

BEFORE
THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
(NEPRA)

APPLICATION FOR MODIFICATION IN GENERATION LICENSE NO.
SPGL/07/2014 FOR
SOLAR POWER GENERATION FACILITY

PURSUANT TO ENABLING PROVISIONS OF NEPRA ACT 1997 READ WITH ENABLING
PROVISIONS OF RULES MADE THEREUNDER , LICENSING (APPLICATION &
MODIFICATION PROCEDURE) REGULATION 1999 AND LICENSING (GENERATION) RULES
2000 &

THE FEDERAL GOVERNMENT'S
'POLICY OF RENEWABLE ENERGY FOR POWER GENERATION 2006'

ON BEHALF OF

SAFE SOLAR POWER (PVT) LIMITED

FOR NEPRA'S APPROVAL OF MODIFICATIONS IN THE GENERATION LICENSE NO.
SPGL/07/2014 DATED 24 FEBRUARY 2016 FOR SAFE SOLAR POWER (PVT) LIMITED

FOR A POWER PROJECT OF 10.275 MW

AT

DHARANWALA, DISTRICT BAHAWALNAGAR, PROVINCE OF PUNJAB, PAKISTAN

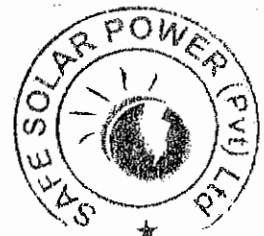
DATED: 25 December 2019

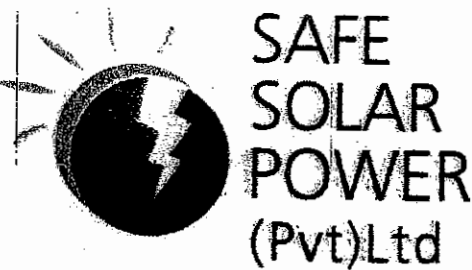
SAFE SOLAR POWER (PVT) LIMITED

ADDRESS : HOUSE 28, STREET 24, F-8/2, ISLAMABAD

PHONE # : +92 51 2099251

MOBILE# : +92 300 2370973





13992

SSPL/CEO/NEPRA/04/19

26th Dec 2019

The Registrar
National Electric Power Regulatory Authority
NEPRA Building,
G-5/2,
Islamabad

Subject: GENERATION LICENSE MODIFICATION APPLICATION FOR SAFE SOLAR POWER (PVT) LIMITED'S 10 MW SOLAR POWER PROJECT AT DHARANWALA, DISTRICT BHAWALNAGAR, PUNJAB.

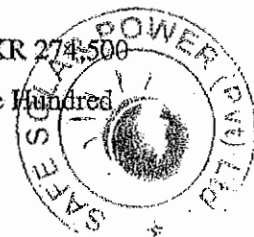
Dear Sir,

We herewith submit the Company's Generation License Modification application along with the fee as determined by the National Electric Power Regulatory Authority (the "NEPRA" or the "Authority") for kind consideration and favorable approval by the Authority in accordance, inter alia, with section to Regulation 10(2) of National Electric Power Regulatory Authority Licensing (Applications and Modifications Procedure) Regulations, 1999, read with Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 and other applicable provisions of NEPRA law.

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

The GL Modification Application (including its Annexures) is submitted in triplicate along with the following:

- The Bank Draft No. 02692411 dated 19th Dec 2019, amounting to PKR 274,500 (Pakistan Rupees Two hundred and Seventy Four Thousand and Five Hundred Only) as requisite fee for the GL Modification Application.

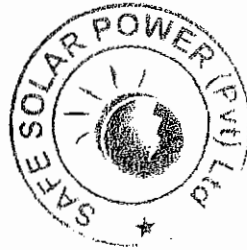


Office: House 28, Street 24, F-8/2 Islamabad.
Ph: +92 51 8358477 Fax: +92 51 8358499
E-mail: info@safesolarpower.com Web: www.safesolarpower.com

- Board Resolution of Safe Solar Power (Pvt) Limited.
- Affidavit of Ms. Afshan Mir.

We submit our GL Modification application for our 10 MW solar power project at Dharanwala, Bhawalnagar, Punjab.

Respectfully submitted for and on behalf of:
Safe Solar Power (Pvt) Limited



Afshan Mir
Ms. Afshan Mir
CEO
Safe Solar Power (Pvt) Limited



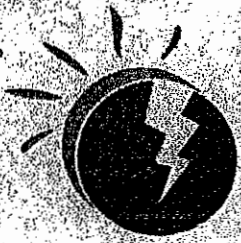
Extract of the Minutes of the Meeting of the Board of Directors of Safe SolarPower (Pvt) Limited held on 05 December 2019 at Islamabad, Pakistan.

The following resolutions were discussed in detail by the Board and approved unanimously:-

" Resolved that the Safe SolarPower (Pvt) Limited (a company incorporated under laws of Pakistan and having offices at 28, Islamabad, Pakistan)(the "Company") is hereby authorized to file a Licensee Proposed Modification (the "LPM") petition for submission to National Electric Power Regulatory Application for modification of its Generation License in respect of its 10 MW Solar Power Project in Dharanwala, Bhawalnagar,Punjab, Pakistan and in relation thereto, enter into and execute all required documents, make all fillings and pay all applicable fees, in each case, of any nature whatsoever, as required".

"Further Resolved that in respect of filing a LPM petition for submission to to National Electric Power Regulatory Application, Ms. Afshan Mir, Chief Executive Officer Safe Solar is hereby empowered and authorized for and on behalf of the Company to:

- i. review, execute, submit, and deliver the LPM application (including any review petitions and any motion for leave for review) and any related documentation required by NEPRA for the modification of the generation license, including any contracts, documents, power of attorney, affidavits, statements, letters, forms, applications, deeds, guarantees, undertakings, approvals, memoranda, amendments, letters, communications, notices, certificates, requests, statement and any other instruments of any nature whatsoever;
- ii. represent the Company in all negotiations, representations, presentations, hearings, conferences and/or meetings of any nature whatsoever with any entity (including, but in no manner limited to NEPRA, any private parties, companies, partnerships, individuals, governmental and/or semi -governmental authorities and agencies, ministries, boards, departments, regulatory authorities and/or any other entity of any nature whatsoever);
- iii. sign and execute the necessary documentation, pay the necessary fees, appear before the NEPRA as needed, and do all acts necessary for the completion and processing of the LPM application (including any review petitions and any motion for leave for review) and procuring NEPRA's modification of its Generation License,;



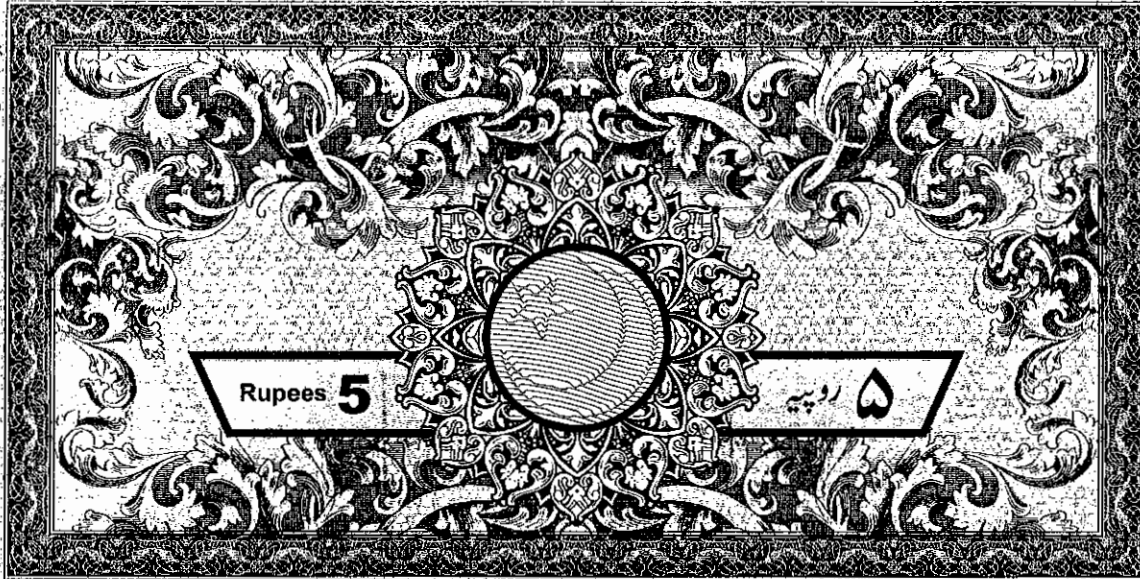
SAFE
SOLAR
POWER
(Pvt)Ltd

- iv. appoint or nominate any one or more officers of the Company or any other person or persons, singly or jointly, in her discretion to communicate, make presentations to and attend NEPRA hearings;
- v. do all such acts, matters and things as may be necessary for carrying out the purposes aforesaid and giving full effect to the above resolutions/resolution".

Secretary Safe SolarPower (Pvt) Limited

Zahid MaSood

AFFIDAVIT



BEFORE

THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

Affidavit

I, Ms. Afshan Mir wife of Mr. Hamid Mir adult resident of House No.28, Street No.24, Sector F-8/2, Islamabad; do hereby solemnly affirm on oath as under:-

- That I am CEO of the firm "M/s. SAFE SOLARPOWER (PVT) LIMITED" with offices located at Islamabad, Pakistan.
- That I am authorized representative of M/S Safe Solar Power(Pvt) Limited.
- That the contents of the accompanied Generation License Modification application dated 26th December 2019 are true to the best of my knowledge, belief and information and nothing has been concealed by me.
- I also affirm that all further documentation and information provided by me in connection with the said application shall be true and correct to best of my knowledge and belief.

DEPONENT

Afshan Mir

Ms. Afshan Mir

CEO Safe Solar Power (Pvt) Limited

Verification

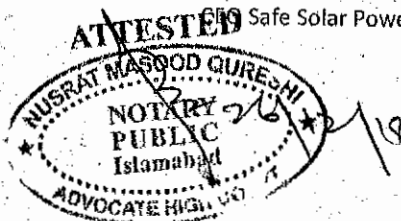
It is hereby verified on solemn affirmation at Islamabad on this 26th Day of December 2019 that the contents of the above Affidavit are true and correct to the best of my knowledge and belief, and that nothing material or relevant thereto has been concealed or held therefrom.

DEPONENT

Afshan Mir

Ms. Afshan Mir

Safe Solar Power (Pvt) Limited

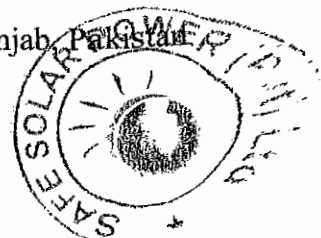


1. BACKGROUND – GRANT OF GENERATION LICENSE

1.1 NEPRA'S GRANT OF GENERATION LICENSE

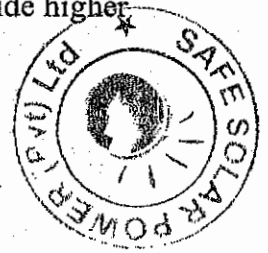
1.1.1 Under the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of) 1997 (the "NEPRA Act") and the National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, the National Electric Power Regulatory Authority (the "NEPRA") is responsible for and has the authority to, *inter alia*, grant licenses for the generation of electric power.

1.1.2 Pursuant to the Sections 7(2) (a) and 15 of the NEPRA Act read with the other enabling provisions of the NEPRA Act, the National Electric Power Regulatory Authority Licensing (Application & Modification Procedure) Regulations 1999 (the "Licensing Regulations 1999"), National Electric Power Regulatory Authority Licensing (Generation) Rules 2000, and in accordance with the Policy for Development of Renewable Energy for Power Generation 2006, SAFE SOLAR POWER (PVT) LIMITED submitted its application (the "Generation License Application") and received on generation license on September 14, 2014 to NEPRA for grant of a generation license to Safe Solar Power (Pvt) Limited for its power generation facility to be located at Dharanwala, District Bhawalnagar, Province of Punjab, Pakistan (the "Project").



1.1.3 NEPRA in exercise of the powers conferred upon it under the laws of Pakistan granted a generation license (Ref: SPGL/7/2014) (the "**Generation License**") to Safe Solar (Pvt) Limited on September 14, 2014.

1.1.4 The Generation License was later modified on 24th February '16 (the "**LPM**") due to the change of land for the project. We are applying for further modification this license as considerable changes in the technology has occurred in the meanwhile and we can utilise the technology to provide higher power generation for the project.



2. APPLICATION FOR MODIFICATION IN THE GENERATION LICENSE

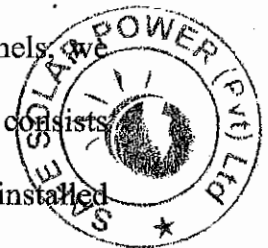
2.1 CHANGES RESULTING IN APPLICATION FOR MODIFICATION II

2.1.1 Safe Solar Power (Pvt) Limited, being the licensee under the Generation License, (the "Licensee"), is desirous of modifying the Generation License, to the extent and in the form set out hereunder in Section 3 (*Proposed Modification in the Generation License*), due to certain changes relating to its Project – as set out in this Generation License Modification Application (the "Project Changes"):

Change in Solar Panel Type

The licensee is applying for a Modification Generation License with the aim in mind to have the latest technology available for the project. The previous panel selected by the Licensee have now been upgraded for improved performance and output. The new upgraded version, which the licensee has now opted for is Trina Solar Bi facial monocrystalline Panels with a power range of 430 watts, is the latest and technically the best of its class available in the market and very well suited for our environment. In addition to the higher capacity panels, we intend to use single axis tracking to increase the output of our project.

Because of this change in the individual capacity of the Panels we propose to change the configuration of the solar farm so that it consists of 23,896 bi-facial monocrystalline panels hence the overall installed

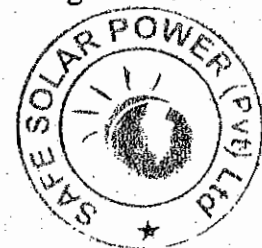


capacity of the project shall become 10.275 MW still in line with the LOI awarded for the Project i.e., 10MW.

The step to install higher capacity Panels was taken keeping in view the power crisis in the country. Though the aggregate installed capacity remains in the same range, these Panels are more efficient and the extra generation produced by the new Panels would be added to our national grid, resulting in a reduced quantum of load shedding, combating the power crisis and giving a boost to our energy deficient economy.

2.2 LOI APPROVAL OF PROJECT CHANGES

- 2.2.1 The Project Changes set out in Section 2.1.1 are same as per the LOI issued to us by the Alternate Energy Development Board hence no additional review or approval by AEDB is required. Similarly no change in the bank guarantees submitted to AEDB or modification of LOS is required.



2.3 PROCESS FOR MODIFICATION

- 2.3.1 Subject to the provisions of sub-regulation (15) and in accordance with sub-regulation (2) of the Regulation 10 of the Licensing Regulation 1999, a licensee may, at any time during the term of its generation license, communicate to NEPRA a licensee proposed modification setting out:

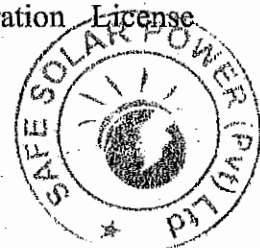
- (a) the text of the proposed modification;
- (b) a statement of the reasons in support of the modification; and

- (c) a statement of the impact on the tariff, quality of service and the performance by the Licensee of its obligations under the generation license.

2.4 APPLICATION FOR MODIFICATION OF LICENSE

2.4.1 PURSUANT TO Regulation 10 of the NEPRA Licensing (Application & Modification Procedure) Regulation 1999: SAFE SOLAR POWER (PVT) LIMITED SUBMITS for NEPRA's kind consideration and approval, the application for modification in its Generation License together with supporting documents (the "Generation License Modification Application") appended to the Generation License Modification Application at **Annexure A (Amended Schedule-I) and Annexure B (Amended Schedule-II)**.

2.5 This Generation License Modification Application is submitted in triplicate, together with Bank Draft No. 02692411 dated 19th December 2019 in the amount of PKR 274,500/- (Rupees two hundred and seventy four thousand and five hundred only) as requisite fee for the Generation License Modification Application, as communicated by NEPRA.



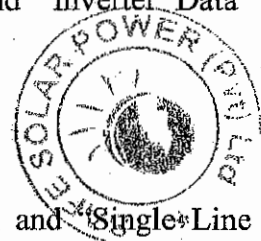
3. PROPOSED MODIFICATION IN THE GENERATION LICENSE

3.1 AMENDMENTS TO SCHEDULE I: PLANT DETAILS – Section entitled “General Information”

- i. The proposed modification to section 1 entitled “GENERAL INFORMATION” of “SCHEDULE I – PLANT DETAILS” of the Modification Generation License is attached hereto at **Annexure A (Modified Schedule-I)**

3.2 AMENDMENTS TO SCHEDULE I: PLANT DETAILS – Sections entitled “Plant System Description”, “Power Simulation”, “Power Loss Diagram” and “Single Line Diagram”

- i. The proposed modifications to sections entitled “Plant System Description”, “Power Simulation”, “Power Loss Diagram” and “Single Line Diagram” of “SCHEDULE I – PLANT DETAILS” of the Modification Generation License are attached hereto at **Annexure A (Modified Schedule-I)** with “Plant System Description” and “Inverter Data” being Modified.

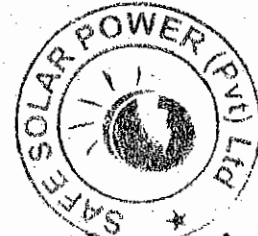


- ii. The sections entitled “Plant System Description”, and “Single Line Diagram” of “SCHEDULE I – PLANT DETAILS” of the Modification Generation License are submitted for modification due to the Panel Type Change (as submitted in Section 2.1.1 above). The mentioned sections reflect the information relating to bifacial Monocrystalline Panels (as selected for the Project).

- iii. Considering that the Licensee has selected the TrinaSolar Duomax bifacial 430 watts Panels with an aim of achieving high standards in technology for its Project, the output and the performance by the Licensee of its obligations under the Generation License will improve as a result of this selection. And as stated above considering the power crisis of the economy, this shift will increase the power available for the national grid, in turn abating the quantum of load shedding and will ameliorate our energy deficient economy at minimal increased project cost.

3.3 AMENDMENTS TO SCHEDULE I: PLANT DETAILS – Section entitled “Project Commissioning Date (Anticipated)”

- i. The proposed modification to the section entitled “Project Commissioning Date (Anticipated)” of “SCHEDULE I – PLANT DETAILS” of the Modification Generation License is attached hereto at **Annexure A (Modified Schedule-I)**.

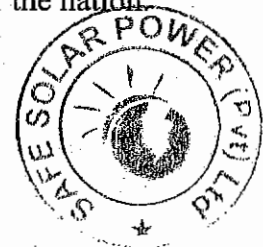


3.4 AMENDMENTS TO SCHEDULE II: NET CAPACITY OF THE LICENSEE'S GENERATION FACILITIES

- i. The proposed modification to Schedule II – “Net CAPACITY OF THE LICENSEE'S GENERATION FACILITIES” of the Generation License is attached hereto at **Annexure B (Modified Schedule-II)**.
- ii. The proposed modifications to Schedule II – “Net CAPACITY OF THE LICENSEE'S GENERATION FACILITIES” of the Modification Generation

License are submitted for modification due to the Panel Type Change (as submitted in Section 2.1.1 above). Schedule II reflects the information relating to bifacial Monocrystalline 430 watts Panels (as selected for the Project). In addition, the table set out the technical parameters for the solar power producers.

- iii. The Modification Application submitted to NEPRA by the Licensee takes into account the modifications proposed by the Licensee and does not have any effect on the quality of service and the performance by the Licensee of its obligations under the Generation License. The Modification in fact increases the available generation and adds power to the national grid, abating load shedding and boosting the energy deficient economy in turn amelioration the power crisis for the nation.

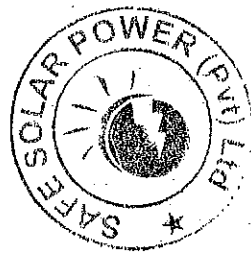


4. CONCLUSION

In light of the submissions set out herein and the information attached hereto (together with the Annexures), this Modification Generation License Application is submitted for NEPRA's approval of the proposed modifications in the Generation License granted to Licensee. Given the advance stage of the Project, NEPRA is kindly requested to process the Modification Generation License Application at the earliest, thereby enabling the Licensee to proceed further with the development process.

Respectfully submitted for and on behalf of:

SAFE SOLAR POWER (PVT) LIMITED



Atshan Asghar

(CHIEF EXECUTIVE OFFICER AND AUTHORIZED REPRESENTATIVE)



**SAFE
SOLAR
POWER
(Pvt)Ltd**

SSPL/CEO/NEPRA/LPM/01/20

06 Jan 2020

The Registrar
National Electric Power Regulatory Authority
NEPRA Building,
G-5/2,
Islamabad.

Subject: IMPACT OF PROPOSED MODIFICATION ON TARIFF.

Dear Sir,

In reference to our LPM petition, impact on tariff of the proposed modification is as follows:

1. The Licensee has selected the TrinaSolar Duomax bifacial 430 watts Panels. These panels have one of the highest capacity in the industry and due its dual face, they have an ability of generating 15-20% more units of electricity than similar single faced panels. Similarly Inverters proposed have higher efficiency. The performance by the Licensee of its obligations under the Generation License will improve as a result of this selection. This proposed modification in Generation License will have positive impact on the company's Tariff.
2. To pass on the result of the positive impact on the Tariff to the consumer, in parallel to this LPM application, Safe Solar Power (Pvt) Limited has also submitted an updated Tariff Application with the Authority.

Respectfully submitted for and on behalf of:

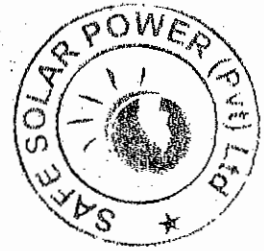
SAFE SOLAR POWER (PVT) LIMITED

.....*Muhammad Asghar*.....

(CHIEF EXECUTIVE OFFICER AND AUTHORIZED)

Office: House 28, Street 24, F-8/2 Islamabad.
Ph: +92 51 8358477 Fax: +92 51 8358499
E-mail: info@safesolarpower.com Web: www.safesolarpower.com

Plant Details - Annexure A (Modified Schedule-I)



“Plant System Description” and “Single Line Diagram”

1) General Information

1	Name of Applicant/Company	Safe Solar Power (Pvt) Limited
2	Registered/Business Office	28, street 24, F-8/2, Islamabad
3	Plant Location	Dharanwala, District Bahawalnagar, Punjab
4	Type of Generation	Solar Photo Voltaic

2) “Plant System Description”

Solar Farm Capacity & Configuration

1	Panel type, Make & Model	Bifacial Monocrystalline Trina Solar DuoMax
2	Installed Capacity of Solar Farm (MW)	10.275 MW
3	Number of Panels/ Size of each unit (Watts)	23,896/430 watts

a) Solar Panel Details

1	Name of manufacturer	Trina Solar
2	Type of Panels	Mono Crystalline Bifacial
3	Panel Capacity	430 watts

please see attached datasheet for details

b) Inverter Details

Name of manufacturer	Sungrow
Model	SG250HX
INPUT (DC)	
Maximum PV input voltage	1500V
Nominal PV input voltage	1130V
MPP voltage range	600-1500V
OUTPUT (AC)	
AC output power	250kVA



Feed-in Phases/Connection Phases 3/3

Efficiency

Max efficiency

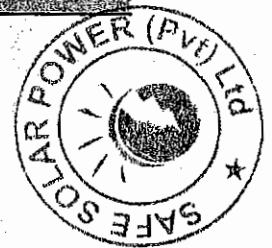
99%

please see attached datasheet

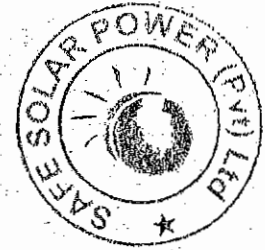
Other Details

1 Project Commissioning Date 1st December 2021
(Anticipated)

2 Expected Life of the Project from 25 years
Commercial Operation Date (COD)



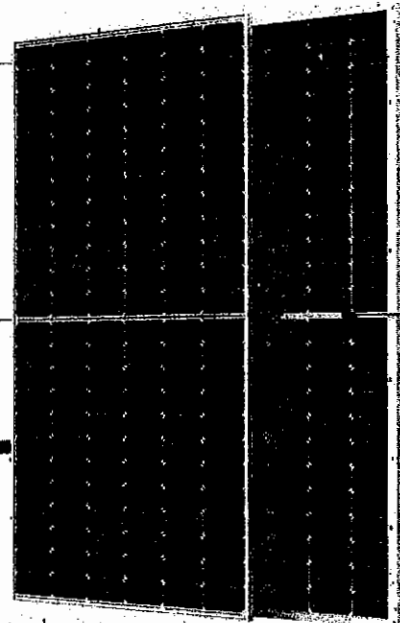
Solar Panel



THE

DUOMAX^{twin}

BIFACIAL DUAL GLASS 72 LAYOUT MODULE

**72 LAYOUT**

MONOCRYSTALLINE MODULE

430-445W

POWER OUTPUT RANGE

20.2%

MAXIMUM EFFICIENCY

0~+5W

POSITIVE POWER TOLERANCE

Founded in 1997, Trina Solar is the world's leading total solution provider for solar energy. With local presence around the globe, Trina Solar is able to provide exceptional service to each customer in each market and deliver our innovative, reliable products with the backing of Trina as a strong, bankable brand. Trina Solar now distributes its PV products to over 100 countries all over the world. We are committed to building strategic, mutually beneficial collaborations with installers, developers, distributors and other partners in driving smart energy together.

Comprehensive Products and System Certificates

IEC61215/IEC61730/IEC61701/IEC62716

ISO 9001: Quality Management System

ISO 14001: Environmental Management System

ISO 14064: Greenhouse Gases Emissions Verification

OHSAS 18001: Occupation Health and Safety

Management System

**PRODUCTS**

TSM-DEG17MC.20(II)

POWER RANGE

430-445W

**High power.**

- Up to 445W front power and 20.2% module efficiency with half-cut and MBB (Multi Busbar) technology bringing more BOS savings
- Lower resistance of half-cut and good reflection effect of MBB ensure high power

**High reliability**

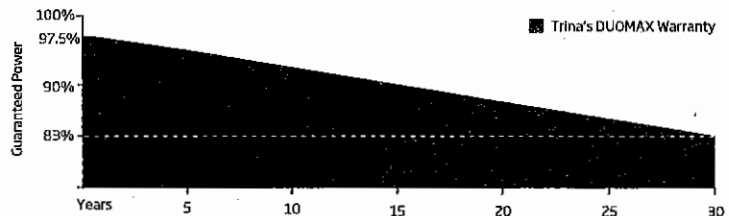
- Ensured PID resistance through cell process and module material control
- Resistant to salt, acid and ammonia
- Proven to be reliable in high temperature and humidity areas
- Certificated to fire class A
- Minimizes micro-crack and snail trails
- Certified to 5400 Pa positive load and 2400 Pa negative load
(For 4-7*10 Installation method: provide 2400 Pa positive load and 2400 Pa negative load)

**High energy generation**

- Up to 25% additional power gain from back side depending on the albedo;
- Excellent IAM and low light performance validated by 3rd party with cell process and module material optimization
- Lower temp coefficient (-0.35%) and NMOT bring more energy leading to lower LCOE
- Better anti-shading performance and lower operating temperature

**Easy to install**

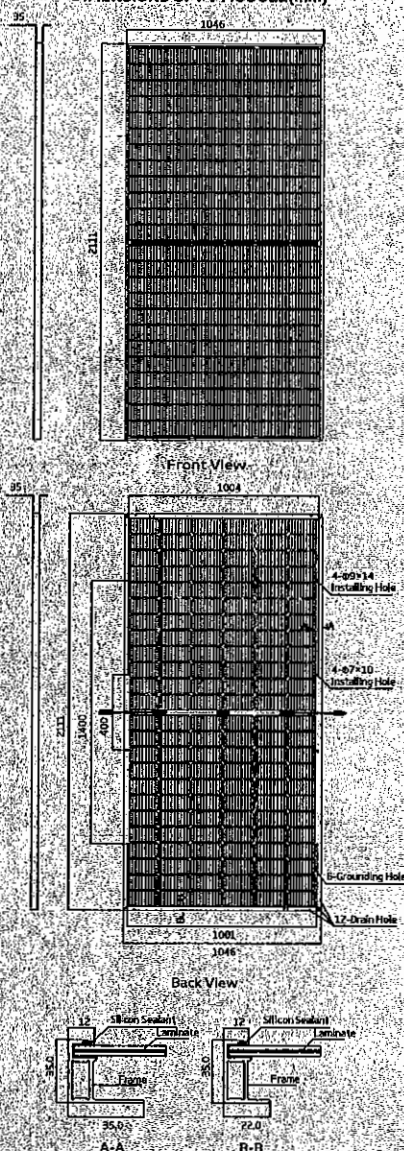
- Frame design makes module compatible with all racking and installation methods
- Easy to handle and install as normal framed module during transportation

Trina Solar's DUOMAX Performance Warranty

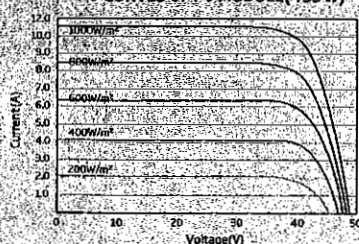
From the 2nd year to the 30th year, the average annual power decline will be no more than 0.5%.

Trina solar

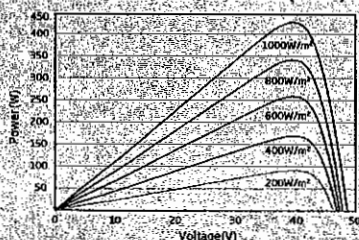
DIMENSIONS OF PV MODULE (mm)



I-V CURVES OF PV MODULE (435 W)



P-V CURVES OF PV MODULE (435 W)



ELECTRICAL DATA (STC)

Peak Power Watts- P_{max} (Wp)*	430	435	440	445
Power Output Tolerance- P_{max} (W)		D ⁺ +5		
Maximum Power Voltage- V_{mp} (V)	40.5	40.8	41.1	41.4
Maximum Power Current- I_{mp} (A)	10.62	10.67	10.71	10.75
Open Circuit Voltage- V_{oc} (V)	48.7	48.9	49.1	49.3
Short Circuit Current- I_{sc} (A)	11.20	11.24	11.28	11.32
Module Efficiency η_m (%)	19.5	19.7	19.9	20.2

STC: Irradiance 1000W/m², Cell Temperature 25°C, Air Mass AM1.5.

*Measuring tolerance: ±3%.

Electrical characteristics with different rear side power gain (reference to 435 Wp front)

Maximum Power- P_{max} (Wp)	457	479	500	522	544
Maximum Power Voltage- V_{mp} (V)	40.8	40.8	40.8	40.8	40.8
Maximum Power Current- I_{mp} (A)	11.20	11.74	12.27	12.80	13.34
Open Circuit Voltage- V_{oc} (V)	49.0	49.1	49.2	49.3	49.4
Short Circuit Current- I_{sc} (A)	11.80	12.35	12.92	13.49	14.05
P_{max} gain	5%	10%	15%	20%	25%

Power Bifaciality: 70±5%

ELECTRICAL DATA (NMOD)

Maximum Power- P_{max} (Wp)	325	329	333	337
Maximum Power Voltage- V_{mp} (V)	38.2	38.5	38.8	39.0
Maximum Power Current- I_{mp} (A)	8.51	8.55	8.58	8.63
Open Circuit Voltage- V_{oc} (V)	46.0	46.2	46.4	46.5
Short Circuit Current- I_{sc} (A)	9.02	9.05	9.08	9.12

NMOD: Irradiance at 800W/m², Ambient Temperature 20°C, Wind Speed 1m/s.

MECHANICAL DATA

Solar Cells	Monocrystalline
Cell Orientation	144 cells (6 × 24)
Module Dimensions	2111 × 1046 × 35 mm (83.11 × 41.18 × 1.38 inches)
Weight	28.5 kg (62.8 lb)
Front Glass	2.0 mm (0.08 inches), High Transmission, AR Coated Heat Strengthened Glass
Encapsulant material	POE/EVA
Back Glass	2.0 mm (0.08 inches), Heat Strengthened Glass (White Grid Glass)
Frame	30mm (1.18 inches) Anodized Aluminium Alloy
J-Box	IP68 rated
Cables	Photovoltaic Technology Cable 4.0mm² (0.006 inches²) Portrait: 280/280 mm (11.02/11.02 inches) Landscape: 1900/1900 mm (74.80/74.80 inches)
Connector	MC4 EV02 / TS4*

*Please refer to regional datasheet for specified connector.

TEMPERATURE RATINGS

NMOD (Nominal Module Operating Temperature)	41°C (±3°C)
Temperature Coefficient of P_{max}	-0.35%/°C
Temperature Coefficient of V_{oc}	-0.25%/°C
Temperature Coefficient of I_{sc}	0.04%/°C

(Do not connect Fuse In Combiner Box with two or more strings in parallel connection)

WARRANTY

- 10 Year Product Workmanship Warranty
- 30 Year Power Warranty

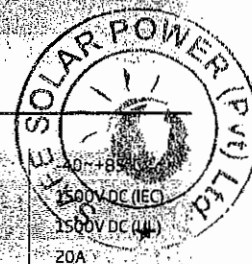
(Please refer to product warranty for details)

MAXIMUM RATINGS

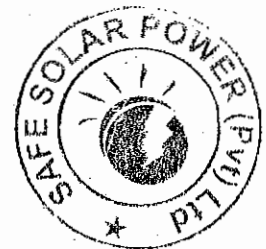
Operational Temperature	-40~+85°C
Maximum System Voltage	1500VDC (IEC) 1500VDC (UL)
Max Series Fuse Rating	20A

PACKAGING CONFIGURATION

- Modules per box: 30 pieces
- Modules per 40' container: 660 pieces



Inverter

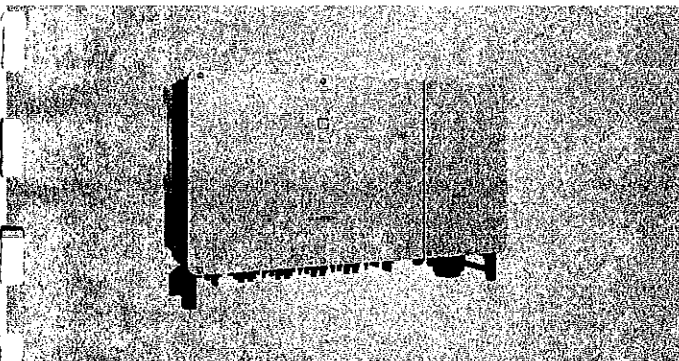


SG250HX New

SUNGROW
Clean power for all

Multi-MPPT String Inverter for 1500 Vdc System

SG250HX



HIGH YIELD

- 12 MPPTs with max. efficiency 99%
- Compatible with bifacial module
- Built-in Anti-PID and PID recovery function

LOW COST

- Compatible with Al and Cu AC cables
- DC2 in 1 connection enabled
- Power line communication (PLC)
- Q at night function

SMART O&M

- Touch free commissioning and remote firmware upgrade
- Online IV curve scan and diagnosis*
- Fuse free design with smart string current monitoring

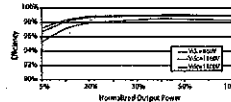
PROVEN SAFETY

- IP66 and CS protection
- Type II SPD for both DC and AC
- Compliant with global safety and grid code

CIRCUIT DIAGRAM

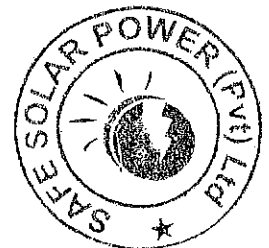


EFFICIENCY CURVE

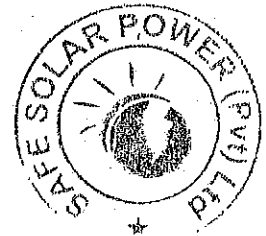


Type designation	SG250HX
Max. PV input voltage	1500 V
Min. PV input voltage / startup input voltage	600 V / 600 V
Nominal PV input voltage	1150 V
MPPT voltage range	600 V ~ 1500 V
MPPT voltage range for nominal power	850 V ~ 1300 V
No. of independent MPPT inputs	12
Max. number of input connectors per MPPT	2
Max. PV input current	26 A * 12
Max. current for input connector	30 A
Max. DC short-circuit current	50 A * 12
AC output power	250 kVA @ 30 °C / 225 kVA @ 40 °C / 200 kVA @ 50 °C
Max. AC output current	180 A
Nominal AC voltage	3 / PE, 600 V
AC voltage range	580 ~ 880 V
Nominal grid frequency / Grid frequency range	50 Hz / 45 ~ 55 Hz, 60 Hz / 55 ~ 65 Hz
THD	< 3 % (at nominal power)
DC current injection	< 0.5 % in
Power factor at nominal power / Adjustable power factor	> 0.99 / 0.8 leading ~ 0.8 lagging
Feed-in phases / connection phases	3 / 3
Max. efficiency	99.0 %
European efficiency	98.0 %
DC reverse connection protection	Yes
AC short circuit protection	Yes
Leakage current protection	Yes
Grid monitoring	Yes
Ground fault monitoring	Yes
DC switch	Yes
AC switch	No
PV string current monitoring	Yes
Q at night function	Yes
PID protection	Anti-PID or PID recovery
Overvoltage protection	DC Type II / AC Type II
Dimensions (W*H*D)	1281 * 650 * 163 mm
Weight	95 kg
Isolation method	Transformerless
Ingress protection rating	IP66
Night power consumption	< 2 W
Operating ambient temperature range	-30 to 60 °C
Allowable relative humidity range (non-condensing)	0 ~ 100 %
Cooling method	Smart forced air cooling
Max. operating altitude	4000 m (> 3000 m derating)
Display	LED, Bluetooth+APP
Communication	RS485 / PLC
DC connection type	Amphenol UTX (Max. 6 mm ²)
AC connection type	OT terminal (Max. 300 mm ²)
Compliance	IEC 62109, IEC 61727, IEC 62116, IEC 60060, IEC 61683, VDE-AR-N 4102:2018, VDE-AR-N 4102:2019, IEC 61000-6-3, EN 50549, UNE 205007-1:2013, P.O.12.3, UTE C15-712-1:2013
Grid Support	Q at night function, LVRT, HVRT active & reactive power control and power ramp rate control

* Only compatible with Sungrow logger and IsolatorCloud

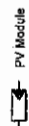


Single Line Drawing



- 1) Monocrystalline Bi-facial Solar Panel, Qty. 23,896
- 2) 250 KW Inverter Grid Tied, Qty. 35
- 3) 50 KVA Transformer, Qty. 01

Legends



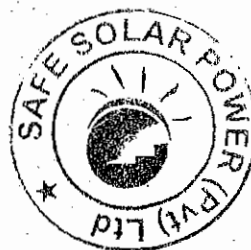
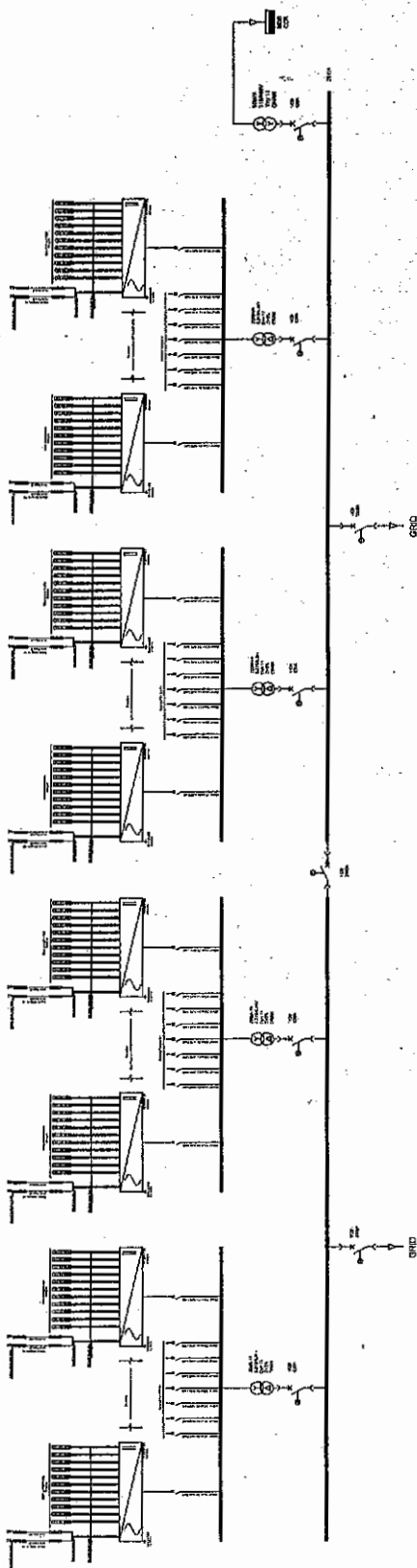
Three Phase Cable




TRANSFORMER

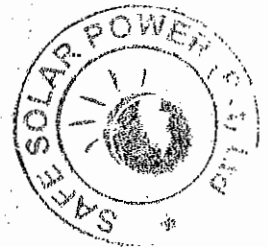


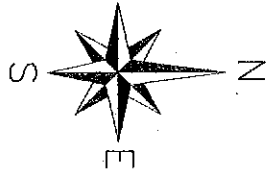
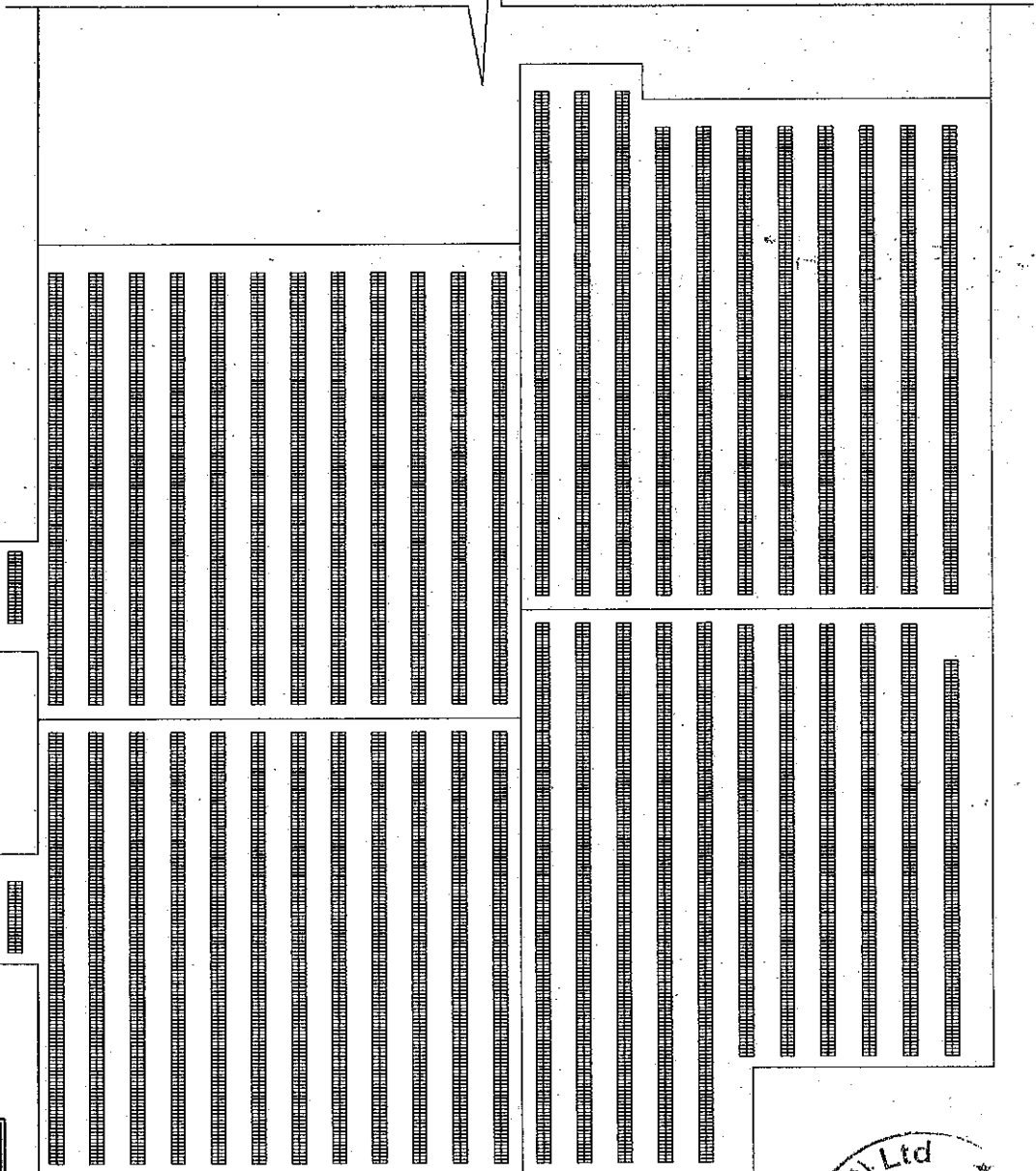
VACUUM CIRCUIT BREAKER (3-POLE)



Project Name	10 MWp Solar Power Project									
Client										
EPC Contractor										
Project No.	Heat Rate Power Station, M. L. Khan Road, Gurgaon, 12203, Pakistan									
Drawing Title	Project No.	Drawn By	A.B.S	Scale	1:1/1.5					
		Checked By	C.M	Unit	mm					
		Single Line Diagram	Approval By	Q.A.S	Size	A0				
Drawing No.		Date	25/11/15	Page	1/1					

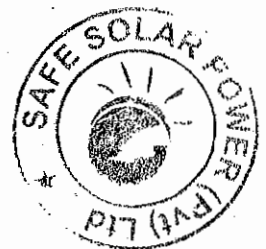
Site Layout





EPC Contractor		Redn <small>Energy Solutions</small> Third Floor Asla House, Ferozpur Road, Lahore.			
Project Name	Safe Solar	Drawn by	Danish Dillal	Scale	1:1
Drawing Title	Site Layout	Design by	Antique Mansob	Unit	mm
Drawing No.	1	Approved by		Size	A4
		Date	5/11/2019	Page	1/1

Simulation & Energy Loss Diagram



Grid-Connected System: Simulation parameters

Project : Safe solar_New Project

Geographical Site	Chak Forty Murad	Country	Pakistan
Situation	Latitude 29.60° N	Longitude	72.78° E
Time defined as	Legal Time Time zone UT+5	Altitude	136 m
	Albedo 0.55		
Meteo data:	Chak Forty Murad	Meteonorm 7.2 (1981-1990), Sat=91% - Synthetic	

Simulation variant : New simulation variant_3

Simulation date 12/12/19 18h52

Simulation parameters-

System type Trackers single array, with backtracking

Tracking plane, tilted Axis

Axis Tilt 0° Axis Azimuth 0°

Rotation Limitations

Minimum Phi -65° Maximum Phi 65°

Tracking algorithm Astronomic calculation

Backtracking strategy

Nb. of trackers 58 Single array

Tracker Spacing 8.50 m Collector width 4.26 m

Inactive band

Left 0.02 m Right 0.02 m

Backtracking limit angle

Phi limits +/- 59.5° Ground cov. Ratio (GCR) 50.1 %

Models used

Transposition Perez Diffuse Perez, Meteonorm

Horizon

Free Horizon

Near Shadings

Linear shadings

Bifacial system

Model Unlimited trackers, 2D calculation

Tracker Spacing 8.50 m Tracker width 4.30 m

Backtracking limit angle 59.5° GCR 50.6 %

Ground albedo 30.0 % Axis height above ground 1.00 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)

PV Array Characteristics

PV module

SI-mono Model TSM-430DEG17MC.20(II)

Custom parameters definition

Manufacturer Trina Solar

Number of PV modules

In series 29 modules

In parallel 824 strings

Total number of PV modules

Nb. modules 23896

Unit Nom. Power 430 Wp

Array global power

Nominal (STC) 10275 kWp

At operating cond. 9376 kWp (50°C)

Array operating characteristics (50°C)

U mpp 1069 V

I mpp 8769 A

Total area

Module area 52765 m²

Cell area 47142 m²

Inverter

Model SG250HX

Custom parameters definition

Manufacturer Sungrow

Characteristics

Operating Voltage 600-1500 V

Unit Nom. Power 225 kWac

Max. power (=>30°C) 250 kWac

Inverter pack

Nb. of inverters 420 * MPPT 8 %

Total Power 7875 kWac

Pnom ratio 1.30

PV Array loss factors

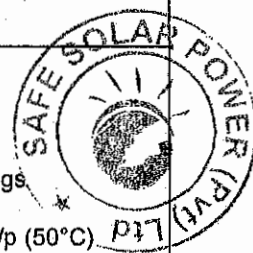
Array Soiling Losses

Loss Fraction 3.0 %

Thermal Loss factor

Uc (const) 29.0 W/m²K

Uv (wind) 0.0 W/m²K / m/s



Grid-Connected System: Simulation parameters

Wiring Ohmic Loss	Global array res.	2.0 mOhm	Loss Fraction	1.5 % at STC
LID - Light Induced Degradation			Loss Fraction	1.0 %
Module Quality Loss			Loss Fraction	0.0 %
Module Mismatch Losses			Loss Fraction	1.0 % at MPP
Strings Mismatch loss			Loss Fraction	0.10 %
Incidence effect (IAM): Fresnel AR coating, n(glass)=1.526, n(AR)=1.290				

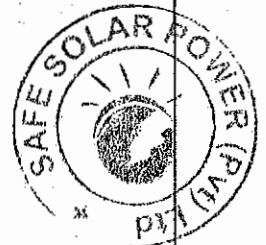
0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.962	0.892	0.816	0.681	0.440	0.000

System loss factors

AC wire loss inverter to transfo	Inverter voltage	800 Vac tri	Loss Fraction	2.0 % at STC
	Wires: 3x5000.0 mm ²	343 m	Loss Fraction	0.1 % at STC
External transformer	Iron loss (24H connexion)	10165 W	Loss Fraction	1.0 % at STC
	Resistive/Inductive losses	0.630 mOhm	Loss Fraction	0.3 %
Unavailability of the system	1.1 days, 3 periods		Time fraction	0.3 %

Auxiliaries loss

constant (fans) 70.0 kW ... from Power thresh. 0.0 kW



Grid-Connected System: Near shading definition

Project : Safe solar_New Project

Simulation variant : New simulation variant_3

Main system parameters

System type

Trackers single array, with backtracking

Near Shadings

Linear shadings

PV Field Orientation

tracking, tilted axis, Axis Tilt

0°

Axis Azimuth

0°

PV modules

Model

TSM-430DEG17MC.20(II)

Pnom

430 Wp

PV Array

Nb. of modules

23896

Pnom total

10275 kWp

Inverter

Model

SG250HX

Pnom

225 kW ac

Inverter pack

Nb. of units

35.0

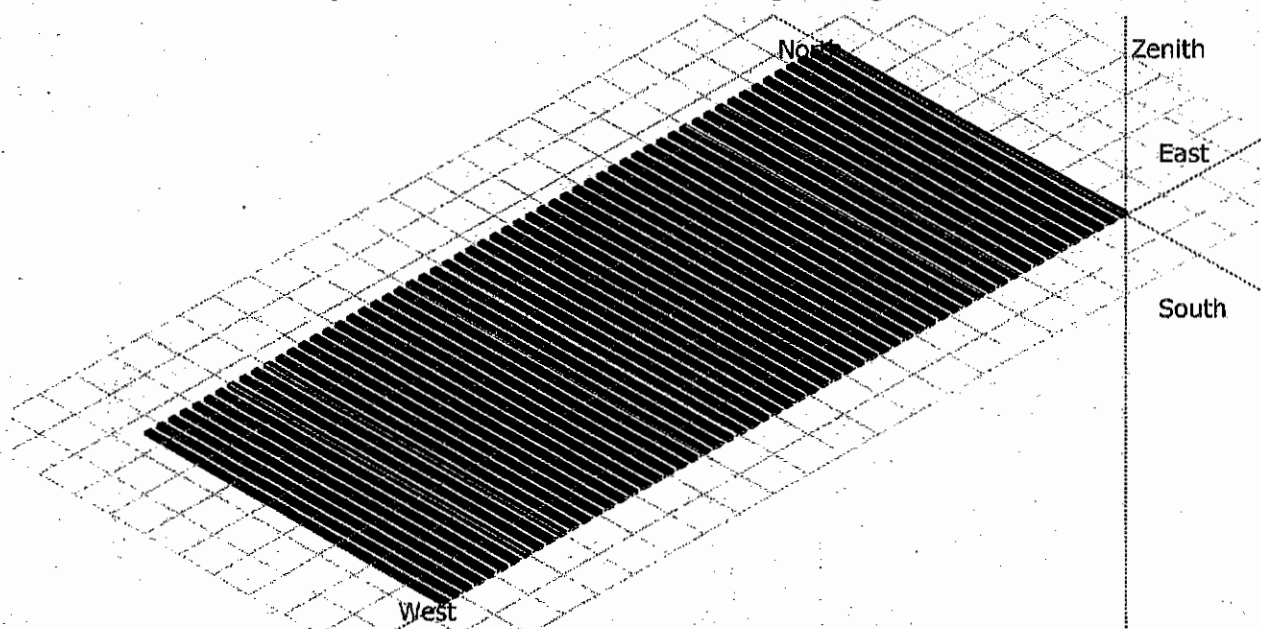
Pnom total

7875 kW ac

User's needs

Unlimited load (grid)

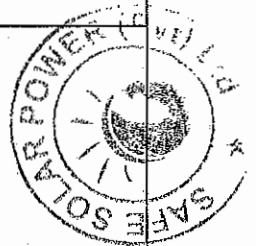
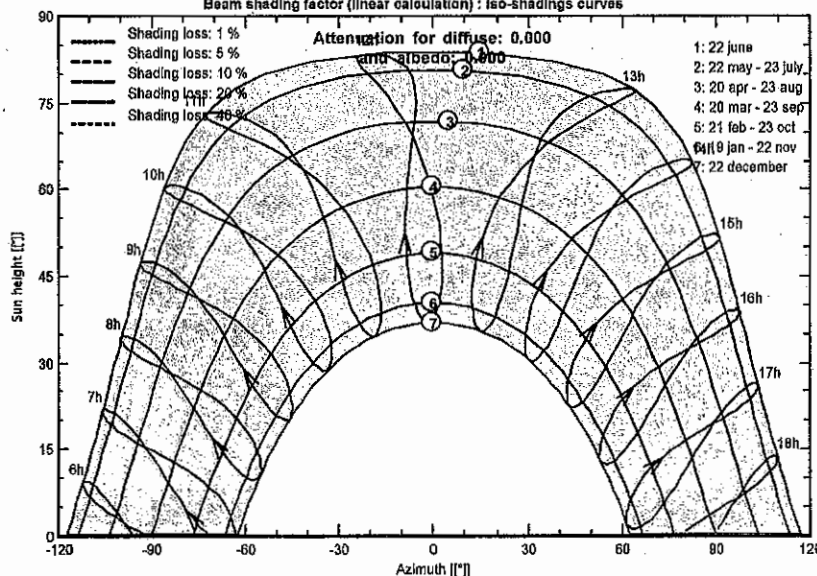
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Safe solar_New Project

Beam shading factor (linear calculation) : Iso-shadings curves



Grid-Connected System: Main results

Project : Safe solar_New Project

Simulation variant : New simulation variant_3

Main system parameters

System type Trackers single array, with backtracking

Near Shadings

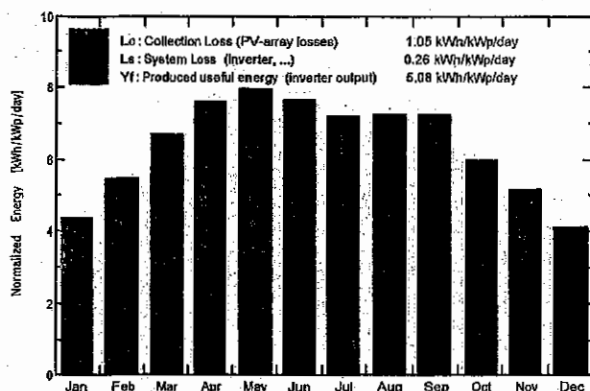
Linear shadings

PV Field Orientation	tracking, tilted axis, Axis Tilt	0°	Axis Azimuth	0°
PV modules	Model	TSM-430DEG17MC.20(II)	Pnom	430 Wp
PV Array	Nb. of modules	23896	Pnom total	10275 kWp
Inverter	Model	SG250HX	Pnom	225 kW ac
Inverter pack	Nb. of units	35.0	Pnom total	7875 kW ac
User's needs	Unlimited load (grid)			

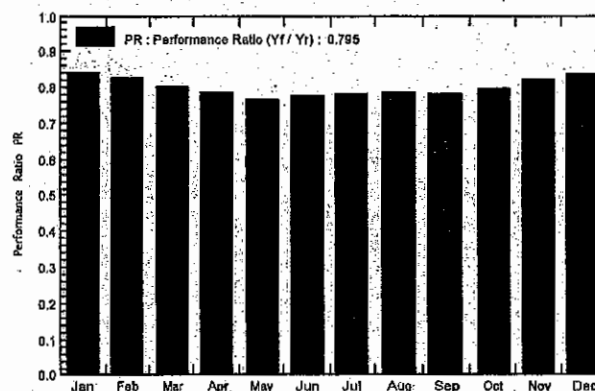
Main simulation results

System Production	Produced Energy	19054 MWh/year	Specific prod.	1854 kWh/kWp/year
	Performance Ratio PR	79.45 %		

Normalized productions (per installed kWp): Nominal power 10275 kWp



Performance Ratio PR



New simulation variant_3

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	PR
January	105.0	42.9	14.88	134.8	122.1	1228	1167	0.842
February	120.4	49.4	19.04	153.7	139.7	1372	1305	0.826
March	162.4	64.5	25.19	207.8	189.9	1799	1709	0.800
April	182.9	81.4	30.51	227.6	207.6	1926	1834	0.784
May	201.2	94.7	35.23	246.2	224.1	2030	1930	0.763
June	191.6	104.2	34.46	229.3	207.2	1922	1828	0.776
July	188.5	103.5	33.34	223.6	202.2	1888	1796	0.781
August	186.4	97.3	32.24	224.1	202.9	1901	1809	0.785
September	171.4	71.2	30.90	217.9	198.6	1849	1752	0.782
October	146.2	61.0	28.34	185.0	168.2	1590	1512	0.795
November	118.7	38.9	21.88	155.6	142.1	1376	1311	0.820
December	100.3	41.0	16.84	128.3	116.0	1160	1102	0.836
Year	1874.9	850.1	26.94	2334.0	2120.7	20040	19054	0.795

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	T amb.	E_Grid	Energy injected into grid
	GlobInc	Global incident in coll. plane	PR	Performance Ratio

Grid-Connected System: Special graphs

Project : Safe solar_New Project

Simulation variant : New simulation variant_3

Main system parameters

System type

Trackers single array, with backtracking

Near Shadings

Linear shadings

PV Field Orientation

tracking, tilted axis, Axis Tilt

0°

Axis Azimuth

0°

PV modules

Model

TSM-430DEG17MC.20(II)

Pnom

430 Wp

PV Array

Nb. of modules

23896

Pnom total

10275 kWp

Inverter

Model

SG250HX

Pnom

225 kW ac

Inverter pack

Nb. of units

35.0

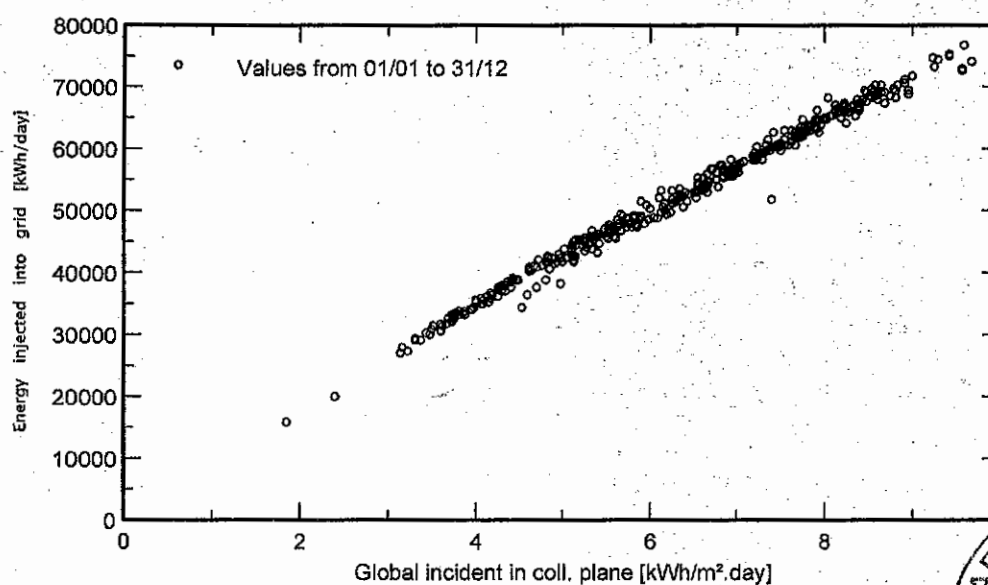
Pnom total

7875 kW ac

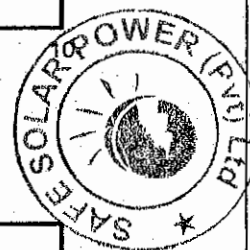
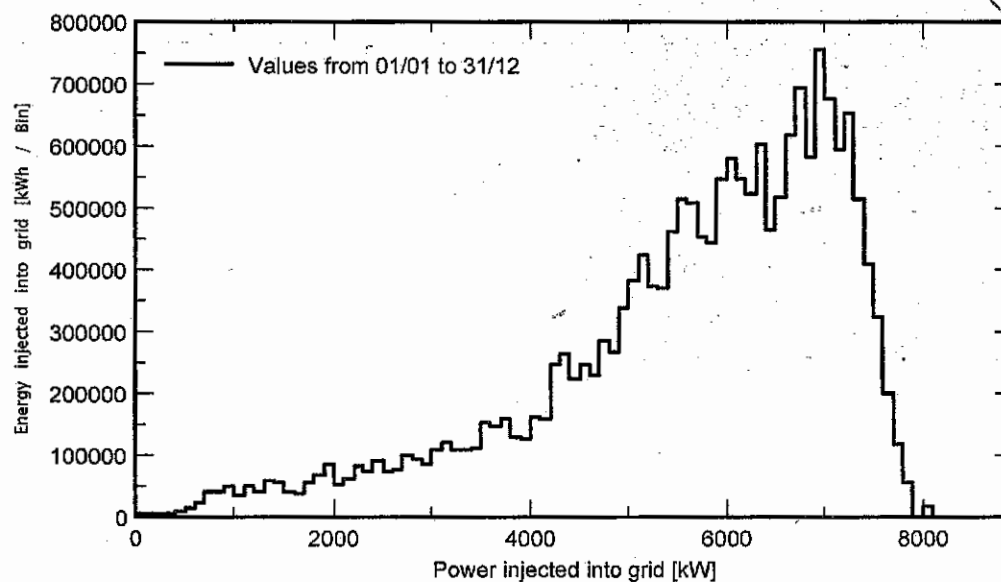
User's needs

Unlimited load (grid)

Daily Input/Output diagram



System Output Power Distribution



Grid-Connected System: Loss diagram

Project : Safe solar_New Project

Simulation variant : New simulation variant_3

Main system parameters

System type Trackers single array, with backtracking

Near Shadings

Linear shadings

PV Field Orientation

tracking, tilted axis, Axis Tilt

0°

Axis Azimuth

0°

PV modules

Model

TSM-430DEG17MC.20(II)

Pnom

430 Wp

PV Array

Nb. of modules

23896

Pnom total

10275 kWp

Inverter

Model

SG250HX

Pnom

225 kW ac

Inverter pack

Nb. of units

35.0

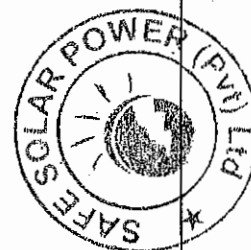
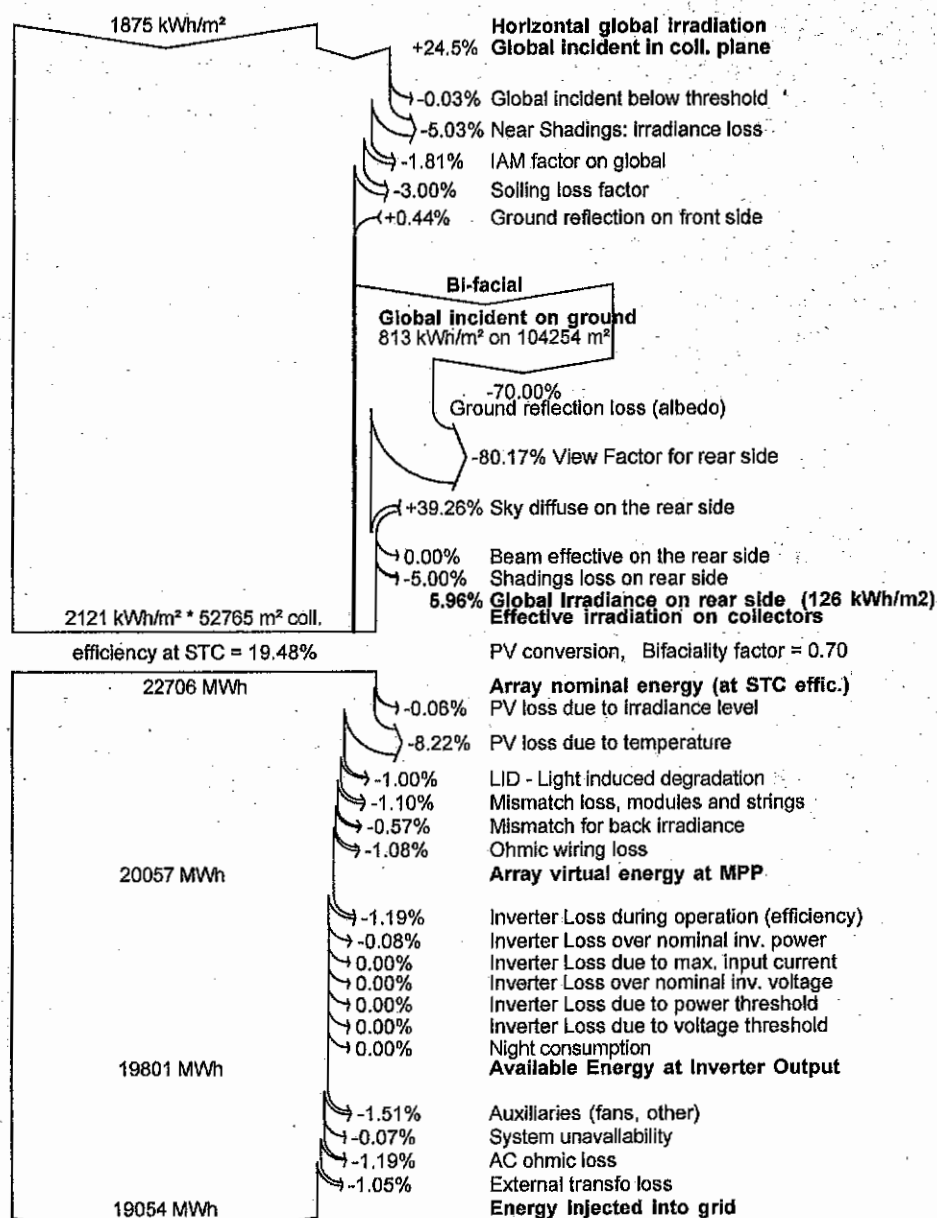
Pnom total

7875 kW ac

User's needs

Unlimited load (grid)

Loss diagram over the whole year



Grid-Connected System: P50 - P90 evaluation

Project : Safe solar_New Project

Simulation variant : New simulation variant_3

Main system parameters	System type	Trackers single array, with backtracking		
Near Shadings	Linear shadings			
PV Field Orientation	tracking, tilted axis, Axis Tilt	0°	Axis Azimuth	0°
PV modules	Model	TSM-430DEG17MC.20(II)	Pnom	430 Wp
PV Array	Nb. of modules	23896	Pnom total	10275 kWp
Inverter	Model	SG250HX	Pnom	225 kW ac
Inverter pack	Nb. of units	35.0	Pnom total	7875 kW ac
User's needs	Unlimited load (grid)			

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:

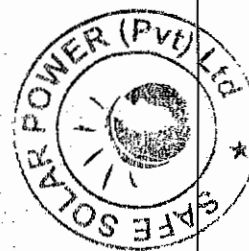
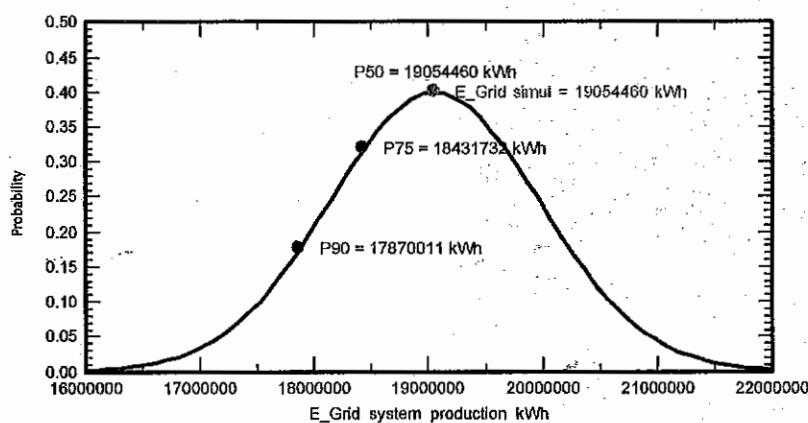
Meteo data source	Meteonorm 7.2 (1981-1990), Sat=91%
Meteo data	Kind TMY, multi-year
Specified Deviation	Climate change 0.0 %
Year-to-year variability	Variance 4.5 %

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	4.8 %	(quadratic sum)

Annual production probability	Variability	924 MWh
	P50	19054 MWh
	P90	17870 MWh
	P75	18432 MWh

Probability distribution



Annexure B Modified SCHEDULE-II**Net Capacity of the Licensee's Generation Facilities**

(1)	Total Installed Gross ISO Capacity of the Generation Facility/Solar Farm (MW/GWh)	10.275 MW
(2)	Auxiliary Consumption	Approximately 3%
(3)	Average Availability	97%
(4)	Net Capacity Factor	Approximately 20.5%
(5)	Annual Energy Generation (20 years Equivalent NET AEP)	18.43 GWh*

Note:

1. All the above figures are indicative as provided by the Licensee. The Net Capacity available to NTDC for dispatch and provision to purchasers will be determined through procedures contained in the Agreements of the Grid code.

