

GHARO SOLAR LIMITED

(Formerly Gharo Solar (Private) Limited)

1485/C-2A, Asad Jan Road, Lahore Cantt.

Ph: 042 36687823-24, Fax: 042 36687825

Ref: GSPL/NEPRA/LPM/19-01

June 17, 2019

The Registrar,
National Electric Power Regulatory Authority,
NEPRA Towers, Sector G-5/1, Islamabad.

Subject: Licensee Proposed Modification Application for 50MWp Solar PV Power Project (the "Project") by Gharo Solar Limited (the "Company").

Dear Sir,

I, Musaddiq Rahim, Company Secretary being the duly authorized representative of Gharo Solar Ltd. by virtue of board resolution dated 15-05-2019, hereby apply to the National Electric Power Regulatory Authority for modification of its Generation License No. SPGL/25/2018 dated 17-07-2018, pursuant to Regulation 10(2) of National Electric Power Regulatory Authority (Application and Modification Procedure) Regulations, 1999, Article 3.2 of the aforementioned Generation Licence and Para 5 of the Decision of the Authority dated 11-01-2019 in the matter of Energy Purchase Agreement ('EPA') between Gharo Solar Limited and K-Electric Limited.

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 ('AMP Regulations'), 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 documents-in-support is true and correct to the best of my knowledge and belief.

A bank draft in sum of Rs. 426,860/- (Rupees Four Hundred Twenty Six Thousand Eight Hundred and Sixty), being the nonrefundable license application fee calculated in accordance with the Schedule II to the National Electric Power Regulatory Authority (License and Modification Procedure) Regulations, 1999, is also attached herewith.

The application is filed in triplicate with all annexures appended with each set.

Sincerely,



Musaddiq Rahim
Company Secretary
Gharo Solar Limited



1. APPLICATION FOR LICENSEE PROPOSED MODIFICATION

This application for modification is being filed pursuant to:

1.1 Sub-regulation 2 of Regulation 10 of the AMP Regulations provides, *inter alia*, that:

"A licensee may, at any time during the term of a licence communicate to the Authority a licensee proposed modification setting out:

(a) the text of the proposed modification;

(b) a statement of reasons in support of the modifications; and

(c) a statement of the impact on tariff, quality of service and the performance of the licensee of its obligations under the license."

1.2 Further, Sub-regulation 5 of Regulation 10 of the AMP Regulations enumerates the conditions applicable to such proposed modification

1.3 Article 3.2 of the Generation License No. SPGL/25/2018 dated 17-07-2018 which states:

"...The Licensee shall provide the final arrangement, technical and financial specifications and other specific details pertaining to its generation facility/Solar Power Plant/Solar Farm before COD."

1.4 Furthermore, Para 5 of the Decision of the Authority dated 11-01-2019 (copy attached) in the matter of Energy Purchase Agreement ('EPA') between Gharo Solar Limited and K-Electric Limited. The Company is now in a position to file this modification application as Single Line Drawing and the design specifications have now been approved by the Power Purchaser.

2. TEXT OF THE PROPOSED MODIFICATION

2.1 The status of Gharo Solar (Private) Limited was changed from a Private Limited Company to a Public Limited Company, thus changing the name to Gharo Solar Limited. The process of conversion of the Company was initiated in January 2019 and was completed in March, 2019.

2.2 The Installed Capacity of the Generation Facility has been updated to 50.00 MWp on the basis of final plant design and technical specifications.

2.3 Schedule-I and II has been modified on account of the detailed design and selected equipment for the Project (Modified Schedule-I and II attached).



3. STATEMENT OF REASONS IN SUPPORT OF MODIFICATIONS

- 3.1 As per requirements under the Project's financing documents, Gharo Solar (Private) Limited was required to convert to a Public Limited company. The status of the Company was changed to Public Limited in March, 2018, thus converting the name of the Company to Gharo Solar Limited (conversion certificate attached).
- 3.2 Given the Project's location near coastal area, the Company conducted a detailed corrosion study which categorized the site environment as 'very highly corrosive and humid (Class C5)' which if not properly addressed could adversely affect the Project's key equipment and therefore hampering the Company from performing its obligations over the 25-year license term.
- 3.3 Based on the findings of the detailed corrosion study the Company modified the specifications to select more robust equipment. The selected inverters are more rugged and suitable to sustain C5 corrosion level. Further, conventional single glass poly-crystalline modules have been substituted with double glass modules (JA Solar JAM72D09-380/BP Bifacial Mono-crystalline, datasheet attached). The double glass type modules are chosen due to the fact that the back sheet used in single glass modules does not offer the resilience required against the high Project site humidity and corrosion factors.
- 3.4 As mentioned in the original application for Generation License dated 26-12-2017, the land for the Project is located at Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh, however, only a single location coordinate was given in the original application. Since, the land acquisition has been finalized, the complete set of coordinates are being provided.
- 3.5 Further, other technical details have been finalized in Schedule-I accordingly based on approved SLD and detailed survey of interconnection route by the Power Purchaser.
- 3.6 The proposed modification will enable the Company to be closer to achievement of the unprecedented plant factor of 22.21% determined by the Authority in the Tariff and achieve higher quality of service and performance. In the Company's original Generation License, the average plant factor at P50 level was 20.5% which is expected to increase to 21.59% at P50 level. The aforementioned plant factors are based on yield simulations using bankable resource databases of Meteonorm and Solargis.
- 3.7 It is highlighted that the above yield simulation figures are based on realistic site parameters including albedo of bare ground. Further yield uplift from bifacial modules would require albedo improvement through cost-intensive and recurring measures such as ground modification of the entire site area with reflective materials e.g. limestone, gypsum, polythene covering etc. which are not considered in the tariff.



4. STATEMENT OF IMPACT ON TARIFF, QUALITY OF SERVICE AND THE PERFORMANCE OF THE LICENSEE

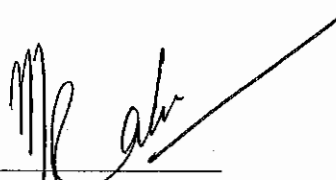
- 4.1 There is no impact on the tariff as the Company is not claiming any cost increase under EPC, O&M or any other head for the modification.
- 4.2 Further, the Company anticipates that the quality of service and performance shall improve as it shall be better positioned to provide the much needed affordable energy to the Power Purchaser.
- 4.3 The modification is expected to increase the quality of the plant that can withstand the very corrosive and aggressive environment for the term of the Generation License and shall enable the Company to meet its performance benchmarks.

5. PRAYER

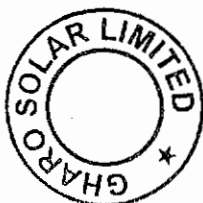
It is most humbly prayed to the esteemed Authority that the Company be granted a modified Generation License to ensure safe and reliable operation of the Project.

We remain at the disposal of the Authority for any further information/clarifications, if required.

Respectfully submitted for and on behalf of the Applicant.



Musaddiq Rahim
Company Secretary
Gharo Solar Limited

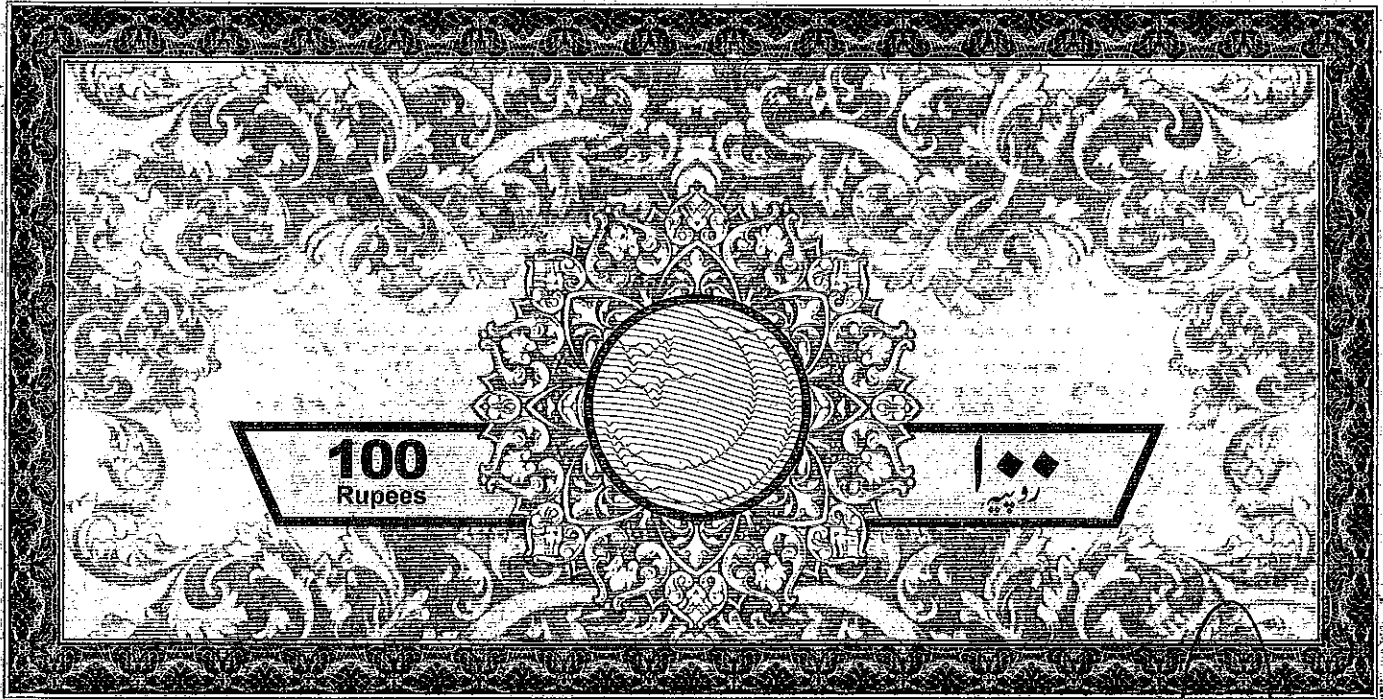


Annex- A	Pay Order dated 17-06-2019
Annex- B	Affidavit
Annex- C	Board of Directors Resolution dated 15-05-2019
Annex- D	Decision of the Authority dated 11-01-2019
Annex- E	Company Conversion Certificate
Annex- F	Modified Schedule I
Annex- G	Modified Schedule II
Annex- H	PVsyst Simulations
Annex- I	Module Data Sheet
Annex- J	Original Generation License dated 17-07-2018
Annex- K	Tariff Determination dated 25-01-2018

ANNEXURE - B

Affidavit

Z960461



BEFORE THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

AFFIDAVIT

I, Musaddiq Rahim S/o Abdul Rahim, CNIC No. 35202-1915617-5, Company Secretary, Gharo Solar Limited, hereby solemnly affirm and declare on oath that the contents of the accompanying application of Gharo Solar Limited for the modification of its Generation License No. SPGL/25/2018 dated 27-07-18, including all attached documents-in-support are true and correct to the best of my knowledge and belief and that nothing has been concealed.

DEPONENT

Signature:

Name:

MUSADDIQ RAHIM

Dated:

June 17, 2019



ANNEXURE - C

Board of Directors Resolution dated 15-05-2019

GHARO SOLAR LIMITED

(Formerly Gharo Solar (Private) Limited)

1485/C-2A, Asad Jan Road, Lahore Cantt.

Ph: 042 36687823-24, Fax: 042 36687825

EXTRACT FROM THE MINUTES OF MEETING

OF THE BOARD OF DIRECTORS OF

GHARO SOLAR LIMITED

HELD AT ITS REGISTERED OFFICE ON MAY 15, 2019

“RESOLVED THAT an application under Regulation 10(2) of National Electric Power Regulatory Authority (Application and Modification Procedures) Regulations, 1999 shall be filed with National Electric Power Regulatory Authority for necessary modifications in Generation License No. SPGL/25/2018 dated July 17, 2018.

RESOLVED FURTHER THAT Mr. Rana Uzair Nasim, Chief Executive Officer of the Company and Mr. Musaddiq Rahim, Company Secretary, be and are hereby singly and severally authorized to take necessary steps file modification application with National Electric Power Regulatory Authority.

RESOLVED FURTHER THAT Mr. Rana Uzair Nasim, Chief Executive Officer of the Company and Mr. Musaddiq Rahim, Company Secretary of the Company be and are hereby singly and severally authorized to sign all / any forms, documents as may be required to be filed with the National Electric Power Regulatory Authority.”

RESOLVED FURTHER THAT Mr. Rana Uzair Nasim, Chief Executive Officer of the Company and Mr. Musaddiq Rahim, Company Secretary of the Company be and are hereby singly and severally authorized to represent the Company before National Electric Power Regulatory Authority on hearings.”

CERTIFIED TRUE COPY
For GHARO SOLAR LIMITED .



A handwritten signature in black ink.

CHAIRMAN

ANNEXURE - D

Decision of the Authority dated 11-01-2019



National Electric Power Regulatory Authority
Islamic Republic of Pakistan

NEPRA Tower, Attaturk Avenue (East), G-5/1, Islamabad
Ph: +92-51-9206500, Fax: +92-51-2600026
Web: www.nepra.org.pk, E-mail: registrar@nepra.org.pk

Registrar

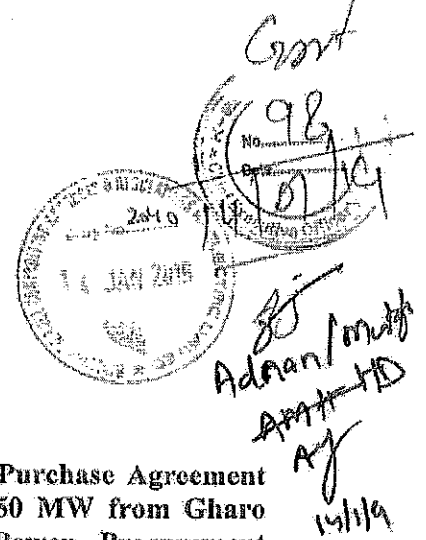
No. NEPRA/R/TRF-403/GSPL-2017/528-24

January 11, 2019

Chief Executive Officer
K-Electric Limited (KEL)
KE House, Punjab Chowrangi,
39 - B, Sunset Boulevard, Phase-II
Defence Housing Authority
Karachi.



Chief Executive Officer,
Gharo Solar (Pvt.) Ltd.,
1485/C, 2A
Asad Jan Road,
Lahore Cantt.
Ph: 042-36687823-4



Subject: Decision of the Authority in the matter of Energy Purchase Agreement submitted by K-Electric Limited for Purchase of 50 MW from Gharo Solar (Private) Ltd. under NEPRA Interim Power Procurement (Procedures & Standards) Regulations, 2005

Enclosed please find herewith subject Decision of the Authority (03 Pages) for information, record and necessary action, if any.

Encl: As above

11/01/19
(Syed Safeer Hussain)

**NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
(NEPRA)**

Decision of the Authority in the matter of

Energy Purchase Agreement

submitted by

K-Electric Limited

For Purchase of 50 MW from

Gharo Solar (Private) Limited

under

NEPRA Interim Power Procurement (Procedures &

Standards) Regulations, 2005



Background

1. National Electric Power Regulatory Authority (NEPRA) granted Generation License No. SPGL/25/2018 to Ghara Solar (Pvt.) Limited ("GSPL") on July 17, 2018 in respect of its 50 MW solar based generation facility at Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh. The Authority also determined a levelized reference tariff of Rs. 5.8877/kWh on January 25, 2018 in respect of GSPL for delivery of electricity to K-Electric (Pvt.) Limited ("K-Electric").

Submission of the Energy Purchase Agreement

2. In pursuance of regulation 5 of NEPRA Interim Power Procurement (Procedures and Standards) Regulations, 2005 ("IPPR-2005"), K-Electric vide its letter dated October 04, 2018 submitted Energy Purchase Agreement ("EPA") signed with GSPL for the approval of the Authority. The Authority has reviewed the EPA in light of the generation license and tariff awarded to GSPL and decided as follows:

Order

3. In pursuance of Regulation 5 of the IPPR-2005, the Authority hereby approves Energy Purchase Agreement signed between K-Electric and GSPL; subject to the following amendments / changes:

- a. The following proviso be added in the definition of RCOD:

"Provided, however, targeted construction period would be ten (10) months after financial close for adjustment of tariff at COD"

- b. The definition of exchange rate in Schedule 1 shall be replaced as under:

ER_(REV) = Revised TT & OD selling rate of US Dollar as notified by the National Bank of Pakistan as at the last day of the preceding quarter

- c. The definition of Tariff Determination be modified as under:

"The tariff determination issued by NEPRA in Case No. NEPRA/TRF-403/GSPL-2017/1190-1192 dated January 25, 2018, as notified by GOP in the Official Gazette, and which may be amended or clarified by NEPRA from time to time."

- d. A clause to be added in Section 1.2 (Rule of Interpretation) specifying that in case of any discrepancy or contradiction in the EPA and Tariff Determination, the Tariff Determination shall prevail.






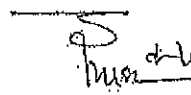
- e. It is to be specified in the EPA (wherever applicable) that protective relays, testing, metering, interconnection, specifications, arrangements, etc. and functional requirements/standards shall conform to "IEC/IEEE or other equivalent international standards" and the provisions of the Grid Code (rather than IEC standards/ K-Electric specifications as currently specified in certain parts of the EPA).
4. K-Electric is directed to incorporate the above mentioned changes and submit the revised EPA to NEPRA for its record.
5. Furthermore, it has been noted that GSPL has finalized to install mono crystalline bifacial modules whereas the license was awarded on poly crystalline modules. In this regard, GSPL is hereby directed to file required Licensee Proposed Modification at the earliest.

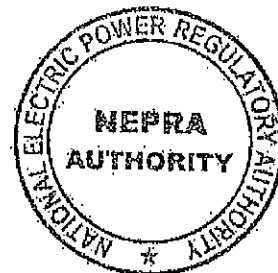
Authority


(Saif Ullah Chahtha)
Member 11.1.2019


(Rafique Ahmed Shaikh)
Member


(Rehmatullah Baloch)
Vice Chairman


Munir
11.01.19



ANNEXURE - E
Company Conversion Certificate



SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN

Company Registration Office
LAHORE

CERTIFICATE OF CONVERSION OF A PRIVATE COMPANY INTO
PUBLIC COMPANY

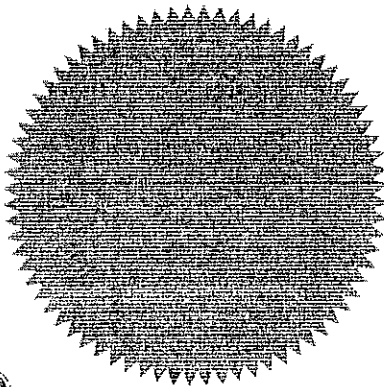
[Under Section 50 (1) of the Companies Act, 2017 (XIX of 2017)]

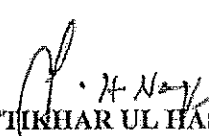
Corporate Universal Identification No. 0100523.

I hereby certify that pursuant to the provisions of Section 50 read with sub-section (5) of Section 46 of the Companies Act, 2017 (XIX of 2017), "**G HARO SOLAR (PRIVATE) LIMITED**" has complied with the requirements precedent and incidental to the conversion of a Private Company into a Public Company. The said company stands converted into a Public Company with effect from 01-01-2019.

Given under my hand at Lahore this 18th day of March, Two Thousand and Nineteen.

Fee Rs.600/-




(SYED IFTIKHAR UL HASAN NAQVI)
Additional Registrar of Companies

No.ARL/ 27685 Dated: 18/3/2019

ANNEXURE - F
Modified Schedule I

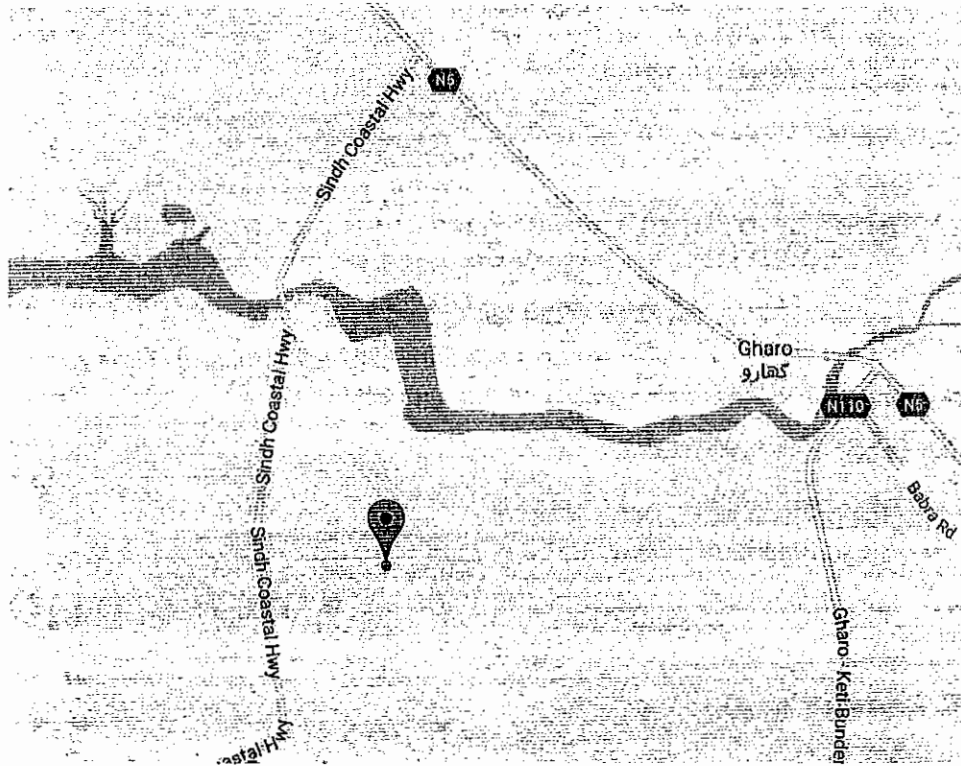
SCHEDULE-I

The Location, Size (i.e. Capacity in MW), Type of Technology, Interconnection Arrangements, Technical Limits, Technical/Functional Specifications and other details specific to the Generation Facilities of the Licensee are described in this Schedule.

A handwritten signature in black ink, appearing to be 'M. R. Akbar', with a long horizontal stroke extending to the right.

**Location of the
Generation Facility/Solar Power Plant/Solar Farm
of the Licensee**

The Project site is located at Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh at approximately 6 km along the Sindh Coastal Highway and then 1.25 km via connecting road from the Highway.

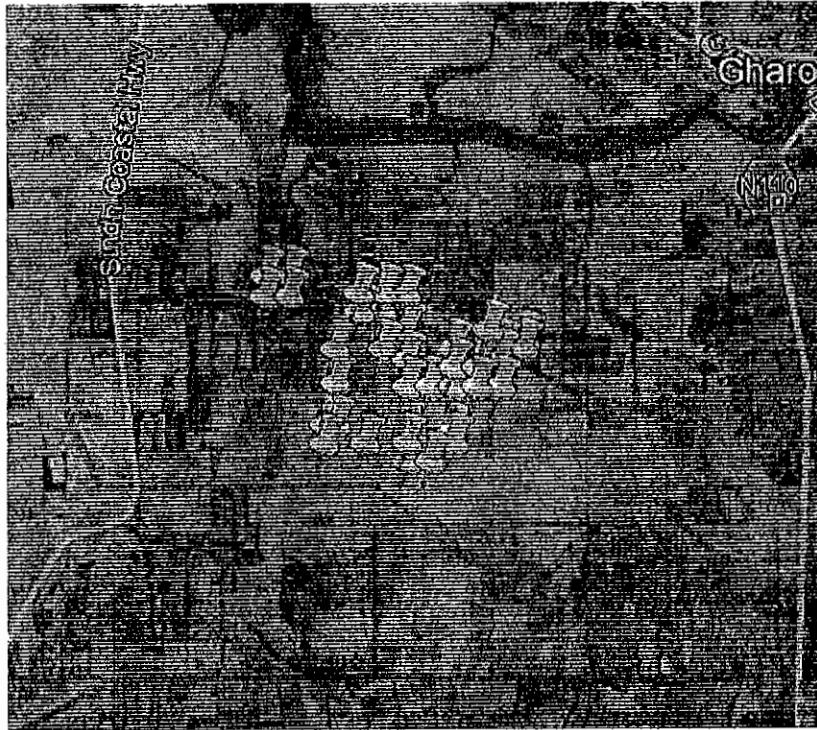


M/Rah

Location of the
Generation Facility/Solar Power Plant/Solar Farm
of the Licensee

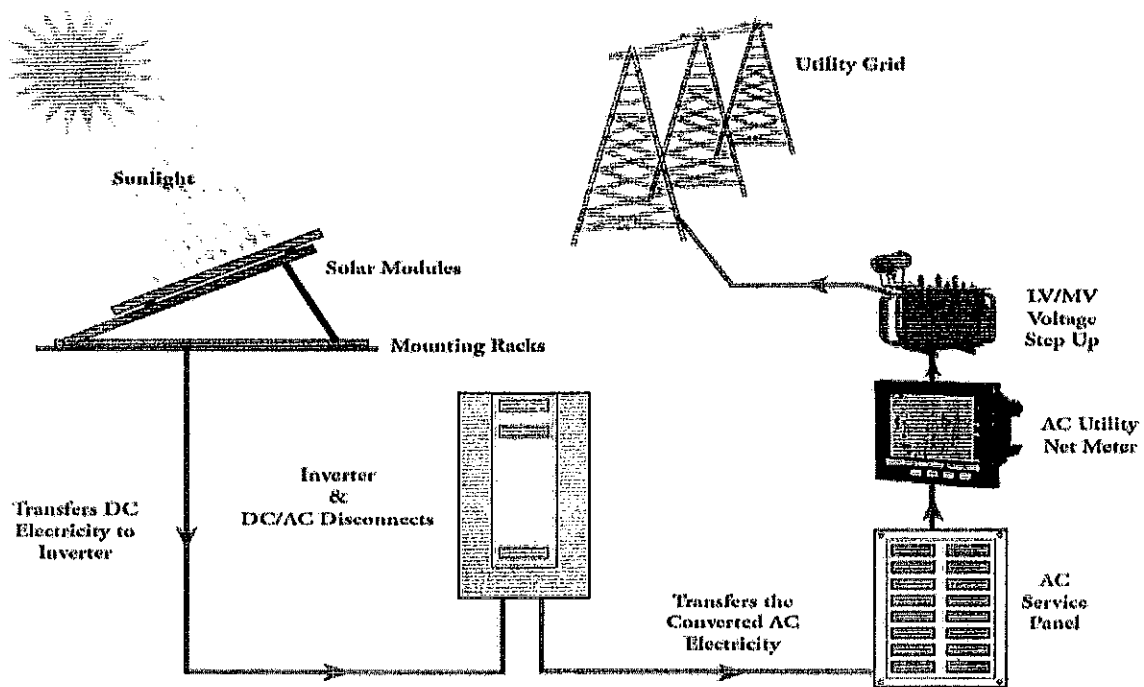
North	East
24°43'14.06"N	67°33'27.04"E
24°43'13.96"N	67°33'19.91"E
24°43'13.89"N	67°33'12.73"E
24°43'8.66"N	67°33'12.79"E
24°43'8.73"N	67°33'19.97"E
24°42'58.26"N	67°33'20.06"E
24°42'58.13"N	67°33'5.75"E
24°42'48.77"N	67°33'5.89"E
24°42'37.20"N	67°33'6.00"E
24°42'37.16"N	67°33'2.40"E
24°42'31.93"N	67°33'2.46"E
24°42'32.04"N	67°33'14.82"E
24°42'32.17"N	67°33'27.51"E
24°42'26.94"N	67°33'27.57"E
24°42'27.00"N	67°33'34.72"E
24°42'32.31"N	67°33'41.85"E
24°42'35.16"N	67°33'41.43"E
24°42'48.01"N	67°33'41.67"E
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24°42'47.87"N	67°33'27.33"E
24°42'55.31"N	67°33'27.26"E
24°43'3.55"N	67°33'27.17"E
24°43'3.77"N	67°33'52.24"E
24°42'58.54"N	67°33'52.30"E
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24°43'18.63"N	67°32'51.51"E
24°43'18.56"N	67°32'44.19"E
24°43'12.78"N	67°32'44.16"E
24°43'12.78"N	67°32'51.54"E





Mr. Rah-

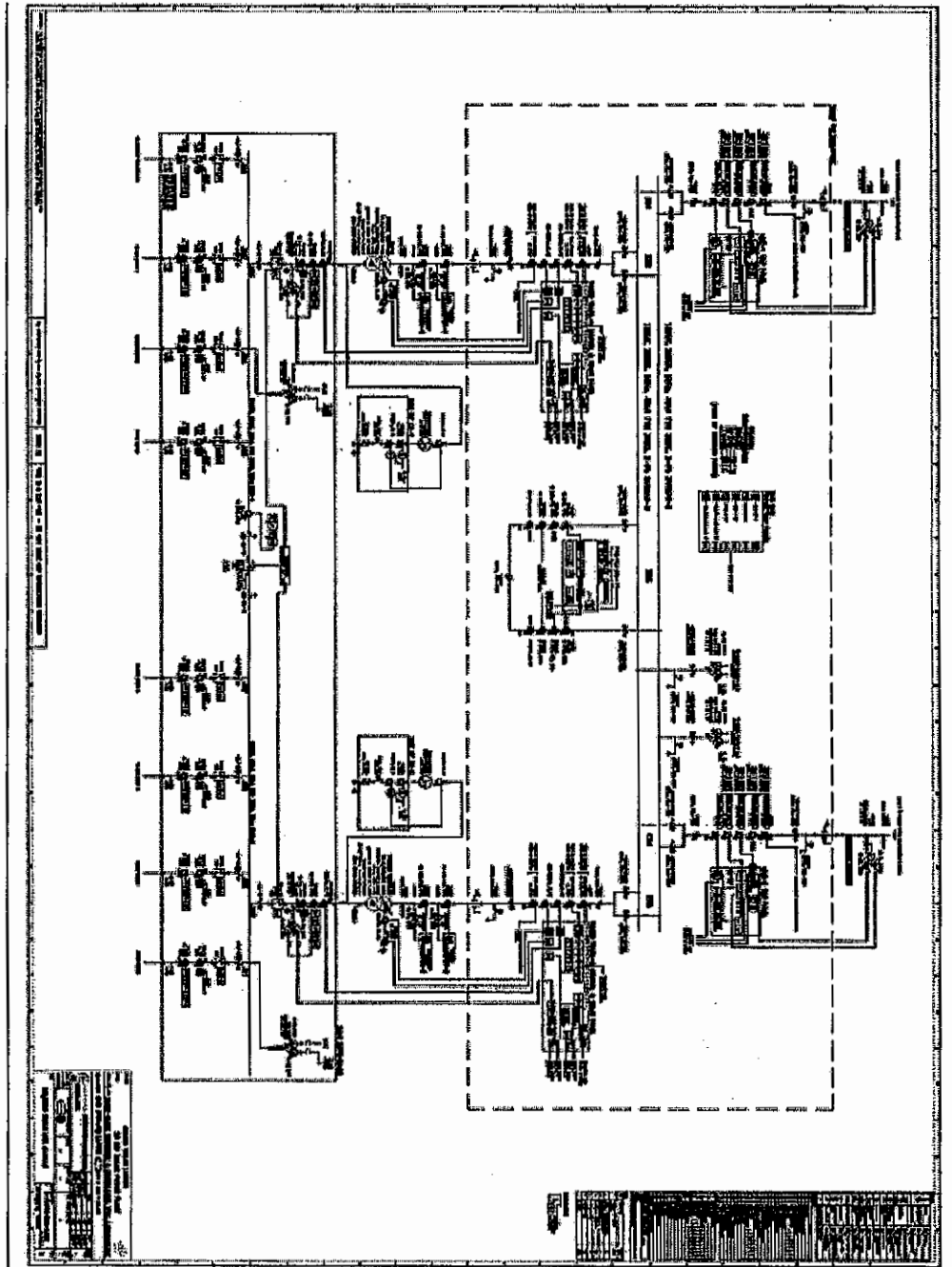
Process Flow Diagram
of the Generation Facility/Solar Power Plant/Solar Farm
of the Licensee



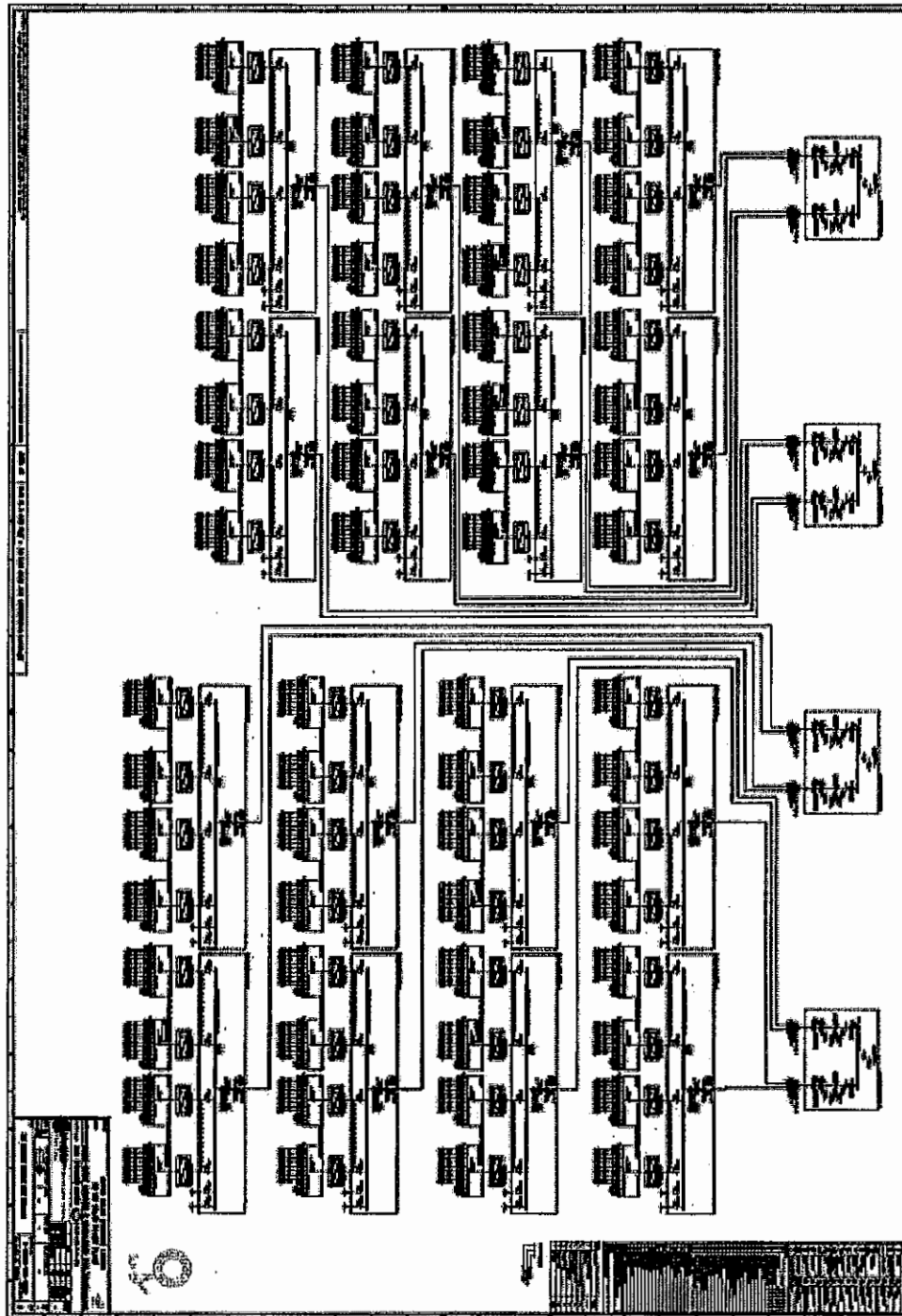
Source: IFC Project Developers Guide - Utility Scale Solar PV power plants

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Single Line Diagram
of the Generation Facility/Solar Power Plant/Solar Farm
of the Licensee



M. Akh



Mr. K. A. K.

**Interconnection Arrangement/Transmission Facilities
for Dispersal of Power from the Generation Facility/Solar Power
Plant/Solar Farm of the Licensee**

The electric power generated from the Generation Facility/Power Plant/Solar Farm of GSPL shall be sold to K-Electric and dispersed to the load center of K-Electric.

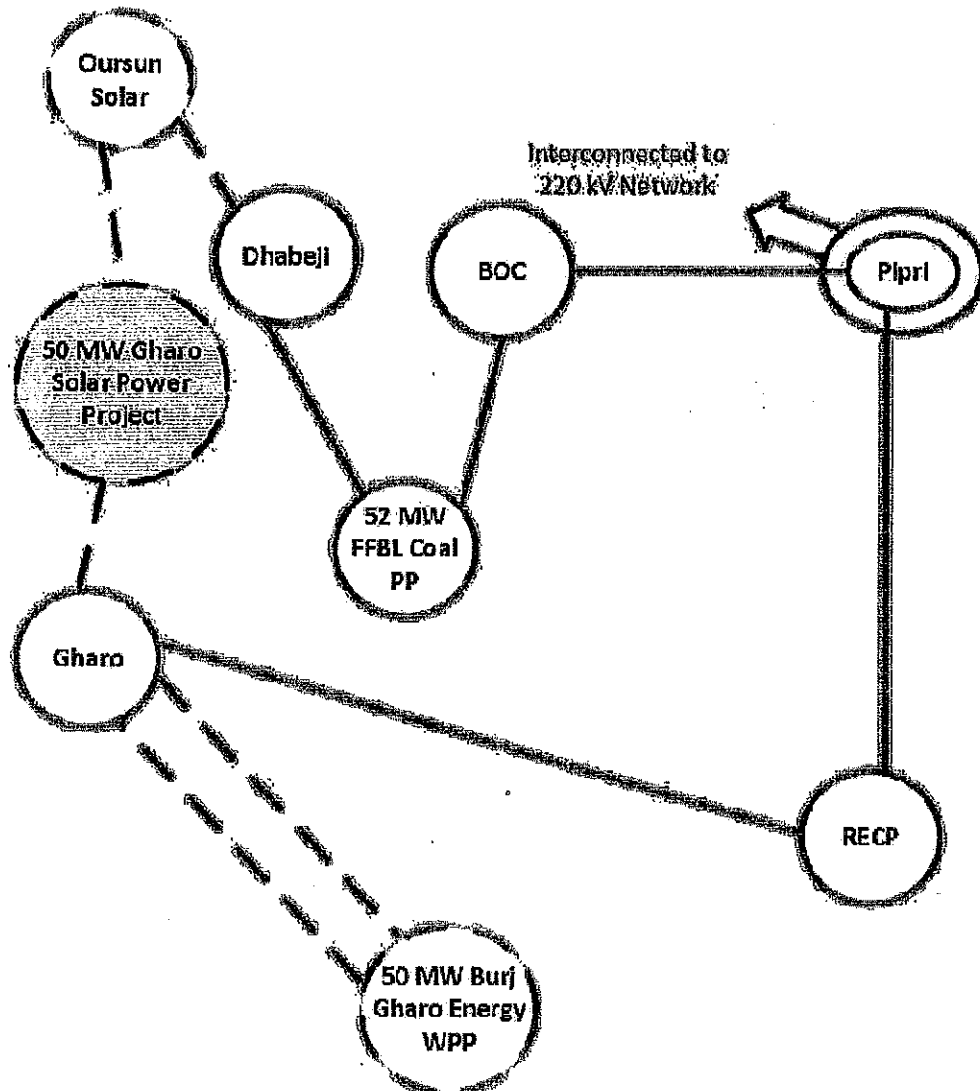
(2). The proposed Interconnection Arrangement/Transmission Facility for dispersal of electric power for the Generation Facility/Solar Power Plant/Solar Farm comprises the following: -

132 kV double circuit (400 sq mm, Cu conductor) of about 2.5 km length to loop in-out the already existing Oursun Solar – Gharo single circuit located near the Gharo Solar Plant:

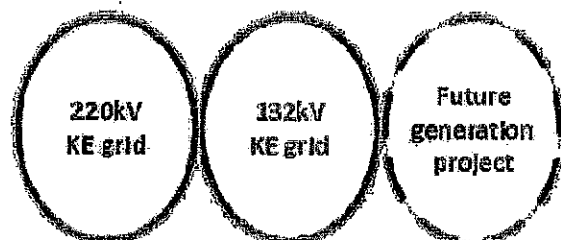
(3). Any change in the above Interconnection Arrangement/Transmission Facility duly agreed by GSPL and K-Electric, shall be communicated to the Authority in due course of time.



**Schematic Diagram for Dispersal of Electric Energy/Power from the
 Generation Facility/Solar Power Plant**



LEGENDS



Existing Circuits



Proposed Loop in out for 50 MW Gharo Solar Project



Proposed ckt's for other new projects



MR. R. Akbar

Detail of
Generation Facility/Solar Power Plant/
Solar Farm

(A). General Information

(i).	Name of the Company/Licensee	Gharo Solar Limited
(ii).	Registered/ Business office of the Company/Licensee	1485/C-2A, Asad Jan Road, Lahore Cantt.
(iii).	Location of the generation facility Solar Power Plant/ Solar Farm	The proposed plant is located at Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh
(iv).	Type of the generation facility/ Solar Power Plant/ Solar Farm	Solar PV Power Plant

(B). Solar Power Generation Technology & Capacity

(i).	Type of Technology	Photovoltaic (PV) with single-axis tracking
(ii).	System Type	Grid Connected
(iii).	Installed Capacity of the generation facility Solar Power Plant/ Solar Farm (MW)	50.00 MWp

(C). Technical Details of Equipment

(a).	Solar Panels – PV Modules	
(i).	Type of Module	380Wp – JA Solar bifacial dual glass module
(ii).	Type of Cell	Mono Crystalline
(iii).	Dimension of each Module	2004±2mm×1000±2mm×30±1mm



(iv).	No. of Panel /Modules	131,579 Nos of 380Wp corresponding to 50.00 MWp
(v).	Single Module Area	2.004 m ²
(vi).	Frame of Panel	Anodised Aluminium Alloy
(vii).	Weight of one Module	29.8kg±3%
(viii).	No of Solar Cells in each module	72 Cells
(ix).	Efficiency of module	19.00%
(x).	Maximum Power (P _{max})	380 Wp
(xi).	Voltage @ P _{max}	40.02V
(xii).	Current @ P _{max}	9.50A
(xiii).	Open circuit voltage (V _{oc})	48.81V
(xiv).	Short circuit current (I _{sc})	10.03A
(xv).	Maximum system open Circuit Voltage	1500V DC
(b).	PV Array	
(i).	Nos. of Strings	11-16 Strings per inverter
(ii).	Modules in a string	30 Nos
(c).	Inverters	
(i).	Capacity of each unit	125kW
(ii).	Manufacturer	Sungrow
(iii).	Nominal Input Voltage	1050Vdc

(iv).	Number of Inverters	352 Nos	
(v).	Efficiency of inverter	98.7% (Euro Efficiency)	
(vi).	Max. Allowable Input voltage	1500 Vdc	
(vii).	Max. Current	148A DC	
(viii).	Max. Power Point Tracking Range	860-1450Vdc	
(ix).	Output electrical system	600V	
(x).	Rated Output Voltage	480-690 V	
(xi).	Power Factor (adjustable)	Adjustable >0.99 (at nominal power)	
(xii).	Power control	Dynamic	
(xiii).	Rated Frequency	50 Hz	
(xiv).	Other Parameters	Allowable Relative Humidity	0-100%
		Audible Noise	< 65 dB(A)
		Operating Elevation	4000m (>3000m derating)
		Corrosion Category	C5
		Operating temperature	-25°C~+60°C
(xv).	Grid Operating protection	A	DC Over Voltage Protection
		B	DC reverse polarity
		C	Low Voltage Ride Through (LVRT)
		D	Anti-Islanding Protection

		E	AC & DC short circuit
		F	AC & DC overvoltage
		G	Leakage Current Protection
(d).	String Combiner Box		
(i).	Number of J/Box units	1 SCB per inverter & 352 Nos of SCB in total	
(ii).	Input circuits in each box	16 Inputs	
(iii).	Max. input current for each circuit	15A	
(iv).	Protection Level	IP 65	
(v).	Over current protection	Over Current and Short Circuit Protection available	
(vi).	Surge protection	Available	
(e).	Data Collecting System		
(i).	Weather Data	Global horizontal irradiation pyranometer Tracking irradiation pyranometer Ambient Air Temperature Sensor PV Panel Temperature Sensor Anemometer Relative Humidity Rain Gauge	
(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)
(f).	Power Transformer		
(i).	Rating	31.5/40/50 MVA	
(ii).	Type of transformer	Power Transformer - ONAN (Oil Natural Air Natural) – ONAF1 – ONAF2	
(iii).	Purpose of transformer	Step-up (22 kV/132 kV)	
(iv).	Output Voltage	132 kV	

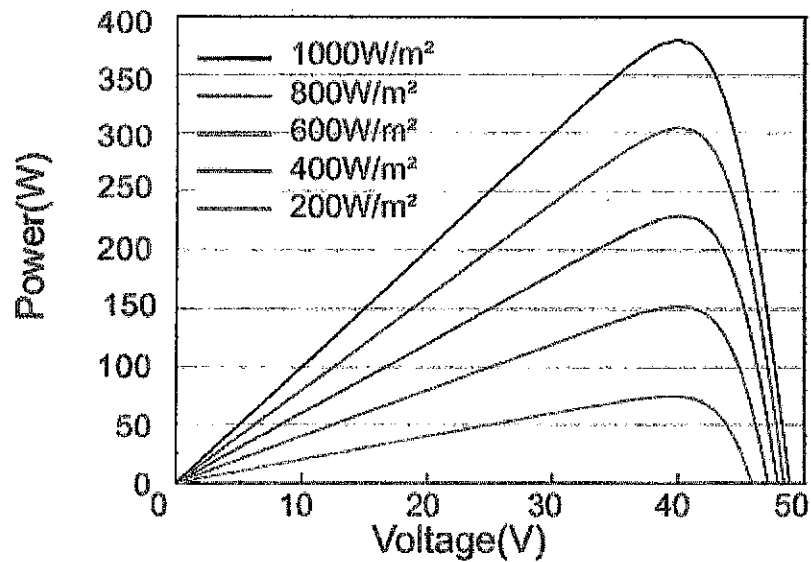
(g).	Unit Transformer		
(i).	Rating	5.60MVA	
(ii).	Type of transformer	Inverter Duty Transformer - ONAN (Oil Natural Air Natural)	
(iii).	Purpose of transformer	Step-up (0.60kV/22kV)	
(iv).	Output Voltage	22 kV	

(D). Other Details

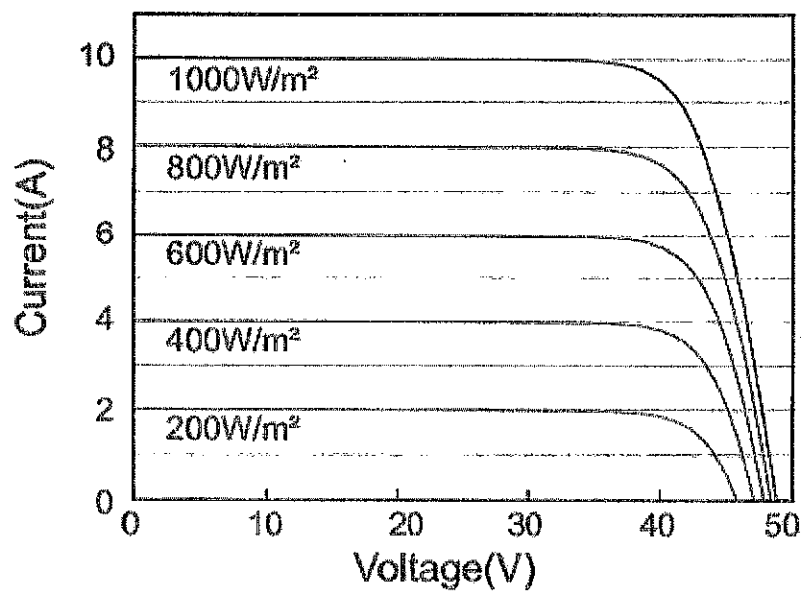
(i).	Expected COD of the generation facility Solar Power Plant/ Solar Farm	November, 2019
(ii).	Expected useful Life of the generation facility Solar Power Plant/ Solar Farm from the COD	25 years

V-I Curve of Solar Cell

Power-Voltage Curve JAM72D09-380/BP



Current-Voltage Curve JAM72D09-380/BP



[Signature]

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ANNEXURE - G
Modified Schedule II

SCHEDULE-II

The Total Installed Gross ISO Capacity of the Generation Facility/Power Plant/Solar Plant (MW), Total Annual Full Load (Hours), Average Sun Availability, Total Gross Generation of the Generation Facility/Solar Farm (in kWh), Annual Energy Generation (25 years Equivalent Net Annual Production-AEP) KWh and Net Capacity Factor of the Generation Facility/Solar Farm of Licensee are given in this Schedule.

A handwritten signature in black ink, appearing to be 'M. Rabe' or similar, with a long horizontal stroke extending to the right.

SCHEDULE-II

(1).	Total Installed Capacity of the Generation Facility/Solar Power Plant/Solar Farm	50.00 MW
(2).	No. of days per year	365
(3).	Annual generating capacity of Generation Facility/Solar Power Plant/Solar Farm (As Per Simulation)	94,564 MWh
(4).	Total expected generation of the Generation Facility/Solar Power Plant/Solar Farm during the twenty five (25) years term of this licence	2,364,105 MWh
(5).	Annual generation of Generation Facility/Solar Power Plant/Solar Farm based on 24 hours working	438,000 MWh
(6).	Net Capacity Factor of Generation Facility/Solar Power Plant/Solar Farm	21.59%

Note

All the above figures are indicative as provided by the Licensee. The Net Delivered Energy available to Power Purchaser for dispatch will be determined through procedures contained in the Energy Purchase Agreement (EPA) or the Applicable Document(s).



ANNEXURE - H
PVsyst Simulations

PVSYST V6.75			01/06/19		Page 1/6	
Grid-Connected System: Simulation parameters						
Project : Grid-Connected Project at Gharo_SGIS						
Geographical Site		Gharo_SGIS		Country	Pakistan	
Situation		Latitude	24.72° N	Longitude	67.53° E	
Time defined as		Legal Time	Time zone UT+5	Altitude	3 m	
		Albedo	0.20			
Meteo data:		Unnamed Road	Solargis v2.1.19 - TMY			
Simulation variant : SAT JAI 380 Wp BP and SG inv. 125kW OL 14% GCR 36% Ab-10% 0.6						
		Simulation date	01/06/19 12h24			
		Simulation for the	1st year of operation			
Simulation parameters		System type		Trackers single array, backtracking		
Tracking plane, tilted Axis		Axis Tilt		0°	Axis Azimuth	0°
Rotation Limitations		Minimum Phi		-55°	Maximum Phi	55°
Backtracking strategy		Nb. of trackers	100	Single array		
		Tracker Spacing	11.1 m	Collector width	4.01 m	
Inactive band		Left	0.02 m	Right	0.02 m	
Backtracking limit angle		Phi limits	+/- 68.5° Ground cov. Ratio (GCR) 36.2 %			
Models used		Transposition	Perez	Diffuse	Imported	
Horizon		Free Horizon				
Near Shadings		According to strings		Electrical effect	100 %	
Bi-facial system		Model	Unlimited trackers, 2D calculation			
		Tracker Spacing	11.10 m	Tracker width	4.05 m	
		Backtracking limit angle	68.5°	GCR	36.5 %	
		Ground albedo	10.0 %	Axis height above ground	2.23 m	
		Module bifaciality factor	70 %	Rear shading factor	5.0 %	
		Module transparency	0.0 %	Rear mismatch loss	10.0 %	
PV Array Characteristics						
PV module		Si-mono	Model	JAM72D09-380/BP		
Custom parameters definition		Manufacturer	JA Solar			
Number of PV modules		In series	30 modules	In parallel	4386 strings	
Total number of PV modules		Nb. modules	131580	Unit Nom. Power	380 Wp	
Array global power		Nominal (STC)	50000 kWp	At operating cond.	45372 kWp (50°C)	
Array operating characteristics (50°C)		U mpp	1079 V	I mpp	42033 A	
Total area		Module area	263686 m²	Cell area	237223 m²	
Inverter		Model	SG125HV_US			
Custom parameters definition		Manufacturer	Sungrow			
Characteristics		Operating Voltage	860-1450 V	Unit Nom. Power	125 kVA	
Inverter pack		Nb. of inverters	352 units	Total Power	44000 kVA	
				Pnom ratio	1.14	
PV Array loss factors						
Array Soiling Losses				Loss Fraction	2.0 %	
Thermal Loss factor		Uc (const)	29.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s	
Wiring Ohmic Loss		Global array res.	0.49 mOhm	Loss Fraction	1.7 % at STC	

Grid-Connected System: Simulation parameters

LID - Light Induced Degradation		Loss Fraction	2.0 %
Module Quality Loss		Loss Fraction	0.0 %
Module Mismatch Losses		Loss Fraction	0.5 % at MPP
Module average degradation	Year no 1	Loss factor	2 %/year
Mismatch due to degradation	Imp RMS dispersion 0.4 %/year	Vmp RMS dispersion	0.4 %/year
Incidence effect, ASHRAE parametrization	IAM = 1 - bo (1/cos i - 1)	bo Param.	0.05

System loss factors

AC wire loss Inverter to transfo	Inverter voltage 600 Vac tri		
	Wires: 3x30000.0 mm ² 82 m	Loss Fraction	0.7 % at STC
External transformer	Iron loss (24H connexion) 48980 W	Loss Fraction	0.1 % at STC
	Resistive/Inductive losses 0.1 mOhm	Loss Fraction	1.5 % at STC
Unavailability of the system	2.9 days, 2 periods	Time fraction	0.8 %

User's needs : Unlimited load (grid)

Auxillaries loss Proportionnal to Power 5.0 W/kW ... from Power thresh. 0.0 kW

Power factor Cos(phi) 0.950 lagging Phi -18.2°

Grid-Connected System: Near shading definition

Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG Inv. 125kW OL 14% GCR 36% Ab-10% 0.6
 Simulation for the 1st year of operation

Main system parameters

System type Trackers single array, backtracking

Near Shadings

PV Field Orientation

PV modules

PV Array

Inverter

Inverter pack

User's needs

According to strings

tracking, tilted axis, Axis Tilt

Model

Nb. of modules

Model

Nb. of units

Unlimited load (grid)

JAM72D09-380/BP

SG125HV_US

352.0

Electrical effect 100 %

Axis Azimuth 0°

Pnom 380 Wp

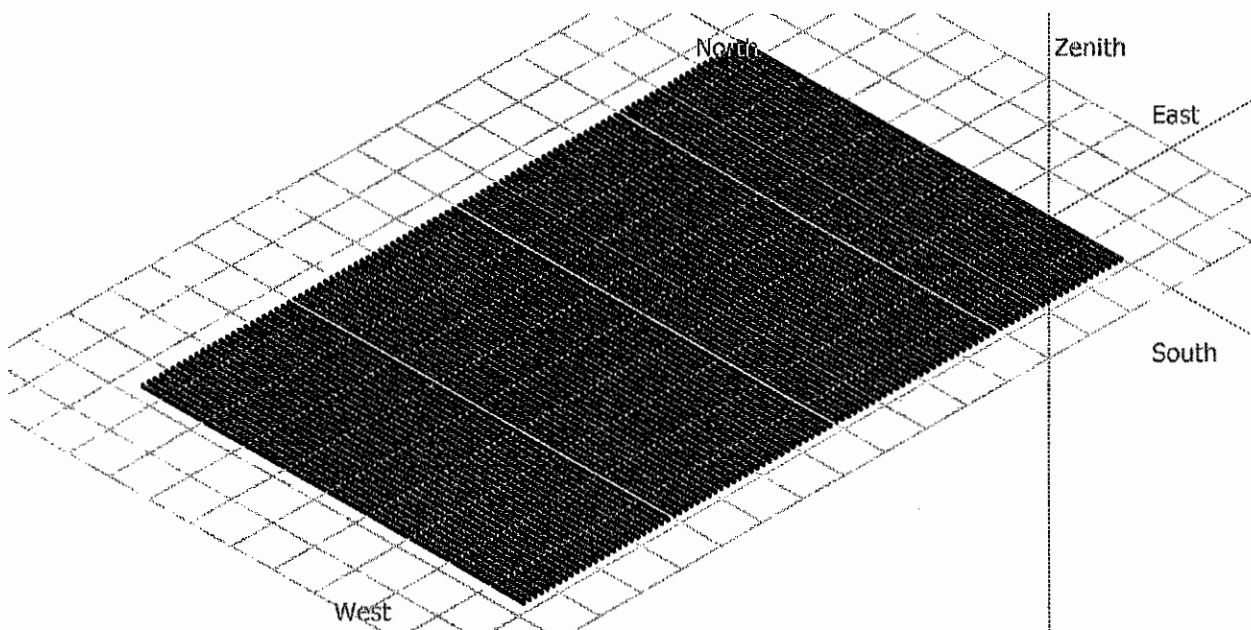
Pnom total 50000 kWp

Pnom 125 kW ac

Pnom total 44000 kW ac

Cos(Phi) 0.950 lagging

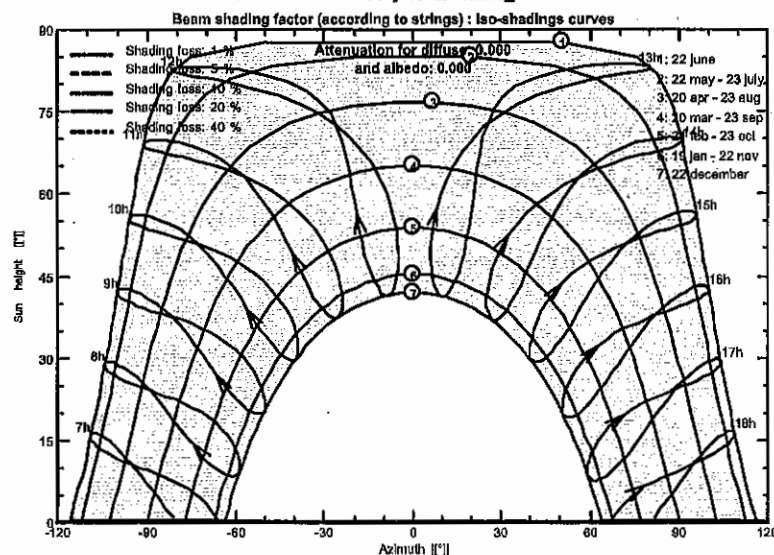
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Grid-Connected Project at Gharo_SGIS

Beam shading factor (according to strings) : Iso-shadings curves



Grid-Connected System: Main results

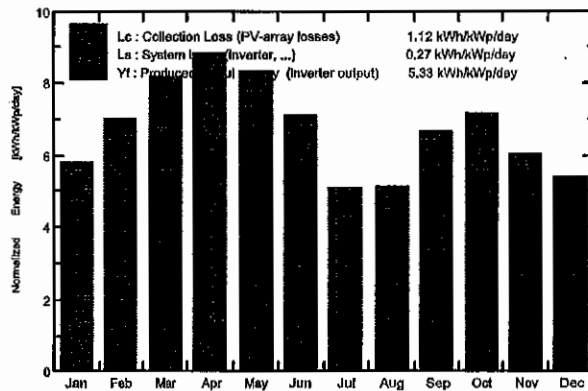
Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG Inv. 125kW OL 14% GCR 36% Ab-10% 0.6
 Simulation for the 1st year of operation

Main system parameters	System type	Trackers single array, backtracking
Near Shadings	According to strings	Electrical effect 100 %
PV Field Orientation	tracking, tilted axis, Axis Tilt 0°	Axis Azimuth 0°
PV modules	Model JAM72D09-380/BP	Pnom 380 Wp
PV Array	Nb. of modules 131580	Pnom total 50000 kWp
Inverter	Model SG125HV_US	Pnom 125 kW ac
Inverter pack	Nb. of units 352.0	Pnom total 44000 kW ac
User's needs	Unlimited load (grid)	Cos(Phi) 0.950 lagging

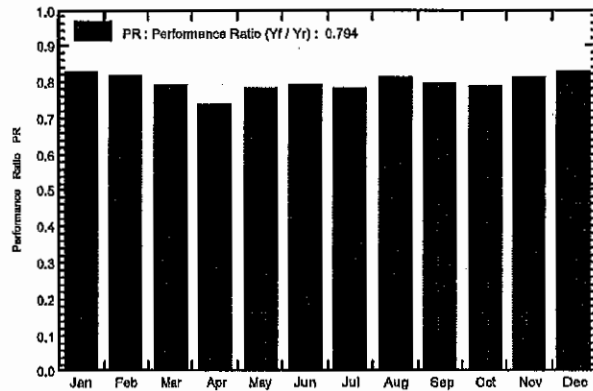
Main simulation results

System Production	Produced Energy 97299 MWh/year	Specific prod. 1946 kWh/kWp/year
	Apparent energy 102430 MVAh	Perf. Ratio PR 79.36 %

Normalized productions (per installed kWp): Nominal power 50000 kWp



Performance Ratio PR



SAT JAI 380 Wp BP and SG Inv. 125kW OL 14% GCR 36% Ab-10% 0.6

Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	EApGrid MVAh	PR
January	138.4	55.0	20.15	179.5	167.0	7725	7419	7811	0.827
February	150.4	54.8	21.44	185.6	183.1	8343	7997	8419	0.818
March	198.4	72.2	26.07	253.4	238.3	10472	10032	10561	0.792
April	212.7	82.9	28.91	265.1	249.5	10787	9770	10285	0.737
May	216.6	103.9	31.16	268.3	241.5	10534	10109	10642	0.783
June	184.8	105.7	31.33	212.6	197.4	8763	8414	8857	0.792
July	147.9	108.4	30.67	158.0	145.2	6839	6179	6505	0.782
August	144.6	99.4	29.60	159.7	147.2	6718	6453	6794	0.808
September	167.5	86.0	29.34	199.6	186.0	8272	7936	8354	0.786
October	174.1	67.8	29.60	222.0	207.8	9108	8743	9204	0.788
November	140.8	57.4	25.71	181.3	168.7	7638	7340	7727	0.810
December	128.6	50.3	20.92	167.0	155.2	7191	6907	7271	0.827
Year	2004.7	943.6	27.09	2452.0	2287.0	102181	97299	102430	0.794

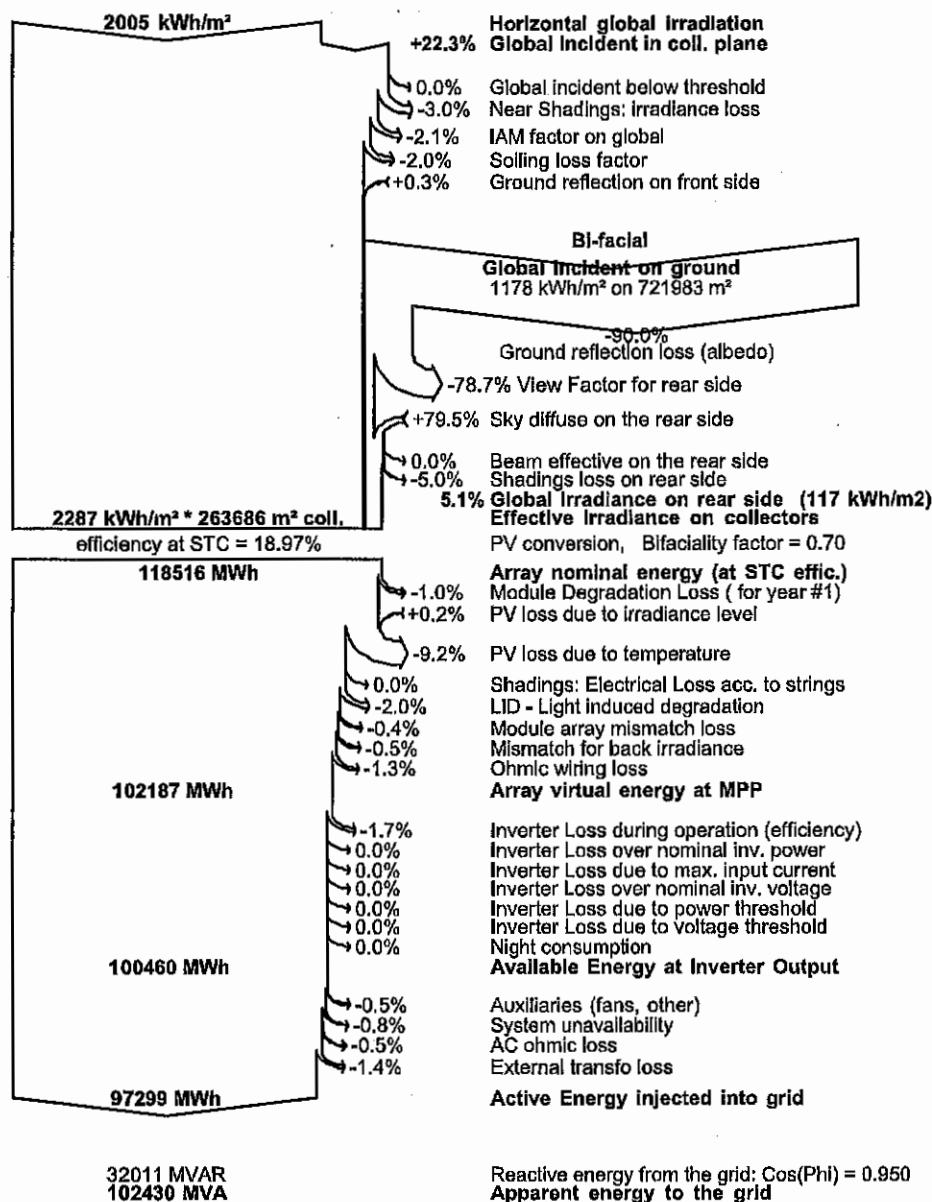
Legends:	GlobHor	Horizontal global irradiation	GlobEff	Effective Global, corr. for IAM and shadings
	DiffHor	Horizontal diffuse irradiation	EArray	Effective energy at the output of the array
	T Amb	Ambient Temperature	E_Grid	Energy injected into grid
	GlobInc	Global incident in coll. plane	EApGrid	Apparent energy to the grid
			PR	Performance Ratio

Grid-Connected System: Loss diagram

Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG Inv. 125kW OL 14% GCR 36% Ab-10% 0.6
 Simulation for the 1st year of operation

Main system parameters	System type	Trackers single array, backtracking
Near Shadings	According to strings	Electrical effect 100 %
PV Field Orientation	tracking, tilted axis, Axis Tilt 0°	Axis Azimuth 0°
PV modules	Model JAM72D09-380/BP	Pnom 380 Wp
PV Array	Nb. of modules 131580	Pnom total 50000 kWp
Inverter	Model SG125HV_US	Pnom 125 kW ac
Inverter pack	Nb. of units 352.0	Pnom total 44000 kW ac
User's needs	Unlimited load (grid)	Cos(Phi) 0.950 lagging

Loss diagram over the whole year



Grid-Connected System: P50 - P90 evaluation

Project : **Grid-Connected Project at Gharo_SGIS**

Simulation variant : **SAT JAI 380 Wp BP and SG Inv. 125kW OL 14% GCR 36% Ab-10% 0.6**
Simulation for the 1st year of operation

Main system parameters		System type	Trackers single array, backtracking	
Near Shadings		According to strings	Electrical effect	100 %
PV Field Orientation		tracking, tilted axis, Axis Tilt	Axis Azimuth	0°
PV modules		Model	Pnom	380 Wp
PV Array		Nb. of modules	Pnom total	50000 kWp
Inverter		Model	Pnom	125 kW ac
Inverter pack		Nb. of units	Pnom total	44000 kW ac
User's needs		Unlimited load (grid)	Cos(Phi)	0.950 lagging

Evaluation of the Production probability forecast

The probability distribution of the system production forecast for different years is mainly dependent on the meteo data used for the simulation, and depends on the following choices:

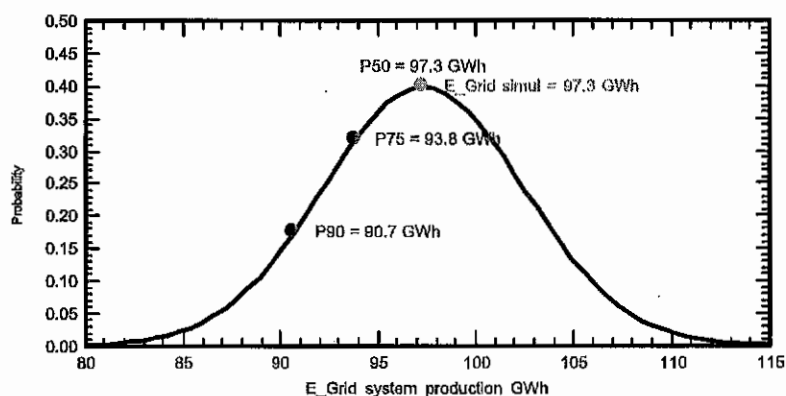
Meteo data source		Solargis v2.1.19
Meteo data	Kind	TMY, multi-year
Specified Deviation	Climate change	0.0 %
Year-to-year variability	Variance	5.0 %

The probability distribution variance is also depending on some system parameters uncertainties

Specified Deviation	PV module modelling/parameters	1.0 %
	Inverter efficiency uncertainty	0.5 %
	Soiling and mismatch uncertainties	1.0 %
	Degradation uncertainty	1.0 %
Global variability (meteo + system)	Variance	5.3 % (quadratic sum)

Annual production probability	Variability	5172 MWh
	P50	97299 MWh
	P90	90668 MWh
	P75	93813 MWh

Probability distribution



PVSYST V6.81		11/06/19		Page 1/8	
Grid-Connected System: Simulation parameters					
Project : Grid-Connected Project at Gharo_SGIS					
Geographical Site		Gharo_SGIS		Country Pakistan	
Situation		Latitude 24.72° N		Longitude 67.53° E	
Time defined as		Legal Time Time zone UT+5		Altitude 3 m	
Meteo data:		Gharo_MN		MeteoNorm file - Synthetic	
Simulation variant : SAT JAI 380 Wp BP and SG Inv. 125kW OL 14% GCR 36% Ab-10% 0.6 with meteonorm					
		Simulation date		11/06/19 16h00	
		Simulation for the		1st year of operation	
Simulation parameters		System type Trackers single array, avec backtracking			
Tracking plane, tilted Axis		Axis Tilt 0°		Axis Azimuth 0°	
Rotation Limitations		Minimum Phi -55°		Maximum Phi 55°	
		Tracking algorithm Astronomic calculation			
Backtracking strategy		Nb. of trackers 100		Single array	
		Tracker Spacing 11.1 m		Collector width 4.01 m	
Inactive band		Left 0.02 m		Right 0.02 m	
Backtracking limit angle		Phi limits +/- 68.5°		Ground cov. Ratio (GCR) 36.2 %	
Models used		Transposition Perez		Diffuse Perez, Meteonorm	
Horizon		Free Horizon			
Near Shadings		According to strings		Electrical effect 100 %	
Bifacial system		Model Unlimited trackers, 2D calculation			
		Tracker Spacing 11.10 m		Tracker width 4.05 m	
		Backtracking limit angle 68.5°		GCR 36.5 %	
		Ground albedo 10.0 %		Axis height above ground 2.23 m	
		Module bifaciality factor 70 %		Rear shading factor 5.0 %	
		Module transparency 0.0 %		Rear mismatch loss 10.0 %	
User's needs :		Unlimited load (grid)			
Power factor		Cos(phi) 0.950 lagging		Phi -18.2°	
PV Array Characteristics					
PV module		Si-mono Model JAM72D09-380/BP			
Custom parameters definition		Manufacturer JA Solar			
Number of PV modules		In series 30 modules		In parallel 4386 strings	
Total number of PV modules		Nb. modules 131580		Unit Nom. Power 380 Wp	
Array global power		Nominal (STC) 50000 kWp		At operating cond. 45372 kWp (50°C)	
Array operating characteristics (50°C)		U mpp 1079 V		I mpp 42033 A	
Total area		Module area 263686 m²		Cell area 237223 m²	
Inverter		Model SG125HV_US			
Custom parameters definition		Manufacturer Sungrow			
Characteristics		Operating Voltage 860-1450 V		Unit Nom. Power 125 kVA	
Inverter pack		Nb. of inverters 352 units		Total Power 44000 kVA	
				Pnom ratio 1.14	
PV Array loss factors					

Grid-Connected System: Simulation parameters

Array Soiling Losses		Loss Fraction	2.0 %
Thermal Loss factor	Uc (const) 29.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s
Wiring Ohmic Loss	Global array res. 0.49 mOhm	Loss Fraction	1.7 % at STC
LID - Light Induced Degradation		Loss Fraction	2.0 %
Module Quality Loss		Loss Fraction	0.0 %
Module Mismatch Losses		Loss Fraction	0.5 % at MPP
Module average degradation	Year no 1	Loss factor	2 %/year
Mismatch due to degradation	Imp RMS dispersion 0.4 %/year	Vmp RMS dispersion	0.4 %/year
Incidence effect, ASHRAE parametrization	IAM = 1 - bo (1/cos i - 1)	bo Param.	0.05

System loss factors

AC wire loss inverter to transfo	Inverter voltage 600 Vac tri		
	Wires: 3x30000.0 mm² 82 m	Loss Fraction	0.7 % at STC
External transformer	Iron loss (24H connexion) 48980 W	Loss Fraction	0.1 % at STC
	Resistive/Inductive losses 0.110 mOhm	Loss Fraction	1.5 % at STC
Unavailability of the system	2.9 days, 2 periods	Time fraction	0.8 %

Auxiliaries loss

Proportionnal to Power	5.0 W/kW	... from Power thresh.	0.0 kW
------------------------	----------	------------------------	--------

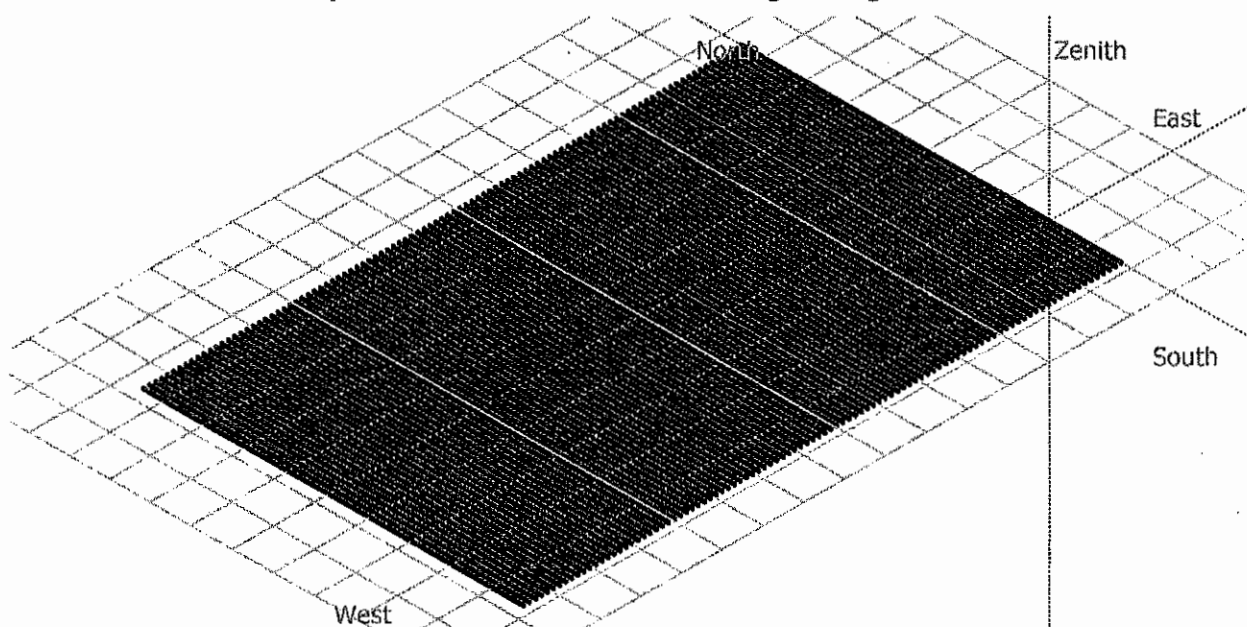
Grid-Connected System: Near shading definition

Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG Inv. 125kW OL 14% GCR 36% Ab-10% 0.6 with meteonorm
 Simulation for the 1st year of operation

Main system parameters

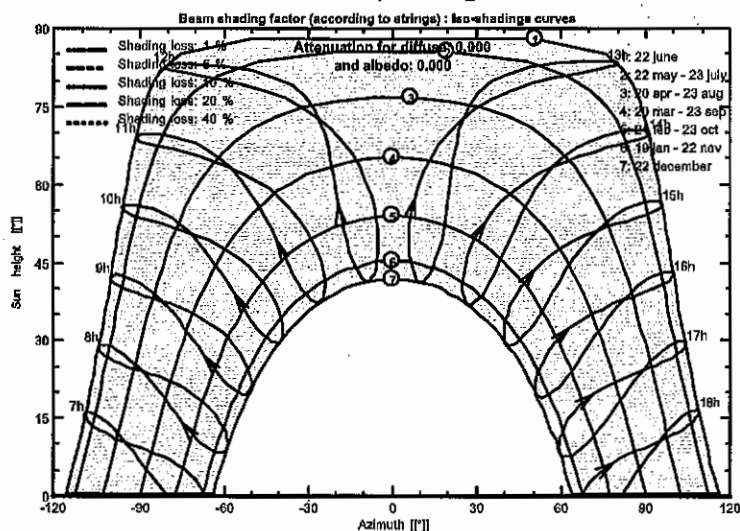
Main system parameters		System type	Trackers single array, avec backtracking		
Near Shadings	According to strings		Electrical effect	100 %	
PV Field Orientation	tracking, tilted axis, Axis Tilt	0°	Axis Azimuth	0°	
PV modules	Model	JAM72D09-380/BP	Pnom	380 Wp	
PV Array	Nb. of modules	131580	Pnom total	50000 kWp	
Inverter	Model	SG125HV_US	Pnom	125 kW ac	
Inverter pack	Nb. of units	352.0	Pnom total	44000 kW ac	
User's needs	Unlimited load (grid)		Cos(Phi)	0.950 lagging	

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Grid-Connected Project at Gharo_SGIS



Grid-Connected System: Main results

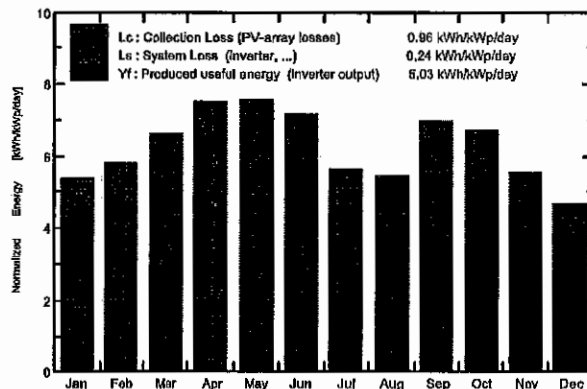
Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG inv. 125kW OL 14% GCR 36% Ab-10% 0.6 with meteonorm
 Simulation for the 1st year of operation

Main system parameters	System type	Trackers single array, avec backtracking
Near Shadings	According to strings	Electrical effect 100 %
PV Field Orientation	tracking, tilted axis, Axis Tilt	Axis Azimuth 0°
PV modules	Model	JAM72D09-380/BP Pnom 380 Wp
PV Array	Nb. of modules	131580 Pnom total 50000 kWp
Inverter	Model	SG125HV_US Pnom 125 kW ac
Inverter pack	Nb. of units	352.0 Pnom total 44000 kW ac
User's needs	Unlimited load (grid)	Cos(Phi) 0.950 lagging

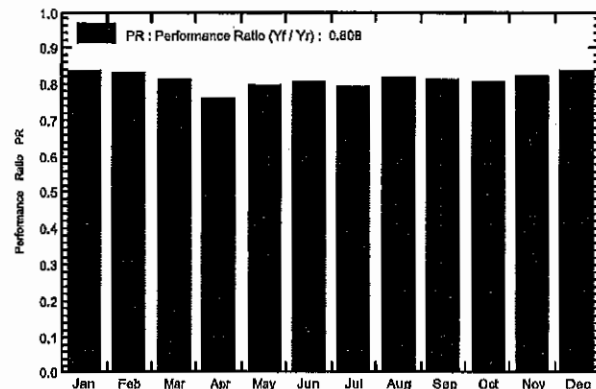
Main simulation results

System Production	Produced Energy	91870 MWh/year	Specific prod.	1837 kWh/kWp/year
	Apparent energy	96714 MVAh	Perf. Ratio PR	80.78 %

Normalized productions (per installed kWp): Nominal power 50000 kWp



Performance Ratio PR



SAT JAI 380 Wp BP and SG inv. 125kW OL 14% GCR 36% Ab-10% 0.6 with meteonorm Balances and main results

	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray MWh	E_Grid MWh	EApGrid MVAh	PR
January	127.6	44.3	19.52	167.5	156.5	7312	7018	7388	0.838
February	128.1	56.0	22.31	162.4	151.6	7010	6730	7085	0.829
March	166.2	81.1	26.42	204.5	191.1	8656	8312	8750	0.813
April	183.4	87.3	28.97	225.0	210.9	9405	8577	9030	0.762
May	192.1	95.2	30.92	233.9	218.9	9718	9328	9820	0.798
June	182.0	102.5	31.19	214.8	199.9	8989	8640	9095	0.804
July	150.4	94.5	30.41	173.9	161.1	7315	6891	7255	0.793
August	149.0	99.0	29.20	168.0	155.3	7129	6847	7208	0.815
September	168.9	80.9	28.92	207.8	194.5	8759	8406	8850	0.809
October	160.8	64.0	29.06	206.7	193.8	8650	8307	8745	0.804
November	126.9	48.4	24.86	165.4	154.5	7054	6775	7132	0.819
December	113.8	48.8	20.93	144.4	134.2	6288	6038	6357	0.836
Year	1849.2	902.1	26.91	2274.5	2122.1	96286	91870	96714	0.808

Legends: GlobHor Horizontal global irradiation
 DiffHor Horizontal diffuse irradiation
 T_Amb Ambient Temperature
 GlobInc Global Incident In coll. plane

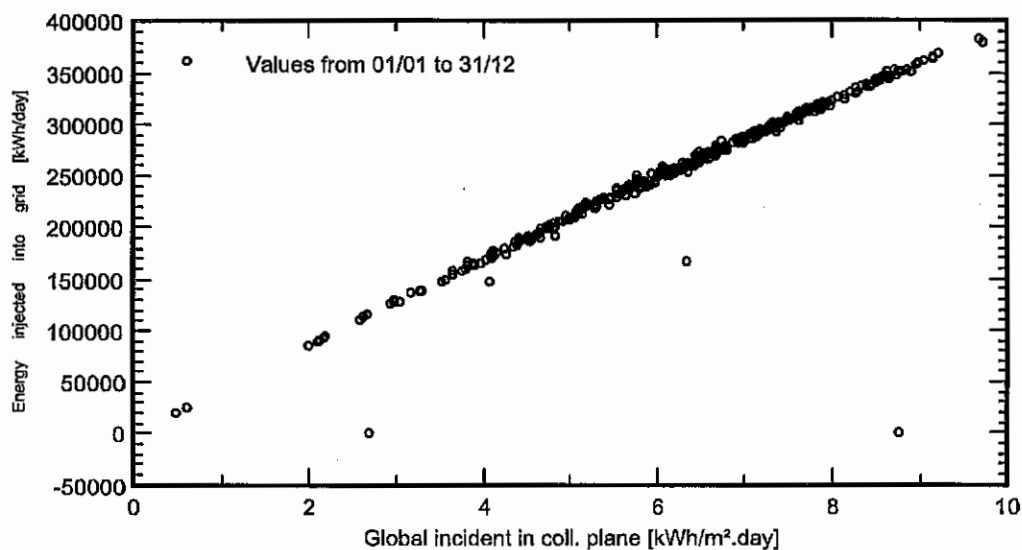
GlobEff Effective Global, corr. for IAM and shadings
 EArray Effective energy at the output of the array
 E_Grid Energy Injected Into grid
 EApGrid Apparent energy to the grid
 PR Performance Ratio

Grid-Connected System: Special graphs

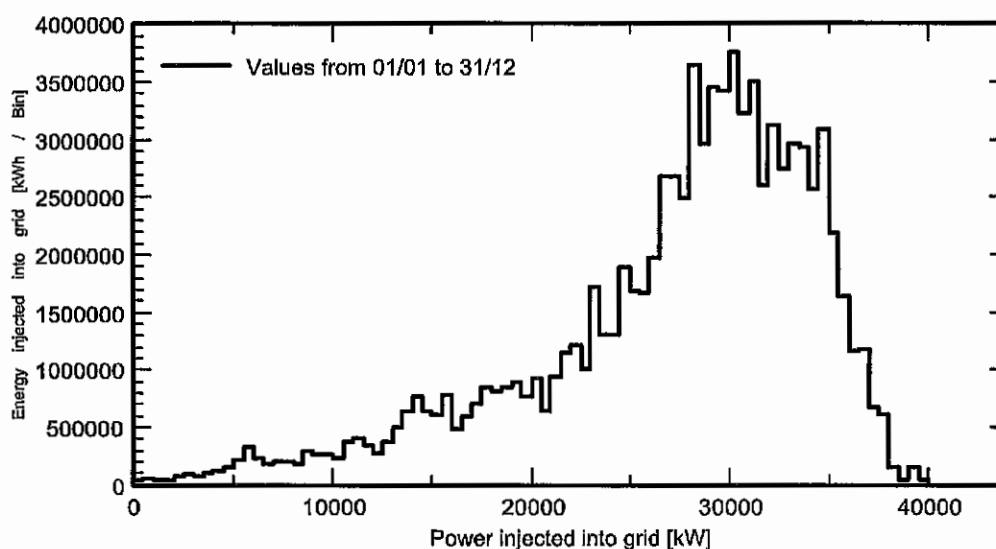
Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG inv. 125kW OL 14% GCR 36% Ab-10% 0.6
 with meteonorm
 Simulation for the 1st year of operation

Main system parameters	System type	Trackers single array, avec backtracking	
Near Shadings	According to strings	Electrical effect	100 %
PV Field Orientation	tracking, tilted axis, Axis Tilt	Axis Azimuth	0°
PV modules	Model	Pnom	380 Wp
PV Array	Nb. of modules	Pnom total	50000 kWp
Inverter	Model	Pnom	125 kW ac
Inverter pack	Nb. of units	Pnom total	44000 kW ac
User's needs	Unlimited load (grid)	Cos(Phi)	0.950 lagging

Daily Input/Output diagram



System Output Power Distribution

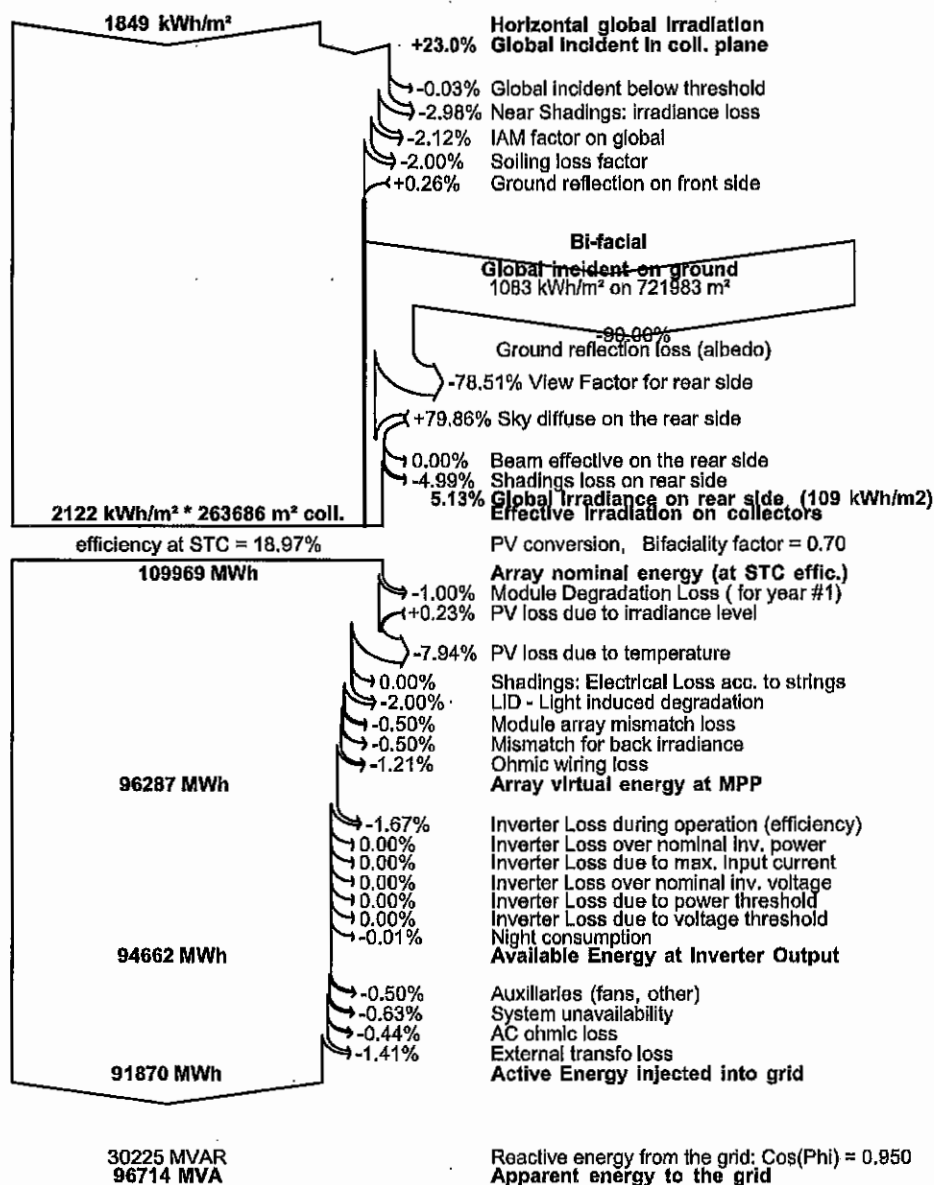


Grid-Connected System: Loss diagram

Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG Inv. 125kW OL 14% GCR 36% Ab-10% 0.6
 with meteonorm
 Simulation for the 1st year of operation

Main system parameters	System type	Trackers single array, avec backtracking		
Near Shadings	According to strings	Electrical effect	100 %	
PV Field Orientation	tracking, tilted axis, Axis Tilt	Axis Azimuth	0°	
PV modules	Model	JAM72D09-380/BP	Pnom	380 Wp
PV Array	Nb. of modules	131580	Pnom total	50000 kWp
Inverter	Model	SG125HV_US	Pnom	125 kW ac
Inverter pack	Nb. of units	352.0	Pnom total	44000 kW ac
User's needs	Unlimited load (grid)	Cos(Phi)	0.950 lagging	

Loss diagram over the whole year



Grid-Connected System: P50 - P90 evaluation

Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG inv. 125kW OL 14% GCR 36% Ab-10% 0.6 with meteonorm
 Simulation for the 1st year of operation

Main system parameters	System type	Trackers single array, avec backtracking	
Near Shadings	According to strings	Electrical effect	100 %
PV Field Orientation	tracking, tilted axis, Axis Tilt	Axis Azimuth	0°
PV modules	Model	Pnom	380 Wp
PV Array	Nb. of modules	Pnom total	50000 kWp
Inverter	Model	Pnom	125 kW ac
Inverter pack	Nb. of units	Pnom total	44000 kW ac
User's needs	Unlimited load (grid)	Cos(Phi)	0.950 lagging

Evaluation of the Production probability forecast

The probability distribution of the system production forecast for different years is mainly dependent on the meteo data used for the simulation, and depends on the following choices:

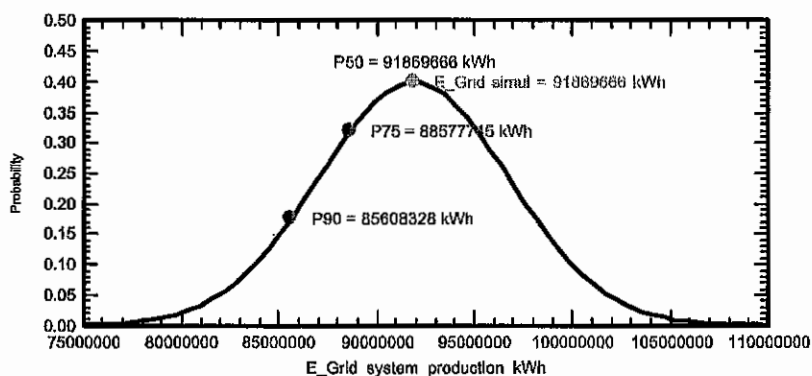
Meteo data source	MeteoNorm file
Meteo data	Kind TMY, multi-year
Specified Deviation	Climate change 0.0 %
Year-to-year variability	Variance 5.0 %

The probability distribution variance is also depending on some system parameters uncertainties

Specified Deviation	PV module modelling/parameters	1.0 %
	Inverter efficiency uncertainty	0.5 %
	Soiling and mismatch uncertainties	1.0 %
	Degradation uncertainty	1.0 %
Global variability (meteo + system)	Variance	5.3 % (quadratic sum)

Annual production probability	Variability	4883 MWh
	P50	91870 MWh
	P90	85608 MWh
	P75	88578 MWh

Probability distribution



Grid-Connected System: CO2 Balance

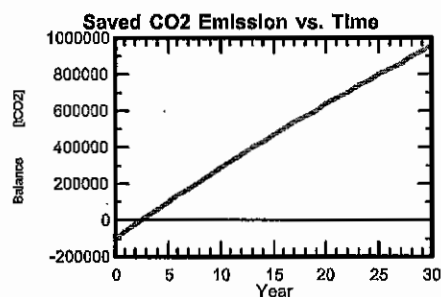
Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG inv. 125kW OL 14% GCR 36% Ab-10% 0.6
 with meteonorm
 Simulation for the 1st year of operation

Main system parameters	System type	Trackers single array, avec backtracking	
Near Shadings	According to strings	Electrical effect	100 %
PV Field Orientation	tracking, tilted axis, Axis Tilt	Axis Azimuth	0°
PV modules	Model	Pnom	380 Wp
PV Array	Nb. of modules	Pnom total	50000 kWp
Inverter	Model	Pnom	125 kW ac
Inverter pack	Nb. of units	Pnom total	44000 kW ac
User's needs	Unlimited load (grid)	Cos(Phi)	0.950 lagging

Produced Emissions	Total:	105164.14 tCO2	
	Source:	Detailed calculation from table below	
Replaced Emissions	Total:	1226460.0 tCO2	
	System production:	91869.67 MWh/yr	Lifetime: 30 years
			Annual Degradation: 1.0 %
	Grid Lifecycle Emissions:	445 gCO2/kWh	
	Source:	IEA List	Country: Pakistan
CO2 Emission Balance	Total:	958992.8 tCO2	

System Lifecycle Emissions Details:

Item	Modules	Supports
LCE	1713 kgCO2/kWp	2.97 kgCO2/kg
Quantity	50000 kWp	6579000 kg
Subtotal [kgCO2]	85636685	19527459



ANNEXURE - I
Module Data Sheet

Grid-Connected System: CO2 Balance

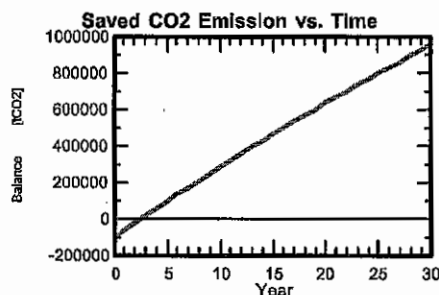
Project : Grid-Connected Project at Gharo_SGIS
Simulation variant : SAT JAI 380 Wp BP and SG Inv. 125kW OL 14% GCR 36% Ab-10% 0.6 with meteonorm
 Simulation for the 1st year of operation

Main system parameters		System type	Trackers single array, avec backtracking	
Near Shadings	According to strings		Electrical effect	100 %
PV Field Orientation	tracking, tilted axis, Axis Tilt	0°	Axis Azimuth	0°
PV modules	Model	JAM72D09-380/BP	Pnom	380 Wp
PV Array	Nb. of modules	131580	Pnom total	50000 kWp
Inverter	Model	SG125HV_US	Pnom	125 kW ac
Inverter pack	Nb. of units	352.0	Pnom total	44000 kW ac
User's needs	Unlimited load (grid)		Cos(Phi)	0.950 lagging

Produced Emissions	Total:	105164.14 tCO2		
	Source:	Detailed calculation from table below		
Replaced Emissions	Total:	1226460.0 tCO2		
	System production:	91869.67 MWh/yr	Lifetime:	30 years
			Annual Degradation:	1.0 %
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CO2 Emission Balance	Total:	958992.8 tCO2		

System Lifecycle Emissions Details:

Item	Modules	Supports
LCE	1713 kgCO2/kWp	2.97 kgCO2/kg
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Subtotal [kgCO2]	85636685	19527459



Harvest the Sunshine

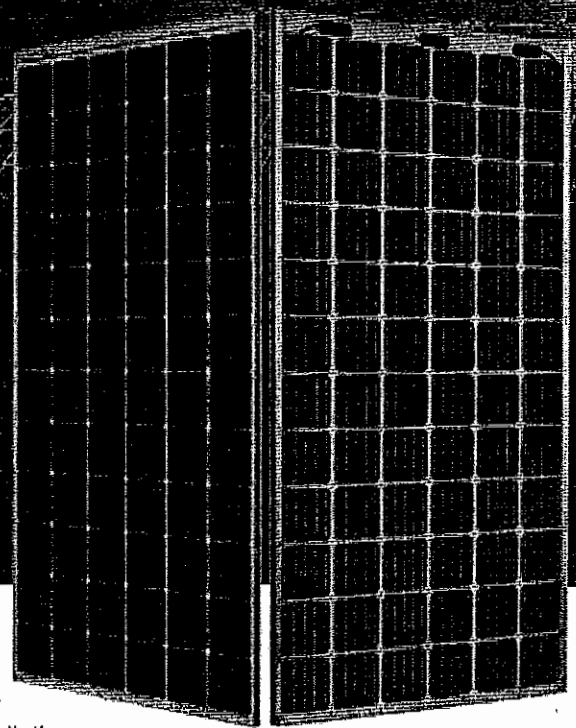
Mono

390W Bifacial Mono PERC Double Glass Module

JAM72D09 370-390/BP Series

Introduction

These double-glass modules assembled with bifacial PERCUM cells have the capability of converting lights incident on their rear side into electricity on top of what is being generated by the front side, making them the best-performed and the most cost-effective modules in terms of solar energy generation as well as tolerance for harsh environment and extreme weather conditions.



3%~15% more energy generation



framed design, ease of transportation and installation



Superior low irradiance performance

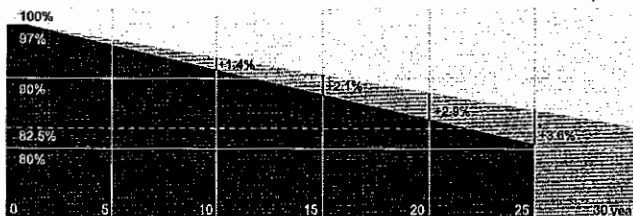


Excellent temperature dependent performance

Superior Warranty

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

0.5% Annual Degradation Over 30 years



■ Additional Value From 30-Year Warranty ■ JA Standard

Comprehensive Certificates

- IEC 61215, IEC 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- OHSAS 18001: 2007 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



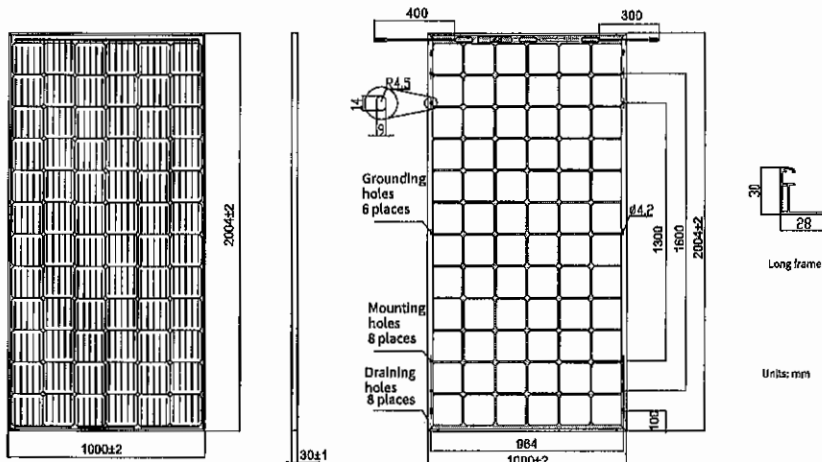
JA SOLAR

www.jasolar.com

Specifications subject to technical changes and tests.
JA Solar reserves the right of final interpretation.



MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono
Weight	29.8kg±3%
Dimensions	2004±2mm×1000±2mm×30±1mm
Cable Cross Section Size	4mm ²
No. of cells	72(6x12)
Junction Box	IP68, 3 diodes
Connector	QC 4.10-35
Packaging Configuration	34 Per Pallet

ELECTRICAL PARAMETERS AT STC

TYPE	JAM72D09 -370/BP	JAM72D09 -375/BP	JAM72D09 -380/BP	JAM72D09 -385/BP	JAM72D09 -390/BP
Rated Maximum Power(P _{max}) [W]	370	375	380	385	390
Open Circuit Voltage(V _{oc}) [V]	48.20	48.51	48.81	49.11	49.42
Maximum Power Voltage(V _{mp}) [V]	39.41	39.73	40.02	40.33	40.63
Short Circuit Current(I _{sc}) [A]	9.91	9.97	10.03	10.09	10.14
Maximum Power Current(I _{mp}) [A]	9.39	9.44	9.50	9.55	9.60
Module Efficiency [%]	18.5	18.7		19.2	19.5
Power Tolerance	0~+5W				
Temperature Coefficient of I _{sc} (α _{Isc})	+0.060%/°C				
Temperature Coefficient of V _{oc} (β _{Voc})	-0.300%/°C				
Temperature Coefficient of P _{max} (γ _{Pmp})	-0.370%/°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.
The efficiency of the bifacial PERC glass-glass modules at 200W/m² to that at 1000W/m² is 98%.

*Bifaciality=P_{max, rear}/Rated P_{max, front}

ELECTRICAL CHARACTERISTICS WITH DIFFERENT REAR SIDE POWER GAIN(REFERENCE TO 380W FRONT)

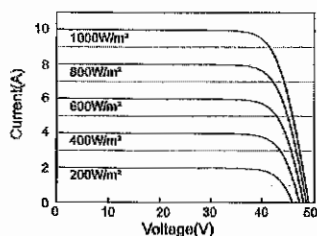
Backside Power Gain	5%	10%	15%	20%	25%
Rated Max Power(P _{max}) [W]	398	418	437	455	474
Open Circuit Voltage(V _{oc}) [V]	49.11	49.11	49.11	49.21	49.21
Max Power Voltage(V _{mp}) [V]	40.33	40.33	40.33	40.43	40.43
Short Circuit Current(I _{sc}) [A]	10.39	10.90	11.40	11.91	12.41
Max Power Current(I _{mp}) [A]	9.86	10.36	10.83	11.25	11.72

OPERATING CONDITIONS

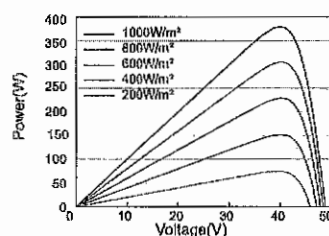
Maximum System Voltage	1500V DC(IEC)
Operating Temperature	-40°C~+85°C
Maximum Series Fuse	20A
Maximum Static Load, Front	5400Pa
Maximum Static Load, Back	2400Pa
NOCT	45±2°C
Bifaciality*	70%

CHARACTERISTICS

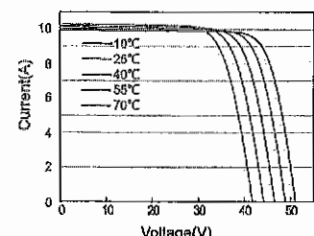
Current-Voltage Curve JAM72D09-380/BP



Power-Voltage Curve JAM72D09-380/BP



Current-Voltage Curve JAM72D09-380/BP



ANNEXURE - J

Original Generation License dated 17-07-2018



National Electric Power Regulatory Authority
Islamic Republic of Pakistan

NEPRA Tower, Attaturk Avenue (East), G-5/1, Islamabad.
Ph: +92-51-9206500, Fax: +92-51-2600026
Web: www.nepra.org.pk, E-mail: registrar@nepra.org.pk

Registrar

No. NEPRA/R/DL/LAG-415/11491-96

July 17, 2018

Mr. Musaddiq Rahim,
Company Secretary,
Gharo Solar (Private) Limited,
1485/C - 2A, Asad Jan Road,
Lahore Cantt.

Subject: Grant of Generation Licence No. SPGL/25/2018
Licence Application No. LAG-415
Gharo Solar (Private) Limited (GSPL)

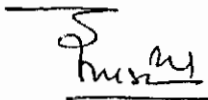
Reference: GSPL's application vide letter dated December 26, 2017 (received on December 29, 2017)

Enclosed please find herewith Generation Licence No. SPGL/25/2018 granted by National Electric Power Regulatory Authority (NEPRA) to Gharo Solar (Private) Limited (GSPL) for its 50.123 MW Solar Power Plant located at Deh Chairabad, Mirpur Sakro, District Thatta in the province of Sindh, pursuant to Section 14B of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 / Amendment Act, 2018. Further, the determination of the Authority in the subject matter is also attached.

2. Please quote above mentioned Generation Licence No. for future correspondence.

Enclosure: Generation Licence
(SPGL/25/2018)




17 07 18
(Syed Safer Hussain)

Copy to:

1. Chief Executive Officer, Alternative Energy Development Board (AEDB), 2nd Floor, OPF Building, G-5/2, Islamabad
2. Managing Director, NTDC, 414-WAPDA House, Lahore.
3. Chief Executive Officer, CPPA-G, ENERCON Building, Sector G-5/2, Islamabad.
4. Chief Executive Officer, Hyderabad Electric Supply Company Limited (HESCO), WAPDA Offices Complex, Hussainabad, Hyderabad
5. Director General, Environment Protection Department, Government of Sindh, Complex Plot No. ST-2/1, Korangi Industrial Area, Karachi.

National Electric Power Regulatory Authority
(NEPRA)

Determination of the Authority
in the Matter of Application of Gharo Solar (Pvt.) Limited for
the Grant of Generation Licence

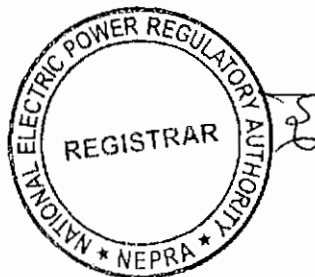
July ¹⁷, 2018
Case No. LAG-415

(A). Background

(i). K-Electric Limited (KEL) is providing electric power services in the metropolitan city of Karachi and its adjoining areas. In this regard, the Authority has granted three (03) separate licences to KEL for generation, transmission and distribution services.

(ii). In order to meet with its requirements, KEL has its own generation fleet of about 2267.00 MW and a few other public and private generation facilities/resources which are not sufficient to meet with the exponentially rising demand of the city of Karachi and its suburbs. In view of the said, KEL has planned addition of more generation capacity in its system through its own as well as other resources. In this regard, K-Electric has issued Letter of Intent (LOI) to Gharo Solar (Pvt.) Limited (GSPL), for setting up a 50.123 MWp generation facility/Solar Power Plant/Solar Farm to be located at Deh Ghairabad, Mirpur Sakro, District Thatta, in the province of Sindh.

(iii). Later on, GSPL executed a term sheet with KEL on November 10, 2016, and according to the terms and conditions of the said, carried out the feasibility study of the project through a reputable consultant. Thereafter, GSPL decided to approach the Authority for the grant of generation licence.



(B). Filing of Application

(i). GSPL submitted an application on December 29, 2017 for the grant of generation licence in terms of Section-15 of Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (the "NEPRA Act") read with the relevant provisions of the NEPRA Licensing (Application and Modification Procedure) Regulations, 1999 (the "Licensing Regulations").

(ii). The Registrar examined the submitted application to confirm its compliance with the Licensing Regulations and observed that the application lacked some of the required information/documentation. Accordingly, GSPL was directed for submitting the missing information/documentation and the same was received on January 15, 2018. The Authority considered the matter and found the form and content of the application in substantial compliance with Regulation-3 of the Licensing Regulations. Accordingly, the Authority admitted the application on January 24, 2018 for consideration of the grant of the generation licence as stipulated in Regulation-7 of the Licensing Regulations. The Authority also approved an advertisement to invite comments of general public, interested and affected persons in the matter as stipulated in Regulation-8 of the Licensing Regulations. Accordingly, notices were published in one (01) Urdu and one (01) English newspapers on January 27, 2018.

(iii). In addition to the above, the Authority also approved a list of stakeholders for seeking their comments for its assistance in terms of the Regulation-9(2) of the Licensing Regulations. Accordingly, letters were sent to the said stakeholders on January 29, 2018, soliciting their comments for assistance of the Authority.

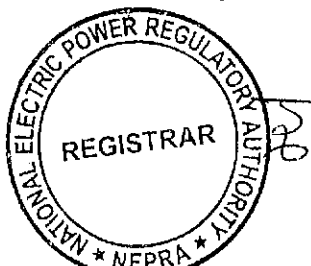
(C). Comments of Stakeholders

(i). In reply to the above, the Authority received comments from four (04) stakeholders. These included Engineering Development Board (EDB), K-Electric Limited (KEL), Pakistan Council of Renewable Energy



Technologies (PCoRET) and Ministry of Science & Technology (MoS&T). The salient points of the comments offered by the said stakeholders are summarized below: -

- (a). EDB remarked that all efforts should be made to utilize indigenous resources available for the execution of the project and supported the grant of generation licence to GSPL;
- (b). KEL commented that the project of GSPL is being setup exclusively for supplying power to it. In this regard, KEL stated that the Authority has already determined a tariff for the project on January 25, 2018. KEL supported the grant of Generation Licence to GSPL;
- (c). PCoRET submitted that installation of the proposed solar based generation facility will help to overcome the electricity shortfall in the rural areas of the province of Sindh. Therefore, the grant of generation licence to GSPL is supported. Further, PCoRET stated that it is providing consultancy services on design, development, system sizing and qualification of solar related equipment. In this regard, a solar testing lab has been setup in Islamabad therefore any testing, if required, can be performed at that lab to ensure quality and safety as per international standards which are mandatory to avoid sub-standard PV modules. In view of the said expertise, PCoRET may be involved in such projects; and
- (d). MoS&T commented that the solar power plant will help to overcome electricity shortfall in the country and



therefore MoS&T has no objection for grant of generation licence to GSPL.

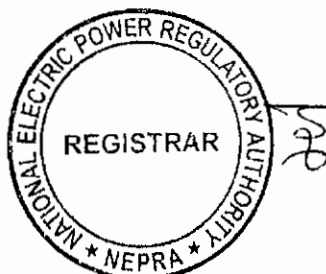
(ii). The Authority considered the above comments of the stakeholders and found the same supportive except to the observations of PCoRET and considered it appropriate seeking the perspective of GSPL. On the said, it was submitted that GSPL would deploy top of the line Tier-1 photovoltaic (PV) modules which are already type tested and do not require testing at the local level.

(iii). The Authority considered the above submissions of GSPL and found the same plausible and decided to proceed further in the matter as stipulated in the Licensing Regulations and NEPRA Licensing (Generation) Rules 2000 ("the Generation Rules").

(D). Evaluation/Findings

(i). The Authority has examined the submissions of GSPL including the information provided in its application for the grant of generation licence. The Authority has also considered the feasibility study of the project, the Grid Interconnection Study (GIS), and the relevant rules & regulations.

(ii). The Authority has observed that the sponsors of the project include an individual in the name of Mr. Rana Nasim Ahmed and two companies namely Windforce (Pvt.) Limited (WFPL) and Norsk Solar AS (NSAS). Mr. Rana Nasim Ahmed has extensive experience in the power sector being associated with JDW group in setting up 2 x 26.35 MW bagasse-based generation facilities and the same have been operational since June 12, 2014 & October 3, 2014 and have supplied approx. 13.8 million and 16.4 million units of electricity to the national grid respectively. Apart from the said, Mr. Nasim is the main sponsor of a solar based generation facility in the name of Harappa Solar having installed capacity of 18.00 MW, which has



successfully been commissioned on October 14, 2017. According to the financial statements, Mr. Nasim has net worth of 1.5 billion rupees.

(iii). WSPL is a pioneering Sri Lankan renewable energy (RE) generation company and has installed nine (09) wind and solar power plants of 90 MW cumulative capacity in Sri Lanka since 2010. It has expertise in in-house engineering and project management and owns & operates a portfolio of solar and small hydro projects. The shareholders of WSPL include several prominent business conglomerates of Sri Lanka. According to the financial statements, WSPL has assets of around 5.2 billion Sri Lankan rupees.

(iv). NSAS is a Norwegian developer and financier of solar PV parks with a long-term Build-Own-Operate strategy. The company is a subsidiary of the NV Group, which is the largest private sector developer of wind parks in Norway with a proven track record, expertise and network of established partners. The group has a portfolio of 700 MW RE projects across different countries. In view of the said, the Authority considers that the sponsors have strong financial and technical background to carry out the project.

(v). In order to implement the project, the sponsors incorporated a special purpose vehicle in the name of GSPL under Section-32 of the Companies Ordinance, 1984 (Corporate Universal Identification No. 0100523, dated June 30, 2016). The Registered/Business office of GSPL is located at 1485/C-2A, Asad Jan Road, Lahore Cantt. in the province of Punjab. According to the Memorandum of Association, the objects of the company, *inter alia*, include business of power generation and its sale thereof.

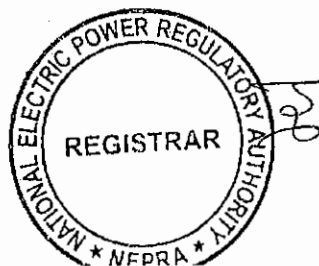
(vi). According to the submitted information, the total outlay of the project is approximately PKR 4,594.0 million which will be financed through a combination of debt (PKR 3,445.5 million) and equity (PKR 1148.5 million) in a ratio of 75:25 which is in line with the benchmark set out in the



determinations of the Authority in the matter. Further, the sponsors are in negotiation with United Bank Limited (UBL) for financing the debt portion of the project.

(vii). As explained in the preceding paragraphs, GSPL had carried out the feasibility study of the project. The review of the feasibility study reveals that GSPL aims to install polycrystalline solar PV modules with single axis trackers and central inverters. GSPL has proposed to consider 325Wp polycrystalline modules, from Tier-1 PV module manufacturers (Phono Solar or equivalent). It is pertinent to mention here that the Tier-1 ranking scale has been devised by Bloomberg New Energy Finance Corporation and is used to rank solar panel manufacturers in terms of their bankability or financial stability whereby it is considered that the solar products manufactured by Tier-1 ranked manufacturers are high in quality and reliability. Moreover, the single axis tracking technology proposed by GSPL is efficient and increases the energy yield of solar modules as much as 30% in comparison with the fixed axis solar modules. GSPL has proposed installation of 154,224 PV modules of 325Wp each making the installed capacity of the plant 50.123 MWp.

(viii). The Authority has observed that the sponsors of the project carried out the required GIS for dispersal of electric power from the proposed generation facility/Solar Power Plant/Solar Farm. According to the said study, the dispersal of electric power will be made at 132kV voltage. The required interconnection/dispersal arrangement of GSPL will be consisting of 132kV D/C transmission line (400 sq. mm, Copper conductor) of about 0.7 km length for making in-out from the planned Oursun Solar — Gharo circuit located near the generation facility/Solar Power Plant/Solar Farm of GSPL. In this regard, KEL has confirmed that the electric power from the proposed generation facility/Solar Power Plant/Solar Farm will not have any adverse effect on its system. Further, necessary arrangements for evacuation of electric power will be made available well before the Commercial Operations Date (COD) of the generation facility/Solar Power Plant/Solar Farm.



(ix). The Authority considers that the proposed project, for which generation licence is being sought, is based on RE source and does not cause pollution as in the case of conventional power plants. However, the Authority considers that the construction and operation of the generation facility/Solar Power Plant/Solar Farm may cause soil and noise pollution. In this regard, the Authority has observed that GSPL carried out the Initial Environmental Examination Study and submitted the same for consideration and approval of the Environmental Protection Agency, Government of Sindh (EPAGoS). The Authority is satisfied that EPAGoS has issued a No Objection Certificate (NOC) for the project.

(x). In terms of Rule-3 of the Generation Rules, the Authority may grant a generation licence to any person to engage in the generation business. The said rule stipulates various conditions pertaining to the grant of generation licence as explained in Rule-3(2), Rule-3(3), Rule-3(4) and Rule-3(5) of the Generation Rules. In this particular case, the Authority has observed that conditions of Rule-3(2) and Rule-3(3) stands satisfied as GSPL has provided details of location, technology, size, net capacity/energy yield, interconnection/dispersal arrangements, technical limits, technical functional specifications and other details specific to the generation facilities.

(xi). Further, Rule-3(5) of the Generation Rules stipulates that the Authority may refuse to issue a generation licence where the site, technology, design, fuel, tariff or other relevant matters pertaining to the generation facility proposed in an application for a generation licence are either not suitable on environmental grounds or do not satisfy the least cost option criteria. In this regard, Rule-3(5) of the Generation Rules also stipulates the conditions pertaining to least cost option criteria which include (a). sustainable development or optimum utilization of the renewable or non-renewable energy resources proposed for generation of electric power; (b). the availability of indigenous fuel and other resources; (c). the comparative costs of the construction, operation and maintenance of the proposed generation facility

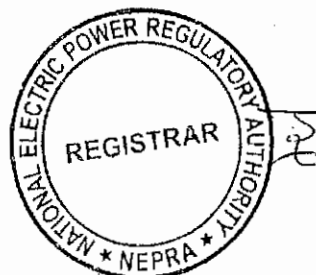


against the preferences indicated by the Authority; (d). the costs and right-of-way considerations related to the provision of transmission and interconnection facilities; (e). the constraints on the transmission system likely to result from the proposed generation facility and the costs of the transmission system expansion required to remove such constraints; (f). the short-term and the long-term forecasts for additional capacity requirements; (g). the tariff resulting or likely to result from the construction or operation of the proposed generation facility; and (h) the optimum utilization of various sites in the context of both the short-term and the long-term requirements of the electric power industry as a whole.

(xii). The Authority considers that the proposed project will result in optimum utilization of the RE resources which were earlier untapped, resulting in pollution free electric power. It is relevant to mention that solar is an indigenous resource and such resources have a preference for the energy security. Further, the Authority through its determination No. NEPRA/TRF-403/GSPL-2017/1190-1192 dated January 25, 2018 has awarded a levelized tariff of Rs. 5.8877/KWh to GSPL which is very competitive considering the overall energy mix of the country in general and that of KEL in particular.

(xiii). As explained in the preceding paragraphs, the sponsors of the project carried out the GIS which concludes that the project will not face any constraints in the transmission system. Further, being located in close proximity to the transmission system, the project will not result in cost and right-of-way issues for the provision of transmission and interconnection facilities. It is pertinent to mention here that KEL has included the project in its long-term forecasts for additional capacity requirements.

(xiv). In view of the above, the Authority is of the considered view that the project of GSPL fulfills the eligibility criteria for the grant of generation licence as stipulated in the NEPRA Act, the relevant rules and regulations and other applicable documents.



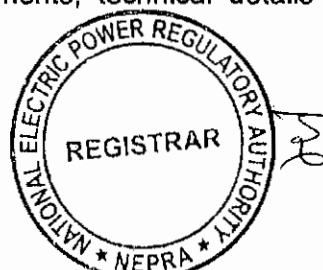
(E). Grant of Generation Licence

(i). The sustainable and affordable energy/electricity is a key prerequisite for socio-economic development of any country. In fact, the economic growth of a country is directly linked with the availability of safe, secure, reliable and cheaper supply of energy/electricity. In view of the said reasons, the Authority is of the considered opinion that for sustainable development, all indigenous power generation resources including RE must be developed on priority basis.

(ii). The existing energy mix of the country is heavily skewed towards thermal power plants, mainly operating on imported fossil fuel. The continuous import of fossil fuel not only creates pressure on the precious foreign exchange reserves of the country but is also an environmental concern. Therefore, in order to achieve sustainable development, it is imperative that RE resources are given priority for power generation and their development is encouraged. The Energy Security Action Plan 2005 approved by GoP, duly recognizes this very aspect of power generation through RE and envisages that at least 5% of total national power generation capacity (i.e. 9700 MW) is to be met through RE resources by 2030.

(iii). The Authority considers that the proposed project of GSPL is consistent with the provisions of Energy Security Action Plan 2005. The project will help in diversifying the energy portfolio of the country in general and that of KEL in particular. Further, not only will it enhance energy security of the country by reducing dependence on the imported fuel but also help in reducing carbon emissions by generating clean electricity, thus improving the environment.

(iv). As explained in the preceding paragraphs, GSPL has provided the details of location, technology, size, net capacity/energy yield, interconnection/dispersal arrangements, technical details and other related



information for the proposed generation facility/Solar Power Plant/Solar Farm. In this regard, the Authority has observed that the sponsors of the projects have purchased 168-acres of private land for the project. The said details have been incorporated in Schedule-I of the proposed generation licence. The Authority directs GSPL to utilize the land exclusively for the proposed generation facility/Solar Power Plant/Solar Farm and not to carry out any other generation activity on the said land without prior approval of the Authority.

(v). The term of a generation licence under Rule-5(1) of the Generation Rules is required to commensurate with the maximum expected life of the units comprised in a generating facility, except where an applicant for a generation licence consents to a shorter term. According to the information provided by GSPL, its generation facility/Solar Power Plant/Solar Farm will achieve COD by June 30, 2019 and will have a useful life of more than twenty-five (25) years from its COD. In this regard, GSPL has requested that the term of the proposed generation licence may be fixed as twenty-five (25) years. The Authority considers that said submission of GSPL about the useful life of the generation facility/Solar Power Plant/Solar Farm and the subsequent request to fix the term of the generation licence is consistent with international benchmarks, therefore, the Authority fixes the term of the generation licence as twenty-five (25) years from COD of the project.

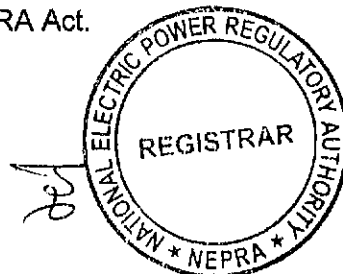
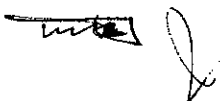
(vi). Regarding the tariff, it is hereby clarified that under Section-7(3)(a) of the NEPRA Act, determining tariff, rate and charges etc. is the sole prerogative of the Authority. In view of the said, the Authority through Article-6 of the generation licence directs GSPL to charge the power purchaser only such tariff which has been determined, approved or specified by the Authority. The Authority directs GSPL to adhere to the Article-6 of the generation licence in letter and spirit without any exception.



(vii). About compliance with the environmental standards, as discussed in the preceding paragraphs, GSPL has provided the NOC from EPAGoS and has confirmed that the project will comply with the required standards during the term of the generation licence. In view of the importance of the issue, the Authority has decided to include a separate article (i.e. Article-10) in the generation licence along with other terms and conditions making it obligatory for GSPL to comply with relevant environmental standards at all times. Further, the Authority directs GSPL to submit a report on a bi-annual basis, confirming that operation of its generation facility/Solar Power Plant/Solar Farm is in compliance with the required environmental standards as prescribed by the concerned environmental protection agency.

(viii). The proposed generation facility/Solar Power Plant/Solar Farm of GSPL will be using RE resource for generation of electric power. Therefore, the project may qualify for the carbon credits under the Kyoto Protocol. Under the said protocol, projects coming into operation up to the year 2020 can qualify for the carbon credits. GSPL has informed that the project will achieve COD by June 30, 2019, which is within the deadline of the Kyoto Protocol. In view of the said, an article (i.e. Article-14) for carbon credits and its sharing with the power purchaser has been included in the generation licence. Accordingly, the Authority directs GSPL to initiate the process in this regard at the earliest so that proceeds for the carbon credits are materialized. GSPL shall be required to share the proceeds of the carbon credits with the power purchaser as stipulated in Article-14 of the generation licence.

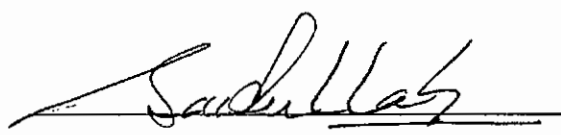
(ix). The Authority observes that GSPL applied for the grant of generation licence in terms of Section-15 of the NEPRA Act. However, NEPRA Act has been amended through Regulation of Generation, Transmission and Distribution of Electric Power (Amendment) Act, 2018 and Section-15 has been replaced with a new section i.e. Section-14B to provide for the grant of generation licences, therefore, the generation licence is being granted under Section-14B of the NEPRA Act.



(x). In view of the above, the Authority hereby approves the grant of generation licence to GSPL on the terms and conditions set out in the generation licence annexed to this determination. The grant of generation licence will be subject to the provisions contained in the NEPRA Act, the relevant rules & regulations framed thereunder and other applicable documents.

Authority:


Saif Ullah Chattha
(Member)


11.7.2018

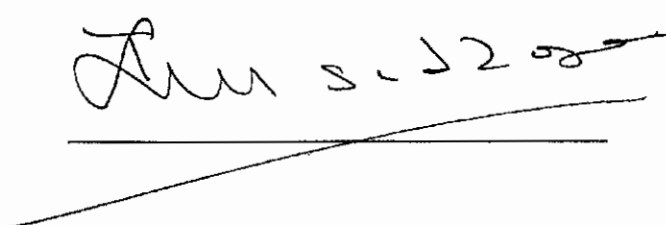
Himayat Ullah Khan
(Member)


13.7.18

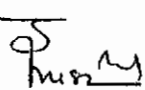
Rehmatullah
(Member/Vice Chairman)


10/07/18

Tariq Saddozai
(Chairman)


17.7.2018




17.07.18

**National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan**

GENERATION LICENCE

No. SPGL/25/2018

In exercise of the powers conferred upon the National Electric Power Regulatory Authority (NEPRA) under Section 14B of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997/Amendment Act, 2018, the Authority hereby grants a Generation Licence to:

GHARO SOLAR (PVT.) LIMITED

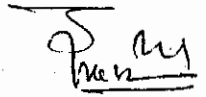
Incorporated under Section 32 of the Companies Ordinance, 1984 (XLVII of 1984) having Corporate Universal Identification No. 0100523, Dated June 30, 2016

**for its Generation Facility/Solar Power Plant/Solar Farm
Located at Deh Ghairabad, Mirpur Sakro, District Thatta,
in the Province of Sindh**

(Installed Capacity: 50.123 MW Gross ISO)

to engage in generation business subject to and in accordance with the Articles of this Licence.

Given under my hand on 17th day of July Two Thousand & Eighteen and expires on 29th day of June Two Thousand & Forty-Four


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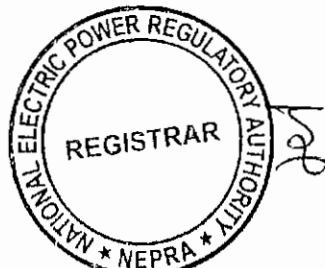
Registrar



Article-1
Definitions

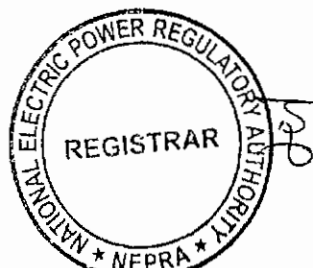
1.1 In this licence

- (a).** "Act" means the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 as amended or replaced from time to time;
- (b).** "Applicable Documents" mean the Act, the rules and regulations framed by the Authority under the Act, any documents or instruments issued or determinations made by the Authority under any of the foregoing or pursuant to the exercise of its powers under the Act, the Grid Code, the applicable Distribution Code, if any, or the documents or instruments made by the Licensee pursuant to its generation licence, in each case of a binding nature applicable to the Licensee or, where applicable, to its affiliates and to which the Licensee or any of its affiliates may be subject;
- (c).** "Applicable Law" means the Act, relevant rules and regulations made there under and all the Applicable Documents;
- (d).** "Authority" means the National Electric Power Regulatory Authority constituted under Section-3 of the Act;
- (e).** "Bus Bar" means a system of conductors in the generation facility/Solar Power Plant/Solar Farm of the Licensee on which the electric power from all the photovoltaic cells is collected for supplying to the Power Purchaser;
- (f).** "Carbon Credits" mean the amount of Carbon Dioxide (CO₂)



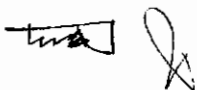
and other greenhouse gases not produced as a result of generation of electric energy by the generation facility/Solar Power Plant/Solar Farm and other environmental air quality credits and related emissions reduction credits or benefits (economic or otherwise) related to the generation of electric energy by the generation facility/Solar Power Plant/Solar Farm, which are available or can be obtained in relation to the generation facility/Solar Power Plant/Solar Farm after the COD;

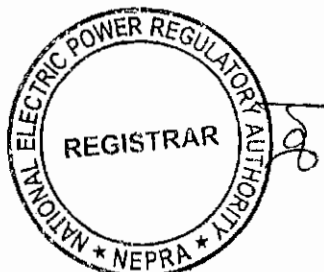
- (g). "Commercial Operations Date (COD)" means the day immediately following the date on which the generation facility/Solar Power Plant/Solar Farm of the Licensee is commissioned;
- (h). "Commissioning" means the undertaking of the Commissioning Tests of the generation facility/Solar Power Plant/Solar Farm as stipulated in the EPA;
- (i). "Commissioning Tests" means the tests to be carried out pursuant to provisions of EPA;
- (j). "Distribution Code" means the distribution code prepared by the concerned distribution company i.e. KEL and approved by the Authority, as it may be revised from time to time with necessary approval of the Authority;
- (k). "Energy Purchase Agreement (EPA)" means the energy purchase agreement, entered or to be entered into by and between the Power Purchaser and the Licensee, for the purchase and sale of electric energy generated by the



generation facility/Solar Power Plant/Solar Farm, as may be amended by the parties thereto from time to time;

- (l). "Generation Rules" mean the National Electric Power Regulatory Authority Licensing (Generation) Rules, 2000 as amended or replaced from time to time;
- (m). "Grid Code" means the grid code prepared by NTDC and approved by the Authority, as it may be revised from time to time by NTDC with necessary approval by the Authority;
- (n). "IEC" means "the International Electrotechnical Commission or its successors or permitted assigns;
- (o). "IEEE" means the Institute of Electrical and Electronics Engineers or its successors or permitted assigns;
- (p). "Licensee" means Gharo Solar (Pvt.) Limited or its successors or permitted assigns;
- (q). "Licensing Regulations" mean the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations, 1999 as amended or replaced from time to time;
- (r). "KEL" means K-Electric Limited or its successors or permitted assigns as a Power Purchaser;
- (s). "Net Delivered Energy" means the net electric energy expressed in kWh generated by the generation facility/Solar Power





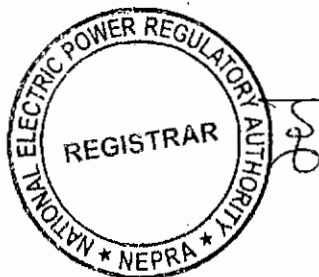
Plant/Solar Farm of the Licensee at its outgoing Bus Bar and delivered to the Power Purchaser;

- (t). "NTDC" means National Transmission and Despatch Company Limited or its successors or permitted assigns;
- (u). "Policy" means the "Policy for Development of Renewable Energy for Power Generation, 2006" of GoP as amended from time to time;
- (v). "Power Purchaser" means KEL which will be purchasing electric energy from the Licensee; pursuant to the EPA for procurement of electric energy;
- (w). "SCADA System" means the supervisory control and data acquisition system for gathering of data in real time from remote locations to control equipment and conditions;
- (x). "Solar Farm" means "a cluster of photovoltaic cells in the same location used for production of electric power";

1.2 The words and expressions used but not defined herein bear the meaning given thereto in the Act or Generation Rules and Licensing Regulations issued under the Act.

Article-2 **Applicability of Law**

This licence is issued subject to the provisions of the Applicable Law, as amended from time to time.



Article-3
Generation Facilities

3.1 The location, size (capacity in MW), technology, interconnection arrangements, technical limits, technical functional specifications and other details specific to the generation facility/Solar Power Plant/Solar Farm of the Licensee are set out in Schedule-I of this licence.

3.2 The net capacity/Net Delivered Energy of the generation facility/Solar Power Plant/Solar Farm of the Licensee is set out in Schedule-II of this licence. The Licensee shall provide the final arrangement, technical and financial specifications and other specific details pertaining to its generation facility/Solar Power Plant/Solar Farm before its COD.

Article-4
Term of Licence

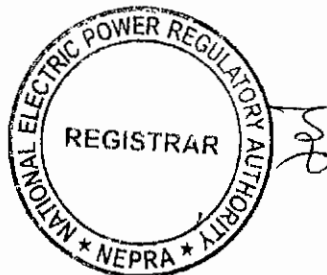
This licence shall become effective from the date of its issuance. The term of licence shall be twenty-five (25) years comprising useful life of the generation facility (s) from its COD, subject to the provisions of Section-14B of the Act. Unless suspended or revoked or licence ceases to have effect, the Licensee may apply for renewal of its licence in terms of Generation Rules read with the Licensing Regulations

Article-5
Licence fee

The Licensee shall pay to the Authority the licence fee as stipulated in the National Electric Power Regulatory Authority (Fees) Rules, 2002 as amended or replaced from time to time.

Article-6
Tariff

The Licensee shall charge only such tariff from the Power Purchaser which has been determined, approved or specified by the Authority.



Article-7
Competitive Trading Arrangement

7.1 The Licensee shall participate in such manner as may be directed by the Authority from time to time for development of a Competitive Trading Arrangement. The Licensee shall in good faith work towards implementation and operation of the aforesaid Competitive Trading Arrangement in the manner and time period specified by the Authority. Provided that any such participation shall be subject to any contract entered into between the Licensee and another party with the approval of the Authority.

7.2 Any variation or modification in the above-mentioned contracts for allowing the parties thereto to participate wholly or partially in the Competitive Trading Arrangement shall be subject to mutual agreement of the parties thereto and such terms and conditions as may be approved by the Authority.

Article-8
Maintenance of Records

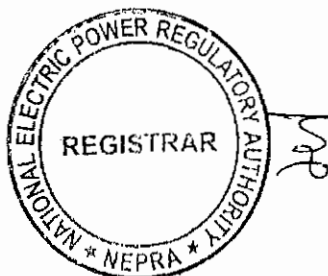
For the purpose of sub-rule (1) of Rule-19 of the Generation Rules, copies of records and data shall be retained in standard and electronic form and all such records and data shall, subject to just claims of confidentiality, be accessible by authorized officers of the Authority.

Article-9
Compliance with Performance Standards

The Licensee shall comply with the relevant provisions of the National Electric Power Regulatory Authority Performance Standards (Generation) Rules 2009 as amended or replaced from time to time.

Article-10
Compliance with Environmental & Safety Standards

10.1 The generation facility/Solar Power Plant/Solar Farm of the Licensee



shall comply with the environmental and safety standards as may be prescribed by the relevant competent authority from time to time.

10.2 The Licensee shall provide a certificate on a bi-annual basis, confirming that the operation of its generation facility/Solar Power Plant/Solar Farm is in conformity with required environmental standards as prescribed by the relevant competent authority.

Article-11
Power off take Point and Voltage

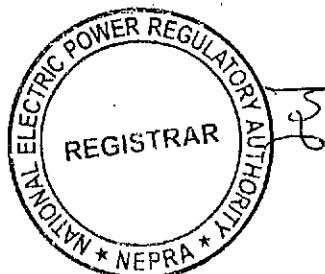
The Licensee shall deliver the electric energy to the Power Purchaser at the outgoing Bus Bar of its generation facility/Solar Power Plant/Solar Farm. The Licensee shall be responsible for the up-gradation (step up) of generation voltage up to the required dispersal voltage level.

Article-12
Performance Data

12.1 The Licensee shall install properly calibrated automatic computerized solar radiation recording device(s) at its generation facility/Solar Power Plant/Solar Farm for recording of the solar radiation data.

12.2 The Licensee shall install SCADA System or compatible communication system at its generation facility/Solar Power Plant/Solar Farm as well as at the side of the Power Purchaser.

12.3 The Licensee shall transmit the solar radiation data and power output data of its generation facility/Solar Power Plant/Solar Farm to the control room of the Power Purchaser.



Article-13
Provision of Information

In accordance with provisions of Section-44 of the Act, the Licensee shall be obligated to provide the required information in any form as desired by the Authority without any exception.

Article-14
Emissions Trading /Carbon Credits

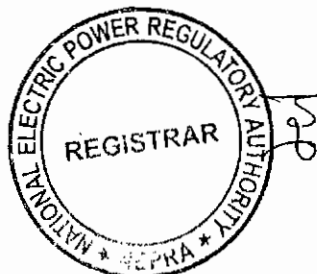
The Licensee shall process and obtain expeditiously the Carbon Credits admissible to the generation facility/Solar Power Plant/Solar Farm. The Licensee shall share the said proceeds with the Power Purchaser as per the Policy.

Article-15
Design & Manufacturing Standards

The photovoltaic cells and other associated equipment of the generation facility/Solar Power Plant/Solar Farm shall be designed, manufactured and tested according to the latest IEC, IEEE standards or any other equivalent standard in the matter. All the plant and equipment of the generation facility/Solar Power Plant/Solar Farm shall be unused and brand new.

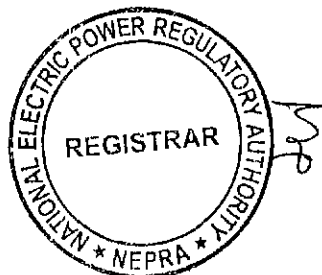
Article-16
Power Curve

The power curve for the individual solar photovoltaic cells provided by the manufacturer and as mentioned in Schedule-I of this generation licence, shall form the basis in determining the cumulative power curve of the generation facility/Solar Power Plant/Solar Farm.

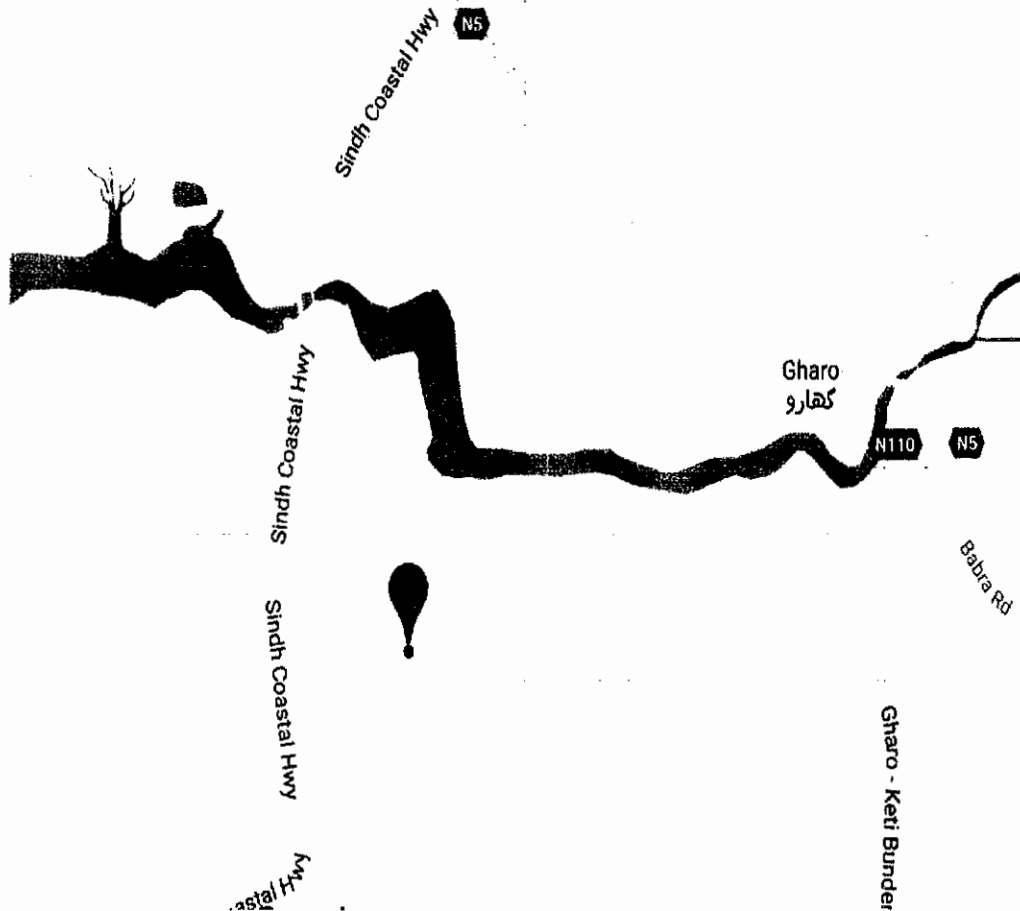


SCHEDULE-I

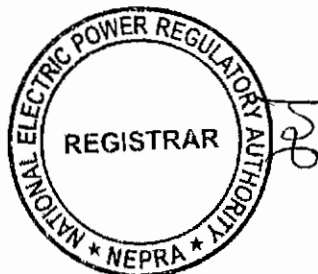
The Location, Size (i.e. Capacity in MW), Type of Technology, Interconnection Arrangements, Technical Limits, Technical/ Functional Specifications and other details specific to the Generation Facilities of the Licensee are described in this Schedule.



**Location of the
Generation Facility/Solar Power Plant/Solar Farm
of the Licensee**



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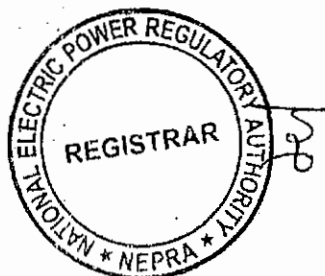
**Location of the
Generation Facility/Solar Power Plant/Solar Farm
of the Licensee**



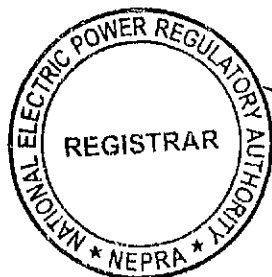
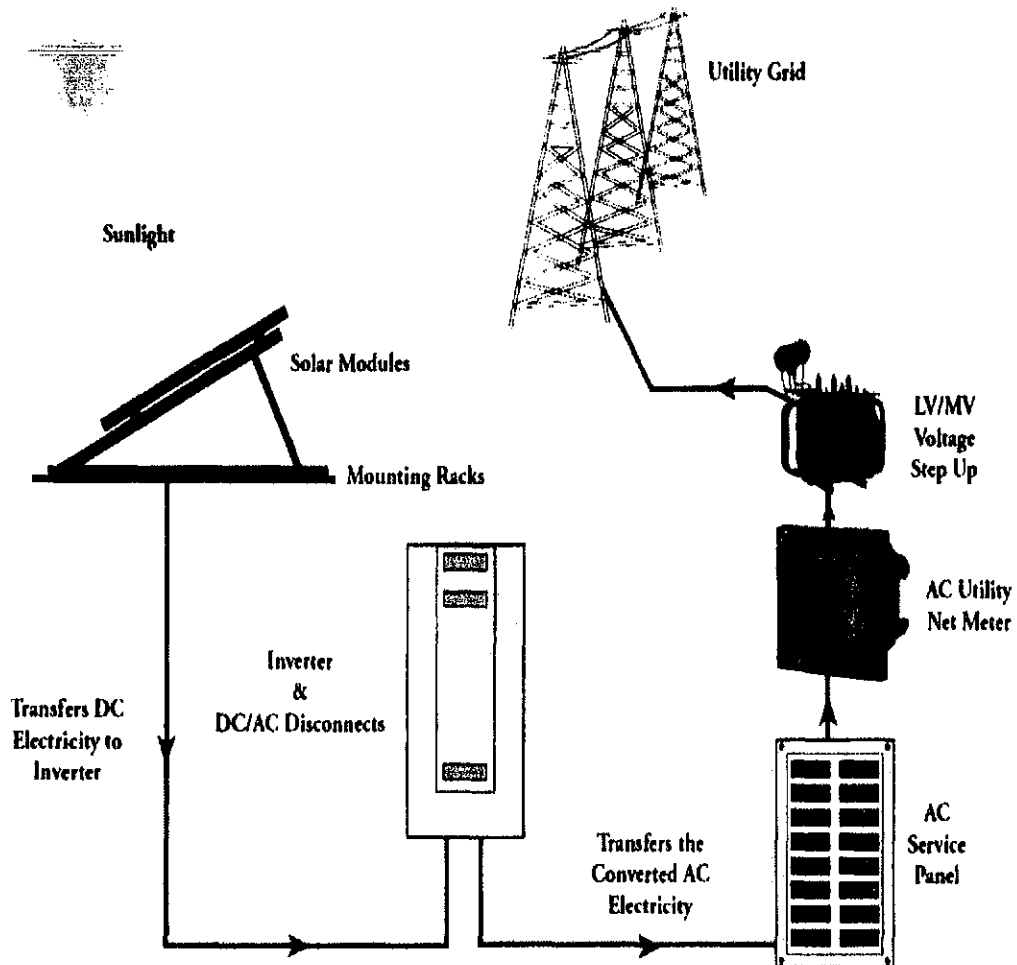
Project Land Coordinates

North	East
24°43'18.70"	67°33'6.83"


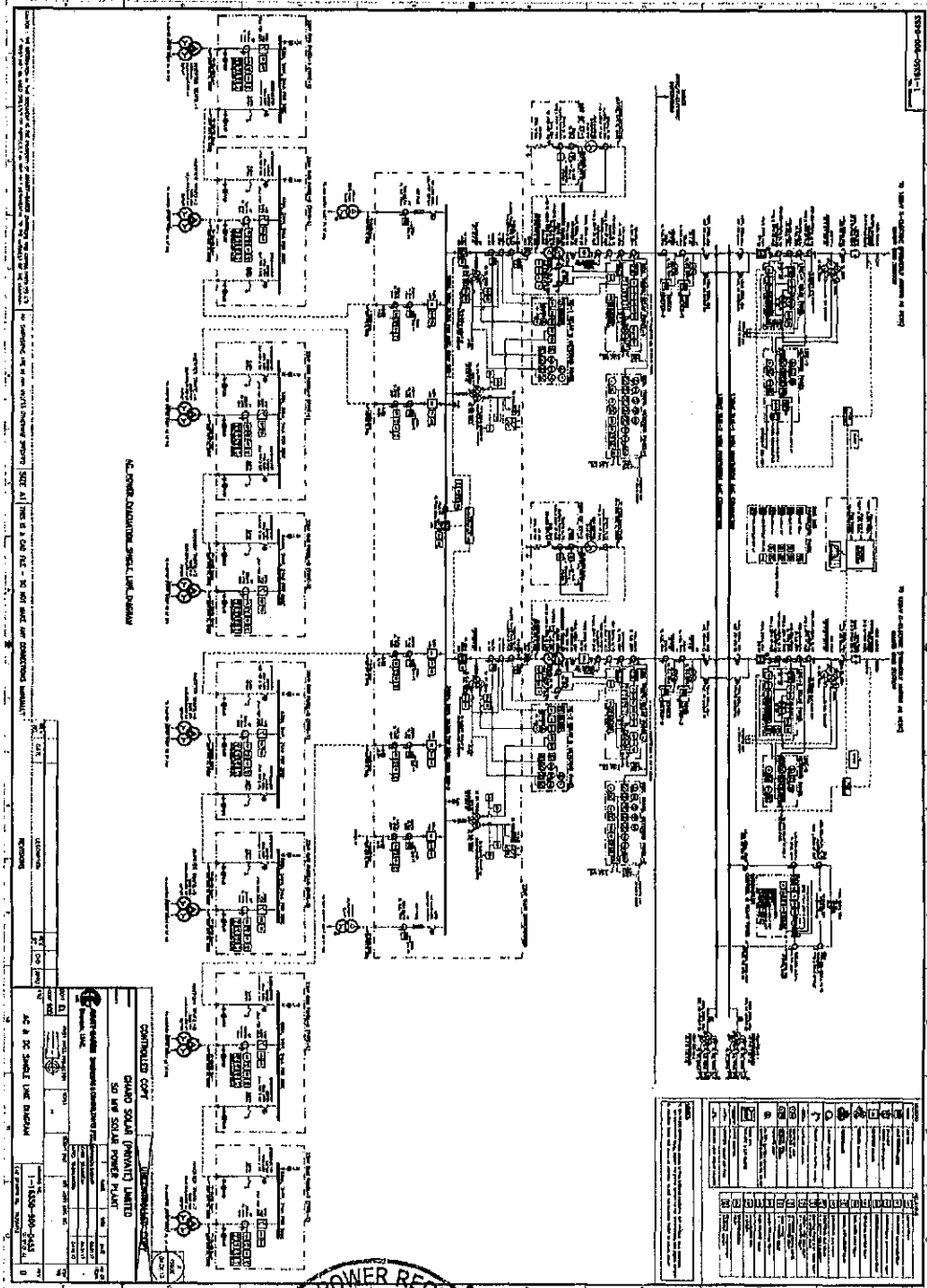




Process Flow Diagram
of the Generation Facility/Solar Power Plant/Solar Farm
of the Licensee



Single Line Diagram
of the Generation Facility/Solar Power Plant/Solar Farm
of the Licensee



A circular stamp from the National Electric Power Regulatory Authority (NEPRA). The outer ring contains the text "NATIONAL ELECTRIC POWER REGULATORY AUTHORITY" and the center contains the word "REGISTRAR".



**Interconnection Arrangement/Transmission Facilities
for Dispersal of Power from the Generation Facility/Solar
Power Plant/Solar Farm of the Licensee**

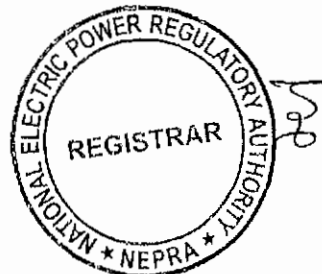
The electric power generated from the generation facility/Solar Power Plant/Solar Farm of GSPL shall be dispersed to the load center of K-Electric Limited (KEL).

(2). The proposed Interconnection Arrangement-IA/Transmission Facility-TF for dispersal of electric power from the generation facility/Solar Power Plant/Solar Farm of GSPL comprises the following: -

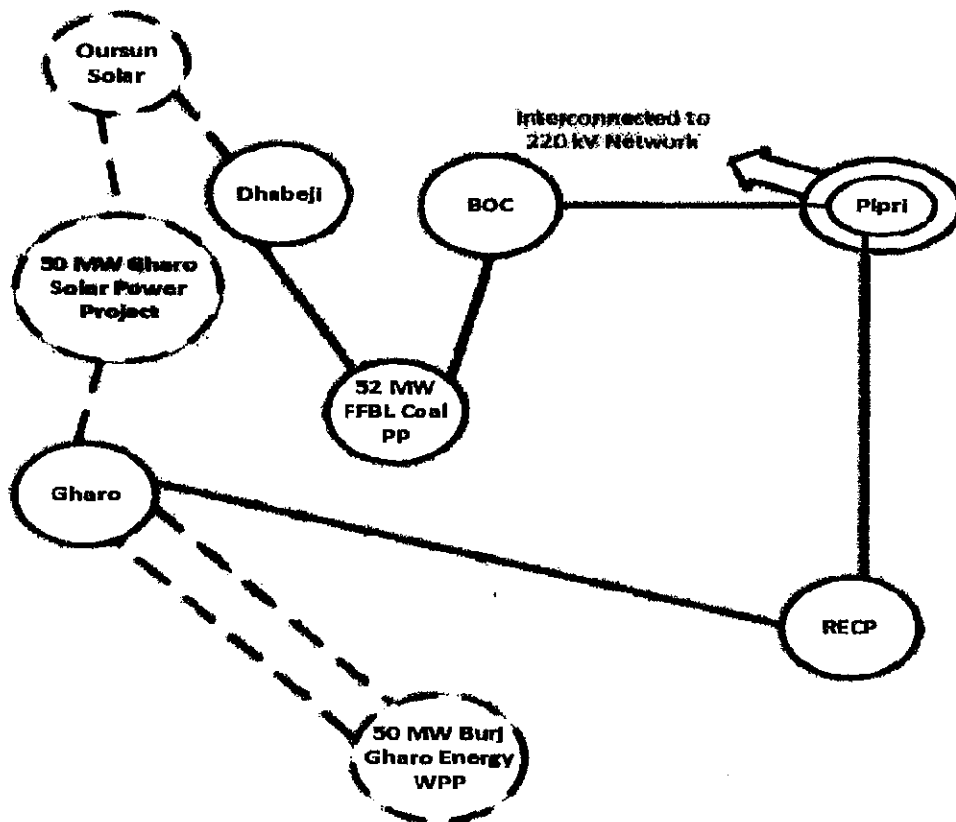
132 kV double circuit transmission line (400 sq. mm, Copper conductor) of about 0.7 km length for making in-out from the planned Oursun Solar – Gharo circuit located near the generation facility/Solar Power Plant/Solar Farm of GSPL.

(3). Any change in the above IA/TF, duly agreed by GSPL and KEL, shall be communicated to the Authority in due course of time.

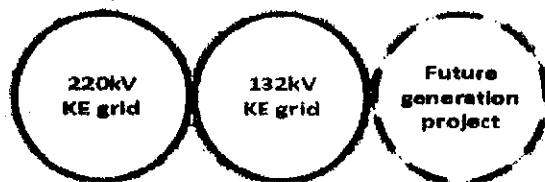
 



**Schematic Diagram for Dispersal of
 Electric Energy/Power from the Generation Facility/
 Solar Power Plant/Solar Farm**



LEGEND

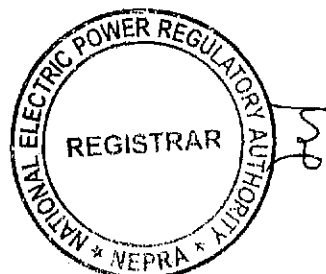


Existing Circuits —————

Proposed lines in and for 50 MW Ghara Solar Project - - - - -

Proposed sites for other power projects

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Details of
Generation Facility/Solar Power Plant/
Solar Farm

(A). General Information

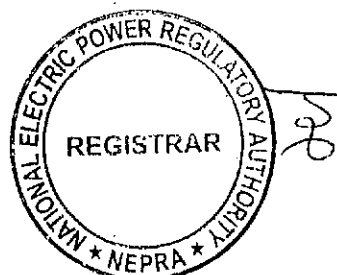
(i).	Name of the Company/Licensee	Gharo Solar (Pvt.) Limited
(ii).	Registered/ Business office of the Company/Licensee	1485/C-2A, Asad Jan Road, Lahore Cantt.
(iii).	Location of the generation facility Solar Power Plant/ Solar Farm	The proposed plant is located at Deh Ghairabad, Mirpur Sakro, District Thatta, in the province of Sindh
(iv).	Type of the generation facility/ Solar Power Plant/ Solar Farm	Photovoltaic (PV) based Solar Power Plant

(B). Solar Power Generation Technology & Capacity

(i).	Type of Technology	PV system with single-axis tracking
(ii).	System Type	Grid Connected
(iii).	Installed Capacity of the generation facility Solar Power Plant/ Solar Farm (MW)	50.123 MWp

(C). Technical Details of Equipment

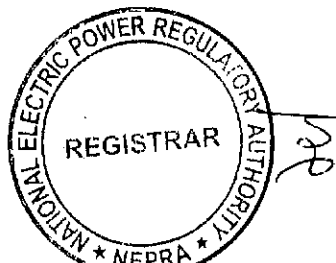
(a).	Solar Panels – PV Modules	
(i).	Type of Module	325Wp – Mono Solar or equivalent
(ii).	Type of Cell	Poly Crystalline



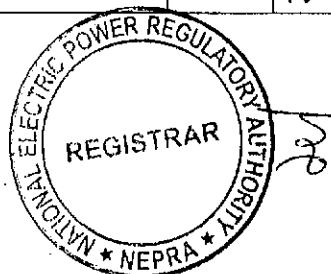
(iii).	Dimension of each Module	1956mmx992mm
(iv).	No. of Panels /Modules	154,224 Nos of 325Wp each corresponding to 50.123 MWp
(v).	Module Area	1.94 m ²
(vi).	Frame of Panel	Anodised Aluminium Alloy
(vii).	Weight of one Module	24 kgs.
(viii).	No of Solar Cells in each module	72 Cells
(ix).	Efficiency of module	16.70%
(x).	Maximum Power (P _{max})	325 W
(xi).	Voltage @ P _{max}	37.4V
(xii).	Current @ P _{max}	8.69A
(xiii).	Open circuit voltage (V _{oc})	46.5V
(xiv).	Short circuit current (I _{sc})	8.99A
(xv).	Maximum system open Circuit Voltage	1000V DC
(b).	PV Array	
(i).	Nos. of Strings	366/368 Strings per inverter
(ii).	Modules in a string	21 Nos



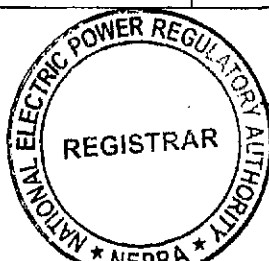
(c).	Inverters		
(i).	Capacity of each unit	2500KW	
(ii).	Manufacturer	Sungrow	
(iii).	Input Operating Voltage Range	1000V	
(iv).	Number of Inverters	Up to 20 Nos	
(v).	Efficiency of inverter	99.0% / 98.7% (Euro Efficiency)	
(vi).	Max. Allowable Input voltage	520-540V	
(vii).	Max. Current	4880 A	
(viii).	Max. Power Point Tracking Range	520-850V	
(ix).	Output electrical system	2500kW @ 50 Deg C	
(x).	Rated Output Voltage	360V	
(xi).	Power Factor (adjustable)	Adjustable >0.99 (at nominal power)	
(xii).	Power control	Three Phase Control	
(xiii).	Rated Frequency	50 Hz	
(xiv).	Environmental Enclosures	Relative Humidity	0~95%, non-condensing
		Audible Noise	< 55 dB(A)
		Operating Elevation	4500m (>3000m derating)



		Operating temperature	-35°C~+60°C
(xv).	Grid Operating protection	A	Ground Fault monitoring
		B	Grid monitoring
		C	Insulation monitoring
		D	DC reverse polarity
		E	AC & DC short circuit and over current
		F	AC & DC overvoltage and temperature
		G	Overheat protection
(d).	Junction Boxes Installed and fixed on main steel structure in Array yard.		
(i).	Number of J/Box units	23 SCBs per inverter & 368 Nos of SCB in total	
(ii).	Input circuits in each box	20 Inputs	
(iii).	Max. input current for each circuit	15A	
(iv).	Protection Level	IP 65	
(v).	Over current protection	Over Current and Short Circuit Protection available	
(vi).	Surge protection	Available in both AC & DC sides	
(e).	Data Collecting System		
(i).	Weather Data	(a).	Global horizontal irradiation pyranometer



		(b).	Tracking irradiation pyranometer
		(c).	Ambient Air Temperature Sensor
		(d).	PV Panel Temperature Sensor
		(e).	Anemometer
		(f).	Relative Humidity
		(g).	Rain Gauge
(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)
(f).	Power Transformer		
(i).	Rating	35/45 MVA	
(ii).	Type of transformer	Power Transformer - ONAN (Oil Natural Air Natural)	
(iii).	Purpose of transformer	Step-up (22 kV/132 kV)	
(iv).	Output Voltage	132 kV	



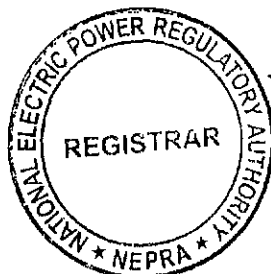
(g).	Unit Transformer	
(i).	Rating	5500kVA
(ii).	Type of transformer	Inverter Duty Transformer - ONAN (Oil Natural Air Natural)
(iii).	Purpose of transformer	Step-up (0.36kV/22kV)
(iv).	Output Voltage	22 kV

(D). Other Details

(i).	Expected COD of the generation facility Solar Power Plant/Solar Farm	June 30, 2019
(ii).	Expected useful Life of the generation facility Solar Power Plant/ Solar Farm from the COD	25 years

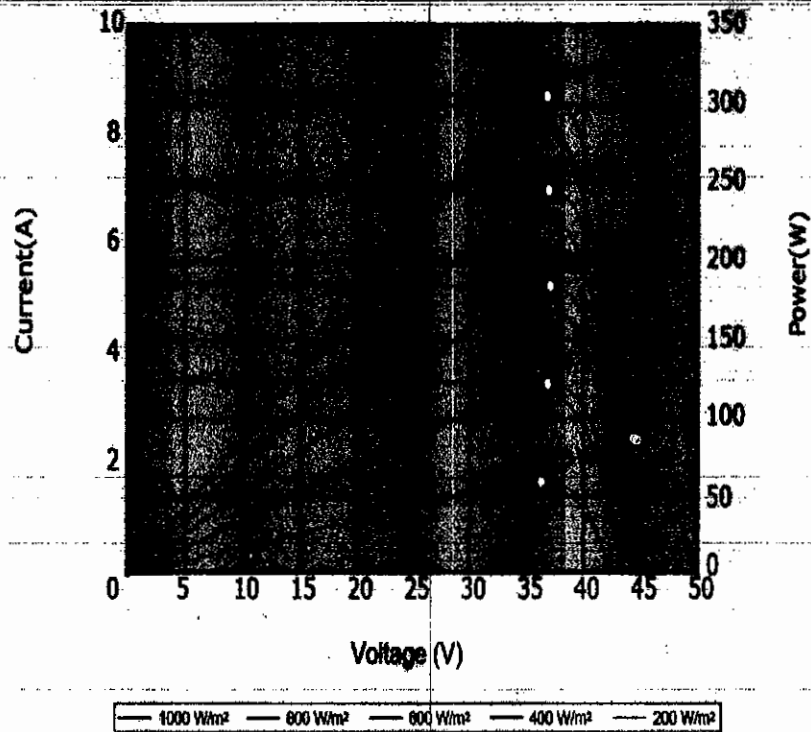




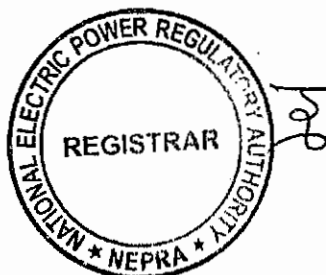


V-I Curve of Solar Cell

Current-Voltage & Power-Voltage Curve (AM1.5, Cell Temperature 25°C)

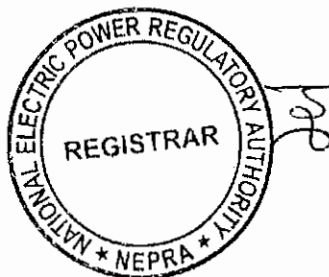




SCHEDULE-II

The Total Installed Gross ISO Capacity of the Generation Facility/Power Plant/Solar Plant (MW), Total Annual Full Load (Hours), Average Sun Availability, Total Gross Generation of the Generation Facility/Solar Farm (in kWh), Annual Energy Generation (25 years Equivalent Net Annual Production-AEP) KWh and Net Capacity Factor of the Generation Facility/Solar Farm of Licensee are given in this Schedule.

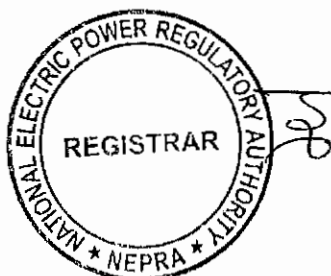


SCHEDULE-II

(1).	Total Installed Capacity of the Generation Facility/Solar Power Plant/Solar Farm	50.123 MW
(2).	No. of days per year	365
(3).	Annual generating capacity of Generation Facility/Solar Power Plant/Solar Farm (As Per Simulation)	90,011 MWh
(4).	Total expected generation of the Generation Facility/Solar Power Plant/Solar Farm during the twenty-five (25) years term of this licence	2,250,275 MWh
(5).	Annual generation of Generation Facility/Solar Power Plant/Solar Farm based on 24 hours working	439,078 MWh
(6).	Net Capacity Factor of Generation Facility/Solar Power Plant/Solar Farm	20.50%

Note:

All the above figures are indicative as provided by the Licensee. The Net Delivered Energy available to Power Purchaser for dispatch will be determined through procedures contained in the Energy Purchase Agreement (EPA) or the Applicable Document(s).

ANNEXURE - K

Tariff Determination dated 25-01-2018



National Electric Power Regulatory Authority
Islamic Republic of Pakistan

NEPRA Tower, Attaturk Avenue (East), G-5/1, Islamabad
Ph: +92-51-9206500, Fax: +92-51-2600026
Web: www.nepra.org.pk, E-mail: registrar@nepra.org.pk

No. NEPRA/TRF-403/GSPL-2017/1190-1192

January 25, 2018

Subject: Determination of National Electric Power Regulatory Authority in the matter of Tariff Petition filed by M/s. Gharo Solar (Pvt.) Limited for Determination of Reference Generation Tariff in respect of 50 MWp Solar Power Project (Case No. NEPRA/TRF-403/GSPL-2017)

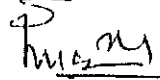
Dear Sir,

Please find enclosed herewith the subject Determination of the Authority along with Annex-I & II (24 pages) in Case No. NEPRA/TRF-403/GSPL-2017.

2. The Determination is being intimated to the Federal Government for the purpose of notification in the official gazette pursuant to Section 31(4) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

3. Order of the Authority along with Annex-I & II of the Determination needs to be notified in the official Gazette.

Enclosure: As above


25 01 18
(Syed Safer Hussain)

Secretary
Ministry of Energy
'A' Block, Pak Secretariat
Islamabad

CC:

1. Secretary, Cabinet Division, Cabinet Secretariat, Islamabad.
2. Secretary, Ministry of Finance, 'Q' Block, Pak Secretariat, Islamabad.



**DETERMINATION OF NATIONAL ELECTRIC POWER REGULATORY AUTHORITY IN THE MATTER
OF TARIFF PETITION FILED BY M/S GHARO SOLAR (PRIVATE) LIMITED FOR DETERMINATION
OF REFERENCE GENERATION TARIFF IN RESPECT OF 50 MWp SOLAR POWER PROJECT**

1. M/s Gharo Solar (Pvt.) Ltd. (hereinafter referred to as the "GSPL" or "the petitioner/company") filed a tariff petition before National Electric Power Regulatory Authority ("NEPRA/the Authority") on July 28, 2017 for determination of reference generation tariff in respect of its 50 MWp solar power project to be set up at Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh under NEPRA (Tariff Standards and Procedure) Rules, 1998 ("Tariff Rules").
2. The petitioner submitted that it is a special purpose company incorporated at Securities and Exchange Commission of Pakistan (SECP) for setting up, owning and operating the subject solar PV project.
3. Summary of the key information provided in the tariff petition is as follows:

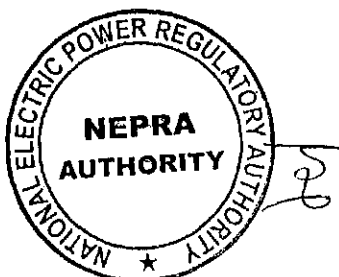
Project company	Gharo Solar (Private) Limited.
Sponsor	Rana Nasim Ahmed (COO JDW Sugar Mills Ltd.) Windforce (Private) Limited
Capacity	50 MWp
Project location	Deh Ghairabad, Mirpur Sakro, District Thatta, Sindh
Concession period	25 years from COD
Purchaser	K-Electric Limited
Capacity Factor	20.50%
EPC contractor	Self EPC mode by GSPL
Project basis	BOO
Project cost	USD (Million)/MW
EPC cost	0.7500
Degradation	0.0270
Adjusted EPC Cost	0.7770
Project Development Land Cost	0.0605



Pre-COD Insurance cost	Included in EPC cost figure	
Financing fees & Charges	0.0186	
Interest during construction	0.0189	
Total project cost	0.875	
Financing structure	Debt: 75% Equity: 25%	
Debt composition	100% Foreign	
Interest rate	3 month LIBOR of 1.22% + 4.5%	
Debt repayment term	13 years	
Grace period	1 year	
Repayment basis	Quarterly	
Return on equity	17% (IRR based)	
Operations cost including Insurance	USD 24,000/ MW/Year	
Tariff:	PKR/kWh	US Cents/kWh
Year (1-13)	7.910	6.663
Year (14-25)	3.706	3.5295
Levelized Tariff	6.996	6.663
Exchange rate	1 USD = 105 PKR	

PROCEEDINGS

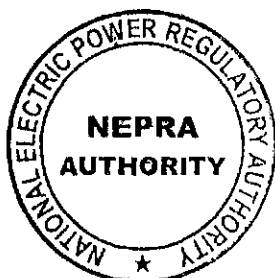
4. In accordance with Rule 4 of Tariff Rules, the tariff petition was admitted by the Authority on August 23, 2017. Notice of admission was published in the daily national newspapers on 16th and 19th September, 2017 providing salient features of the petition and inviting comments/intervention request from the interested parties. In response to notice of Admission, intervention requests were received from Whistleblower Pakistan (WBP) and Mr. Muhammad Arif Bilvani, which were approved by the Authority. Further, comments were received from K-Electric Limited (KE) and Chaudhary Mazhar Ali. The submissions of interveners and commentators were sent to the petitioner for comments on which the petitioner vide letter dated November 28, 2017 has submitted its response.



5. Based on the submissions of the petitioner and interveners/commentators, following issues were proposed to be considered during the course of hearing:-

ISSUES OF HEARING

6. Following is the list of issues that were framed by the Authority for the hearing:
- Whether the claimed EPC cost is competitive, comparative and justified?
 - Whether the claimed Non-EPC cost is justified?
 - Whether the claimed capacity utilization factor of 20.5% is reasonable and justified?
 - Whether the petitioner's proposed solar modules and inverter technology satisfies the international standards of quality and operation?
 - Whether calculation/study of ground irradiance data was carried out or otherwise?
 - Whether the assumed degradation factor of 0.5% per annum is reasonable and justified?
 - Whether the claimed O&M costs are justified?
 - Whether the claimed return on equity of 17% is justified?
 - Whether the financing/debt terms are justified?
 - Whether the claimed construction period of 12 months is justified?
 - Whether K-Electric considered GSPL project in its long term transmission system study conducted for determining the share of renewable energy?
 - Whether KE has completed its study for interconnection of renewable energy in its network?
 - Whether the proposed indexation/adjustment mechanism at COD and during operation is justified?
 - Any other issue with the approval of the Authority.
7. The Authority also decided to conduct a hearing for which notices of hearing were also published in daily national newspapers on 26th and 27th October, 2017 conveying schedule of hearing for November 9, 2017 and issues framed for the hearing. Individual notices of hearing were also served to the relevant stakeholders vide letters dated October 26, 2017 for participation in the hearing. Subsequently, the hearing was adjourned by the Authority and re-scheduled for November 21, 2017. Notice of re-scheduling of hearing was published in daily national newspapers on November 8, 2017 and individual notices were also sent to the petitioner and the stakeholders vide letters dated November 10, 2017 accordingly.



b

8. The hearing was held on November 21, 2017 (Tuesday) at 11:00 A.M. at NEPRA Tower, G-5/1, Islamabad which was attended by a large number of participants including the petitioner, K-Electric and others.
9. Having considered the respective submissions of the parties and after careful consideration of record, issue wise findings of the Authority are as under:-

Whether the claimed EPC cost is competitive, comparative and justified?

10. The petitioner has claimed USD 0.75 million per MW on account of EPC cost. To support its claim, following comparison has been submitted by GSPL. Explaining its claim, GSPL submitted that the module price has been targeted at 0.340 USD million/MW even though the average spot price is currently varying between 0.37 to 0.38 USD million/MW. GSPL submitted that the mounting system cost assumed by GSPL is for single axis tracking which is typically 0.08 – 0.12 USD million/MW higher than fixed system, however, it is aggressively assuming increase of only 0.05 USD million/MW in this category compared to the NEPRA's benchmark. The substantial cost decline has also been assumed for inverters in line with global trends, GSPL submitted that other cost benchmarks such as cable & transformer and civil & general work remain the same as assumed by NEPRA in the upfront solar tariff as these are general equipment and works and not linked to solar PV price declines. Further, GSPL submitted that it is taking on a very substantial execution role itself and not incorporating margin for an external EPC contractor.
11. In its petition, GSPL submitted that under the claimed EPC cost, it shall install the equipment of following brands which is subject to change following the completion of project design:

No.	Equipment	Brands
1	PV Modules	Tier 1 (JA Solar, Trina, Jinko, Lerri Solar, Phono Solar, etc.)
2	Single Axis Tracker	Leading global supplier (Soltec, Optimum Tracker, Grupo Clavijo, Gonvarri, etc.)
3	Central Inverter	ABB, GE, Sungrow, etc.
4	String Combiner Boxes	Schneider, Sungrow, etc.
5	DC/AC Cables	Any top tier Pakistani or Chinese brand
6	Step Up Transformers	Siemens, ABB, TBEA, QRE, Chint, etc.





7	Medium Voltage Switchgear & Sub-station	Siemens, ABB, Chint, etc.
8	SCADA	ABB, Schneider, Meteocontrol, etc.

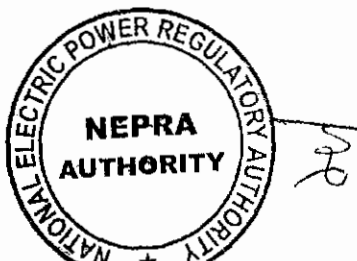
12. However, GSPL vide its letter dated December 26, 2017 submitted its application for the grant of generation license. In the instant application, GSPL submitted that it shall setup its project based on PV modules from Phono Solar. For inverters, GSPL has submitted that it shall purchase and install inverters from Sungrow.
13. GSPL submitted that it does not intend to award EPC contracts either whole or part of the Project and shall implement the Project in self-EPC mode through direct supervision and management of multiple consultants, suppliers and contractors. Accordingly, the recently issued NEPRA (Selection of Engineering, Procurement and Construction Contractor by Independent Power Producers) Guidelines, 2017 ("EPC Guidelines") are not applicable to the instant petition.
14. WBP submitted that the petitioner is executing the project in self EPC mode which is a way to circumvent the provisions of EPC Guidelines and NEPRA Competitive Bidding Tariff (Approval Procedure) Regulations, 2017 ("Tariff Bidding Regulations"). The Authority has considered this submission of the intervener and is of the view that EPC Guidelines provide applicability on the projects that intend to award EPC contracts for whole or part of their power projects. It does not bind the companies to execute the projects only under the EPC mode. As GSPL does not intend to award EPC contract, therefore, the said EPC Guidelines do not apply on this project. Regarding the point of Tariff Bidding Regulations, it is informed that NEPRA dated March 03, 2017 Issued its tariff decision for solar power projects. In the instant decision, the Authority decided to discontinue the upfront tariff regime and shifted towards competitive bidding for induction of solar power. Nevertheless, the Authority is of the view that it cannot refuse the interested parties, subject to fulfilment of the stipulated conditions, to not file petition under the Tariff Rules, 1998 especially when the agencies who have to carry out the bidding process are in process of developing the requisite documents.
15. K-Electric submitted that the EPC cost of USD 0.75 Million offered by GSPL is quite competitive for single axis tracking system which is quite capital intensive. K-Electric also submitted that civil works have been assumed in line with the latest upfront tariff allowed by NEPRA although the actual piling cost on the project site are much higher considering the low elevation and tidal/marshy land.



16. To evaluate the EPC cost claim of GSPL, the Authority has relied upon the EPC cost and project cost data in different countries. The prices of different types of modules, inverters and mounting structures in different parts of the world were researched through a number of reports published by credible organizations. Moreover, a number of online sources providing spot prices data of equipment of solar power system were also surfed. Furthermore, the costs being claimed by other comparable solar power projects were also examined. It was found that the equipment prices (modules, inverters, mounting structures etc.) in most of the countries were roughly the same. The differences were noticed in total setup cost primarily because of the soft costs such as land cost, development cost, available expertise, cost of labour, manufacturing facilities etc. Analysing all this data, the Authority is of the view that cost claimed by GSPL of USD 0.75 million per MW (USD 37.50 million) is reasonable and decided to approve the same.
17. The allowed EPC cost is the maximum limit on overall basis. Applicable foreign portion of this cost shall be allowed variations at Commercial Operations Date ("COD") due to change in PKR/USD parity during the allowed construction period, on production of authentic documentary evidence to the satisfaction of the Authority.

Whether the claimed Non-EPC cost is justified?

18. Project development cost: The petitioner has claimed USD 36,658/MW or USD 1.833 million on account of project development cost. The petitioner stated that development cost has been assumed in line with the recent NEPRA upfront solar tariff. The Authority has examined this cost claim of GSPL while comparing the same with the claim of other solar power projects and has decided to allow USD 1.50 million under this head. Project Development Cost shall be adjusted at actual, subject to allowed amount as maximum limit, at the time of COD on production of authentic documentary evidences to the satisfaction of the Authority.
19. Land cost: The petitioner has claimed USD 23,810/MW or USD 1.191 million in respect of cost of land. The petitioner has stated that land for the project has been selected based on input from power purchaser i.e. K-Electric. As per GSPL petition, land acquisition for the project is currently underway with earnest money has been paid to the vendor and final registration and transfer formalities being concluded. Chaudhary Mazhar Ali submitted that cost of land in this remote area can be much less than estimated by GSPL. The Authority noted that comparing the cost of land of GSPL with other projects shall not be meaningful as the land of other projects have been leased out by respective provincial government on concessionary rates. Further, it has been learnt that the projects developed on tracking technology requires relatively more land.



11



Moreover, the Authority noted the claimed cost is the same which was allowed to the previous projects under upfront tariff. In view of the above, the Authority has decided to allow USD 1.190 million under this head. Cost of land shall be adjusted at actual, subject to allowed amount as maximum limit, at the time of COD on production of authentic documentary evidences to the satisfaction of the Authority.

20. Financing fees & charges: The petitioner has claimed USD 0.942 million on account of financing fees & charges on the basis of 3% of the debt portion of the claimed capital cost. In line with its most recent decision in the comparable renewable energy projects, the Authority has decided to allow financing fee & charges at the rate of 2.5% on the allowed debt portion of the approved capital cost of GSPL. Accordingly, the allowed amount under this head works out to be around USD 0.754 million. Financial Charges shall be adjusted at actual, subject to allowed amount as maximum limit, at the time of COD on production of authentic documentary evidences to the satisfaction of the Authority.
21. Interest During Construction: The petitioner has claimed USD 0.929 million on account of interest during construction (IDC) based on 3 months LIBOR (1.22%) plus spread of 4.5%. Based on the approved EPC cost, drawdowns schedule as provided by the petitioner and taking into account the allowed construction period of ten months, the interest during construction works out to be around USD 0.676 million and is hereby approved. The terms of financing used to work out the aforesaid amount of IDC is discussed in the ensuing relevant sections. The allowed IDC shall be re-computed at COD, for the allowed construction period starting from the date of financial close, on the basis of actual drawdowns (within the overall debt allowed by the Authority at COD) by applying 3 month LIBOR applicable at the day of the respective drawdowns.
22. Recapitulating above, the approved project cost under various heads is given hereunder:

Project cost	(USD Million)
EPC Cost	37.500
Project Development Cost	1.500
Land Cost	1.190
Financing fees & Charges	0.754
Interest During Construction	0.676
Total	41.620



**Whether the claimed capacity utilization factor of 20.5% is reasonable and justified?
Whether the petitioner's proposed solar modules and inverter technology satisfies the
international standards of quality and operation? And whether calculation/study of
ground irradiance data was carried out or otherwise?**

23. GSPL in its petition submitted that it intends to achieve the highest capacity factor by installing latest equipment including sun trackers. GSPL also submitted that it has done detailed PV system simulations using two of the most bankable databases namely Meteonorm and Solargis for assessment of the capacity factor. According to GSPL, the average capacity factor for single axis tracker varies from 19.21% to 20.69% which is a significant uplift over the fixed system. In addition to the aforementioned, GSPL is of the view that it has assumed more ambitious capacity factor for 20.5% close to the average P50 value to align with the basis for the NEPRA fixed systems benchmark. The assumed capacity factor of 20.5% is approximately 14% higher than the NEPRA benchmark of 18% and represents a cutting edge solar plant with the local context.
24. WBP submitted that the capacity factor of GSPL is lower than capacity factor of 22.21%, proposed by comparable solar power projects, and will thereby result in higher capacity charges. WBP further submitted that GSPL has not mentioned any mechanism for sharing the benefit of extra electricity produced. K-Electric submitted that the capacity factor of 20.5% assumed by GSPL compares favourably with the NEPRA's benchmark figure of 18.0% for South Region in last Upfront Tariff.
25. The Authority has considered the submissions of the petitioner and commentators. The solar resource figure as submitted by the petitioner has also been checked. Most importantly, the Authority has given due consideration to the submission of the WBP that the projects being setup in the comparable locations are claiming considerably better net plant capacity utilization factors. In view thereof, the Authority has decided to approve the tariff of GSPL on net annual plant capacity factor of 22.21%. Further, the Authority has decided that the solar resource risk shall be borne by the power producer and a sharing mechanism given in the order part of this determination shall be applied on the energy produced beyond the approved capacity utilization factor.





Whether the assumed degradation factor of 0.5% per annum is reasonable and justified?

26. GSPL in its petition claimed a levelized annual degradation factor of 0.5% of EPC cost in its tariff petition. WBP submitted that the proposed degradation factor of 0.5% per annum is on the higher side and needs to be allowed on comparable basis as being allowed in the rest of the world. The Authority has considered the submissions of the petitioner and intervener. The data with respect to degradation being allowed in different parts of the world has also been referred. Based on that, the Authority has decided to allow degradation factor of 0.5%. As requested by the petitioner, the impact of degradation factor has been capitalized in the approved project cost. The amount of USD 1.357 million has been made part of the approved project cost based on the levelized rate of 3.62% of the allowed EPC cost.

Whether the claimed O&M costs are justified?

27. The petitioner has claimed O&M cost of USD 24,000 per MW inclusive of insurance during operation. Justifying its claim, GSPL has submitted that the proposed cost is competitive figure and is 35% lower than the comparable benchmark in the proposed upfront solar tariff advertised by NEPRA on 14 June 2016. GSPL further submitted that a tracking system typically has higher operational costs due to motors and rotating parts. GSPL also emphasized that its project size is relatively small; hence, it does not benefit from the very substantial economies of scale in O&M costs available to large solar plants. For that purpose, GSPL referred that the operational manpower requirements for both 50 and 100 MW plants will be almost same and so the larger plant will have close to half the O&M cost of GSPL.
28. WBP submitted that O&M cost of GSPL needs to be reduced as the O&M of solar projects is on the lower side. K-Electric submitted that the GSPL has claimed O&M of USD 0.024 million/MW which is lower than the O&M cost claimed by Zorlu solar project on per MW basis.
29. To evaluate this claim of GSPL, the O&M cost being allowed in other parts of the world has been referred while keeping in view the market conditions, required skilled manpower, spare parts, inverters etc. As this cost component constitutes significant portion of the cost of human resource, hence, it was noted that doing comparison of O&M cost with the developed countries may not appropriate due to higher labour costs in those countries. The submissions of the petitioner regarding higher O&M cost of tracking solar power plants and smaller size of the project were also given due consideration. Based on these analyses, the Authority has decided to approve USD 0.759 million per year in respect of O&M cost to GSPL. The Authority has noted





that the cost of manpower required for management office and site office constitutes quite a large portion of the total O&M cost which can be incurred in local currency. Further, it has also been noted that O&M cost in upfront tariffs were approved allowing major portion in local cost. In view thereof, the allowed O&M cost has been divided into local and foreign components in the ratio of 50:50. For insurance during operation, the Authority has decided to allow USD 0.187 million per year on the basis of 0.5% of the allowed EPC cost of the project.

Whether the claimed return on equity of 17% is justified?

30. GSPL has submitted that return on equity has been assumed at 17% on IRR basis as per established precedent for renewable energy projects. GSPL also added that it has no implementation agreement as well as sovereign guarantee like other IPPs supplying electricity to the system of National Transmission and Despatch Company Limited ("NTDCL"). WBP submitted that IRR proposed by Zorlu itself is 11.9% whereas the IRR proposed by GSPL is way higher.
31. The Authority has noted that in the most recent comparable cases of renewable technologies, it has allowed IRR to the limit of 15%. In view thereof, the Authority has decided to approve ROE of 15% on IRR basis for GSPL.

Whether the financing/debt terms are justified?

32. GSPL has claimed a debt: equity structure of 75:25 with foreign financing on the basis of LIBOR plus 4.5%. The debt utilized by GSPL will be repayable in a period of 13 years plus grace period of 1 year. GSPL has not claimed any indexation of debt servicing component on the basis of variation in LIBOR/KIBOR and has requested that no adjustment shall be made to the any debt mix of local or foreign currency including debt secured under the SBP financing scheme for renewable energy.
33. Chaudhary Mazhar Ali submitted that the debt service period of 13 years is not justified and should be around 08 years. WBP submitted that the financing terms need to be rationalized.
34. The Authority has noted that the premiums of 4.25% over base LIBOR has been allowed in the most recent cases of comparable renewable technologies. In view thereof, the Authority has decided to allow financing cost at the rate of LIBOR plus premium of 4.25% to GSPL. The



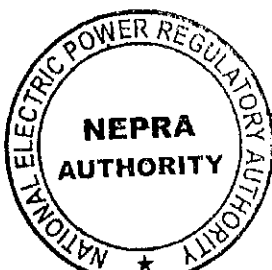
claimed debt to equity ratio of 75:25 and debt servicing tenor of thirteen years are found reasonable and hereby approved.

Whether the claimed construction period of 12 months is justified?

35. The petitioner in its tariff petition has proposed a construction period of 12 months. WBP submitted that the construction period in development of a solar power project is on the lower side therefore, the construction period of GSPL being a solar power plant should not be more than 9 months. GSPL during the hearing requested the Authority to award a construction period of 12 months while submitting that the site is very tough with fish ponds and water pools which make it difficult for civil works. According to GSPL a 10 months construction period for 50MW will be a tight period for the company. The Authority pointed out that if GSPL had chosen other part of land then construction period should have not been 12 months. Responding that, GSPL submitted that the project has been planned in the same area as Oursun Solar which is being developed right next to GSPL. The said site has been selected to minimize the interconnection cost to KE.
36. The Authority noted that the construction period of 10 months was allowed for a solar power project of 50 MW under the previous upfront tariffs. Oursun solar project of 50 MW next to GSPL project site also opted for upfront tariff with a construction period of 10 months. The Authority has considered that the claim of the petitioner is not reasonable and has decided to allow the construction period of 10 months to GSPL.

Whether K-Electric considered GSPL project in its long term transmission system study conducted for determining the share of renewable energy? Whether K-Electric has completed its study for interconnection of renewable energy in its network?

37. GSPL submitted that KE has included GSPL in its long term transmission study which is being conducted by Shanghai Electric Power Design Institute and is scheduled to be completed in January 2018. During the hearing, K-Electric also submitted that GSPL has been included in the transmission study which shall be completed in January 2018. KE further submitted during the hearing that a transmission line is being laid from KE's Dhabeji grid station to Gharo to evacuate power from Oursun Solar project. As the project of GSPL is adjacent to Oursun site a minimal infrastructure cost of 700 meters line would only be required to interconnect and evacuate power from GSPL as well with which KE has no issues. The Authority has considered these submissions of GSPL and K-Electric. Further, the Authority has noted that with its petition, GSPL



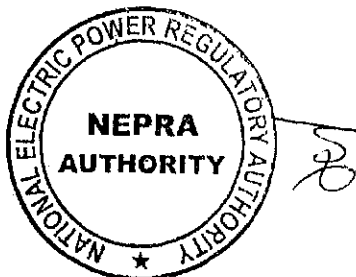
submitted a term sheet signed between the petitioner and K-Electric which, inter alia, provides that the power purchaser shall exclusively purchase all the energy produced by GSPL under the provisions of EPA. In view thereof, the Authority understands that these issues have been settled between the power purchaser and the project company.

Whether the proposed indexation/adjustment mechanism at COD and during operation is justified?

38. GSPL had claimed indexations of tariff components different than the indexation mechanism generally claimed by the petitioners and allowed by NEPRA. GSPL had not solicited any one time adjustment at COD for exchange rate variation in EPC price, variation in interest during construction, insurance during construction, sinsoure fee, debt mix etc. Further, no indexation for variation in LIBOR/KIBOR rates had been solicited by GSPL during its operation period. GSPL has submitted that the 65% and 35% of the approved tariff may be allowed indexations with respect to variations in exchange rate and local inflation respectively on every 1st January, 1st April, 1st July and 1st September. The Authority has considered the submissions of GSPL and is of the view that the proposed mechanism may not be entertained under the Tariff Rules, 1998. The adjustment mechanism approved by the Authority is given in the Order Part of this determination.

General Submissions of WBP

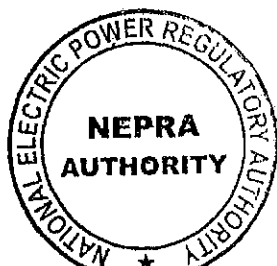
39. WBP submitted that tariff petition of GSPL has been admitted by the Authority prior to the submission of the application of generation license by the petitioner which is contrary to the provision of rules and regulations of NEPRA. The intervener said that the technical scrutiny of the power project can only be made during the process of application of generation on the basis of feasibility study submitted along generation license application which covers the technical details. GSPL vide its petition submitted that the instant tariff petition is submitted in advance pursuant to the NEPRA Tariff Rules, 1998 which permit "any licensee", "consumer" or a "person interested in tariff" to file a tariff petition with the Authority. GSPL while advocating for its case also referred the tariff petition of Matiari-Lahore Transmission line wherein NEPRA acknowledged the petitioner PPIB as an interested person and awarded tariff without the application and award of generation license. During the hearing GSPL was inquired by the Authority regarding its generation license to which GSPL responded that the application for generation license application shall be filed at the earliest. The Authority has noted that GSPL





dated December 26, 2017 has filed the application for its generation license which is currently under process with NEPRA.

40. WBP argued that solar PV power plants are replacing energy generation from base load thermal power plants with fixed capacity payments which results in an increase in costs for the power purchaser. GSPL submitted that unlike coal, furnace oil and other thermal projects, solar projects do not have capacity payments linked to their installed capacity. Further, a sizeable portion of the current installed capacity of Pakistan is inefficient and uneconomical to operate. GSPL also highlighted that even in the best scenario of low fossil fuel prices; the tariff based on furnace oil/diesel is still higher than the proposed solar tariff. GSPL also pointed out that the current power mix of the country is heavily dependent on imported fossil fuels, thus creating severe environmental as well as balance of payment issues and putting pressure on the Rupee. The Authority has noted that around 50% of the owned generation capacity of K-Electric and quite a large portion of its total basket comprises of old and relatively inefficient units. K-Electric's whole fleet is primarily based on fossil fuels, i.e. gas and furnace oil. Due to non-availability of sufficient gas, K-Electric has been running its power stations/units on furnace oil which costs higher both due to relatively higher prices and less efficiency. It has been analysed that fuel cost component of furnace oil based power stations is higher than the tariff being approved for GSPL even for the first thirteen years. It has also been noted that power purchase price that has been approved vide recent multi-year tariff of K-Electric works out to be around Rs. 8/kWh and the tariff being approved for GSPL is considerably lower at any time of its control period. Further, this arrangement shall also increase the share of renewables in the system of K-Electric.
41. WBP also raised its concerns regarding these projects being planned on "Take or Pay" and 'Must Run' policy for renewable energy projects. WBP also submitted that levelized tariff of GSPL is although lower, however, GSPL power project may not be economically and financially viable as the same is non-base load power plant with a capacity factor of only 19-20% which increases the cost of evacuation/ interconnection from a solar power plant. In response GSPL submitted that unlike thermal projects, the proposed project does not have the capability to store the energy resource, so any 'Take and Pay' model would render the project unviable. Any un-evacuated energy would impact the plant factor negatively and the Company would not be able to recover its costs and investment. GSPL highlighted that solar power plants are globally considered as must-run units. Various countries including India, China, Chile, European Union, Sri Lanka, Turkey, Egypt, Mexico, UAE etc. all have policies ensuring must-run / priority dispatch status for solar projects and Pakistan has followed the same principle in its Renewable Energy Policy 2006. GSPL also submitted that the current market operates with a single buyer model in



place and in this scenario solar projects would not be bankable on 'Take and Pay' basis. GSPL also submitted that NEPRA has acknowledged the same policy in its previous determination dated 09.08.16 for NPPML, an LNG based power plant wherein it was stated: "Regarding Take or pay arrangement, it is observed that this arrangement is in accordance with the application Power Policy and unless there is a competitive power market in the country this regime will be hard to change." The Authority has noted that the tariff being approved is not based on "take or pay" arrangement as the project sponsor shall not be ensured the recovery of its tariff on certain level of energy. Doing so, the risk of resource shall be borne by the power producing company. K-Electric has agreed to purchase all the energy offered for sale by GSPL which is in line with the arrangement given in Renewable Energy Policy, 2006. Regarding the submission of transmission cost, K-Electric has submitted that the project site is adjacent to the Oursun solar project for which KE is already in process of laying a 132 KV double circuit line from Dhabeji to the switchyard of Oursun solar in Gharo. Hence, the line being built shall be utilized for the evacuation of additional power which would result in optimization of transmission line and reduction of transmission cost.

42. WBP further submitted that it is in favour of the induction of the renewable power projects only if they are economically feasible and GSPL solar tariff is still higher than solar tariff in UAE and India which is in the range of around US cents 3/kWh. Further, WBP also pointed out that the tariff of GSPL is higher than the tariff requested by Helios, Meridian, Helios and HNDS. GSPL submitted that the proposed tariff by Gharo Solar is one of the lowest tariffs offered for any type of project in Pakistan. According to GSPL, the proposed tariff is lower than thermal (e.g. coal, LNG), large hydel and wind projects. With development in renewable technologies, electricity tariffs for the same have become cheaper than conventional power plants. GSPL also submitted that it is important to understand that solar tariffs are dependent on multiple factors which include solar irradiance in the area of installation and cost of capital of the country. Comparison of solar tariffs across countries has to be made within context of these factors and other considerations including state of maturity of the sector. Further, when comparing costs with neighbouring countries such as India, it needs to be recognized that India is a mature market with an installed solar PV capacity of over 14,000 MW till September 2017 and plans to add further 20,000 MW in 2017-18 alone. Regarding the comparison with Helios, HNDS and Meridian, GSPL submitted that every project is different in capacity, technology selection, capital structure and is not practical to compare projects while they are different in their base assumptions. The Authority has considered the submissions of the intervener and petitioner and has addressed the certain concerns of the interveners while approving the parameters of this tariff determination.





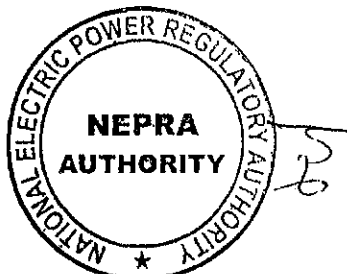
43. Mr Arif Bilvani and WBP have submitted that after the recovery of all the development and operational costs by the investor the project should be transferred to an appropriate Government Agency. It is informed that the tariff under the transfer model works out to be higher as the redemption of equity is made part thereof which burdens the consumer upfront. Further, in view of rate of technological advancement in the solar energy, there are higher chances that such projects may become obsolete after the control period of twenty five years. In view thereof, it may not be considered a good option to transfer the project either to power purchasing agency or any government entity.

44. **ORDER**

The Authority hereby determines and approves the following generation tariff along with terms and conditions for M/s Gharo Solar (Private) Limited for its 50 MWp power project for delivery of electricity to the power purchaser:

Rs./kWh		
Tariff Components	Year 1-13	Year 14-25
Operations and Maintenance Cost	0.8192	0.8192
Insurance during Operation	0.2024	0.2024
Return on Equity	1.8446	1.8446
Debt Servicing	3.8610	-
Total	6.7272	2.8662

- Levelized tariff works out to be US Cents 5.6073/kWh.
- The aforementioned tariff is applicable for twenty five (25) years.
- Debt Service shall be paid in the first 13 years of commercial operation of the plant.
- Debt Servicing has been worked out using three months LIBOR (1.694%) + Spread (4.25%).
- Debt to Equity of 75:25 has been used.
- Return on Equity during construction and operation of 15% has been allowed.
- Construction period of ten (10) months has been allowed for the workings of ROEDC and IDC.
- Insurance during Operation has been calculated as 0.50% of the allowed EPC Cost.
- Reference Exchange Rates of 105 PKR/USD has been used.
- Detailed component wise tariff is attached as **Annex-I** of this order.
- Debt Servicing Schedule is attached as **Annex-II** of this order.

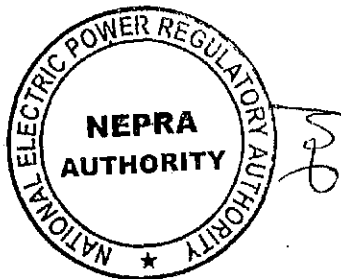


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A. One Time Adjustments at COD

- Applicable foreign portion of the allowed EPC cost will be adjusted at COD on account of variation in PKR/USD parity, on production of authentic documentary evidences to the satisfaction of the Authority. The adjustment in approved EPC cost shall be made only for the currency fluctuation against the reference parity values.
- For cost items other than EPC cost, the amounts allowed in USD will be converted in PKR using the reference PKR/USD rate of 105 to calculate the maximum limit of the amount to be allowed at COD.
- Duties and/or taxes, not being of refundable nature, relating to the construction period directly imposed on the company up to COD will be allowed at actual upon production of verifiable documentary evidence to the satisfaction of the Authority.
- IDC will be recomputed at COD on the basis of actual timing of debt draw downs (for the overall debt allowed by the Authority at COD), applicable LIBOR and premium.
- The tariff has been determined on debt : equity ratio of 75 :25. The tariff shall be adjusted on actual debt : equity mix at the time of COD, subject to equity share of not more than 25%. For equity share of more than 25%, allowed IRR shall be neutralized for the additional cost of debt : equity ratio.
- The reference tariff has been worked out on the basis of 3 month LIBOR of 1.694% plus a premium of 425 basis points. In case negotiated spread is less than the said limits, the savings in the spread over LIBOR shall be shared between the power purchaser and the power producer in the ratio of 60:40 respectively.
- ROEDC will be adjusted at COD on the basis of actual equity injections (within the overall equity allowed by the Authority at COD) during the project construction period of ten months allowed by the Authority.



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B. Indexations

i) Operation and Maintenance Costs

O&M components of tariff shall be adjusted on account of change in local Inflation (CPI), foreign inflation (US CPI) and exchange rate quarterly on 1st July, 1st October, 1st January and 1st April based on the latest available information with respect to CPI notified by the Pakistan Bureau of Statistics (PBS), US CPI issued by US Bureau of Labor Statistics and revised TT & OD selling rate of US Dollar notified by the National Bank of Pakistan as per the following mechanism:

$F. O\&M_{(REV)}$	=	$F. O\&M_{(REF)} * US CPI_{(REV)} / US CPI_{(REF)} * ER_{(REV)} / ER_{(REF)}$
$L. O\&M_{(REV)}$	=	$L. O\&M_{(REF)} * CPI_{(REV)} / CPI_{(REF)}$
Where;		
$F V. O\&M_{(REV)}$	=	The revised O&M Foreign Component of Tariff
$L. O\&M_{(REV)}$	=	The revised O&M Local Component of Tariff
$F. O\&M_{(REF)}$	=	The reference O&M Foreign Component of Tariff
$L. O\&M_{(REF)}$	=	The reference O&M Local Component of Tariff
$US CPI_{(REV)}$	=	The revised US CPI (All Urban Consumers)
$US CPI_{(REF)}$	=	The reference US CPI (All Urban Consumers) of 246.669 for the month of November, 2017
$CPI_{(REV)}$	=	The revised CPI (General)
$CPI_{(REF)}$	=	The reference CPI (General) of 220.420 for the month of November, 2017
$ER_{(REV)}$	=	The revised TT & OD selling rate of US dollar
$ER_{(REF)}$	=	The reference TT & OD selling rate of RS. 105/USD

Note: The reference indexes shall be revised after making the required adjustments in tariff components at the time of COD.

ii) Insurance during Operation

The actual insurance cost for the minimum cover required under contractual obligations with the Power Purchaser, not exceeding 0.5% of the EPC cost, will be treated as pass through. Insurance





component of reference tariff shall be adjusted annually as per actual upon production of authentic documentary evidence according to the following formula:

AIC	=	$Ins_{(Ref)} / P_{(Ref)} * P_{(Act)}$
Where;		
AIC	=	Adjusted insurance component of tariff
$Ins_{(Ref)}$	=	Reference insurance component of tariff
$P_{(Ref)}$	=	Reference premium @ 0.5% of EPC Cost at Rs. 105
$P_{(Act)}$	=	Actual premium or 0.5% of the EPC Cost converted into Pak Rupees on exchange rate prevailing at the time of insurance premium payment of the insurance coverage period whichever is lower

iii) **Return on Equity**

The ROE component of the tariff will be adjusted on quarterly basis on account of change in USD/PKR parity. The variation relating to these components shall be worked out according to the following formula;

$ROE_{(Rev)}$	=	$ROE_{(Ref)} * ER_{(Rev)} / ER_{(Ref)}$
Where;		
$ROE_{(Rev)}$	=	Revised ROE Component of Tariff
$ROE_{(Ref)}$	=	Reference ROE Component of Tariff
$ER_{(Rev)}$	=	The revised TT & OD selling rate of US dollar as notified by the National Bank of Pakistan
$ER_{(Ref)}$	=	The reference TT & OD selling rate of Rs. 105/USD

Note: The reference tariff component shall be revised after making the required adjustments at the time of COD.



iv) **Indexations applicable to debt**

Foreign debt and its interest will be adjusted on quarterly basis, on account of revised TT & OD selling rate of US Dollar, as notified by the National Bank of Pakistan as at the last day of the preceding quarter, over the applicable reference exchange rate.

v) **Variations in LIBOR**

The interest part for the tariff shall remain unchanged throughout the term except for the adjustment due to variation in interest rate as a result of variation in LIBOR according to the following formula;

ΔI	=	$P_{(REV)} * (LIBOR_{(REV)} - 1.694\%) / 4$
Where;		
ΔI	=	The variation in interest charges applicable corresponding to variation in 3 month LIBOR. ΔI can be positive or negative depending upon whether 3 month LIBOR _(REV) per annum > or < 1.694%. The interest payment obligation will be enhanced or reduced to the extent of ΔI for each quarter under adjustment.
$P_{(REV)}$	=	The outstanding principal (as indicated in the attached debt service schedule to this order), at the relevant quarterly calculations date. Quarter 1 shall commence on the commercial operations date (i.e. the first figure will be used for the purposes of calculation of interest for the first quarter after commercial operations date).
$LIBOR_{(REV)}$	=	Revised 3 month LIBOR as at the last day of the preceding quarter

Note: The reference tariff component shall be revised after making the required adjustments at the time of COD.





C. Terms and Conditions

The following terms and conditions shall apply to the determined tariff:

- All plant and equipment shall be new and of acceptable standards. The verification of the plant and equipment will be done by the independent engineer at the time of the commissioning of the plant duly appointed by the power purchaser.
- This tariff will be limited to the extent of net annual energy generation supplied to the power purchaser up to 22.21% net annual plant capacity factor. Net annual energy generation supplied to the power purchaser in a year, in excess of 22.21% net annual plant capacity factor will be charged at the following tariffs:

Net annual plant capacity factor	% of the prevalent tariff
Above 22.21% to 23.21%	80%
Above 23.21% to 24.21%	90%
Above 24.21%	100%

- The risk of solar resource shall be borne by the power producer.
- In the tabulated above tariff no adjustment for certified emission reductions has been accounted for. However, upon actual realization of carbon credits, the same shall be distributed between the power purchaser and the power producer in accordance with the applicable GOP Policy, amended from time to time.
- In case the company shall secure full or certain portion of debt under any concessionary financing including one introduced by State bank of Pakistan, the tariff of the company shall be adjusted at COD on the terms of the said financing.
- Allowed limit of degradation has been made part of the approved project cost. No extra financial compensation shall be provided in the EPA.
- The plant PV capacity may vary from 50 MWp, provided that the maximum power to be evacuated in MWac shall remain consistent with grid study approved by KE. Benchmark energy calculations shall be made on revised PV capacity and no additional cost in this regard shall be allowed to GSPL.
- The company will have to achieve financial close within one year from the date of issuance of this tariff determination. The tariff granted to the company will no longer remain





applicable/valid, if financial close is not achieved by the company in the abovementioned timeline or its generation license is declined/revoked by NEPRA.

- The targeted maximum construction period after financial close is ten months. No adjustment will be allowed in this tariff to account for financial impact of any delay in project construction. However, the failure of the company to complete construction within ten months will not invalidate the tariff granted to it.
- Pre COD sale of electricity is allowed to the power producer, subject to the terms and conditions of EPA, at 50% of the applicable tariff. However, pre COD sale will not alter the required commercial operations date stipulated in the EPA in any manner.
- In case the company is obligated to pay any tax on its income from generation of electricity, or any duties and/or taxes, not being of refundable nature, are imposed on the company, the exact amount paid by the company on these accounts shall be reimbursed on production of original receipts. This payment shall be considered as a pass-through payment. However, withholding tax on dividend shall not be passed through.
- No provision for the payment of Workers Welfare Fund and Workers Profit Participation has been made in the tariff. In case, the company has to pay any such fund, that will be treated as pass through item in the EPA.
- The approved tariff along with terms & conditions shall be made part of the EPA. General assumptions, which are not covered in this determination, may be dealt with as per the standard terms of the EPA.

45. The Order part along with two Annexures is recommended for notification by the Federal Government in the official gazette in accordance with Section 31(4) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.



NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

Case No. NEPA/TRF-403/GSPL-2017

January _____, 2018

Petitioner:

Gharo Solar (Pvt.) Limited

Authority:

Himayat Ullah Khan
Member

Himayat Ullah Khan
23.1.2018

Syed Masood-ul-Hassan Naqvi
Member

Syed Masood-ul-Hassan Naqvi
23.1.2018

Saif Ullah Chattha
Vice Chairman

Saif Ullah Chattha
23.1.2018

Brig (R) Tariq Saddozai
Chairman

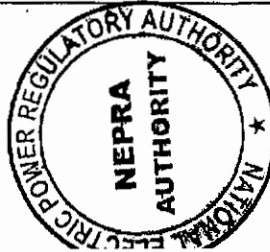
Brig (R) Tariq Saddozai
23.1.2018



S. M. Naqvi
25.01.18

**Gharo Solar (Pvt.) Ltd.
Reference Tariff Table**

Year	O&M Local	O&M Foreign	Insurance	Return on Equity		Loan Repayment		Interest Charges		Tariff	
	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh	Rs. / kWh
1	0.4096	0.4096	0.2024	1.8446	1.8333	2.0277	6.7272	2.0277	6.7272	6.7272	6.7272
2	0.4096	0.4096	0.2024	1.8446	1.9447	1.9163	6.7272	1.9163	6.7272	6.7272	6.7272
3	0.4096	0.4096	0.2024	1.8446	2.0629	1.7981	6.7272	1.7981	6.7272	6.7272	6.7272
4	0.4096	0.4096	0.2024	1.8446	2.1883	1.6727	6.7272	1.6727	6.7272	6.7272	6.7272
5	0.4096	0.4096	0.2024	1.8446	2.3213	1.5397	6.7272	1.5397	6.7272	6.7272	6.7272
6	0.4096	0.4096	0.2024	1.8446	2.4624	1.3986	6.7272	1.3986	6.7272	6.7272	6.7272
7	0.4096	0.4096	0.2024	1.8446	2.6121	1.2489	6.7272	1.2489	6.7272	6.7272	6.7272
8	0.4096	0.4096	0.2024	1.8446	2.7709	1.0901	6.7272	1.0901	6.7272	6.7272	6.7272
9	0.4096	0.4096	0.2024	1.8446	2.9393	0.9217	6.7272	0.9217	6.7272	6.7272	6.7272
10	0.4096	0.4096	0.2024	1.8446	3.1179	0.7431	6.7272	0.7431	6.7272	6.7272	6.7272
11	0.4096	0.4096	0.2024	1.8446	3.3074	0.5536	6.7272	0.5536	6.7272	6.7272	6.7272
12	0.4096	0.4096	0.2024	1.8446	3.5085	0.3525	6.7272	0.3525	6.7272	6.7272	6.7272
13	0.4096	0.4096	0.2024	1.8446	3.7217	0.1393	6.7272	0.1393	6.7272	6.7272	6.7272
14	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
15	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
16	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
17	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
18	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
19	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
20	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
21	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
22	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
23	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
24	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
25	0.4096	0.4096	0.2024	1.8446	-	-	2.8662	-	2.8662	2.8662	2.8662
Levelized Tariff	0.4096	0.4096	0.2024	1.8446	1.9375	1.0840	5.8877	1.0840	5.8877	5.8877	5.8877



Gharo Solar (Pvt.) Ltd.
Debt Servicing Schedule

Relevant Quarters	Principal (USD)	Principal Repayment (USD)	Interest (USD)	Balance Principal (USD)	Total Debt Service (Million USD)	Annual Principal Repayment Rs./kWh	Annual Interest Rs./kWh
1	32,232,891	415,279	479,003	31,817,612	894,282	1.8333	2.0277
2	31,817,612	421,450	472,832	31,396,162	894,282		
3	31,396,162	427,713	466,569	30,968,448	894,282		
4	30,968,448	434,070	460,213	30,534,379	894,282		
5	30,534,379	440,520	453,762	30,093,859	894,282		
6	30,093,859	447,067	447,216	29,646,792	894,282	1.9447	1.9163
7	29,646,792	453,710	440,572	29,193,082	894,282		
8	29,193,082	460,453	433,830	28,732,629	894,282		
9	28,732,629	467,295	426,987	28,265,333	894,282		
10	28,265,333	474,240	420,043	27,791,094	894,282		
11	27,791,094	481,287	412,995	27,309,806	894,282	2.0629	1.7981
12	27,309,806	488,440	405,843	26,821,367	894,282		
13	26,821,367	495,698	398,584	26,325,668	894,282		
14	26,325,668	503,065	391,218	25,822,604	894,282		
15	25,822,604	510,540	383,742	25,312,063	894,282		
16	25,312,063	518,127	376,155	24,793,936	894,282	2.1883	1.6727
17	24,793,936	525,827	368,455	24,268,109	894,282		
18	24,268,109	533,641	360,641	23,734,467	894,282		
19	23,734,467	541,572	352,711	23,192,896	894,282		
20	23,192,896	549,620	344,663	22,643,276	894,282		
21	22,643,276	557,788	336,495	22,085,488	894,282	2.3213	1.5397
22	22,085,488	566,077	328,206	21,519,412	894,282		
23	21,519,412	574,489	319,794	20,944,923	894,282		
24	20,944,923	583,026	311,256	20,361,897	894,282		
25	20,361,897	591,690	302,592	19,770,206	894,282		
26	19,770,206	600,483	293,799	19,169,723	894,282	2.4624	1.3986
27	19,169,723	609,407	284,876	18,560,316	894,282		
28	18,560,316	618,463	275,819	17,941,853	894,282		
29	17,941,853	627,654	266,628	17,314,199	894,282		
30	17,314,199	636,981	257,301	16,677,218	894,282		
31	16,677,218	646,447	247,835	16,030,770	894,282	2.6121	1.2489
32	16,030,770	656,054	238,228	15,374,716	894,282		
33	15,374,716	665,803	228,479	14,700,913	894,282		
34	14,700,913	675,698	218,585	14,033,215	894,282		
35	14,033,215	685,739	208,543	13,347,476	894,282		
36	13,347,476	695,930	198,353	12,651,547	894,282	2.7709	1.0901
37	12,651,547	706,272	188,011	11,945,275	894,282		
38	11,945,275	716,767	177,515	11,228,508	894,282		
39	11,228,508	727,419	166,863	10,501,089	894,282		
40	10,501,089	738,229	156,054	9,762,860	894,282		
41	9,762,860	749,200	145,083	9,013,660	894,282	2.9393	0.9217
42	9,013,660	760,333	133,949	8,253,327	894,282		
43	8,253,327	771,632	122,650	7,481,695	894,282		
44	7,481,695	783,099	111,183	6,698,596	894,282		
45	6,698,596	794,737	99,546	5,903,859	894,282		
46	5,903,859	806,547	87,735	5,097,312	894,282	3.1179	0.7431
47	5,097,312	818,533	75,750	4,278,779	894,282		
48	4,278,779	830,697	63,586	3,448,083	894,282		
49	3,448,083	843,042	51,241	2,605,041	894,282		
50	2,605,041	855,570	38,713	1,749,471	894,282		
51	1,749,471	868,284	25,998	881,187	894,282	3.7217	0.1393
52	881,187	881,187	13,095	(0)	894,282		

