

# PVsyst - Simulation report

## Grid-Connected System

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Project: Sansera Rudarpur

Variant: New simulation variant (15)

No 3D scene defined, no shadings

System power: 860 kWp

Nūrābād - India

**Author**

Oriana power private limited (India)

**PVsyst V7.4.8**

VC2, Simulation date:  
10/24/24 12:22  
with V7.4.8

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**Project summary****Geographical Site****Nūrābād**

India

**Situation**

Latitude 26.40 °N

Longitude 78.07 °E

Altitude 176 m

Time zone UTC+5.5

**Project settings**

Albedo 0.20

**Weather data**

Nūrābād

Meteonorm 8.1 (1996-2015), Sat=100% - Synthetic

**System summary****Grid-Connected System****No 3D scene defined, no shadings****PV Field Orientation**

Fixed planes 4 orientations

Tilts/azimuths 12 / 0 °

12 / 180 °

5 / -90 °

5 / 90 °

**Near Shadings**

No Shadings

**User's needs**

Unlimited load (grid)

**System information****PV Array**

Nb. of modules

1284 units

Pnom total

860 kWp

**Inverters**

Nb. of units

8 units

Pnom total

670 kWac

Pnom ratio

1.284

**Results summary**

Produced Energy	1230846 kWh/year	Specific production	1431 kWh/kWp/year	Perf. Ratio PR	85.56 %
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**Table of contents**

Project and results summary	2
General parameters, PV Array Characteristics, System losses	3
Main results	9
Loss diagram	10
Predef. graphs	11



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## General parameters

### Grid-Connected System

No 3D scene defined, no shadings

### PV Field Orientation

#### Orientation

Fixed planes 4 orientations  
Tilts/azimuths 12 / 0 °  
12 / 180 °  
5 / -90 °  
5 / 90 °

### Sheds configuration

No 3D scene defined

### Models used

Transposition Perez  
Diffuse Perez, Meteonorm  
Circumsolar separate

### Horizon

Free Horizon

### Near Shadings

No Shadings

### User's needs

Unlimited load (grid)

## PV Array Characteristics

### PV module

Manufacturer Trina Solar  
Model TSM-670DE21  
(Custom parameters definition)  
Unit Nom. Power 670 Wp  
Number of PV modules 960 units  
Nominal (STC) 643 kWp

### Inverter

Manufacturer Sungrow  
Model SG125CX-P2  
(Custom parameters definition)  
Unit Nom. Power 125 kWac  
Number of inverters 4 units  
Total power 500 kWac

### Array #1 - Sub-array #4

Orientation #1  
Tilt/Azimuth 12/0 °  
Number of PV modules 209 units  
Nominal (STC) 140 kWp  
Modules 11 string x 19 In series

Number of inverters 10 \* MPPT 8% 0.8 unit  
Total power 104 kWac

### At operating cond. (50°C)

Pmpp 128 kWp  
U mpp 655 V  
I mpp 195 A

Operating voltage 180-1000 V  
Pnom ratio (DC:AC) 1.34  
No power sharing between MPPTs

### Array #2 - Sub-array #2

Orientation #1  
Tilt/Azimuth 12/0 °  
Number of PV modules 40 units  
Nominal (STC) 26.80 kWp  
Modules 2 string x 20 In series

Number of inverters 2 \* MPPT 8% 0.2 unit  
Total power 20.8 kWac

### At operating cond. (50°C)

Pmpp 24.48 kWp  
U mpp 690 V  
I mpp 35 A

Operating voltage 180-1000 V  
Pnom ratio (DC:AC) 1.29

### Array #3 - Sub-array #3

Orientation #2  
Tilt/Azimuth 12/180 °  
Number of PV modules 209 units  
Nominal (STC) 140 kWp  
Modules 11 string x 19 In series

Number of inverters 10 \* MPPT 8% 0.8 unit  
Total power 104 kWac

### At operating cond. (50°C)

Pmpp 128 kWp  
U mpp 655 V  
I mpp 195 A

Operating voltage 180-1000 V  
Pnom ratio (DC:AC) 1.34  
No power sharing between MPPTs



## PV Array Characteristics

## Array #4 - Sub-array #4

Orientation	#2		
Tilt/Azimuth	12/180 °		
Number of PV modules	40 units	Number of inverters	2 * MPPT 8% 0.2 unit
Nominal (STC)	26.80 kWp	Total power	20.8 kWac
Modules	2 string x 20 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	180-1000 V
Pmpp	24.48 kWp	Pnom ratio (DC:AC)	1.29
U mpp	690 V		
I mpp	35 A		

## Array #5 - Sub-array #5

Orientation	#3		
Tilt/Azimuth	5/-90 °		
Number of PV modules	162 units	Number of inverters	9 * MPPT 8% 0.8 unit
Nominal (STC)	109 kWp	Total power	93.8 kWac
Modules	9 string x 18 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	180-1000 V
Pmpp	99.1 kWp	Pnom ratio (DC:AC)	1.16
U mpp	621 V	No power sharing between MPPTs	
I mpp	160 A		

## Array #6 - Sub-array #6

Orientation	#4		
Tilt/Azimuth	5/90 °		
Number of PV modules	72 units	Number of inverters	3 * MPPT 8% 0.3 unit
Nominal (STC)	48.2 kWp	Total power	31.3 kWac
Modules	4 string x 18 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	180-1000 V
Pmpp	44.1 kWp	Pnom ratio (DC:AC)	1.54
U mpp	621 V		
I mpp	71 A		

## Array #14 - Sub-array #14

Orientation	#3		
Tilt/Azimuth	5/-90 °		
Number of PV modules	114 units	Number of inverters	6 * MPPT 8% 0.5 unit
Nominal (STC)	76.4 kWp	Total power	62.5 kWac
Modules	6 string x 19 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	180-1000 V
Pmpp	69.8 kWp	Pnom ratio (DC:AC)	1.22
U mpp	655 V		
I mpp	106 A		

## Array #15 - Sub-array #15

Orientation	#4		
Tilt/Azimuth	5/90 °		
Number of PV modules	114 units	Number of inverters	6 * MPPT 8% 0.5 unit
Nominal (STC)	76.4 kWp	Total power	62.5 kWac
Modules	6 string x 19 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	180-1000 V
Pmpp	69.8 kWp	Pnom ratio (DC:AC)	1.22
U mpp	655 V		
I mpp	106 A		



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## PV Array Characteristics

## PV module

Manufacturer	Trina Solar
Model	TSM-670DE21
(Custom parameters definition)	
Unit Nom. Power	670 Wp
Number of PV modules	286 units
Nominal (STC)	192 kWp

## Array #7 - Sub-array #7

Orientation	#4
Tilt/Azimuth	5/90 °
Number of PV modules	72 units
Nominal (STC)	48.2 kWp
Modules	4 string x 18 In series

## At operating cond. (50°C)

Pmpp	44.1 kWp
U mpp	621 V
I mpp	71 A

## Array #8 - Sub-array #8

Orientation	#4
Tilt/Azimuth	5/90 °
Number of PV modules	19 units
Nominal (STC)	12.73 kWp
Modules	1 strings x 19 In series

## At operating cond. (50°C)

Pmpp	11.63 kWp
U mpp	655 V
I mpp	18 A

## Array #9 - Sub-array #9

Orientation	#3
Tilt/Azimuth	5/-90 °
Number of PV modules	68 units
Nominal (STC)	45.6 kWp
Modules	4 string x 17 In series

## At operating cond. (50°C)

Pmpp	41.6 kWp
U mpp	586 V
I mpp	71 A

## Array #10 - Sub-array #10

Orientation	#4
Tilt/Azimuth	5/90 °
Number of PV modules	32 units
Nominal (STC)	21.44 kWp
Modules	2 string x 16 In series

## At operating cond. (50°C)

Pmpp	19.58 kWp
U mpp	552 V
I mpp	35 A

## Inverter

Manufacturer	Sungrow
Model	SG50CX
(Custom parameters definition)	
Unit Nom. Power	50.0 kWac
Number of inverters	3 units
Total power	150 kWac

Number of inverters	4 * MPPT 20% 0.8 unit
Total power	40.0 kWac

Operating voltage	200-1000 V
Max. power (=>40°C)	55.0 kWac
Pnom ratio (DC:AC)	1.21
No power sharing between MPPTs	

Number of inverters	1 * MPPT 20% 0.2 unit
Total power	10.0 kWac

Operating voltage	200-1000 V
Max. power (=>40°C)	55.0 kWac
Pnom ratio (DC:AC)	1.27

Number of inverters	3 * MPPT 20% 0.6 unit
Total power	30.0 kWac

Operating voltage	200-1000 V
Max. power (=>40°C)	55.0 kWac
Pnom ratio (DC:AC)	1.52
No power sharing between MPPTs	

Number of inverters	2 * MPPT 20% 0.4 unit
Total power	20.0 kWac

Operating voltage	200-1000 V
Max. power (=>40°C)	55.0 kWac
Pnom ratio (DC:AC)	1.07



## PV Array Characteristics

## Array #12 - Sub-array #12

Orientation	#3		
Tilt/Azimuth	5/-90 °		
Number of PV modules	76 units	Number of inverters	4 * MPPT 20% 0.8 unit
Nominal (STC)	50.9 kWp	Total power	40.0 kWac
Modules	4 string x 19 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	46.5 kWp	Operating voltage	200-1000 V
U mpp	655 V	Max. power (=>40°C)	55.0 kWac
I mpp	71 A	Pnom ratio (DC:AC)	1.27
		No power sharing between MPPTs	

## Array #13 - Sub-array #13

Orientation	#3		
Tilt/Azimuth	5/-90 °		
Number of PV modules	19 units	Number of inverters	1 * MPPT 20% 0.2 unit
Nominal (STC)	12.73 kWp	Total power	10.0 kWac
Modules	1 strings x 19 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	11.63 kWp	Operating voltage	200-1000 V
U mpp	655 V	Max. power (=>40°C)	55.0 kWac
I mpp	18 A	Pnom ratio (DC:AC)	1.27

## Array #11 - Sub-array #11

Orientation	#4		
Tilt/Azimuth	5/90 °		
<b>PV module</b>		<b>Inverter</b>	
Manufacturer	Trina Solar	Manufacturer	Sungrow
Model	TSM-670DE21	Model	SG20RT-P2
(Custom parameters definition)		(Original PVsyst database)	
Unit Nom. Power	670 Wp	Unit Nom. Power	20.0 kWac
Number of PV modules	38 units	Number of inverters	2 * MPPT 50% 1 unit
Nominal (STC)	25.46 kWp	Total power	20.0 kWac
Modules	2 string x 19 In series	Operating voltage	160-1000 V
<b>At operating cond. (50°C)</b>		Pnom ratio (DC:AC)	1.27
Pmpp	23.25 kWp	No power sharing between MPPTs	
U mpp	655 V		
I mpp	35 A		
<b>Total PV power</b>		<b>Total inverter power</b>	
Nominal (STC)	860 kWp	Total power	670 kWac
Total	1284 modules	Number of inverters	8 units
Module area	3989 m²	Pnom ratio	1.28
Cell area	3737 m²	No power sharing	

## Array losses

## Array Soiling Losses

Loss Fraction 1.0 %

## Thermal Loss factor

Module temperature according to irradiance  
Uc (const) 27.0 W/m²K  
Uv (wind) 0.0 W/m²K/m/s

## LID - Light Induced Degradation

Loss Fraction 2.0 %

## Module Quality Loss

Loss Fraction -0.8 %

## Module mismatch losses

Loss Fraction 0.1 % at MPP

## Strings Mismatch loss

Loss Fraction 0.1 %

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**Array losses****IAM loss factor**

Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	0.998	0.993	0.966	0.923	0.820	0.577	0.000

**DC wiring losses**

Global wiring resistance 8.6 mΩ  
Loss Fraction 1.5 % at STC

**Array #1 - Sub-array #4**

Global array res. 55 mΩ  
Loss Fraction 1.5 % at STC

**Array #3 - Sub-array #3**

Global array res. 55 mΩ  
Loss Fraction 1.5 % at STC

**Array #5 - Sub-array #5**

Global array res. 64 mΩ  
Loss Fraction 1.5 % at STC

**Array #7 - Sub-array #7**

Global array res. 144 mΩ  
Loss Fraction 1.5 % at STC

**Array #9 - Sub-array #9**

Global array res. 136 mΩ  
Loss Fraction 1.5 % at STC

**Array #11 - Sub-array #11**

Global array res. 305 mΩ  
Loss Fraction 1.5 % at STC

**Array #13 - Sub-array #13**

Global array res. 610 mΩ  
Loss Fraction 1.5 % at STC

**Array #15 - Sub-array #15**

Global array res. 102 mΩ  
Loss Fraction 1.5 % at STC

**Array #2 - Sub-array #2**

Global array res. 321 mΩ  
Loss Fraction 1.5 % at STC

**Array #4 - Sub-array #4**

Global array res. 321 mΩ  
Loss Fraction 1.5 % at STC

**Array #6 - Sub-array #6**

Global array res. 144 mΩ  
Loss Fraction 1.5 % at STC

**Array #8 - Sub-array #8**

Global array res. 610 mΩ  
Loss Fraction 1.5 % at STC

**Array #10 - Sub-array #10**

Global array res. 257 mΩ  
Loss Fraction 1.5 % at STC

**Array #12 - Sub-array #12**

Global array res. 152 mΩ  
Loss Fraction 1.5 % at STC

**Array #14 - Sub-array #14**

Global array res. 102 mΩ  
Loss Fraction 1.5 % at STC

**System losses****Unavailability of the system**

Time fraction 0.2 %  
0.7 days,  
2 periods



### AC wiring losses

#### Inv. output line up to injection point

Inverter voltage 400 Vac tri  
Loss Fraction 0.16 % at STC

#### Inverter: SG125CX-P2

Wire section (1 Inv.) Alu 1 x 3 x 300 mm<sup>2</sup>  
Wires length 92 m

#### Inverter: SG125CX-P2

Wire section (1 Inv.) Alu 1 x 3 x 120 mm<sup>2</sup>  
Wires length 0 m

#### Inverter: SG50CX

Wire section (2 Inv.) Alu 2 x 3 x 35 mm<sup>2</sup>  
Average wires length 0 m

#### Inverter: SG50CX

Wire section (1 Inv.) Alu 1 x 3 x 25 mm<sup>2</sup>  
Wires length 0 m

#### Inverter: SG125CX-P2

Wire section (2 Inv.) Alu 2 x 3 x 150 mm<sup>2</sup>  
Average wires length 0 m

#### Inverter: SG125CX-P2

Wire section (1 Inv.) Alu 1 x 3 x 240 mm<sup>2</sup>  
Wires length 0 m

#### Inverter: SG50CX

Wire section (1 Inv.) Alu 1 x 3 x 50 mm<sup>2</sup>  
Wires length 0 m

#### Inverter: SG20RT-P2

Wire section (1 Inv.) Alu 1 x 3 x 10 mm<sup>2</sup>  
Wires length 0 m





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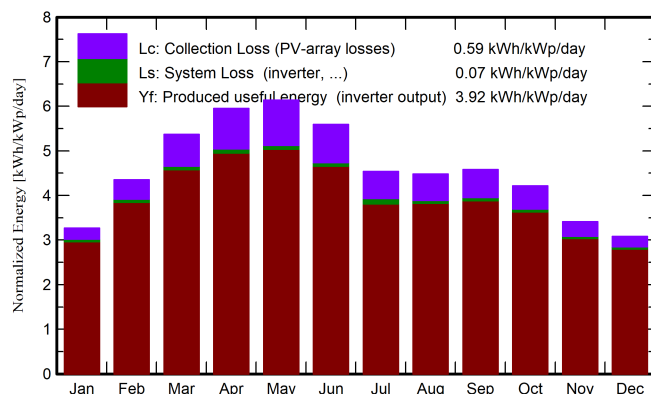
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### Main results

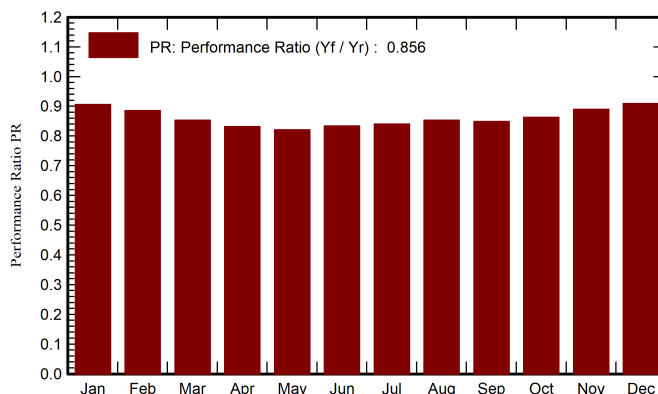
#### System Production

Produced Energy (Sim.)	1230846 kWh/year	Specific production (Sim.)	1431 kWh/kWp/year	Perf. Ratio PR	85.56 %
Produced Energy (P50)	1229615 kWh/year	Specific production (P50)	1429 kWh/kWp/year		
Produced Energy (P90)	1220696 kWh/year	Specific production (P90)	1419 kWh/kWp/year		
Produced Energy (P75)	1224926 kWh/year	Specific production (P75)	1424 kWh/kWp/year		

#### Normalized productions (per installed kWp)



#### Performance Ratio PR



### Balances and main results

	GlobHor kWh/m <sup>2</sup>	DiffHor kWh/m <sup>2</sup>	T_Amb °C	GlobInc kWh/m <sup>2</sup>	GlobEff kWh/m <sup>2</sup>	EArray kWh	E_Grid kWh	PR ratio
January	102.0	44.5	14.13	101.4	99.0	80601	79068	0.906
February	122.3	55.3	18.42	121.8	119.1	94459	92756	0.885
March	167.2	72.4	24.94	166.5	163.3	124317	122197	0.853
April	179.3	88.0	30.30	178.6	175.4	130298	127854	0.832
May	191.1	97.6	34.43	190.3	186.9	136700	134409	0.821
June	168.8	102.2	33.46	167.9	164.7	122426	120373	0.834
July	141.6	93.0	30.71	140.8	137.8	104919	101801	0.841
August	139.7	84.9	29.44	138.9	136.2	103854	102039	0.854
September	138.2	72.9	28.64	137.4	134.6	102121	100348	0.849
October	131.4	70.7	26.29	130.6	127.9	98679	96942	0.863
November	102.9	56.2	20.34	102.4	99.9	79792	78358	0.889
December	96.0	51.2	15.46	95.5	93.0	76126	74702	0.909
Year	1680.6	888.8	25.58	1672.1	1637.8	1254291	1230846	0.856

#### Legends

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



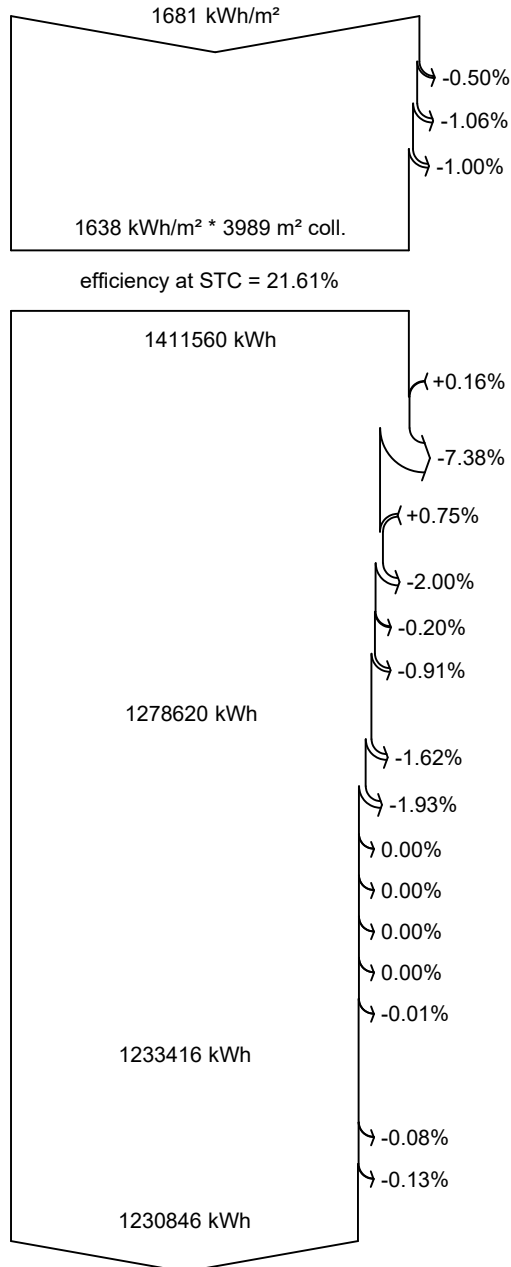
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### Loss diagram



**Global horizontal irradiation**

**Global incident in coll. plane**

IAM factor on global

Soiling loss factor

**Effective irradiation on collectors**

PV conversion

**Array nominal energy (at STC effic.)**

PV loss due to irradiance level

PV loss due to temperature

Module quality loss

LID - Light induced degradation

Mismatch loss, modules and strings

Ohmic wiring loss

**Array virtual energy at MPP**

Inverter Loss during operation (efficiency)

Inverter Loss over nominal inv. power

Inverter Loss due to max. input current

Inverter Loss over nominal inv. voltage

Inverter Loss due to power threshold

Inverter Loss due to voltage threshold

Night consumption

**Available Energy at Inverter Output**

AC ohmic loss

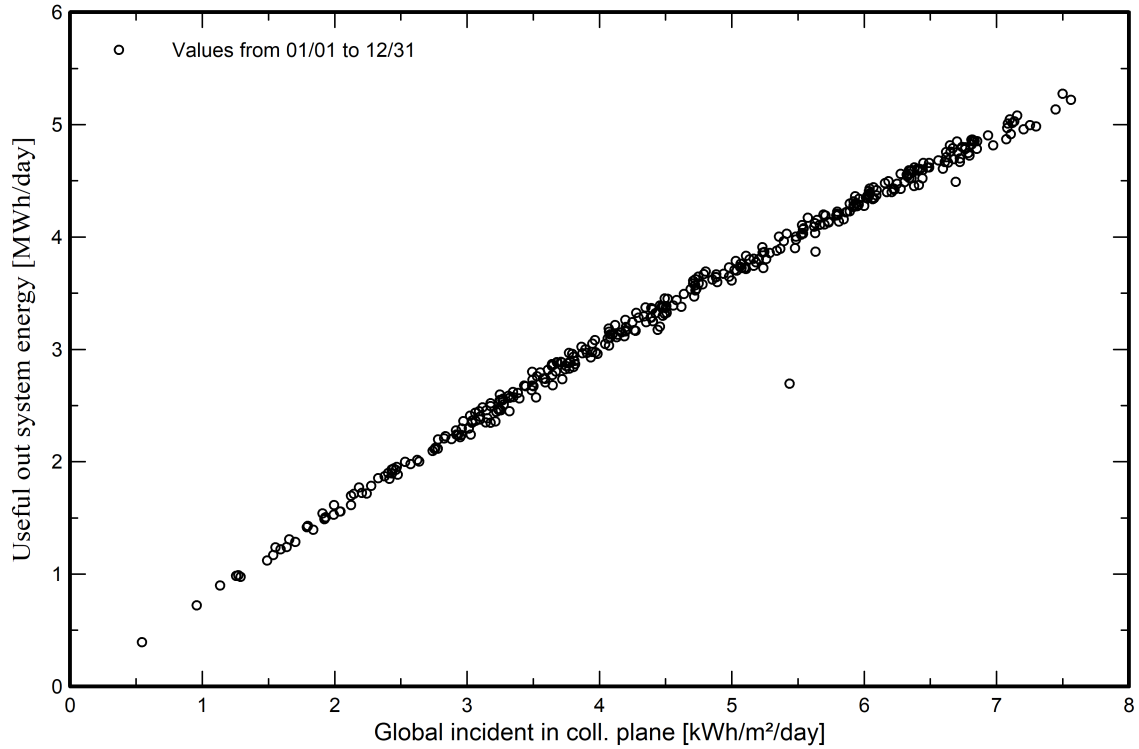
System unavailability

**Energy injected into grid**



### Predef. graphs

Daily Input/Output diagram



System Output Power Distribution

