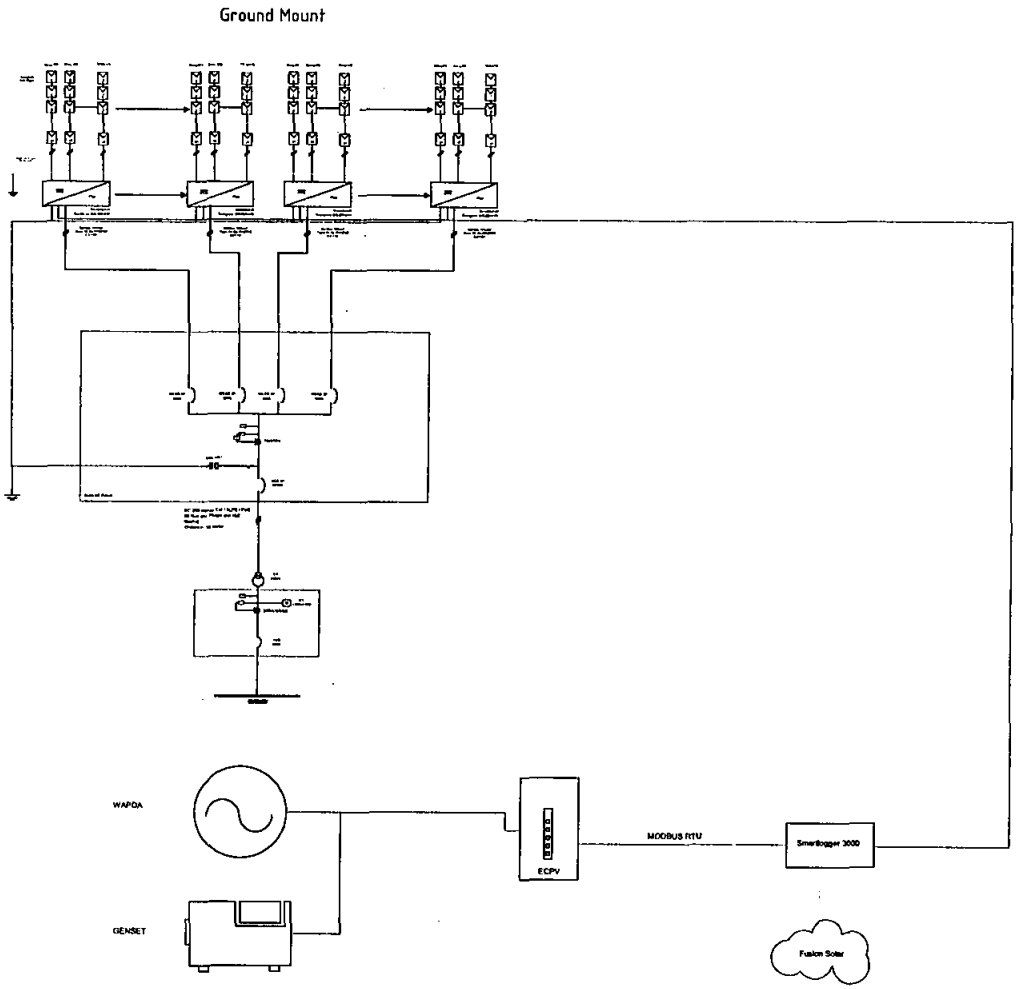
PROJECT 3 MWp PV System - FrieslandCampina Engro Sahiwal, Pakistan

TITLE SINGLE LINE DIAGRAM

SCALE	SHEET SIZE	REV
-	A3	

SHEET: 01

Communication Diagram - 3 MWp Solar PV Plant FrieslandCampina Engro Sahiwal



SR NO	DESCRIPTION	DOC/DRAWING NO

REFERENCE DOCUMENT/ DRAWING

Legends

Navigation :

Notes:

1-Sungrow Inverter SG350-HX
2-JA/Longi 545W PV Module.
3-Protection Equipment

REV	DATED	DESCRIPTION	DRAWN BY
A	00-00-00	PROPOSAL DRAWINGS	UA

87-Block B1 MM Alam Road
Gulberg, III Lahore.
info@zerocarbon.com.pk

DATE 26-09-2022

PROJECT
3 MWp PV System - FrieslandCampina Engro Sahiwal, Pakistan

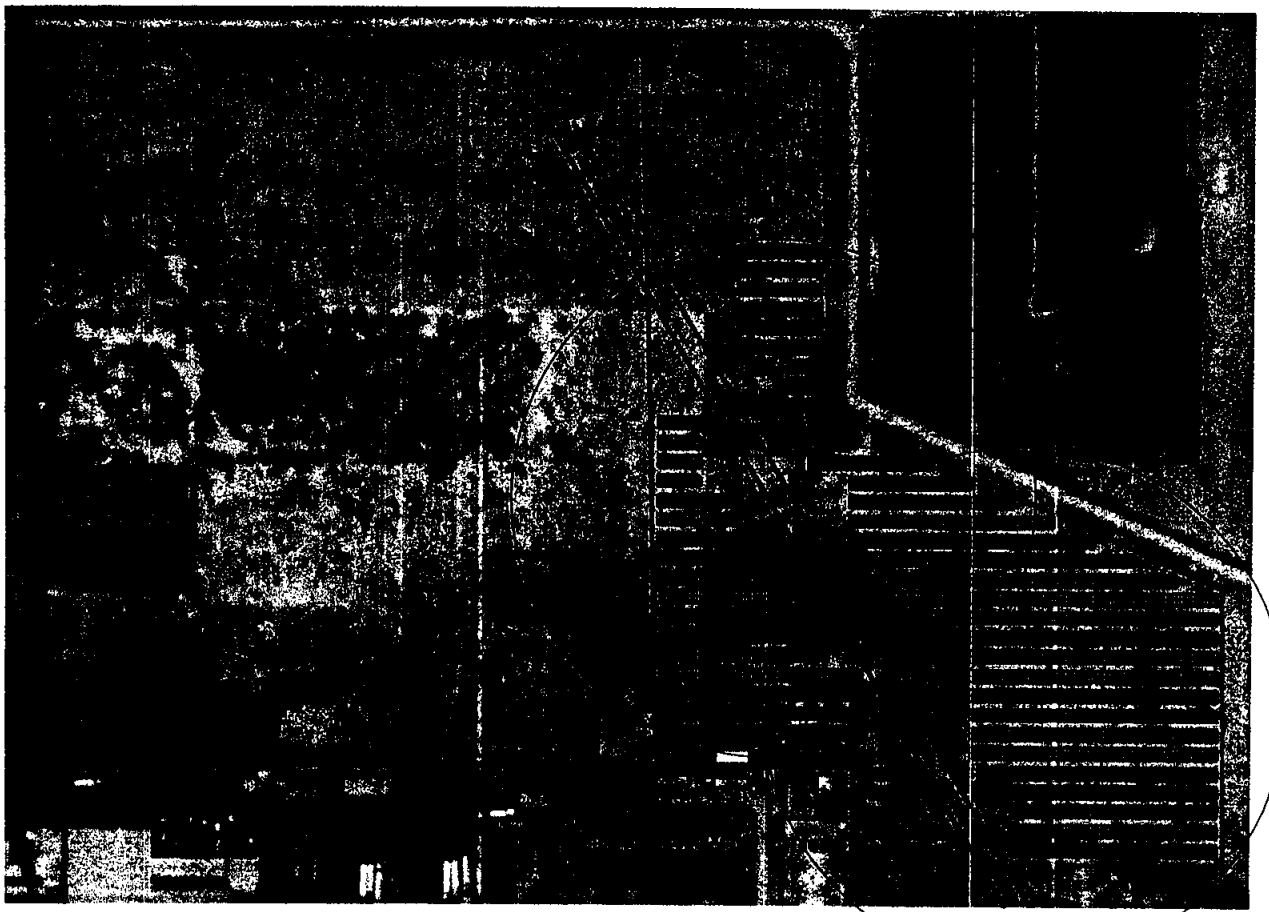
TITLE SINGLE LINE DIAGRAM

SCALE	SHEET SIZE	REV
-	A3	

SHEET: 01

Annexure-A2.3

3MWp Solar PV System - FrieslandCampina Engro Sahiwal



General Notes

1) 545 Watts Monocrystalline Solar Panel, Qty. 5516
2) Inverter SG-350 HX
3) Tilt Angle 20°
4) Azimuth 0°

Legend

	PV Panel
	ESE LPS
	Coverage Area

SR NO	DESCRIPTION	DOC/DRAWING NO

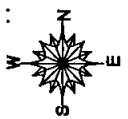
REFERENCE DOCUMENT/ DRAWING

REV NO	DESCRIPTION	DRAWN BY			DATED
0	ISSUE FOR APPROVAL	Usman			

DESIGN PARAMETERS

Load Description	Value	Unit	Reference
PV Module Weight	28	Kgs	PV Panel

Navigation :



Notes

REV	DATED	DESCRIPTION	DRAWN BY		
	00-00-00	DRAWING	Usman		

87-Block B1 MM Alam Road
Gulberg, III Lahore.
info@zerocarbon.com.pk

PROJECT Code

DATE 26-09-2022

PROJECT 3MWp Solar System - FrislandCampina Engro Sahiwal

TITLE PV Panel Layout

SCALE	SHEET SIZE		REV
-	A3	DWG.No	00

Water Distribution Network - FrieslandCampina Engro Sahiwal

General Notes

1) 545 Watts Monocrystalline Solar Panel, Qty. 5516
2) Inverter SG-350 HX
3) Tilt Angle 20°
4) Azimuth 0°

Legend

	PV Panel
	Inverter Room
	Handle Valve
	PPRC - 63mm, PN-16
	PPRC - 32mm, PN-16
	Underground water Bore
	Water tank

SR NO	DESCRIPTION	DOC/DRAWING NO

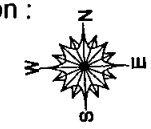
REFERENCE DOCUMENT/ DRAWING

REV NO	DESCRIPTION	DRAWN BY	DATED
0	ISSUE FOR APPROVAL	Usman	

DESIGN PARAMETERS

Load Description	Value	Unit	Reference
PV Module Weight	28	Kgs	PV Panel

Navigation :



Notes

REV	DATED	DESCRIPTION	DRAWN BY
	00-00-00	DRAWING	Usman

87-Block B1 MM Alam Road
Gulberg, III Lahore.
info@zerocarbon.com.pk

PROJECT Code

DATE 26-09-2022

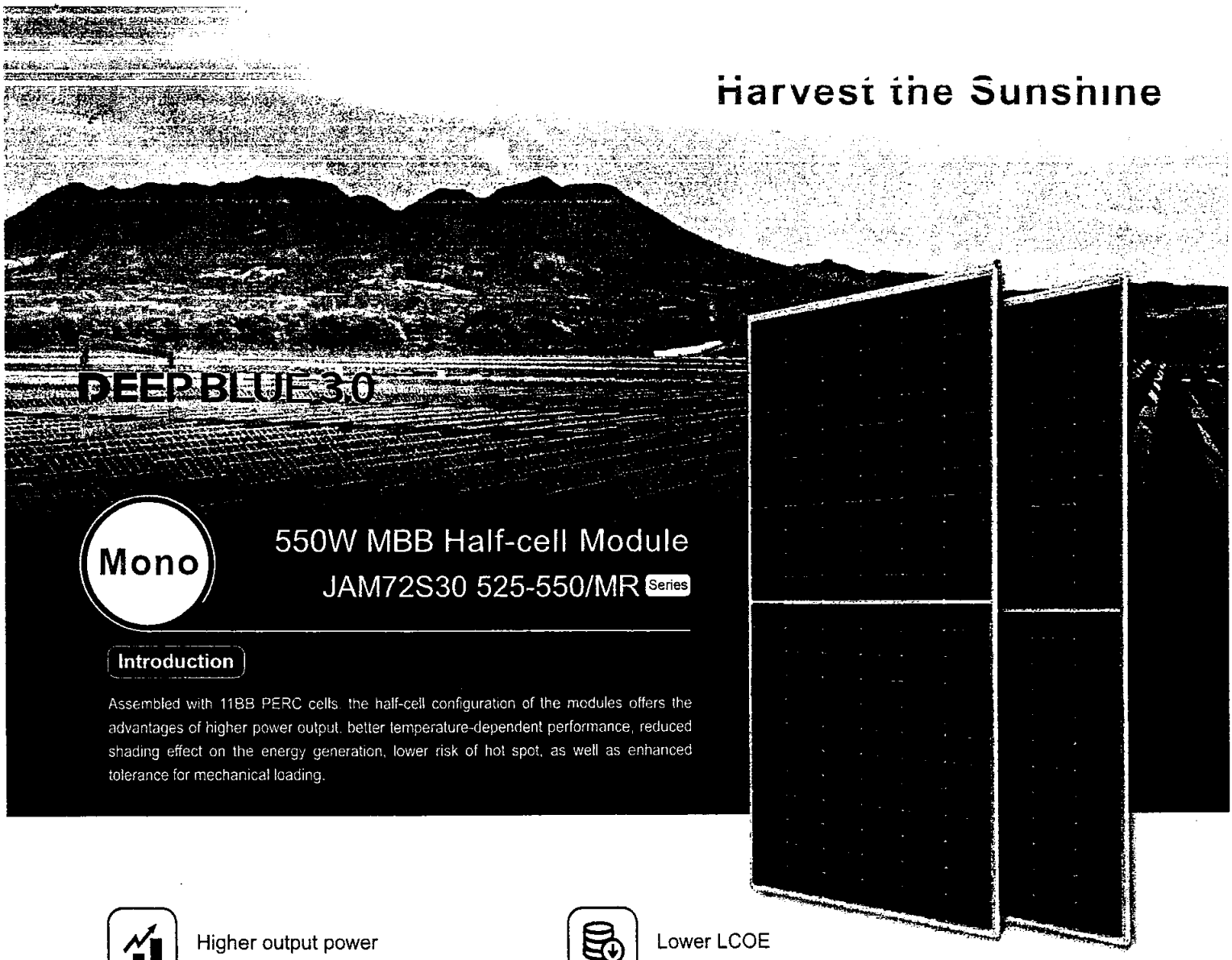
PROJECT 3MWp Solar System - FrieslandCampina Engro Sahiwal, Pakistan

TITLE PV Panel Layout

SCALE	SHEET SIZE	DWG.No	REV
-	A3		00

Annexure-A2.4

Harvest the Sunshine



Mono

550W MBB Half-cell Module

JAM72S30 525-550/MR Series

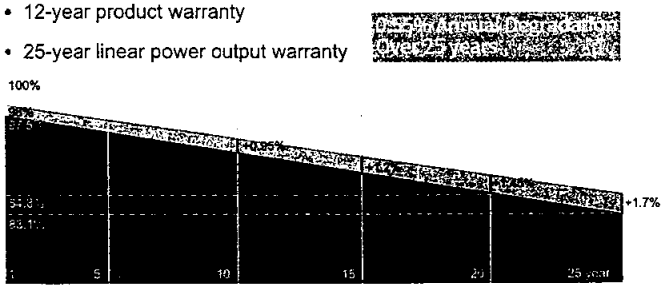
Introduction

Assembled with 11BB PERC cells, the half-cell configuration of the modules offers the advantages of higher power output, better temperature-dependent performance, reduced shading effect on the energy generation, lower risk of hot spot, as well as enhanced tolerance for mechanical loading.

- Higher output power
- Lower LCOE
- Less shading and lower resistive loss
- Better mechanical loading tolerance

Superior Warranty

- 12-year product warranty
- 25-year linear power output warranty



New linear power warranty ■ Standard module linear power warranty

Comprehensive Certificates

- IEC 61215, IEC 61730,UL 61215, UL 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- ISO 45001: 2018 Occupational health and safety management systems
- IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules – Guidelines for increased confidence in PV module design qualification and type approval

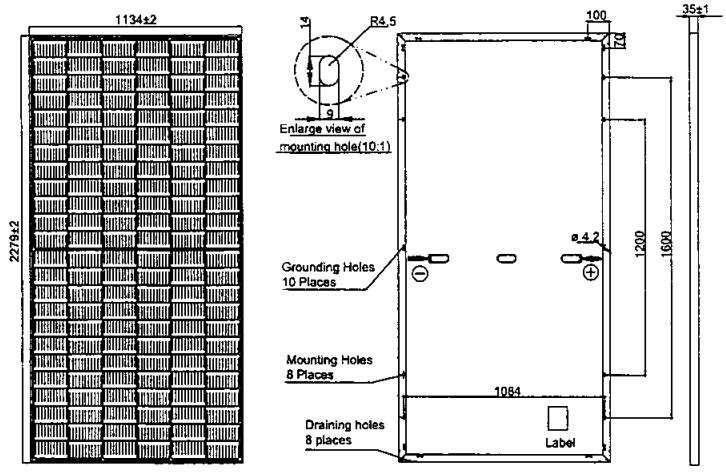
JA SOLAR

www.jasolar.com

JA SOLAR

JAM72S30 525-550/MR Series

MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono
Weight	28.6kg±3%
Dimensions	2279±2mm×1134±2mm×35±1mm
Cable Cross Section Size	4mm² (IEC) , 12 AWG(UL)
No. of cells	144(6×24)
Junction Box	IP68, 3 diodes
Connector	QC 4.10(1000V) QC 4.10-35(1500V)
Cable Length (Including Connector)	Portrait: 300mm(+)/400mm(-); Landscape: 1300mm(+)/1300mm(-)
Packaging Configuration	31pcs/Pallet, 620pcs/40ft Container

ELECTRICAL PARAMETERS AT STC

TYPE	JAM72S30 -525/MR	JAM72S30 -530/MR	JAM72S30 -535/MR	JAM72S30 -540/MR	JAM72S30 -545/MR	JAM72S30 -550/MR
Rated Maximum Power(Pmax) [W]	525	530	535	540	545	550
Open Circuit Voltage(Voc) [V]	49.15	49.30	49.45	49.60	49.75	49.90
Maximum Power Voltage(Vmp) [V]	41.15	41.31	41.47	41.64	41.80	41.96
Short Circuit Current(Isc) [A]	13.65	13.72	13.79	13.86	13.93	14.00
Maximum Power Current(Imp) [A]	12.76	12.83	12.90	12.97	13.04	13.11
Module Efficiency [%]	20.3	20.5	20.7	20.9	21.1	21.3
Power Tolerance	0~+5W					
Temperature Coefficient of Isc(α_Isc)	+0.045%/°C					
Temperature Coefficient of Voc(β_Voc)	-0.275%/°C					
Temperature Coefficient of Pmax(γ_Pmp)	-0.350%/°C					
STC	Irradiance 1000W/m², cell temperature 25°C, AM1.5G					

Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer.They only serve for comparison among different module types.

ELECTRICAL PARAMETERS AT NOCT

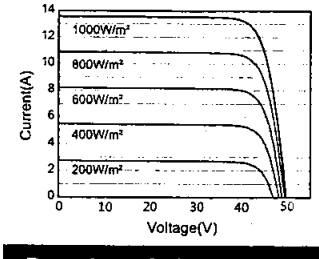
TYPE	JAM72S30 -525/MR	JAM72S30 -530/MR	JAM72S30 -535/MR	JAM72S30 -540/MR	JAM72S30 -545/MR	JAM72S30 -550/MR
Rated Max Power(Pmax) [W]	397	401	405	408	412	416
Open Circuit Voltage(Voc) [V]	46.05	46.18	46.31	46.43	46.55	46.68
Max Power Voltage(Vmp) [V]	38.36	38.57	38.78	38.99	39.20	39.43
Short Circuit Current(Isc) [A]	10.97	11.01	11.05	11.09	11.13	11.17
Max Power Current(Imp) [A]	10.35	10.39	10.43	10.47	10.51	10.55
NOCT	Irradiance 800W/m², ambient temperature 20°C,wind speed 1m/s, AM1.5G					

OPERATING CONDITIONS

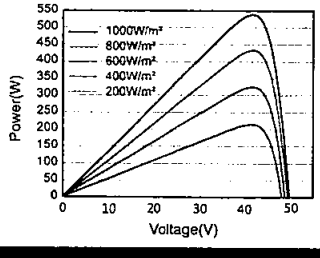
Maximum System Voltage	1000V/1500V DC
Operating Temperature	-40°C~+85°C
Maximum Series Fuse Rating	25A
Maximum Static Load,Front*	5400Pa(112lb/ft²)
Maximum Static Load,Back*	2400Pa(50lb/ft²)
NOCT	45±2°C
Safety Class	Class Ⅱ
Fire Performance	UL Type 1

CHARACTERISTICS

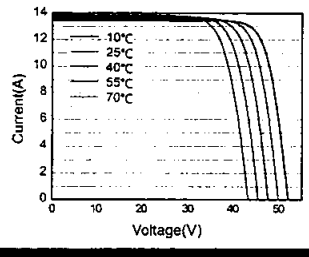
Current-Voltage Curve JAM72S30-540/MR



Power-Voltage Curve JAM72S30-540/MR



Current-Voltage Curve JAM72S30-540/MR

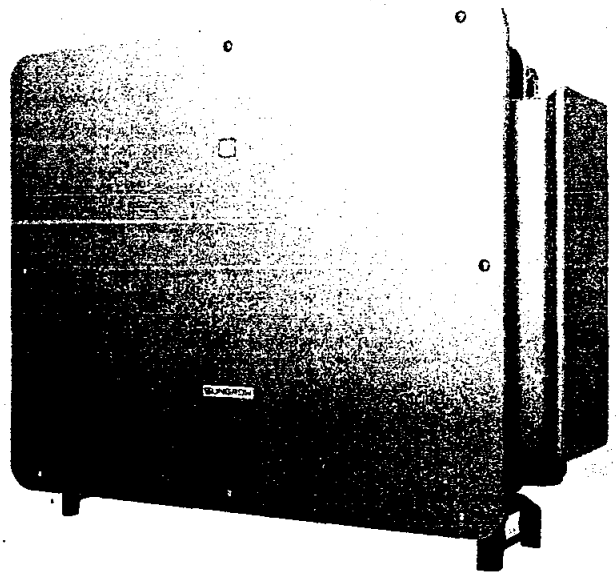


Annexure-A2.5

SG350HX

Multi-MPPT String Inverter for 1500 Vdc System

NEW



HIGH YIELD

- Up to 16 MPPTs with max. efficiency 99%
- 20A per string, compatible with 500Wp+ module
- Data exchange with tracker system, improving yield

LOW COST

- Q at night function, save investment
- Power line communication (PLC)
- Smart IV Curve diagnosis*,active O&M

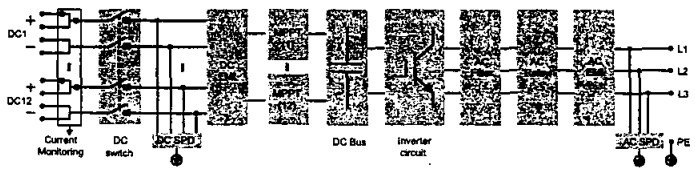
GRID SUPPORT

- SCR≥1.16 stable operation in extremely weak grid
- Reactive power response time <30ms
- Compliant with global grid code

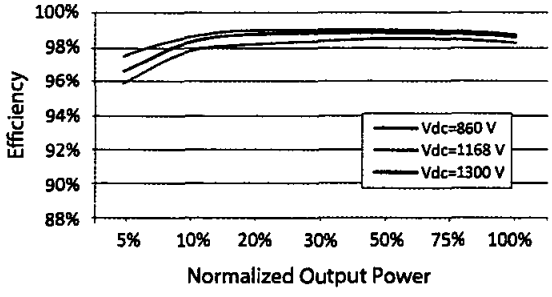
PROVEN SAFETY

- 2 strings per MPPT, no fear of string reverse connection
- Integrated DC switch, automatically cut off the fault
- 24h real-time AC and DC insulation monitoring

CIRCUIT DIAGRAM



EFFICIENCY CURVE



SUNGROW
Clean power for all

Type designation	SG350HX
Input (DC)	
Max. PV input voltage	1500 V
Min. PV input voltage / Startup input voltage	500 V / 550 V
Nominal PV input voltage	1080 V
MPP voltage range	500 V – 1500 V
MPP voltage range for nominal power	860 V – 1300 V
No. of independent MPP inputs	12 (optional: 14/16)
Max. number of input connector per MPPT	2
Max. PV input current	12 * 40 A (Optional: 14 * 30 A / 16 * 30 A)
Max. DC short-circuit current per MPPT	60 A
Output (AC)	
AC output power	352 kVA @ 30°C/ 320 kVA @40 °C / 295 kVA @50°C
Max. AC output current	254 A
Nominal AC voltage	3 / PE, 800 V
AC voltage range	640 – 920V
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
Efficiency	
Max. efficiency / European efficiency/CEC efficiency	99.01 % / 98.8 % / 98.5%
Protection	
DC reverse connection protection	Yes
AC short circuit protection	Yes
Leakage current protection	Yes
Grid monitoring	Yes
Ground fault monitoring	Yes
DC switch / AC switch	Yes / No
PV string current monitoring	Yes
Q at night function	Yes
Anti-PID and PID recovery function	Optional
Overvoltage protection	DC Type II / AC Type II
General Data	
Dimensions (W*H*D)	1136*870*361 mm (44.7'' * 34.3'' * 14.2'')
Weight	≤116 kg(≤255.7 lbs)
Isolation method	Transformerless
Ingress protection rating	IP66 (NEMA 4X)
Night power consumption	< 6 W
Operating ambient temperature range	-30 to 60°C(-22 to 140 °F)
Allowable relative humidity range (non-condensing)	0 – 100 %
Cooling method	Smart forced air cooling
Max. operating altitude	4000 m (> 3000 m derating) / 13123 ft (> 9843 ft derating)
Display	LED, Bluetooth+APP
Communication	RS485 / PLC
DC connection type	MC4-Evo2 (Max. 6 mm², optional 10mm² /Max. 10AWG, optional 8AWG.)
AC connection type	Support OT/DT terminal (Max. 400 mm²/ 789 Kcmil)
Compliance	IEC 62109, IEC 61727, IEC 62116, IEC 60068, IEC 61683, VDE-AR-N 4110:2018, VDE-AR-N 4120:2018, EN 50549-1/2, UNE 206007-1:2013, P.O.12.3, UTE C15-712-1:2013, UL1741, UL1741SA, IEEE1547, IEEE1547.1, CSA C22.2 107.1-01-2001, California Rule 21, UL1699B
Grid Support	Q at night function, LVRT, HVRT,active & reactive power control and power ramp rate control, Q-U control, P-f control

*: Only compatible with Sungrow logger and iSolarCloud

SUNGROW
Clean power for all

Logger4000

SMART AND FLEXIBLE

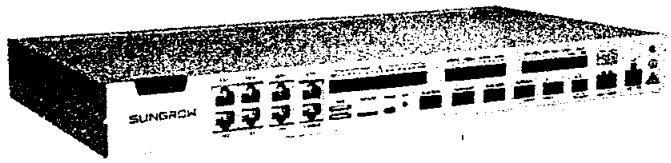
- Intelligent communication and control of the data collection
- Communication with up to 300 devices
- 30ms fast dispatch via Goose protocol
- Built-in Web for commissioning and O&M

SIMPLE AND EFFICIENT

- Automatically distributing Modbus addresses
- Remote parameter setting and control of active & reactive power
- Local maintenance via WLAN access
- Rack-mounted, wall mounting

SAFE AND RELIABLE

- Built-in anti-surge protection for communicaton ports, and support isolation voltage up to 2500V
- Dual power supply, automatic switch



Type designation	Logger4000
Communication	
Max. number of devices	300
RS485	7
Fiber port	2*100 / 1000 Mbps
Ethernet port	4*10 / 100 Mbps
Fast dispatch port	1*10 / 100 Mbps
Digital inputs	16, max. 24 Vdc
Digital outputs	4
Built-in MPLC	1
PT100 / PT1000	2
Analog Input	4 (1 Analog Input: 0 – 10 Vdc, 3 Analog Input: 4 – 20 mA)
Power Supply	
AC input	100 – 277 Vac, 50 / 60 Hz
DC input	24 Vdc, 1.25 A
Power consumption	Typ. 18 W, max. 30 W
Ambient conditions	
Operating Temperature	-30 °C to 60 °C
Storage Temperature	-40 °C to 70 °C
Relative air humidity	≤ 95% (non-condensing)
Elevation	≤ 4000 m
Protection class	IP20
Mechanical parameters	
Dimensions (W*H*D)	440*44*224 mm
Weight	3 kg
Installation	Rack-mounting, wall mounting

Annexure-A2.6

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技术规格书
Approval Sheets

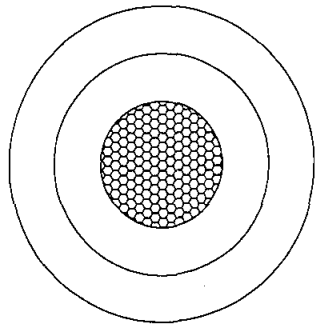
Customer/客户		Valuable customer
Standard/标准		EN50618
Construction/规格		H1Z2Z2-K 1X4mm^2
Construction Item	Units	4.0mm^2
Construction/构造	mm	52/0.30±0.01
Material/材质	---	Tinned copper wire
O.D/绞合外径	mm	2.40
Insulation (绝缘)		
Material/材质	---	XLPO
Avg.Thick/平均厚度	mm	0.70
Min.Thick最小厚度	mm	0.50
O.D/线径	mm	3.95±0.15
Color/颜色	---	黑色
Twisted Pair (对绞)		
Ins.Color/芯线颜色	---	/
Lay of Strand/绞距	mm	/
O.D/绞合外径	mm	/
Assemble (成缆)		
Filling/填充	---	/
Lapping/包带	---	/
Drain.wire/地线	---	/
Covering (内护)		
Material/材质	---	/
Avg.Thick/标准厚度	mm	/
Min.Thick/最小厚度	mm	/
O.D/线径	mm	/
Color/颜色	---	/
Armour(铠装)		
Construction/结构	'---	/
Coverage/覆盖率	%	/
Shield (屏蔽)		
Material/材质	---	/
Construction/结构	---	/
Coverage/覆盖率	%	/
Jacket (护套)		
Material/材质	---	XLPO
Avg.Thick/平均厚度	mm	0.80
Min.Thick/最小厚度	mm	0.60
O.D/线径	mm	5.55±0.2
Color/颜色	'---	Black
Surface/外观	---	/

Marking (印字)

TÜV DC1500V H1Z2Z2-K 1×4.0mm^2
Shanghai Jiukai Wire & Cable Co., Ltd

Sheet NO/编号	S0518001

Construction Figure/截面图：



Electric Characters 电气性能

Voltage rating/额定电压: DC1500V
Temperature rating/使用环境温度等级:-40~90℃
Dielectric strength/耐压强度:AC-6.5kV/5min
Spark test/火花测试:AC-10kV/In the air
Conductor resistance/导体电阻：5.09ΩKM Max at20℃
Weathering/UV-resistance/抗紫外线:720h，No cracking
Thermal endurance properties/热寿命: 25 Years

Physical Properties 物理性能

Elongation of unaged values/老化前伸长率(%):≥125%
Insulation Tensile strength of unaged values /绝缘老化前抗张强度(N/mm2):≥6.5；Jacket Tensile strength of unaged values /护套老化前抗张强度(N/mm2):≥8.0
Aged in a full draft circulating air oven/老化条件: 150±2.0℃
Elongation of After aging/老化后伸长变化率(%):≦30%
Tensile strength of After aging/老化后抗张强度变化率：≦30%
Ozone resistance/耐臭氧性:25±2℃*24h No cracking
Cold bend test/冷弯: -40±2℃*16h No cracking
Cold impact test/冷冲击:-40℃*16h/1000g；100mm No cracking
Flame test/阻燃性:IEC 60332

上海玖开电线电缆有限公司
ShangHai JiuKai Wire&Cable Co.,Ltd
Add:No.875 PuWei Highway FengXian District ShangHai City China
Tel:86-021-57428799EXT8005 Fax:86-021-57404050
地址：上海奉贤区浦卫公路875号

APPROVED批准	CHECKED审查	DESIGNED编制
张学武	/	WKB

APPROVED BY THE CLIENT 客户认可

备注：

Revision Date:2018-7-30

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技术规格书
Approval Sheets

Customer/客户	Valuable customer
Standard/标准	EN50618
Construction/规格	H1Z2Z2-K 1X6mm²

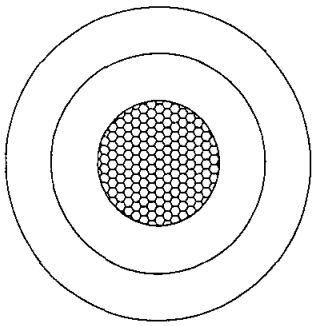
Construction Item	Units	6.0mm²
Construction/构造	mm	78/0.30±0.01
Material/材质	---	Tinned copper wire
O.D/绞合外径	mm	3.00
Insulation (绝缘)		
Material/材质	---	XLPO
Avg.Thick/平均厚度	mm	0.70
Min.Thick最小厚度	mm	0.50
O.D/线径	mm	4.55±0.15
Color/颜色	---	黑色
Twisted Pair (对绞)		
Ins.Color/芯线颜色	---	/
Lay of Strand/绞距	mm	/
O.D/绞合外径	mm	/
Assemble (成缆)		
Filling/填充	---	/
Lapping/包带	---	/
Drain.wire/地线	---	/
Covering (内护)		
Material/材质	---	/
Avg.Thick/标准厚度	mm	/
Min.Thick/最小厚度	mm	/
O.D/线径	mm	/
Color/颜色	---	/
Armour(铠装)		
Construction/结构	---	/
Coverage/覆盖率	%	/
Shield (屏蔽)		
Material/材质	---	/
Construction/结构	---	/
Coverage/覆盖率	%	/
Jacket (护套)		
Material/材质	---	XLPO
Avg.Thick/平均厚度	mm	0.80
Min.Thick/最小厚度	mm	0.60
O.D/线径	mm	6.15±0.2
Color/颜色	---	Black
Surface/外观	---	/

Marking (印字)

TÜV DC1500V H1Z2Z2-K 1×6.0mm²
Shanghai Jiukai Wire & Cable Co., Ltd

Sheet NO/编号	S0905003

Construction Figure/截面图：



Electric Characters 电气性能

Voltage rating/额定电压: DC1500V
Temperature rating/使用环境温度等级:-40~90℃
Dielectric strength/耐压强度:AC-6.5kV/5min
Spark test/火花测试:AC-10kV/In the air
Conductor resistance/导体电阻：3.39ΩKM Max at20℃
Weathering/UV-resistance/抗紫外线:720h，No cracking
Thermal endurance properties/热寿命: 25 Years

Physical Properties 物理性能

Elongation of unaged values/老化前伸长率(%):≥125%
Insulation Tensile strength of unaged values /绝缘老化前抗张强度(N/mm2):≥6.5；Jacket Tensile strength of unaged values /护套老化前抗张强度(N/mm2):≥8.0
Aged in a full draft circulating air oven/老化条件: 150±2.0℃
Elongation of After aging/老化后伸长变化率(%):≤30%
Tensile strength of After aging/老化后抗张强度变化率：≤30%
Ozone resistance/耐臭氧性:25±2℃*24h No cracking
Cold bend test/冷弯: -40±2℃*16h No cracking
Cold impact test/冷冲击:-40℃*16h/1000g；100mm No cracking
Flame test/阻燃性:IEC 60332

上海玖开电线电缆有限公司
ShangHai JiuKai Wire&Cable Co.,Ltd
Add:No.875 PuWei Highway FengXian District ShangHai City China
Tel:86-021-57428799EXT8005 Fax:86-021-57404050
地址：上海奉贤区浦卫公路875号

APPROVED批准	CHECKED审查	DESIGNED编制
张学武	/	WKB

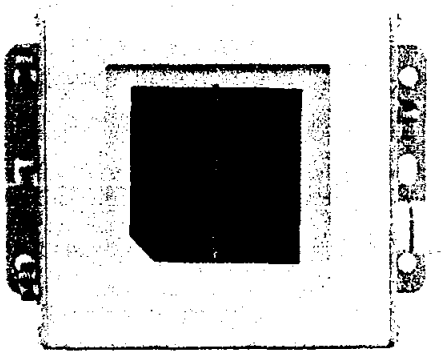
APPROVED BY THE CLIENT 客户认可

备注：

Revision Date:2017-12-2

Annexure-A2.7

Solar Radiation Sensor Box
Measurement of Solar Irradiance
3S-IS-T-MB



MODE OF OPERATION

A silicon solar cell can be used as an irradiance sensor, because the short-circuit current is proportional to irradiance. Our sensors are built out of a monocrystalline solar cell connected to a shunt. Due to the low resistance of the shunt the cell operates next to short circuit.

The temperature coefficient of the short-circuit current creates a small error.

The compensation is realized by using a specific temperature sensor laminated to the rear side of the solar cell. The measuring signals of short- circuit current of the cell and the resistance value of the temperature sensor are measured by a micro controller.

The calculated values of irradiance and temperature given onto a RS485 port with customer specification protocol. The electronic circuit is optimized for low power consumption.

MECHANICAL CONSTRUCTION

The solar cell is embedded in Ethylene- Vinyl- Acetate (EVA) between glass and Tedlar. Plain integration into the top cover of the box Advanced weatherproof junction box made of UV resistant material with cable gland and screw-less terminal for the connection of the measuring cable, therefore, the sensor construction is comparable to that of a standard PV module. The electrical connection is realized by a 3m cable.

3S-IS-AT-MT-WS-WD-P

ALL SENSORS ARE CALIBRATED IN SIMULATED SUNLIGHT AGAINST A REFERENCE CELL OF THE SAME TYPE. THE REFERENCE CELL IS PERIODICALLY CALIBRATED AGAINST A REFERENCE CELL CALIBRATED BY FRAUNHOFER ISE, FREIBURG.

TECHNICAL DATA

General Information	
Solar Cell	Monocrystalline Silicon (52 mm x 52 mm)
Sensor Classification	Class A according to IEC 61724
Current Shunt	High precision shunt resistor directly soldered to the terminals of the cell
Operating Temperature	–30°C to +70°C
Electrical Connection	3 m PUR Cable, UV and weather resistant
Power Supply	12 to 30 VDC (30 mA typically at 20 VDC)
Interface	RS485 up to 19200 Baud
Protocol	The sensor is connected via a 2-wire RS485 bus with open vendor-independent Modbus RTU protocol
Galvanic Isolation	1000 V between power supply and RS485 bus
Case	Advanced weatherproof junction box made of UV resistant material
Dimensions, Weight	104 mm x 104 mm x 35 mm, approx. 280 g
Protection	IP54

Accuracy	
Irradiance	10...1500W/m², Accuracy of monthly sums compared to a W.M.O. class 1 Pyranometer (e.g. CMP 11) according to ISO 9060: better ±5%
Drift	Very small drift of <0.3%/ year

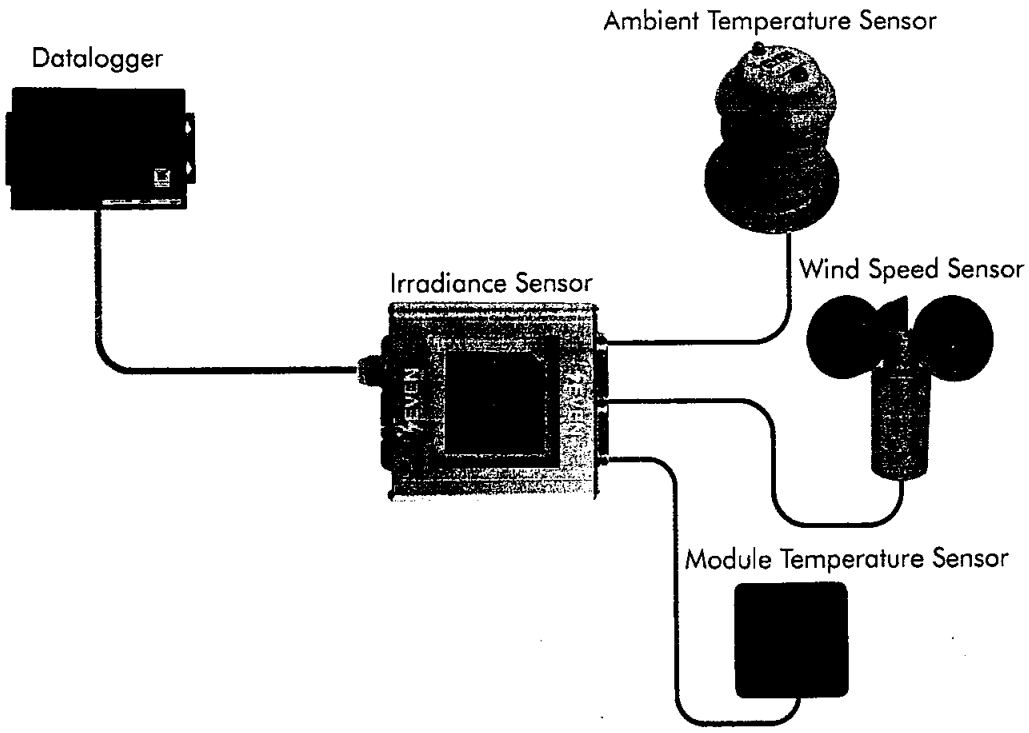
Electrical Connection	
Brown	Power (+)
White	Power (-)
Green	RS485 Data (+) / A
Yellow	RS485 Data (-) / B
Input 1	3S-WS-PLS-P, Wind speed sensor, 2 pin connector
Input 2	3S-AT-18B20, Ambient temperature sensor, 3 pin connector
Input 3	3S-MT-18B20, Module temperature sensor, 4 pin connector
Input 4	3S-MT-18B20, Wind direction sensor, 5 pin connector

Others	
Calibration	Individual calibration of each sensors in the natural sunlight at AM 1,5 spectrum by means of a compatible calibrated reference cell.
Handling Case	The sensor can be cleaned using a smooth cotton cloth, water and a mild cleaning fluid. Opening of the sensor case by the user or installation staff is not necessary. If the case is opened, we cannot guarantee the seal of the case anymore.

Modbus Specification	
Baud Rate	1200, 2400, 9600, 19200, 38400
Parity	No, even, odd
Stop Bit	1, 2 (only at no parity)
Factory Default	9600 Baud, 8N1, address: 1

3S-IS-AT-MT-WS-WD-P

WIRING EXTERNAL SENSORS



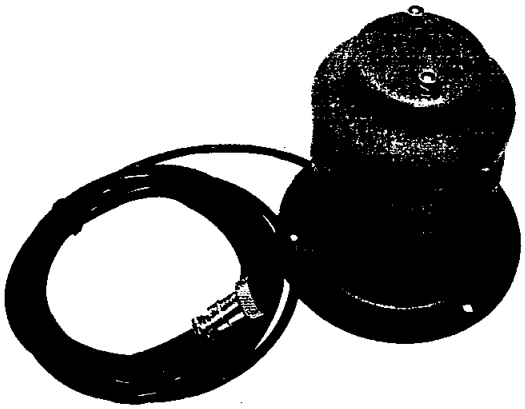
RELATED PRODUCTS

3S-AT-18B20	Ambient temperature sensor, DS18B20
3S-MT-18B20	Module temperature sensor, DS18B20
3S-WS-PLS-P	Wind speed sensor, reed contact, pulse

Ambient Temperature Sensor 3S-AT-18B20

APPLICATION

Maxim DS18B20 is an economical digital ambient temperature sensor for universal application as well as for solar photovoltaics projects. Compatible with SEVEN Sensor Box. For this, SEVEN provides an UV resistant solar radiation shield.



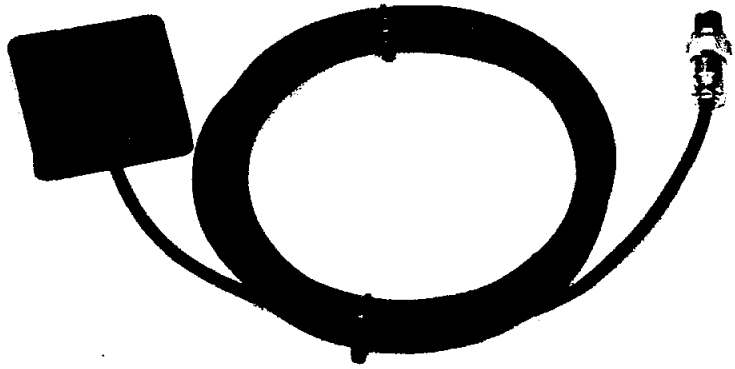
TECHNICAL DATA

General Information	
Sensor Type	DS18B20 digital temperature probe
Measuring Range	-55...+125°C
Accuracy	± 0.5 °C
Sensor Housing	Stainless steel tube, 6 mm diameter, 50 mm length
Cable	3 m or 5 m PUR Cable, UV and weather resistant
Protection	IP65
Connection	One-Wire-Bus technique

Module Temperature Sensor 3S-MT-18B20

APPLICATION

Maxim DS18B20 is an economical digital module temperature sensor for universal application as well as for solar photovoltaics projects. Compatible with SEVEN Sensor Box.



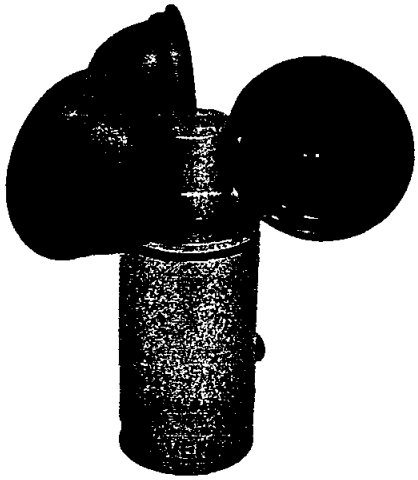
TECHNICAL DATA

General Information	
Sensor Type	DS18B20 digital temperature probe, for flat surfaces (back side of solar panel)
Measuring Range	-55...+125°C
Accuracy	± 0.5 °C
Sensor Housing	Plastic housing with aluminum plate, H x W x L: 12 mm x 50 mm x 50 mm
Cable	5 m PUR Cable, UV and weather resistant
Protection	IP67
Connection	One-Wire-Bus technique

Wind Speed Sensor 3S-WS-PLS-P

APPLICATION

Small and economical anemometer with digital output used to measure wind speed at solar power plants as well as at universal applications. Compatible with SEVEN Sensor Box and supplied with a Cable.

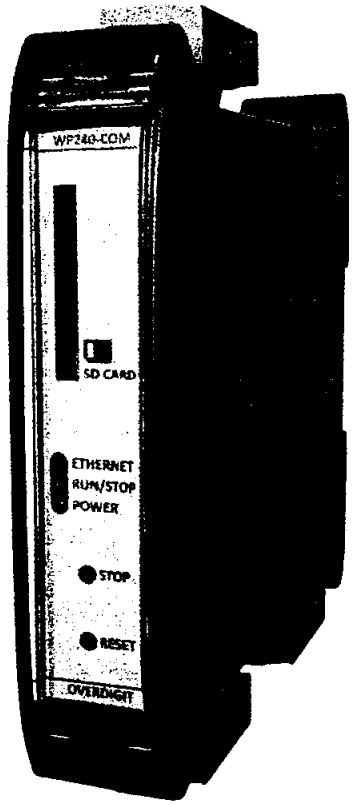


TECHNICAL DATA

General Information	
Sensor type	UV resistant plastic material cup star anemometer
Output Signal	Reed relays, 2.5 Hz / (m/s) pulse
Measuring Range	0,9...60m/s
Accuracy	±0.5 m/s or ±5 % of measuring value
Resolution	0.4 m wind run
Frequency	0...150 Hz
Contact Load	10 W, max. 42 V DC, max. 0.4 A
Ambient Temperature	-25...+60 °C, ice-free
Cable	3 m LiYY Cable, UV and weather resistant
Protection	IP54
Survival Speed	Max. 60 m/s
Dimensions	176 mm x 174 mm
Weight	0.4 kg
Mounting Type	Connected to the Pipe

Annexure-A2.8

ENcombi



ECpv

Datasheet

Encombi ApS. Holstebrovej 75, 8800 Viborg. Denmark.
www.encombi.com

Overview

Is the **EN**combi plug and play controller for decentralized PV plants with or without gensets. Pick any interface protocol from our list of supported interfaces and connect - it is that easy!

Connect with inverters, controllers and power meters via RS-485 or TCP/IP and have full control of your grid export / self-consumption and safely run your gensets while saving fuel in hybrid plants

Setup and monitoring is easily done via the built-in webserver, **EC**web, describing every step of the setup and providing you with a wide range of monitoring and reports - run it on your PC or on mobile devices. With the **EC**logic feature, you can program custom logics - a simple and powerful tool.

Use the **EC**cloud remote monitoring system web app for live and historical data visualization and analysis or your PV and PV-Genset plants. You can try it out for a full 90 days free of charge when purchasing any **EC**pv variant.

Variants

The **EC**pv comes in the following five variants all running on the same HW.

Capacity

Function \ Variant	Logger	Solar	S	M	L
32 inverters	●	●	●	●	●
16 gensets	●	●	●	●	●
16 grid connections	●	●	●	●	●
16 PV feed in points	●	●	●	●	●
Stacking support for >32 inverter PV plants		●	●	●	●

Control

Function \ Variant	Logger	Solar	S	M	L
EClogic	●	●	●	●	●
Active power control of PV plant		●	●	●	●
Reactive power control of PV plant		●	●	●	●
Self consumption unlimited PV plant capacity		*	*	*	*
PV/Diesel up to 100kWp PV plant			●	●	●
PV/Diesel up to 500kWp PV plant				●	●
PV/Diesel unlimited PV plant capacity					*
Genset Management			●	●	●

* Limited by the maximum amount of inverters supported only

Monitoring

Function \ Variant	Logger	Solar	S	M	L
ECweb	●	●	●	●	●
ECpanel	*	*	*	*	*
ECcloud - 90 days free trial	●	●	●	●	●
ECcloud	*	*	*	*	*

* Accessories

Communication

Function \ Variant	Logger	Solar	S	M	L
PV inverters via Modbus RTU or TCP	●	●	●	●	●
Power meters via Modbus RTU or TCP	●	●	●	●	●
Genset controllers via Modbus RTU or TCP	●	●	●	●	●
Sensors via Modbus RTU	●	●	●	●	●
Modbus TCP server	●	●	●	●	●
Modbus RTU slave	*	*	*	*	*

* On RS485 serial port not used for inverter, power meter, genset controller or sensor comm.

Logs and notifications

Function \ Variant	Logger	Solar	S	M	L
Lifetime event log on USB or SD-card	●	●	●	●	●
Summary logs on USB or SD-card	●	●	●	●	●
Production (time series data) logs on USB or SD-card	●	●	●	●	●
Alarm notification via email	●	●	●	●	●
Logs via email or ftp	●	●	●	●	●

HW Specifications

The hardware is a high quality, fast and extremely compact and DIN rail mounted unit allowing you to fit it into almost any electrical cabinet at your site when doing brown field projects - or as a part of our **EC**cube offering.

Ethernet	1 x RJ45 - 10/100Mbs
RS485	2 x isolated fieldbus (master/slave)
Memory	16GB SD card included
Power supply	24Vdc ±15% / 250mA max
Operating Temperature	-20°C to +70°C
Mounting	DIN rail
Dimension	107 x 22.5 x 119 mm (H x W x D)
Weight	About 200g

For more information visit:

www.encombi.com

Annexure-A2.9

LV Switchgear Details

Sr. No.	Description	Make	Qty	Unit
1	Field AC Collector LT Panel - IP 42/IP54	Local	1	Nos
2	Incoming MCCB 3P,300A 18KA, 800V	ABB/Schneider	9	Nos
3	ACBs 4P, 2500A 66KA	ABB/Schneider	1	Nos
4	Single Pole Current Transformers (2500 / 5A) Metering Class	FICO / Eqv.	3	Nos
5	AC SPD 40KA	Phoenix/Eqv	1	Nos
6	Relay - (UV/OV/Phase Sequence/Frequency)	Klemsan / Eqv.	3	Nos
7	Digital Voltmeter with Selector Switch	Entes / Eqv.	1	Nos
8	Power Analyzer	Entes / Eqv.	1	Nos
9	Indication LED Lights (RYB)	Schneider / Eqv.	5	Nos
10	Digital Ammeter with Selector Switch	Entes / Eqv.	1	Nos
11	98% Pure Copper Bus-Bars with Sleeves	Local / Imported	1	Job

Characteristics and performance

ComPact NSX circuit breakers from 100 to 250 A up to 690 V

ComPact NSX single-pole.

ComPact NSX two-pole.

ComPact circuit breakers			
Number of poles			
Control	manual	toggle	
		direct or extended rotary handle	
	electric		
Connections	fixed	front connection	
		rear connection	
	withdrawable	front connection	
		rear connection	
Electrical characteristics as per IEC/EN 60947-2			
Rated current (A)	**In**	40 °C	
Rated insulation voltage (V)	**Ui**		
Rated impulse withstand voltage kV)	**Uimp**		
Rated operational voltage (V)	**Ue**	AC 50/60 Hz	
		DC	
Type of circuit breaker			
Ultimate breaking capacity (kA rms)	**Icu**	AC 50/60 Hz	220/240 V
			380/415 V
			440 V
			500/525 V
			660/690 V
		DC	250 V (1P)
			500 V (2P)
Service breaking capacity (kA rms)	**Ics**	% Icu	
Suitability for isolation			
Utilisation category			
Durability (C-O cycles)	mechanical		
	electrical	277 V	In/2
			In
Protection and measurements			
Type of trip units			
Ratings		**In**	
Overload protection (thermal)	long time threshold	**Ir**	
Short-circuit protection (magnetic)	instantaneous pickup	**Im**	value indicated for AC [1] real value for DC
Add-on earth-leakage protection	Vigi add-on combination with Vigirex relay		
Additional indication and control auxiliaries			
Indication contacts			
Voltages releases	MX shunt release		
	MN undervoltage release		
Installation			
Accessories	terminal extensions and spreaders		
	terminal shields and interphase barriers		
	escutcheons		
Dimensions (mm)	W x H x D		
Weight (kg)			
Source changeover system			
Manual mechanical interlocking			

[1] The thresholds for TMD and TMG 1-pole and 2-pole magnetic trip units up to 63 A are indicated for AC. The real DC thresholds are indicated on the following line.

100% UL RATED CIRCUIT BREAKERS

The 100% rated versions for Isomax circuit breakers are available thanks to the excellent thermal sizing of the latter.

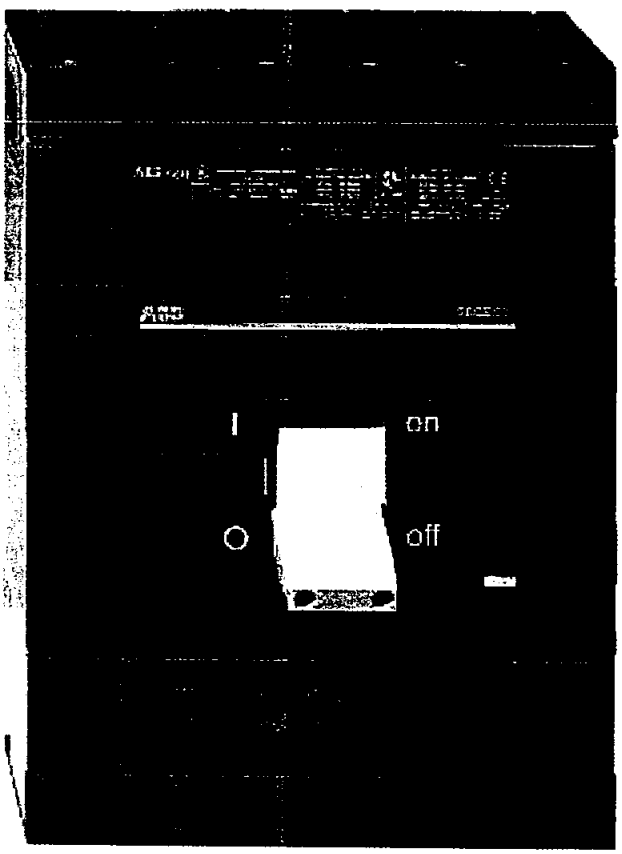
ALL THE APPLICATIONS

ABB offers the right solution for any application up to 2500 A thanks to Isomax S6, S7 and S8 circuit breakers, perfectly integrated with the Tmax family:

– MCCB: S6, S7 and S8 molded case circuit breakers for power distribution;

– MCP: S6, S7 and S8 circuit breakers with magnetic only trip unit for motor control protection;

– MCS: S6, S7 and S8 molded case switches for using as isolators or switching devices for lines, busbars or parts of plants.



MAXIMUM VERSATILITY

Isomax circuit breakers can be fitted with a wide range of terminals for every kind of connections. Modular design also makes installation and assembly extremely simple.

COMPLETE RANGE OF ACCESSORIES

Isomax circuit breakers are complemented by a complete range of accessories to satisfy the widely differing operational and automation requirements. Accessories are standardized for groups of circuit breakers to streamline storage logistics and simplify installation.

Isomax circuit breakers can be customized as required under conditions of absolute safety.

All the accessories can be mounted with simple operations without exposing the main contacts (except for the Isomax S8).

UL 489 CSA C22.2

				Tmax T1 1P	Tmax T1	Tmax T2	Tmax T3
Frame size			[A]	100	100	100	225
Number of poles			[Nr]	1	3,4	3,4	3,4
Rated voltage	**AC (50-60Hz)**		[V]	277	480	480	480
	DC		[V]		500		500
Interrupting ratings				**B**	**N**	**S H**	**N S**
	AC 240 V		[kA]		50[2]	65 100	50 65
	277 V		[kA]	18[1]			
	480 V		[kA]		22[2]	35 65	25 35
	600 V		[kA]				
	DC 250 V - 2 poles in series		[kA]		25		25 35
	500 V - 3 poles in series		[kA]		25		25 35
	500 V - 2 poles in series		[kA]				
	600 V - 3 poles in series		[kA]				
Trip units		TMF		■	■	■	■
		TMD/TMA					
		ELT				■	
		MA				■	■
Versions		MCCB		■	■	■	■
		MCS			■		■
		MCP				■	■

IEC 60947-2

				Tmax T1 1P	Tmax T1	Tmax T2	Tmax T3
Rated uninterrupted current, **Iu**			[A]	160	160	160	250
Number of poles			[Nr]	1	3,4	3,4	3,4
Rated service voltage, **Ue**		**AC (50-60Hz)**	[V]	240	690	690	690
		DC	[V]	125	500	500	500
Rated ultimate short circuit breaking capacity, **Icu**				**B**	**B C N**	**N S H L**	**N S**
	AC (50-60 Hz)	220/230 V	[kA]	25	25 40 50	65 85 100 120	50 85
		380/415 V	[kA]		16 25 36	36 50 70 85	36 50
		440 V	[kA]		10 15 22	30 45 55 75	25 40
		500 V	[kA]		8 10 15	25 30 36 50	20 30
		690 V	[kA]		3 4 6	6 7 8 10	5 8
	DC	250V - 2 poles in series	[kA]		16 25 36	36 50 70 85	36 50
		250V - 3 poles in series	[kA]		20 30 40	40 55 85 100	40 55
		500V - 2 poles in series	[kA]				
		500V - 3 poles in series	[kA]		16 25 36	36 50 70 85	36 50
		750V - 3 poles in series	[kA]				
Trip units		TMF		■			
		TMD/TMA			■	■	■
		ELT				■	
		MF				■	
		MA				■	■

UL 489 CSA C22.2 and IEC 60947-2

Dimensions	H	[in/mm]	5.12/130	5.12/130	5.12/130	5.9/150
	W 1p or 3p	[in/mm]	1/25.4	3/76	3.54/90	4.13/105
	W 4p	[in/mm]		4/102	4.72/120	5.51/140
	D	[in/mm]	2.76/70	2.76/70	2.76/70	2.76/70
Mechanical life		[No.operations]	25000	25000	25000	25000
		[No. Hourly operations]	240	240	240	240
Electrical life @ 415 V AC		[No.operations]	8000	8000	8000	8000
		[No. Hourly operations]	120	120	120	120

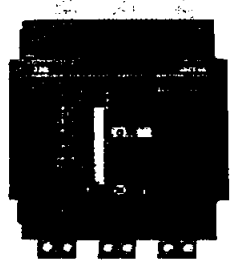
[1] In15A = 10kA @ 277 V AC
[2] In15A = 35 kA @ 240 V AC, 14 kA @ 480 V AC
[3] Please ask ABB for 600 A availability

TMF = Thermomagnetic trip unit with fixed thermal and magnetic threshold

TMD = Thermomagnetic trip unit with adjustable thermal threshold and fixed magnetic threshold







Tmax T4	Tmax T5	Isomax S6	Isomax S7	Isomax S8
250	400-630	800	1250-1600	2000-2500-3200
3/4	3/4	3/4	3/4	3/4
690	690	690	690	690
N S H L V	N S H L V	N S H L	S H L	H V
36 50 70 120 200	36 50 70 120 200	35 50 65 100	50 65 100	85 120
30 40 65 100 180	30 40 65 100 180	30 45 50 80	40 55 80	70 100
20 25 40 70 80	20 25 40 70 80	20 22 25 30	20 25 35	40 50
100 100 100 100 100	100 100 100 100 100	100 100 100 75	100 75 50	50 50
8.07/205	8.07/205	14.25-268	16-406	15.75-400
4.13/105	5.51/140	8.27-210	8.27-210	15.98-406
4.07/103.5	4.07-103.5	4.07-103.5	5.45-138.5	9.25-235

T4	T5	S7
250	400	1250-1600
3	3	3
80...250	320-400	1000...1600
690	690	690
■		
■	■	
■	■	
		■
		■

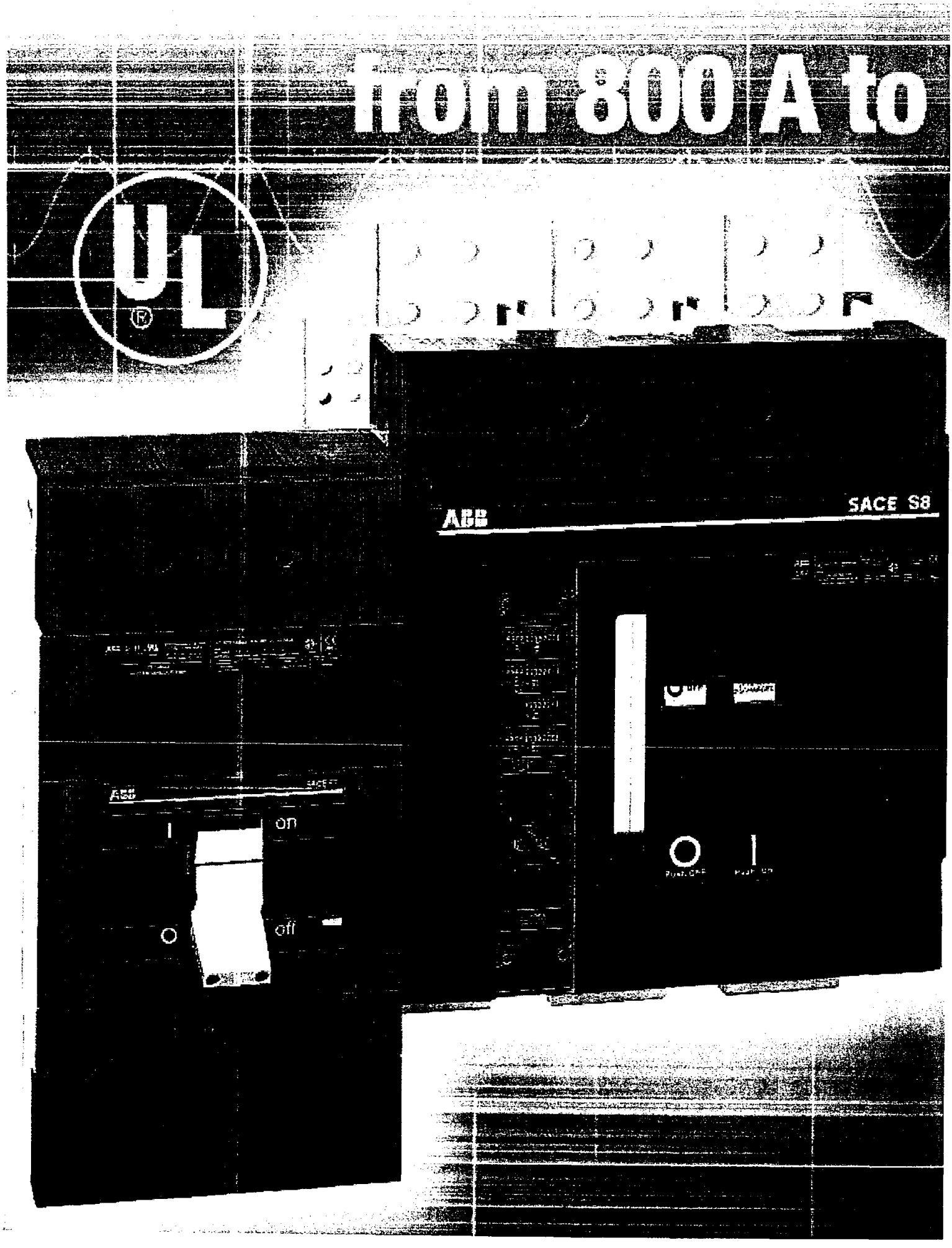
T4D	T5D	S6D	S7D	S8D
3/4	3/4	3/4	3/4	3/4
250-320	400-630	800	1000-1250-1600	2000-2500-3200
690	690	690	690	690
8	8	8	8	8
800	800	800	800	800
5.3	11	30	52.5	85
3.6	6	15	25	40

Characteristics and performance

ComPact NSX circuit breakers from 100 to 250 A up to 690 V

	NSX100		NSX160		NSX250
	1	2	1	2	1
	◉	◉	◉	◉	◉
	-	-	-	-	-
	-	-	-	-	-
	◉	◉	◉	◉	◉
	◉	◉	◉	◉	◉
	-	-	-	-	-
	-	-	-	-	-
	100	100	160	160	250
	750	750	750	750	750
	8	8	8	8	8
	277	690	277	690	277
	250	500	250	500	-
	F N M	F M S	F N M	F M S	N
	18 25 40	36 85 100	18 25 40	36 85 100	25
	- - -	18 25 70	- - -	18 25 70	-
	- - -	15 25 65	- - -	15 25 65	-
	- - -	10 18 35	- - -	10 18 35	-
	- - -	5 8 10	- - -	5 8 10	-
	36 50 85	36 85 100	36 50 85	36 85 100	-
	- - -	36 85 100	- - -	36 85 100	-
	100 %	100 %	100 %	100 %	100 %
	◉	◉	◉	◉	◉
	A	A	A	A	A
	20000	20000	20000	20000	10000
	20000	20000	20000	20000	10000
	10000	10000	10000	10000	5000
	built-in thermal-magnetic		built-in thermal-magnetic		built-in thermal-magnetic
	16 20 25 30 40	50 63 80 100	125 160		160 200 250
	fixed		fixed		fixed
	16 20 25 30 40	50 63 80 100	125 160		160 200 250
	fixed		fixed		fixed
	190 190 300 300 500	500 500 640 800	1000 1250		850 850 850
	260 260 400 400 700	700 700 800 1000	1200 1250		- - -
	-	-	-	-	-
	-	◉	-	◉	-
	-	-	-	-	-
	-	◉	-	◉	-
	-	-	-	-	-
	-	◉	-	◉	-
	◉	◉	◉	◉	◉
	◉	◉	◉	◉	◉
	◉	◉	◉	◉	◉
	35 x 161 x 86	70 x 161 x 86	35 x 161 x 86	70 x 161 x 86	35 x 161 x 86
	0.7	1.2	0.7	1.2	0.7
	◉	◉	◉	◉	◉

From 800 A to



100% UL RATED CIRCUIT BREAKERS

The 100% rated versions for Isomax circuit breakers are available thanks to the excellent thermal sizing of the latter.

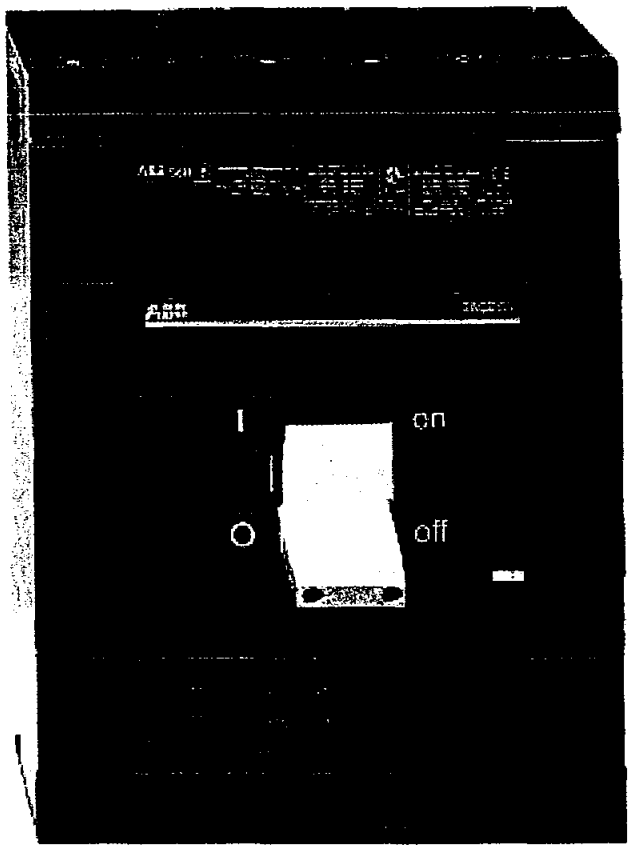
ALL THE APPLICATIONS

ABB offers the right solution for any application up to 2500 A thanks to Isomax S6, S7 and S8 circuit breakers, perfectly integrated with the Tmax family:

– MCCB: S6, S7 and S8 molded case circuit breakers for power distribution;

– MCP: S6, S7 and S8 circuit breakers with magnetic only trip unit for motor control protection;

– MCS: S6, S7 and S8 molded case switches for using as isolators or switching devices for lines, busbars or parts of plants.



MAXIMUM VERSATILITY

Isomax circuit breakers can be fitted with a wide range of terminals for every kind of connections. Modular design also makes installation and assembly extremely simple.

COMPLETE RANGE OF ACCESSORIES

Isomax circuit breakers are complemented by a complete range of accessories to satisfy the widely differing operational and automation requirements. Accessories are standardized for groups of circuit breakers to streamline storage logistics and simplify installation.

Isomax circuit breakers can be customized as required under conditions of absolute safety.

All the accessories can be mounted with simple operations without exposing the main contacts (except for the Isomax S8).

UL 489 CSA C22.2

				Tmax T1 1P	Tmax T1	Tmax T2	Tmax T3
Frame size			[A]	100	100	100	225
Number of poles			[Nr]	1	3,4	3,4	3,4
Rated voltage	AC (50-60Hz)		[V]	277	480	480	480
	DC		[V]		500		500
Interrupting ratings				B	N	S H	N S
	AC	240 V	[kA]		50[2]	65 100	50 65
		277 V	[kA]	18[1]			
		480 V	[kA]		22[2]	35 65	25 35
		600 V	[kA]				
	DC	250 V - 2 poles in series	[kA]		25		25 35
		500 V - 3 poles in series	[kA]		25		25 35
		500 V - 2 poles in series	[kA]				
		600 V - 3 poles in series	[kA]				
Trip units		TMF		■	■	■	■
		TMD/TMA					
		ELT				■	
		MA				■	■
Versions		MCCB		■	■	■	■
		MCS			■		■
		MCP				■	■

IEC 60947-2

				Tmax T1 1P	Tmax T1	Tmax T2	Tmax T3
Rated uninterrupted current, Iu			[A]	160	160	160	250
Number of poles			[Nr]	1	3,4	3,4	3,4
Rated service voltage, Ue		AC (50-60Hz)	[V]	240	690	690	690
		DC	[V]	125	500	500	500
Rated ultimate short circuit breaking capacity, Icu				B	B C N	N S H L	N S
	AC (50-60 Hz)	220/230 V	[kA]	25	25 40 50	65 85 100 120	50 85
		380/415 V	[kA]		16 25 36	36 50 70 85	36 50
		440 V	[kA]		10 15 22	30 45 55 75	25 40
		500 V	[kA]		8 10 15	25 30 36 50	20 30
		690 V	[kA]		3 4 6	6 7 8 10	5 8
	DC	250V - 2 poles in series	[kA]		16 25 36	36 50 70 85	36 50
		250V - 3 poles in series	[kA]		20 30 40	40 55 85 100	40 55
		500V - 2 poles in series	[kA]				
		500V - 3 poles in series	[kA]		16 25 36	36 50 70 85	36 50
		750V - 3 poles in series	[kA]				
Trip units		TMF		■			
		TMD/TMA			■	■	■
		ELT				■	
		MF				■	
		MA				■	■

UL 489 CSA C22.2 and IEC 60947-2

Dimensions	H	[in/mm]	5.12/130	5.12/130	5.12/130	5.9/150
	W 1p or 3p	[in/mm]	1/25.4	3/76	3.54/90	4.13/105
	W 4p	[in/mm]		4/102	4.72/120	5.51/140
	D	[in/mm]	2.76/70	2.76/70	2.76/70	2.76/70
Mechanical life		[No.operations]	25000	25000	25000	25000
		[No. Hourly operations]	240	240	240	240
Electrical life @ 415 V AC		[No.operations]	8000	8000	8000	8000
		[No. Hourly operations]	120	120	120	120

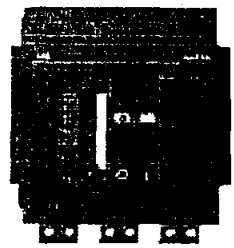
[1] In15A = 10kA @ 277 V AC
[2] In15A = 35 kA @ 240 V AC, 14 kA @ 480 V AC
[3] Please ask ABB for 600 A availability

TMF = Thermomagnetic trip unit with fixed thermal and magnetic threshold

TMD = Thermomagnetic trip unit with adjustable thermal threshold and fixed magnetic threshold







Tmax T4	Tmax T5	Isomax S6	Isomax S7	Isomax S8
250	400 - 600[a]	800	1200	1600, 2000, 2500
3,4	3,4	2,3,4	2,3,4	3
600	600	600	600	600
600	600	600		
N S H L V	N S H L V	N H L	H	V
65 100 150 200 200	65 100 150 200 200	65 150 200	100	125
25 35 65 100 150	25 35 65 100 150	50 65 100	65	100
18 25 35 65 85	18 25 35 65 85	25 35 42	50	85
25 35 50 65 100	25 35 50 65 100	35 50 65		
16 25 35 50 65	16 25 35 50 65	20 35 50		
■				
■	■	■		
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■

Tmax T4	Tmax T5	Isomax S6	Isomax S7	Isomax S8
250 - 320	400 - 630	630 - 800	1250 - 1600	2000, 2500, 3200
3,4	3,4	3,4	3,4	3,4
690	690	690	690	690
750	750	750		
N S H L V	N S H L V	N S H L	S H L	H V
70 85 100 200 300	70 85 100 200 300	65 85 100 200	85 100 200	85 120
36 50 70 120 200	36 50 70 120 200	35 50 65 100	50 65 100	85 120
30 40 65 100 180	30 40 65 100 180	30 45 50 80	40 55 80	70 100
25 30 50 85 150	25 30 50 85 150	25 35 40 65	35 45 70	50 70
20 25 40 70 80	20 25 40 70 80	20 22 25 30	20 25 35	40 50
36 50 70 120 200	36 50 70 120 200	35 50 65 100		
25 36 50 70 100	25 36 50 70 100	20 35 50 65		
16 25 36 50 70	16 25 36 50 70	16 20 35 50		
■	■	■		
■	■	■	■	■
■				

8.07/205	8.07/205	10.55/268	15.98/406	15.75/400
4.13/105	5.51/140	8.27/210	8.27/210	15.98/406
5.51/140	7.24/184	11.02/280	11.02/280	21.89/556
4.07/103.5	4.07/103.5	4.07/103.5	5.45/138.5	9.53/242
20000	20000	20000	10000	10000
240	120	120	120	20
8000(250A)-6000(320A)	7000(400A)-5000(630A)	7000(630A)-5000(800A)	7000(1250A)-5000(1600A)	2500(2500A)-1500(3200A)
120	60	60	20	20(2500A)-10(3200A)

TMA = Thermomagnetic trip unit with adjustable thermal and magnetic threshold

MF = Magnetic fixed trip unit
MA = Magnetic adjustable trip unit

ELT = Electronic trip unit

TRANSFOPOWER INDUSTRIES (PVT) LTD.

R&D DEPARTMENT

TECHNICAL DATA SHEET OF TRANSFORMER

Customer	**Standard Transformer As Per IEC**		

SPECIFICATION

Rated kVA	3000		Basic Insulation Level (BIL)		LV LI 0 AC 3
Voltage Ratio	11000 Y / 800 Δ V				HV LI 75 AC 28
Frequency / Phases	50 Hz / 3 ϕ		Tapping Voltages (%)	+	2.5,5.0
Vector Group	Dyn-11			-	2.5,5.0,7.5
Type of Cooling	ONAN		HV Terminals		4
Insulation Class	A		LV Terminals		3
Ambient Temperature	50 °C		Service Altitude Above Sea Level		1000 meter
Temperature Rise at Rated kVA	Top Oil	50 °C	Type of Tank		Conservator
	Winding Average	55 °C	Type		Indoor /Outdoor

PERFORMANCE

No Load Losses at Principle Tap Position	3.200 kW
Load Losses at Principle Tap Position & Rated Current	37.00 kW
Impedance	7.00 %
Regulation at Unity Power Factor & Rated Current	1.47 %
Regulation at 0.8 Power Factor & Rated Current	5.23 %
Efficiency at Unity Power Factor & 100% Rated Current	98.68 %
Efficiency at Unity Power Factor & 50% Rated Current	99.18 %

COMPONENTS & ACCESSORIES

Off Circuit Tap Changer	Oil Thermometer (with contacts) (Elmek, Turkey)
Oil Filling Hole and Plug	Pressure Relief Valve (with contacts) (Elmek, Turkey)
Oil Level Indicator	Double Float Buchholz Relay (Elmek, Turkey)
Oil Drain Valve	Marshalling Box
Oil Conservator	
Silicagel Breather	
Cooling Tubes	
Lifting Lugs	
Transport Eyes	
Earthing Terminals	
Bi Directional Roller Wheels	
Rating & Diagram Plate (Stainless Steel)	

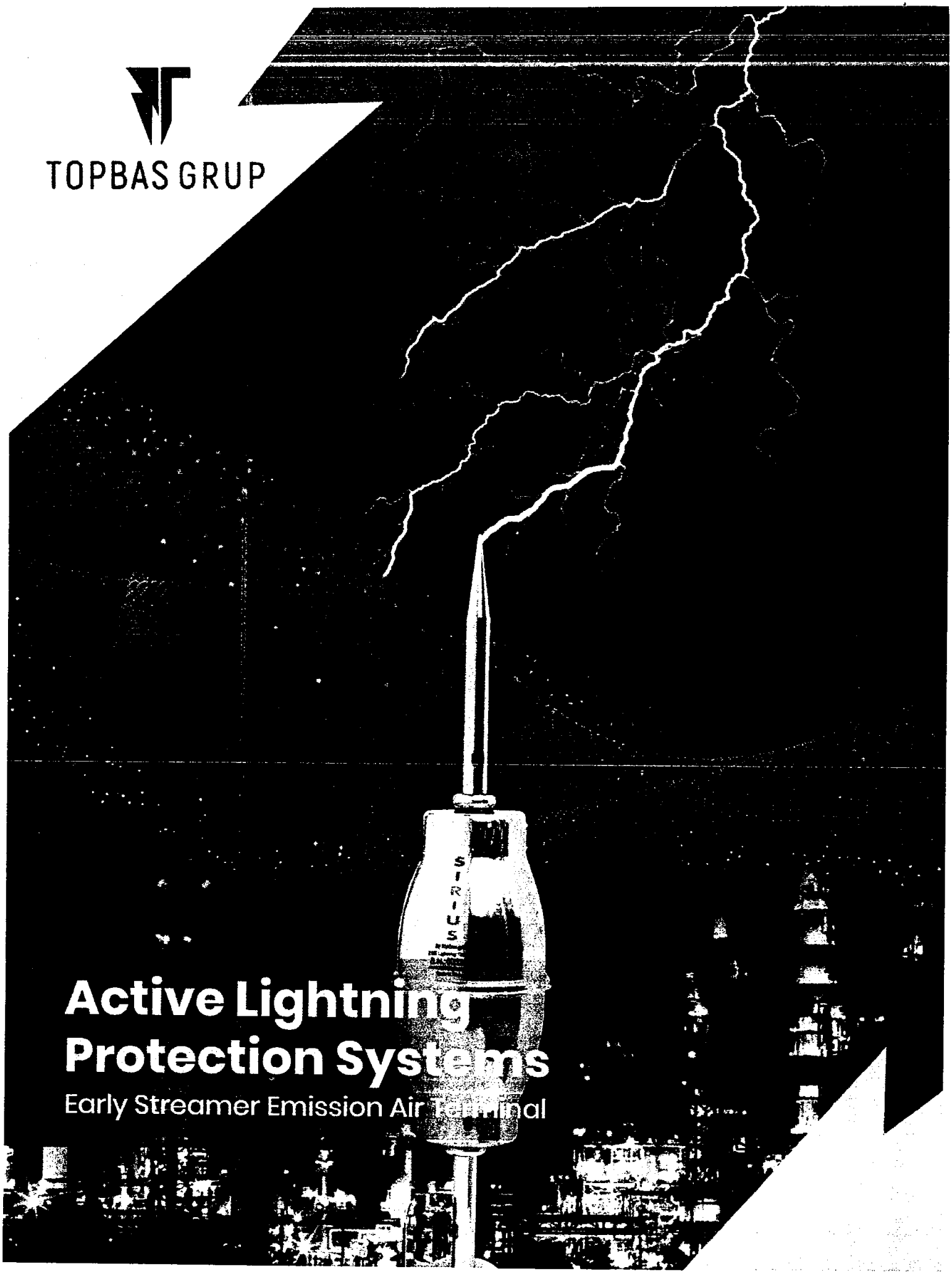
Remarks :

1) Transformer shall be offered with first filling of oil. Transformer Oil shall be in accordance with IEC-60296
2) Transformer shall be manufactured and tested as per IEC 600-76 Standard.

R&D DEPARTMENT

Annexure-A2.10

TOPBAS GRUP



Active Lightning Protection Systems

Early Streamer Emission Air Terminal

Area **Of Protection**

The protection radius (Rp) of a Topbas ESE terminal is calculated using the following formula as defined in NF C 17-102 (September 2011)

Where $h \geq 5$ m, then Rp can be calculated from

$$R_p(h) = \sqrt{2rh - h^2 + \Delta(2r + \Delta)}$$

Where $2\text{ m} \leq h \leq 5$ m, then Rp can be calculated from

$$R_p = h \times R_p(5) / 5$$

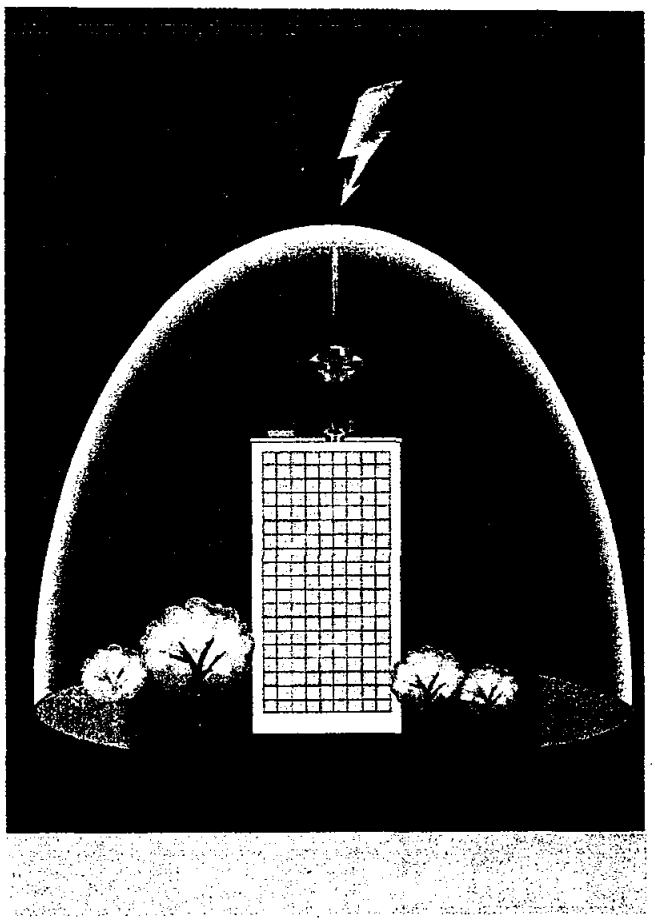
$R_p(h)(m)$ is the protection radius at a given height h

h (m) is the height of the ESEAT tip over the horizontal plane through the furthest point of the object to be protected

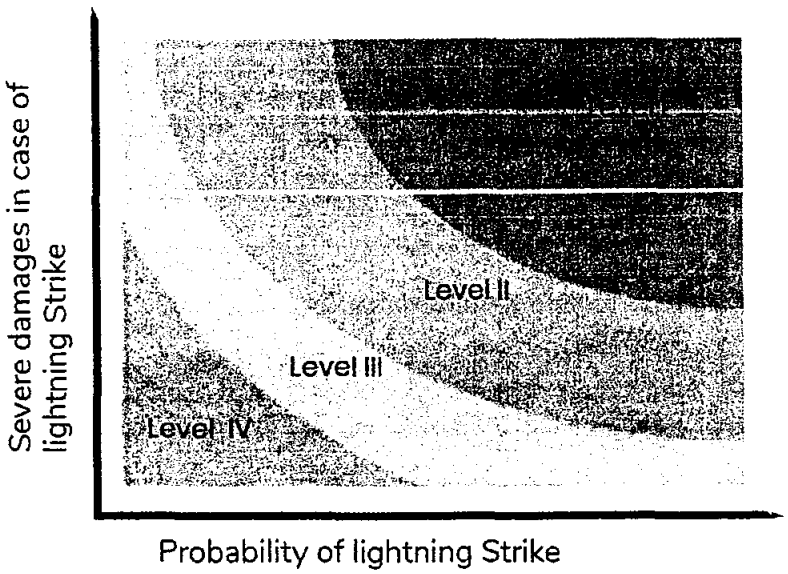
r (m)
20 m for protection level I
30 m for protection level II
45 m for protection level III
60 m for protection level IV

Δ (m) $\Delta = \Delta T \times 10^6$

Field experience has proved that is Δ equal to the efficiency obtained during the ESEAT evaluation tests



Lightning **Protection Level**



Disclaimer

- Topbas Grup maintains a policy of on-going product development, specifications are subject to change without notice.
- Application detail, illustrations and schematic drawings are representative only and should be used as guides.
- It should be noted that 100% protection for direct strike lightning, lightning detection and surge and transient protection equipment is not possible and cannot be provided due to the lightning discharge process being a natural atmospheric event.

SIRIUS ESE Air Terminal

Standard

- NF C 17-102 (2011) designed & tested

Design

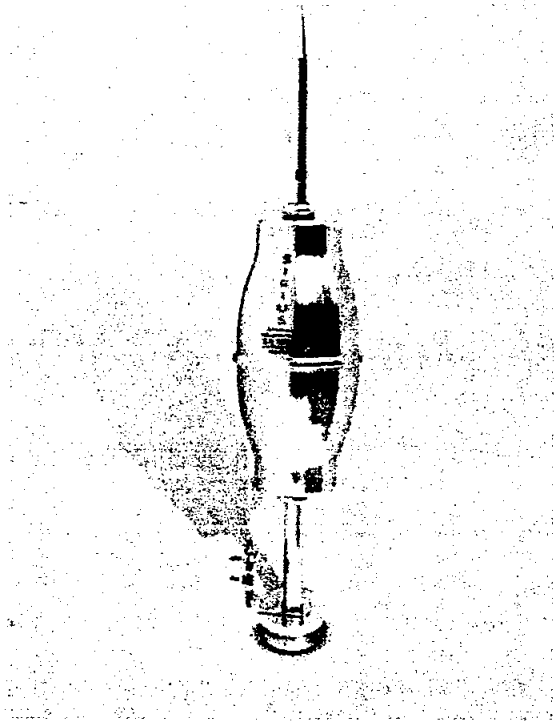
- Non-Electronic ESE
- No use of battery or external power source
- 304L (Inox) Stainless Steel – suitable for any environmental conditions

Testing

- Delta T, ΔT = 60 µSec (Triggering Time Advance)
- 204 kA (10/350 µSec) Lightning Impulse Current tested
- 70 kA (8/20 µSec) Impulse Current - CPRI (Government of India) tested
- CE certified

Usability

- Suitable for various down conductors Round/Flat (Bare & Insulated), Cables, etc



20 Years **Warranty**

Protection radius as per NF C 17-102 (2011)

Mast Height h (m)	Level I Very High	Level II High	Level III Medium	Level IV Standard
2	31	35	39	43
3	47	52	58	63
4	63	69	78	85
5	79	86	97	107
6	79	87	97	107
8	79	88	98	108
10	79	88	99	109
15	80	89	101	111
100	80	89	105	120

STRIKERX Lightning Strike Counter

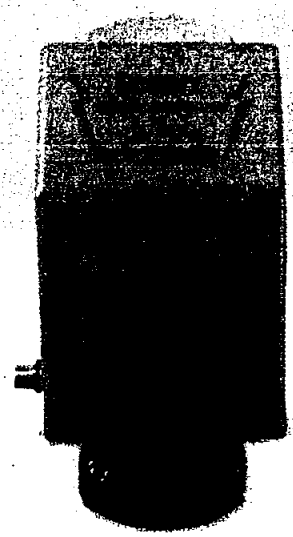
StrikerX is designed to sense, record and count the lightning strikes captured by lightning protection system such as ESE Air Terminal, Normal Lightning Rod, Cage Method, Rolling Sphere Method system.

StrikerX is connected to the lightning down conductor. The flow of lightning current to the counter terminals is sensed and counted by the electromechanical device fitted inside. With every pass by lightning strike through the counter, the customer can follow the number of strikes with the count displayed.

StrikerX Lightning Strike Counter does not require any additional or external power source for its operation. The counter is provided with the testing jack so that the customers can check the working condition on field.

Technical Features

- IP 65 rated enclosure suitable for external application.
- Ease of installaion, StrikerX can be retro-fitted to any lightning protection system.
- Non-intrusive and fast acting proximity circuit detects lightning transient currents.
- Non re-settable electro-mechanical counter.



Model	StrikerX
Display	6 Digits Electromechanical Display (non re-settable)
Current Sample Mode	Inductive Probe (Built-in)
Current Sensitivity (8/20 µs)	>250A
Lightning Current (10/350 µs)	100 kA
Operating Temperature (°C)	-20~+85
Enclosure Material	Plastic
Degree of Protection	IP 65 (IEC 529)
Dimension (cm)	107 (L) x 64 (W) x 53 (H)

Lightning Strike Counter Test Device

- Internal battery
- On field test device
- Tests up to 500+

Annexure-A2.11

Expected Annual Generation & Reduction in CO_2		
	Expected Annual PV Generation (MWh)	**Expected Annual GHG Reduction (tCO_2)**
Year-1	4217.0	2479.6
Year-2	4191.7	2464.7
Year-3	4166.5	2449.9
Year-4	4141.5	2435.2
Year-5	4116.7	2420.6
Year-6	4092.0	2406.1
Year-7	4067.4	2391.7
Year-8	4043.0	2377.3
Year-9	4018.8	2363.0
Year-10	3994.7	2348.9
Year-11	3970.7	2334.8
Year-12	3946.9	2320.8
Year-13	3923.2	2306.8
Year-14	3899.7	2293.0
Year-15	3876.3	2279.2
Year-16	3853.0	2265.6
Year-17	3829.9	2252.0
Year-18	3806.9	2238.5
Year-19	3784.1	2225.0
Year-20	3761.4	2211.7
Year-21	3738.8	2198.4
Year-22	3716.4	2185.2
Year-23	3694.1	2172.1
Year-24	3671.9	2159.1
Year-25	3649.9	2146.1
Total	***98172.3***	***57725.3***

Annexure-A2.12

Bill of Material- Engro Foods-Friesland Campina, Sahiwal (3MWp PV Solar Plant)

Sr#	Description	Unit	Qty	Brand	
1	**PV Modules**				***PKR 68.20***
	545Wp- mono PERC or higher	Nos	-	Top Five of Tier-1	*PKR 205,020,923*
2	***Inverters , Remote Monitoring & PV-DG Controller***				***PKR 11.94***
	PV Inverters (With 10-Years Warranty)	Nos.		Huawei / Sun grow / Eqv.	*PKR 28,917,000*
	Data Logger	Nos.		Huawei / Sun grow / Eqv.	*PKR 226,100*
	Communication Cables & Switches	Mtrs			*PKR 430,950*
	Weather Station + EMS	Nos.	1		*PKR 776,832*
	PV-DG controller	Nos.	1	Eombi / Eqv.	*PKR 2,446,912*
	DC Isolator Box	Nos.			*PKR 2,010,000*
	Air Conditioning Expenses				*PKR 1,075,200*
3	***AC Panel***				***PKR 2.19***
	Field AC Collector LT Panel IP54 16SWG Sheet of appropriate size with bus bars and accessories	Nos	1	Local	*PKR 6,581,199*
	Incoming MCCB 3P,250A 36KA for Inverters' Output	Nos	8	Schneider/ ABB	
	Outgoing ACB 4P 2500A 65KA (Motorized)	Nos	2	Schneider/ ABB	
	AC Surge Protector Device 40KA max Per Pole, 1.25KV	Nos	1	Citel / Eqv.	
	Relay - Undervoltage, Overvoltage, Phase failure, Phase Sequence, Frequency	Nos	1	Schneider/ ABB	
	Digital Voltmeter with Selector Switch	Nos	1	Entes / Eqv.	
	Digital Ampere meter with Selector Switch	Nos	1	Entes / Eqv.	
	Phase Indication Integral LED Lights (RYB)	Nos	3	Schneider/ ABB	
	Current transformer 2500A	Nos	6	FICO / Metlex / Eqv.	
	Energy meter	Nos	1	KBK / Eqv.	
4	***MV Panles & Transformers***				***PKR 8.05***
	MV Transformer (3000kVA = 0.8/11kV)	Job	1	Chinese/Local	*PKR 20,575,000*
	MV Panle (630 = 25kA/611kV)	Job	1	Chinese/Local	*PKR 3,022,000*
	MV Transformer (25kVA = 11/0.4kV)	Job	1	Chinese/Local	*PKR 607,000*

5	***PV Support Structure (RCC, PEB Roofs & Ground)***				***PKR 15.80***
	HDG Structure for Inverted Beam Roof	Job		Chinese/Local	*Not Required*
	HDG Structure for Metal Shed Roof	Job		Chinese/Local	*Not Required*
	Aluminium Structure for RCC Roof Area	Job		Chinese/Local	*Not Required*
	HDG Structure for Ground Mounted	Job	1	Chinese/Local	*PKR 47,502,785*
6	***Civil Works***				***PKR 4.13***
	Construction of Electrical Room/Shed	*Job*	*1*	*Local*	*PKR 5,045,410*
	Water Pipelines	*Job*	*1*	*Local*	*PKR 3,931,873*
	Excavation for DC Cables for Ground Mounted Area Only	*Job*	*1*	*Local*	*PKR 3,431,025*
7	***AC / DC / Earthing Cables***				***PKR 6.69***
	Single Core 4 Sq. mm Flexible CU/XLPO/XLPO 1500Volt DC Cable from Strings to Inverter	Mtr	67,400	Imported / Local	*PKR 20,112,612*
	Single Core 6 Sq. mm Flexible CU/XLPO/XLPO 1500Volt DC Cable from Strings to Inverter	Mtr	3,000	Imported / Local	
	Single Core 6 Sq. mm Flexible Earthing Cable CU/PVC 1000Volt DC For All Electrical Equipment and Support structure. (Yellow Green)	Mtr	500	Imported / Local	
	Single Core 2.5mm2 Flexible Earthing CU/PVC 1000Volt DC For earthing of PV Modules. (Yellow Green)	Mtr	500	Imported / Local	
	Other Earthing cables	Mtr		Imported / Local	
	LV Cable: PVC Cable for 60kW Inverters to LV Panels.	Mtr		Imported / Local	
	LV Cable: PVC Cable for 100kW Inverters to to LV Panels.	Mtr		Imported / Local	
	LV Cable: **70 Sq. mm** XLPE / PVC Single Core Power Cable for LV Panel to Client's Circuit Breaker	Mtr	250	Imported / Local	
	LV Cable: **120 Sq. mm** XLPE / PVC Single Core Power Cable for LV Panel to Client's Circuit Breaker	Mtr		Imported / Local	
	LV Cable: **150 Sq. mm** XLPE / PVC Single Core Power Cable for LV Panel to Client's Circuit Breaker	Mtr		Imported / Local	
	LV Cable: **240 Sq. mm** XLPE / PVC Single Core Power Cable for LV Panel to Client's Circuit Breaker	Mtr	280	Imported / Local	
	MV Cable: **200 Sq. mm** ACSR Single Core Power	Mtr	380	Imported / Local	
8	***Cable Trays, Bridges , Conduit Pipes.***				***PKR 0.58***
	Pvc wiring conduit 2"x 2"	Mtr		Local	*PKR 1,553,933*
	Perforated GI Cable Tray 4"x"4 **(up to 55 DC Cables)**	Mtr		Local	
	Perforated GI Cable Tray 8"x"4 **(up to 120 DC Cables)**	Mtr		Local	
	Perforated GI Cable Tray 12"x"4 **(up to 180 DC Cables)**	Mtr		Local	
	Perforated GI Cable Tray 18"x"4 **(up to 280 DC Cables)**	Mtr		Local	
	Cable Tray Bridge	Mtr		Local	
	Fire Extinguishers				*PKR 182,500*
9	***Lightening Protection, Net Metering & Earthing Equipment***				***PKR 1.39***
	NEPRA License fees	Job		Local	*PKR 850,000*
	Processing fee	Job		Local	*Not Required*
	Earthing Pits	Nos		Local	*PKR 598,000*
	Load Flow Study	Job		Local	*Not Included*
	Early Steam Emission Lightening Protection System	Nos		Local / Imported	*PKR 1,226,550*
	Earthing Wire / Cable			Local / Imported	
	Electrical Inspector Fees				*PKR 750,000*
	Punjab Environmental Department Fees				*PKR 750,000*

10	***Designing, Installation & Commissioning (Electrical + Civil + Mechanical)***				***PKR 10.20***
	Ground Preparation , Compaction , Levelling.	Job			*PKR 5,036,000*
	Roof Stability Studies				*Not Required*
	Ground Stability Studies	Job			*Already Available*
	Installation Cost	Job			*PKR 25,629,994*
	Labour Cost	Job			*Not Required*
	Any Civil Works	Job			*Not Required*
11	***Auxiliary Items (If any)***				***PKR 2.07***
	Bid Guarantee (5%)				*PKR 3,321,873*
	Contigency				*Not Included*
	Ancliary Items				*PKR 1,494,843*
	Storage and Security of Equipment at Site				*PKR 1,405,333*
12	***Transportation to site***				***PKR 3.00***
		Job	1		*PKR 9,018,000*
13	***1st Year O&M***				***PKR 4.50***
		Job	1		*PKR 13,527,000*
14	***Spare Items Price***				***PKR 2.99***
	Please Include **30 Nos. of additional PV Modules** **50 Meter Additional DC Cables of each Size.** **01 No. of Inverter.**	Job	1		*PKR 9,000,000*
				Total EPC Cost of Project	***PKR 425,206,847.20***
				Total $ / Watt	***PKR 0.595***

Annexure-A2.13

Table of Contents

1. Introduction

The following document gives the detailed operations and maintenance plan for the project "399kWp Renewable Solar PV Energy for Sir Syed University of Engineering & Technology". It completely elaborates the procedures, standards and guidelines to ensure effective operation of the system throughout the O&M tenure.

Both aspects of preventive and corrective maintenance are covered along with detailed information regarding general maintenance and troubleshooting.

2. General Scope of Work

Scope of O&M includes operational guarantee of the PV Solar System for the tenure of contract. During this period, it is ensured that online monitoring, performance monitoring, Corrective maintenance and troubleshooting will be provided for the PV Generator. It also includes any repair or replacement as long as it might be caused by component failure, workmanship of installation or lacking O&M execution.

A preventive schedule of maintenance will also be provided. Furthermore, adequate PPE for maintenance personnel will be given and care will be taken for their health and safety during maintenance exercise. A date of visit and list of personnel to visit the Government institute facility for maintenance activities will also be given. All maintenance personnel will carry identity card to enter the facility. The Government institute can seek a police verification report for maintenance workers.

Full service Operation and Maintenance service will be provided in order to maintain a fully functional PV Generator for each building including all equipment, subsystems and structures.

- Scheduled inspection routines: e.g. PV modules to check for discoloration, first signs of delamination, loose wires in the electronics, corrosion of mounting structures, erosion.
- Maintenance of spare parts inventory (prompt replenishment of used spare parts) including continuous reporting of status and consumption.

- Corrective maintenance with guaranteed response and reaction times, including all repair and replacement costs
- Technical operation of the PV Generator including presence of O&M personnel close to the Project site as required to fulfil all O&M Contract obligations.
- Regular cleaning of the PV On-Grid System site, preventive and corrective maintenance of civil works and cabinets.
- Smooth functioning of data communication over Remote Monitoring System.
- Provision of system performance reports that compare actual production to predicted production.
- Regular performance of variance analysis of the entire fleet of PV Generators.
- Ensuring that any warranties and insurance policies for the PV On-Grid System are assignable/transferrable to Employer
- Provision of all O&M personnel, trained and certified as far as applicable. The staffing concept and selected key employees will be presented to the Employer for approval.
- Arrangement of service contracts with specialized sub-contractors, permitting the requested response and reaction times and quality of work required to maintain the PV Generator.
- Weed abatement for ground mount

2.1 Gateway/Remote Monitoring System

A gateway, that will be capable of providing a reliable, stable and continuous (24/7) remote access with the monitoring system of the PV On-Grid System, will be provided.

Remote access to all operational data for the PV On-Grid System will guarantee the uninterrupted transfer and acquisition of operational data to the remote monitoring system. The remote monitoring system will also provide a safe and redundant archive for all acquired operational data.

The chosen gateway and remote monitoring system will be subject to review and approval by Employer prior to procurement. It will provide different access levels and access rights. The communication network between the PV On-Grid System and the remote monitoring system will be built with common and standardized components and network cables. The long availability of spare parts will be assured. Standardized communication protocol will be used.

Following gateway and remote monitoring system functionalities will be provided:

- Remote monitoring and management of the whole system on a 7-days 12 hour daytime basis, with the capability of web-based information sharing.
- Continuous transmission of monitoring data to remote monitoring server.
- Data will be readily available for the fulfilment of all warranties and performance guarantees.
- Remote backup of monitoring data.
- Frequent data collection (15-min sampling interval), analysis, and display of the fundamental parameters of the system and sub-system. Real-time transmission of Alarms.
- Alarm/alerts and timely notification of key performance indicators.
- Monthly, quarterly and annual reporting including opening/closing of service tickets, spare parts used, and any deviations from the guaranteed PR.
- Status of overvoltage protection and grounding protection (DC).
- The data will present the current status of PV On-Grid System, including power, voltage, current, energy production, balance of energy flows within system and via its system boundaries, daily, monthly, and annual overview, and the current power being exported to the grid (in future).
- Separate monitoring at inverter level.
- Actual Energy generated by the PV Project (kWh and kWh/ kWp)
- The Employer will be provided permanent online read access to the remote monitoring system for parallel monitoring of the PV On-Grid System raw data and performance. Additionally, data will be sent automatically and regularly (minimum every 15 min) to and ftp server set up by employer.

Detail of IT system architecture (the physical link, internet, transport, and application layers), hardware and software descriptions of servers, bus drivers, communication cables, and security and information exchange protocols for the data management outlined above, will be provided. It will also explain the business and data backup processes to be implemented to ensure timely information for preventive and corrective measure in order to maintain optimal system output.

Project will have a real-time self-monitoring capability to alert client's NOC team to potential problems or required maintenance needed. Upon the indication of any problems, client's NOC team should try to get it fixed at level-1 however for escalation the issue will be reported to the vendor for its timely fixture. the vendor will inspect the site and perform any necessary repairs.

2.2 Allocation of O&M Personnel

All O&M, trained and certified as far as applicable will be provided. Personnel will be available to notify client, for an outage or decreased system production. The staffing concept and selected key employees will be presented to the Employer for approval. Service contracts with specialized sub-contractors permitting the requested response times and the required quality of work to maintain the PV On-Grid System will be arranged. All operational data will be logged on-site parallel to the remote monitoring data storage.

3. O&M General Rules

3.1 Performance variance analysis of module string and inverter

The parameter of weather condition, module string and inverter operational parameters can tell whether or not the module and inverter are working at the rated power. A Performance variance analysis will be done every three months to detect potential faults and then summarized in the operational status report.

The modules will be replaced in case of following conditions:

1. In condition of broken glass, burnt panel, and obvious colour change.
2. Twisted, burnt and damaged junction box
3. Module power generation is 5% lower than the average.

3.1.1 PV Modules

a) Module clip must be tightened without any looseness.

b) Visual inspection with polarized sunglass to avoid any visible damage.

c) Inspection of moving parts, monitoring of dust intrusion and corrosion.

d) Modules panels should not be deformed, twisted, burnt or broken.

e) Cleaning of modules will be done by dry or wet soft cloth material. Corrosive fluids and hard materials are forbidden. Frequency of cleaning should refer to **Module cleaning rules**.

f) In heavy rain, snow and high wind condition, cleaning is forbidden.

g) Inspection of modules with polarized sunglasses to check for discoloration, the first signs of de-lamination, looseness of wiring connections, corrosion of mounting structures, erosion.

h) Carry out chronic negative test of modules to ensure that the heavily degraded and disqualified modules are replaced by new one which reduces mismatch loss.

i) When cleaning modules, water or cleaning liquid should not be flow into the junction box and connection

terminals.

j) The junction box should not be deformed, twisted, burnt or broken, also the connection terminals should be well tightened.

k) In condition of no shading, irradiance above 500W/m2, wind speed below 2m/s, temperature differential on the surface of modules must be below than 27 °C, measured by tools of infra-red thermography.

l) Grounding test (with ground meter) of module to module, module to ground. Ground resistance should below 4Ω.

Module cleaning rules:

1. Determine all modules in one specific combiner box as reference for comparison of power loss due to soiling. The reference modules will be cleaned at least 2 times per week.
2. When the reference modules' power output is 3% higher than nearby modules, all modules in the power plant must be cleaned.
3. All modules must be cleaned at least one time in a month as mentioned in the maintenance schedule.

Chronic negative check (When required):

A chronic negative test of module is done by measuring the incoming irradiance, operating temperature and power output from modules.

3.1.2 Inverters

a) Check water leakage, rust and flag early obsolescence lost or indistinct.

b) All connection inside the inverter should be stable including internal control cable, DC and AC cables and monitoring cables.

c) There should be no strange noise and huge noise during operation, replace the fan if it is faulty.

d) The module, inductor, transformer and heat dissipation fan should turn on and off according to the setting temperature, if the heat dissipation fan produces abnormal noise or vibration, the inverter should be turned off for detail check.

e) Check whether data is correct during grid-tied power generation. Data can be compared with date from DC distribution cabinet at front and from switch cabinet at end.

f) Check the circuit breaker, verify that the contactors (auxiliary switches and micro switches) are in good mechanical operation.

g) Save the running data, parameters, and logs to a USB flash drive or computer.

h) Check warning labels and nameplates.

All other detailed maintenance items and period should refer to maintenance manual from the manufacturer manual in Appendix.

3.1.3 Mounting Structure

a) Check steadiness of the mounting foundation/system and inspect regarding corrosion at substructure.

b) All of the screw, grounding clamps should be fastening tightly and welding should be intact.

c) Antirust coat of all mounting structure should be intact, if it is cracked or has fell off, antirust coat will be repainted.

d) Any unexpected displacement of screw and rail should be noticed and fixed as soon as possible, if the displacement is beyond the on-site staff capability, the construction and structure supplier and subcontractor will be called.

e) The connections between PV system and mounting structure should be tight and the tilt and azimuth should be in design requirements during typhoon and in other harsh weather conditions.

f) The PV arrays should not be deformed, dislocated or loose.

g) The screws for fixing the mounting structure should not be loose; mounting structures with foundation bed should be steady, neat and no displacement.

h) The main structures of PV arrays should be complete, not loose and their soldering must be good; the paint of metallic material should not be rusty or falling off.

i) There should be no other facilities among mounting structures.

3.1.4 Monitoring System

a) Monitoring and data transmission system of the equipment should show clear reading.

b) Data transmission system will be checked on daily basis so that it can display alarm in faulty conditions.

c) All sensors (If any) will be calibrated once a year.

3.1.5 Cables

a) Documentation of wear and tear of PV cables, replace the damaged PV cables if necessary.

b) Check the connections of PV cables, replace the connector if damaged and burnt.

c) PV cable behind the panels should be tightened.

d) Check cable heads and other equipment necessary to identify excessive temperatures.

e) Inspection of trenches, bridges, manholes etc. in order to inspect cables. Repair of mechanical damage and flag early obsolescence or other concerns/conditions.

f) All cables must be place in tidiness.

g) Any replacement of cable should be reported and should be relocated at the original position.

h) Check for flag early obsolescence or indistinct, replace the flag or repaint if needed.

i) Regularly measure the actual surface temperature and check for premature insulation failure.

3.1.6 DC Distribution Cabinet

a) Check of water leakage, deformation, rust and flag early obsolescence lost or indistinct. The waterproof lock should be opened and valid.

b) Function check of internal SPD, replace if the SPD is not functioning properly.

c) The circuit breaker should be flexible and valid.

d) Grounding resistance of DC distribution cabinet to ground should be below 4Ω.

e) The connection terminals with the combiner box as well as the inverter should be stable.

f) The DC distribution cabinet should be stably fixed on foundation or on the rail, welding to the rail should be firmly intact.

g) In condition of no shading, the differential of power output with other DC distribution cabinet should be below 5%, if not, the DC distribution cabinet should be repaired or replaced.

3.1.7 AC Distribution Cabinet

Maintenance of AC cabinets should satisfy following rules:

a) Before checking the AC cabinets, the period of power shut down should be informed and all the tools should be prepared.

b) The following safety rules should be applied during maintenance of AC cabinets:

1. Verification of live part should be done after shut down the power to ensure that the maintenance work is done at zero potential.

2. Isolating devices should be set between charged and uncharged cabinets during segmented maintenance.

3. Insulating boots and gloves should be worn and there should be a guardian during operating vacuum breakers.

4. Capacitor cabinets should not be touched before they are fully discharged.

5. Make sure that no tool is left in the cabinets before the inverter is turned on.

c) The following subjects should be aware of during maintenance of AC cabinets:

1. Make sure that the connection between metallic frame and screw bolt should be reliable and the lock components should be complete.

2. The sign of connected devices like their numbers, name or identification should be complete and clear.

3. Connectors on the bus should be tight. The lock screw should not be rusty.

4. Handcart and drawer type cabinets should be flexible. Central lines of kinetic and stable contact terminals should be on the same line and terminals can contact tightly.

5. The contact terminals and breakers should not have burned imprint. Tight the screws for each cable and clean the dust.

d) The cable terminals of devices should be plunged and the diameters of holes should not be larger than 10mm, otherwise they would be plunged by fireproof mud.

e) The cables should be intact with the steel pipes and the pipes should be smooth internally. Pipes should not be rusty.

f) The trash in cable trenches should be cleaned and the damages of cable skins should be managed immediately.

g) Make sure of not to damage the cables while checking the cable trenches.

h) The sign piles of direct-bury cables should be complete and the nearby road should not be dug; exposed cable should be protected well.

i) Make sure that the covers of cable trenches are complete; no trash inside and trestles must be stable.

j) The currents and skin temperatures of multiple paratactic cables should be checked to avoid short circuit condition caused by burning.

k) The grounding at the terminals of the cables should be good. Isolating pipes should be complete and clean. The colours for different phases should be obvious.

l) Metallic tray, other supporting and metallic cable pipe should be grounded or connected to the zero phase.

m) The wall-through hole of cables should be plugged tight.

n) Make sure that the screw bolts between trays and supporting should be tight.

o) No ponding should exist in trays.

3.1.8 Switch Board

a) Visual check of structural elements, metallic elements, locks and hinges, seals. Cleaning of elements with appropriate cleansing agents, anticorrosion, primer and painting if required, cleaning and /or substitution of tags and signs wherever necessary.

b) Visual check of functionality and rules concerning motors, relays, key blocks, auxiliary circuits.

c) Instrumental and visual check of buttons and switches.

3.1.9 Grounding System

a) Module to module grounding is provided by common rail without cables, random test of ground resistance for module to module grounding per month and resistance should be below than 5Ω.

b) Before and after thunderstorm season, the validity of SPD must be checked.

c) Connections between grounding system of PV plant and concrete iron structure should be reliable.

d) Connections among metallic grounding net, PV modules, mounting structures and cable armour should be reliable.

e) Connection between PV arrays and grounding system should be satisfied with relative standards.

f) The over voltage protection devices among monitoring system, control system, capacity control system and lightning protection system should be in normal status and the grounding resistance should satisfy relative standards.

3.1.10 Communication and Supervision Maintenance

a) The appearance of monitoring and data communication system facilities should be in good condition. The screw bolts and seal parts should be complete. Operation key should be good and data display should be clear.

b) The display terminal of the operation communication system should be checked at least one time a day for the detection of fault and if there is a fault then inform the relative maintenance company to clear the fault.

c) The sensitivity test should be done for the data loggers and transmitters and adjustment for A/D converters should be done at least one time per year.

d) The over-aged main devices in the communication system should be replaced immediately.

4. Safety and Reliability

4.1 Fault Correction:

4.1.1 Fault Message

All of the fault messages will be registered and a fault diagnosis will be completed in 12 hours (if on-site assistance required) or immediately (through remote control) and then restart the operation of the affected site.

All fault messages and results relevant for profit will be documented. Also, all fault messages resulting in fault calls which will be documented in the corresponding monthly reports indicating start and end of fault, reason and/ or any performed repair works as well as the respective components of the plant.

Daily check of fault message appears in the monitoring system, all of the fault messages should be recorded and be ready to send out if needed.

4.1.2 Fault Call

If the fault cannot be fully described by the fault message or the restart of operation is not possible, additional service staff or a service partner will take action. The response time will strictly have followed by the tender rules.

Failure Response Time Model	
Fault/Error/Defect	**Response time**
- Failure of PV, battery or grid connection - Failure of complete communication or single components - Failure of safety breakers - Shut down of system due to weather conditions/accidents.	12 Hours

The response time guarantee will be done strictly by O&M staff management.

5. Types of O&M Services:

Preventive:

General condition

There will be a series of preventive maintenance activities to ensure all the sites are operational. Most of the monitoring will be done remotely and if possible, troubleshooting will be done through software and hardware control. Seasonal periodic maintenance will be done for physical inspection of the equipment. We take systematic and rigorous preventive actions to identified faults. Any faults will be recorded and fixed according to the corrective maintenance and condition-based maintenance.

Normally there are several service activities as below in preventive maintenance:

1. Control of PV modules: Thorough verification of the general status of PV modules. Checked is overall status of the module front and back side, including voltage, current and temperature. Furthermore, the modules are random checked hot point.

Material tool: Multimeter, thermo graphic camera

2. Control of inverters: Thorough verification of the general status of electrical connections, inverters and outer inverters. State of inverters: water tightness, cleanliness and cooling condition of the inverter and other electrical appliances of the installation. Possible deviation need to be corrected. We ensure that no dust entered into the inverters housings with special cabinets. Operation of inverters: operation of the internal blower of the inverter should be optimized by removing dust. The status indicators of the inverters need to be checked on correct operation. Also, to verify on strange failures, alarms, humming's and overheating. In case detect any failure needs to be corrected according to the inverter manual.

Material tool: Multimeter, insulation tape.

Frequency: 4 times per year

3. Support system: To control the correct state of the support construction of the module. All the roof tops for existing corrosion possibilities (support structure), with the purpose of repair these spots with zinc painting, and spray for cold galvanization. When checking the support structures also possible relaxations, clamps, breakages and etc. have to be detected and repaired.

Material tool: Zinc painting, spray for cold galvanization

Frequency: 1-2 times per year

4. Control of cable ducts and tubes: To control the state of cable ducts and pipes of the installation. Verify the structural (possible breakage) and interior state of all cable ducts of installation (DC, AC and security) and

to verify the tightness of seals. If needed, have to be repaired or renew the seals.

Material tool: Multimeter, insulation tape and etc.

Frequency: 1-2 times per year

5. AC & DC Breakers: To ensure all the safety breakers and disconnect/connect switches are in good condition. This is to timely replace the breakers which close to faulty.

Material tool: Observance and on/off Testing

Frequency: 4 times per year

Corrective:

On-site monitoring is available at every branch. The monitoring levels include from panels to inverter level. Preventive check can early detect problems and can be corrected before malfunction happens. If fault detects, the maintenance staff will reach site with 12 hours of response time.

Normally there are several service activities as below in corrective maintenance:

1. Change of PV modules
2. Change of inverters
3. Change of internal components of electrical devices
4. Restarting the data acquisition system (If Required): When the PV installation has been shut down from the internet, the router and data logger might need to be re-started as soon as possible.

Communication

Communication of the power plant will be done by message, calls and data real- time transmit. The maintenance of the communication system is done by preventive and corrective maintenance. Monitoring system, message sender, 24h hotline will be kept in function. Periodical check and test of the communication system will be done.

O&M service levels

Service level	
Condition based maintenance	Web portal availability
	Remote production monitoring (24hours)
	Performance reporting
	Incident warning calls

	Fault clearance
	Additional reporting
Preventive maintenance	Preventive maintenance management
	Field inspections
	Inspection reporting
	Module cleaning
Corrective maintenance	Corrective maintenance management
	Incident management
	Incident reporting
	Parts replacement during contract period
	Performance warranty
Other technical support	ADSL/GPRS/Satellite Com

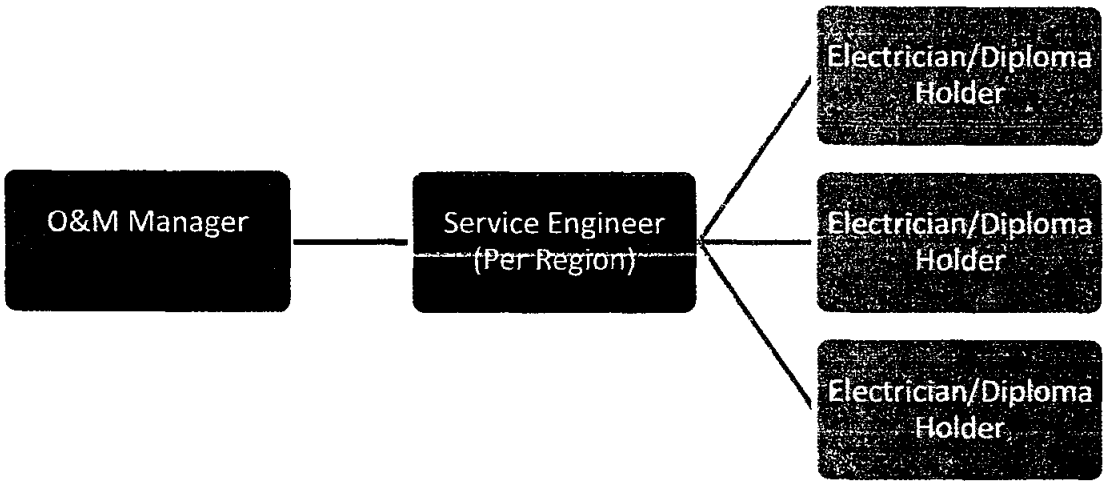
- System pilot run
- Data logger setting
- ADSL/GPRS/ Satellite Com
- Professional technical support
- Thermal photographic service
- System performance report/Energy output report
- Reserved devices storage management
- Bill & report mailing
- Load elevating machine supply

6. Staff:

6.1 O&M Management Plan

One O&M Manager will look after all the O&M activities. This person will fulfil all local requirements and standards, will have sufficient experience and will be approved by the Employer. Any replacement or substitute of this person shall be subject to approval by the Employer.

In addition to this, there will be a dedicated O&M team consisting one service engineer and 3 diploma holders.. The below organogram illustrates the plan clearly.



These teams will be responsible for preventive and corrective O&M activities at sites.

6.2 Maintenance Staff Training

O&M training for 1 day will be held before after commissioning at each site. The courses will include activities of preventive, corrective, reactive and condition-based maintenance, safety knowledge, operation methods of monitoring and recording & reporting institution.

Training plan:

Date	Training content
1	Preventative maintenance
2	Safety (Electrical basic & Preventative maintenance)
3	Corrective maintenance
4	Condition-based maintenance
5	Monitoring system

7. Performance of Maintenance and Repair Work

7.1 Deactivation

During maintenance works site will be suspended due to safety reasons. All shutdowns during maintenance works shall be completely documented. The staff will perform the work in accordance with all applicable laws. In case of conflict between the specified requirements and the applicable law, the team shall propose a solution to adapt the works accordingly and resolve the matter in a mutual sense for Employer's approval.

8. Spare Parts

Spare parts will be available at every regional office to reduce the response and fault correction time. Any faulty product will be removed and at the same time replacement (Temporary or Permanent depending upon the fault) would be provided to keep the system operational. Below is an overview of spare stock. Spare parts will cover the complete PV System with all subsystems.

No.	Item Description	Quantity
1	PV Modules	26 Pcs
2	Inverters	1 Pcs
3	DC Cabling	250m + 250m
4	AC Cabling 70mm2	110m
5	Cable Trays, Ducts, PVC Pipe, Nut bolts etc	1 Job

9. Location for Staff and Facility:

Head Office for Bidder

Office # 202, 11-C, Al-Murtaza Comm Lane 2, Phase 8, DHA Karachi

Contractor Staff Facility + Warehouse

87 Block B1, MM Alam Road, Gulberg III, Lahore

10. Codes, Standards, Regulations, Permit etc

State of the art O&M will be provided. The fulfilment of all relevant IEC and Pakistan norms, standards, and regulations will be ensured.

The O&M of the PV On-Grid Systems will fulfil all applicable international and regional norms, standards, and grid connection requirements.

All applicable permits and the conditions imposed on the PV On-Grid System by all authorities will be complied.

All applicable health and safety standards required by the relevant Pakistani authorities during the entire Operation and Maintenance phase will be fulfilled.

11. Miscellaneous

11.1 Change of Inspection and Maintenance Work Procedures

In case of conflict between the specified requirements and the applicable law, a solution will be proposed to adapt the works accordingly and resolve the matter in a mutual sense for the Employers' approval.

11.2 Person in Control of PV On-Grid Systems

At least one main responsible and suitable person in charge of the PV On-Grid System for each region will be proposed, the "O&M Managers". These persons will fulfil the local requirements, permits and standards, will have sufficient experience and be approved by Employer. Any replacement or substitute of these persons will be subject to approval by Employer.

11.3 As Built Checklist

Sr No	Activity/Document	Provided By	Approved By	Comments
1	Project Information	Bidder	Employer	All relevant information to be shared with Employer and O&M team after Commercial Operations Date and Taking Over Certificate by the Bidder/Contractor.
2	As Built Drawings			
3	Contracts			
4	Customer Consents			
5	Data Sheet of Equipment			
6	Manuals and Technical Specifications			
7	Installation Photos (to be Attached)			
8	Performance Parameters and Commitments			

11.4 Close Out Checklist

Sr No	Activity/Document	Provided By	Approved By	Comments
1	Document Control Register Listing all previous approvals and requests	Bidder/O&M Team	Employer	Through reporting on preventive and curative maintenance with stock management of spares and warranty claim process
2	List of Equipment replaced under warranty/spares			
3	List of equipment under warranty process or claims			
4	Unresolved issues			

11.5 Handing Over Documents after end of O&M Contract

Within one month after the end of the O&M Contract, complete electronic, printed and written documentation for the O&M of the PV On-Grid Systems will be handed over. This also includes the complete raw data of the PV On-Grid System monitoring acquired through the remote monitoring system.

The Quarterly Energy Production and Operational Status Reports will also be provided no later than the 30 days after the end of each calendar quarter for a period of initial term of operation and any extension thereof from Commissioning. Each report shall include the

following information:

- Time period covered by the report
- Operational status of any project's components (modules, inverters, transformers)
- Description of any unusual operational events that occurred during the quarter
- Description of any unusual weather events that occurred during the quarter if they impact production
- Description of improvements, expansion or repairs to any projects during the quarter
- List of needed and/or planned improvements, expansions or repairs
- Energy production for the quarter and cumulative to-date
- Degradation comparison to projected performance
- Copies of any engineering reports or independent evaluations of any projects completed during the quarter.

APPENDICES

Appendix 1

Module chronic negative Test

Tested module quantities:

Module series number

Measured power — Year

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	

Module series number

Measured power — Year

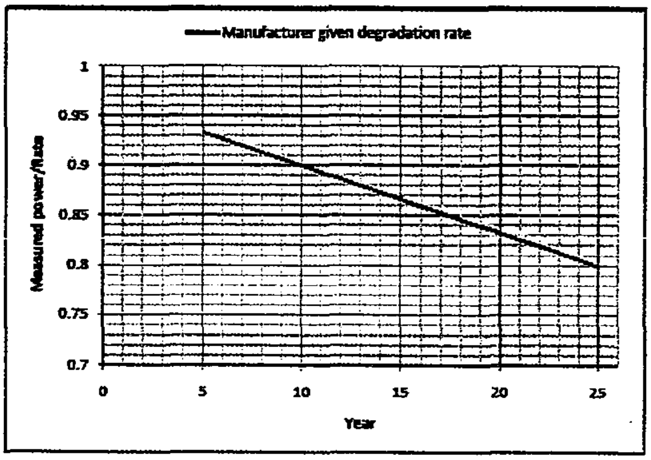
1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	

Module series number

Measured power — Year

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	

Degradation Check



Appendix 2

Troubleshooting report

Maintenance site:	
Problem found:	Date:
Maintenance content:	
Solution and process:	
Results:	
Remark:	
Maintenance person:	Date:
Inspector:	Date:

Appendix 3

Deactivation report

Deactivation site:				
Reason for deactivation:			Date:	
Any alternatives instead of deactivation Y : ☐ _____ N: ☐ Approval from Employer Y: ☐ N: ☐				
Weather condition				
Irradiance level	Temperature	Wind	Snow	Rain
Deactivate period: Maintenance process				
Results:				
Remark:				
Maintenance person:			Date:	
Inspector:			Date:	

Appendix 4

[redacted]

Detail every event

1 _____ date _____ Used quantities ____
_____ Remain _____

2 _____ date _____ Used quantities ____
_____ Remain _____

3 _____ date _____ Used quantities ____
_____ Remain _____

4 _____ date _____ Used quantities ____
_____ Remain _____

5 _____ date _____ Used quantities ____
_____ Remain _____

6 _____ date _____ Used quantities ____
_____ Remain _____

7 _____ date _____ Used quantities ____
_____ Remain _____

8 _____ date _____ Used quantities ____
_____ Remain _____

9 _____ date _____ Used quantities ____
_____ Remain _____

10 _____ date _____ Used quantities ____
_____ Remain _____

11 _____ date _____ Used quantities ____
_____ Remain _____

12 _____ date _____ Used quantities ____
_____ Remain _____

Annexure-A2.14

Sr. No.	Activity	Sub-activity	Month				
Project's Tentative Timeline - EFC 3MWp							
			1	2	3	4	5
1	Site Preliminary & Civil Works						
2	Design Engineering						
3	Material Procurement & Delivery						
	a	Module Mounting Structure					
	b	PV Modules					
	c	DC Cable					
	d	DC Cable Connetector's Termination					
	e	Inverter					
	f	AC FT/LT Cables					
	g	AC Combiner Box					
	h	Earthing System					
	i	Data Logger and Weather Monitoring System					
	j	Communication Cable					
	k	DG-PV Controller					
	l	LT Panel (Final Termination)					
4	Commissioning and Handing Over						

Annexure-3 (Affidavit for Existing Gls)

AB440472

100
Rupees

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روپیہ

SARDAR ALI STAMP VENDOR
Licence # 18, Shop # 55, SITE Market
SITE Karachi
S.No.......................DATE......................
ISSUED TO ...102402.......
THROUGH WITH ADDRESS......S. SHAHID ALI
PURPOSE.......................... Advocate
Lic. # 833
VALUE RS......................ATTACHED.........
STAMP VENDOR'S SIGNATURE..................
This Stamp Paper is not valid for Divorce & Free Will Purpose

01 SEP 2023

BEFORE THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

AFFIDAVIT

I,. Saleem Uz Zaman S/O Mr. Qamar Uz Zaman, Chief Executive Officer of Burj Solar Energy (Private), Limited, office #: 202, 11-C, Al Murtaza Lane-2, DHA Phase-VIII, Karachi, Pakistan, the duly authorized representative of the Applicant Company deposes on oath that the company has no previous Generation License(s) issued by NEPRA.

Annexure-4 (Undertaking for Non Refusal of Gls)

Ref.: BSPPL/GLA- 23-002 **Dated:** October 05th, 2023.

TO WHOM IT MAY CONCERN.

I,. Saleem Uz Zaman S/O Mr. Qamar Uz Zaman, Chief Executive Officer of **Burj Solar Energy (Private), Limited**, office #: 202, 11-C, Al Murtaza Lane-2, DHA Phase-VIII, Karachi, Pakistan, the duly authorized representative of the Applicant Company herby confirm that the company has not been refused by NEPRA for any Generation License application.

BURJ SOLAR ENERGY (PVT) LTD.

Deponent

Annexure-5 (Water Resources, Control & Protection)

Water Sources at Site:

The proposed site has vast arrangements of water resources, required for O&M and cleaning purposes of the designed PV plant.

02 water bores and pumps will be installed to extract sufficient water to meet the washing of PV modules. As per high recommendations by PV module manufacturers, approximately 1.5 Litre of water will be used to wash a single module in a week. Water spraying and an efficient nozzle and brushing system will be used to further reduce the consumption of water.

Control Metering Instrumentation and Protection:

There is one interconnection point and the distance of the point to the PV plant is approximately 175 - 200 meters. The metering of PV plants will be performed at the main MV load busbar. Accuracy Class for meters will be at least 0.5 with bidirectional 4 quadrant calculations algorithm. Metering parameters, including total import and export units TOD Calculations, MDI, active and reactive power calculations etc. can be extracted over the period, Solar power plant is designed to have the following protections for the line and load side;

- Over and under voltage/frequency protections
- Phase Failure, Unbalance and Phase reversal protection
- Short Circuit protections
- Earth Fault detection
- Over current protection
- Surge Protection

Degradation Factors:

Since high-grade and efficient material will be installed to meet the reliability and continuity of maximum power from the proposed PV Plant. A major portion of degradation comprises PV Modules. As per recommendations by PV Modules manufacturers, 0.5% of annual degrading has be considered to estimate the yield for 24 years, starting from second year. On the safer side, additional 0.1% annual degradation has also been assumed for rest of material and equipment/

Annexure-6 (Pay order)