

# PVsyst - Simulation report

## Grid-Connected System

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Project: TVS SRICHAKRA

Variant: New simulation variant24

No 3D scene defined, no shadings

System power: 1010 kWp

Rudrapur - India

**Author**

Oriana power private limited (India)

**PVsyst V7.4.8**

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

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**Project summary****Geographical Site****Rudrapur**

India

**Situation**

Latitude 29.01 °N

Longitude 79.41 °E

Altitude 207 m

Time zone UTC+5.5

**Project settings**

Albedo 0.20

**Weather data**

Rudrapur

SolarGIS Monthly aver. , period not spec. - Synthetic

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

Fixed planes 2 orientations

Tilts/azimuths 5 / 0 °

5 / -180 °

**Near Shadings**

No Shadings

**User's needs**

Unlimited load (grid)

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

Nb. of modules

1836 units

Pnom total

1010 kWp

**Inverters**

Nb. of units

7 units

Pnom total

800 kWac

Pnom ratio

1.262

**Results summary**

Produced Energy 1528087 kWh/year Specific production 1513 kWh/kWp/year Perf. Ratio PR 83.47 %

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## PVsyst V7.4.8

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## General parameters

## Grid-Connected System

No 3D scene defined, no shadings

## PV Field Orientation

## Orientation

Fixed planes 2 orientations  
Tilts/azimuths 5 / 0 °  
5 / -180 °

## 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 GOLDI SUN PRIVATE LIMITED  
Model GS10-B144-GF-550

(Custom parameters definition)

Unit Nom. Power 550 Wp  
Number of PV modules 1716 units  
Nominal (STC) 944 kWp

## Array #1 - PV Array

Orientation #1  
Tilt/Azimuth 5/0 °  
Number of PV modules 620 units  
Nominal (STC) 341 kWp  
Modules 31 string x 20 In series

## At operating cond. (50°C)

Pmpp 311 kWp  
U mpp 765 V  
I mpp 407 A

## Array #2 - Sub-array #2

Orientation #1  
Tilt/Azimuth 5/0 °  
Number of PV modules 120 units  
Nominal (STC) 66.0 kWp  
Modules 6 string x 20 In series

## At operating cond. (50°C)

Pmpp 60.3 kWp  
U mpp 765 V  
I mpp 79 A

## Array #3 - Sub-array #3

Orientation #1  
Tilt/Azimuth 5/0 °  
Number of PV modules 36 units  
Nominal (STC) 19.80 kWp  
Modules 2 string x 18 In series

## At operating cond. (50°C)

Pmpp 18.09 kWp  
U mpp 689 V  
I mpp 26 A

## Inverter

Manufacturer Sungrow  
Model SG125CX-P2

(Custom parameters definition)

Unit Nom. Power 125 kWac  
Number of inverters 6 units  
Total power 750 kWac

Number of inverters 2 units  
Total power 250 kWac

Operating voltage 180-1000 V  
Pnom ratio (DC:AC) 1.36  
Power sharing within this inverter

Number of inverters 5 \* MPPT 8% 0.4 unit  
Total power 52.1 kWac

Operating voltage 180-1000 V  
Pnom ratio (DC:AC) 1.27

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

Operating voltage 180-1000 V  
Pnom ratio (DC:AC) 0.95



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## PV Array Characteristics

## Array #4 - Sub-array #4

Orientation	#1		
Tilt/Azimuth	5/0 °		
Number of PV modules	57 units	Number of inverters	2 * MPPT 8% 0.2 unit
Nominal (STC)	31.4 kWp	Total power	20.8 kWac
Modules	3 string x 19 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	28.64 kWp	Operating voltage	180-1000 V
U mpp	727 V	Pnom ratio (DC:AC)	1.50
I mpp	39 A		

## Array #5 - Sub-array #5

Orientation	#2		
Tilt/Azimuth	5/-180 °		
Number of PV modules	76 units	Number of inverters	3 * MPPT 8% 0.3 unit
Nominal (STC)	41.8 kWp	Total power	31.3 kWac
Modules	4 string x 19 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	38.2 kWp	Operating voltage	180-1000 V
U mpp	727 V	Pnom ratio (DC:AC)	1.34
I mpp	53 A		

## Array #6 - Sub-array #6

Orientation	#2		
Tilt/Azimuth	5/-180 °		
Number of PV modules	247 units	Number of inverters	1 unit
Nominal (STC)	136 kWp	Total power	125 kWac
Modules	13 string x 19 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	124 kWp	Operating voltage	180-1000 V
U mpp	727 V	Pnom ratio (DC:AC)	1.09
I mpp	171 A	Power sharing within this inverter	

## Array #7 - Sub-array #7

Orientation	#2		
Tilt/Azimuth	5/-180 °		
Number of PV modules	560 units	Number of inverters	2 units
Nominal (STC)	308 kWp	Total power	250 kWac
Modules	28 string x 20 In series		
<b>At operating cond. (50°C)</b>			
Pmpp	281 kWp	Operating voltage	180-1000 V
U mpp	765 V	Pnom ratio (DC:AC)	1.23
I mpp	368 A	Power sharing within this inverter	

## Array #8 - Sub-array #9

Orientation	#2
Tilt/Azimuth	5/-180 °



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## PV Array Characteristics

## PV module

Manufacturer GOLDI SUN PRIVATE LIMITED  
Model GS10-B144-GF-550

(Custom parameters definition)

Unit Nom. Power 550 Wp  
Number of PV modules 120 units  
Nominal (STC) 66.0 kWp  
Modules 6 string x 20 In series

## At operating cond. (50°C)

Pmpp 60.3 kWp  
U mpp 765 V  
I mpp 79 A

## Total PV power

Nominal (STC) 1010 kWp  
Total 1836 modules  
Module area 4741 m<sup>2</sup>  
Cell area 4378 m<sup>2</sup>

## Inverter

Manufacturer Sungrow  
Model SG50CX

(Custom parameters definition)

Unit Nom. Power 50.0 kWac  
Number of inverters 1 unit  
Total power 50.0 kWac  
Operating voltage 200-1000 V  
Max. power (=>40°C) 55.0 kWac  
Pnom ratio (DC:AC) 1.32  
Power sharing within this inverter

## Total inverter power

Total power 800 kWac  
Number of inverters 7 units  
Pnom ratio 1.26  
No power sharing

## Array losses

## Array Soiling Losses

Loss Fraction 0.5 %

## Thermal Loss factor

Module temperature according to irradiance  
Uc (const) 20.0 W/m<sup>2</sup>K  
Uv (wind) 0.0 W/m<sup>2</sup>K/m/s

## Serie Diode Loss

Voltage drop 0.7 V  
Loss Fraction 0.1 % at STC

## LID - Light Induced Degradation

Loss Fraction 2.0 %

## Module Quality Loss

Loss Fraction 0.0 %

## Module mismatch losses

Loss Fraction 0.1 % at MPP

## Strings Mismatch loss

Loss Fraction 0.1 %

## IAM loss factor

Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	0.997	0.988	0.952	0.899	0.785	0.537	0.000

## DC wiring losses

Global wiring resistance 10 mΩ  
Loss Fraction 1.5 % at STC

## Array #1 - PV Array

Global array res. 31 mΩ  
Loss Fraction 1.5 % at STC

## Array #3 - Sub-array #3

Global array res. 430 mΩ  
Loss Fraction 1.5 % at STC

## Array #5 - Sub-array #5

Global array res. 227 mΩ  
Loss Fraction 1.5 % at STC

## Array #7 - Sub-array #7

Global array res. 34 mΩ  
Loss Fraction 1.5 % at STC

## Array #2 - Sub-array #2

Global array res. 159 mΩ  
Loss Fraction 1.5 % at STC

## Array #4 - Sub-array #4

Global array res. 303 mΩ  
Loss Fraction 1.5 % at STC

## Array #6 - Sub-array #6

Global array res. 70 mΩ  
Loss Fraction 1.5 % at STC

## Array #8 - Sub-array #9

Global array res. 159 mΩ  
Loss Fraction 1.5 % at STC

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

Time fraction	0.2 %
	0.7 days,
	3 periods

**AC wiring losses****Inv. output line up to injection point**

Inverter voltage	400 Vac tri
Loss Fraction	0.50 % at STC

**Global System**

Wire section	Alu 3 x 2000 mm <sup>2</sup>
Wires length	51 m

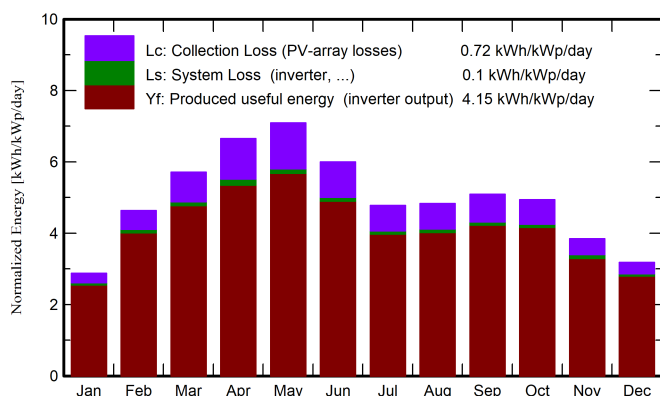


## Main results

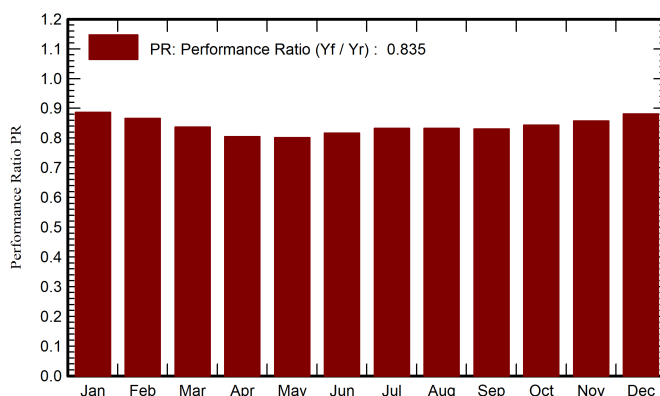
## System Production

Produced Energy (P50)	1528087 kWh/year	Specific production (P50)	1513 kWh/kWp/year	Perf. Ratio PR	83.47 %
Produced Energy (P90)	1510101 kWh/year	Specific production (P90)	1495 kWh/kWp/year		
Produced Energy (P75)	1518631 kWh/year	Specific production (P75)	1504 kWh/kWp/year		

## Normalized productions (per installed kWp)



## Performance Ratio PR



## Balances and main results

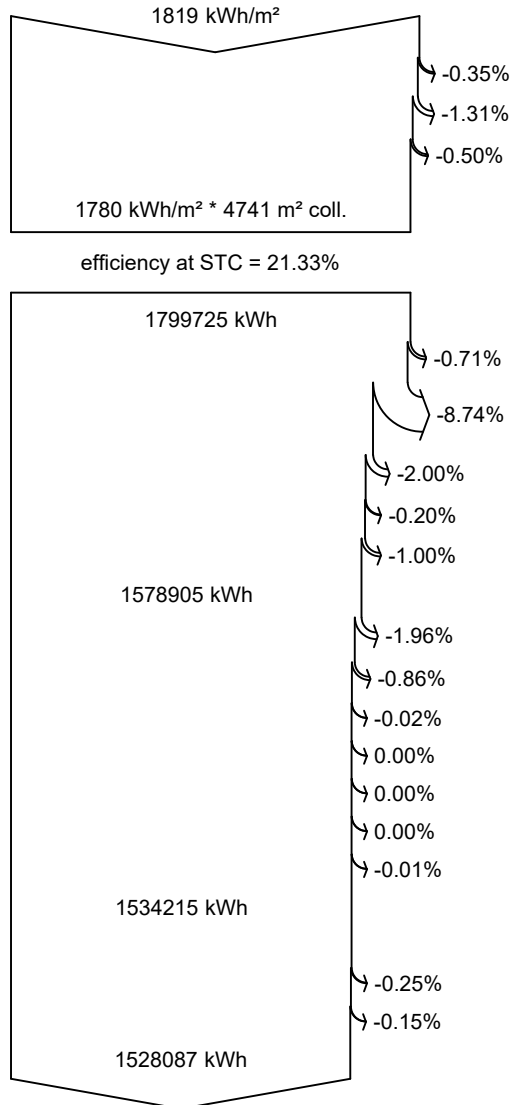
	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	°C	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	kWh	kWh	ratio
January	90.0	50.7	13.40	89.2	87.0	81807	79860	0.886
February	130.5	56.6	16.50	129.8	127.2	116218	113526	0.866
March	177.6	73.7	21.90	176.9	173.9	152956	149535	0.837
April	200.0	86.9	27.50	199.6	196.6	167319	162186	0.805
May	220.0	101.6	30.30	219.8	216.7	181826	177946	0.802
June	180.0	95.8	30.50	179.9	177.2	151734	148460	0.817
July	148.2	88.5	27.90	148.0	145.4	127260	124444	0.833
August	150.2	85.6	27.30	149.9	147.2	128949	126085	0.833
September	153.2	75.3	26.50	152.7	150.0	130928	128023	0.830
October	154.0	67.5	23.60	153.2	150.5	133373	130402	0.843
November	116.2	56.3	19.20	115.3	112.6	103061	99891	0.858
December	99.4	51.1	14.89	98.6	95.9	89808	87728	0.881
Year	1819.3	889.6	23.32	1812.9	1780.2	1565238	1528087	0.835

## Legends

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



### Loss diagram



#### 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

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

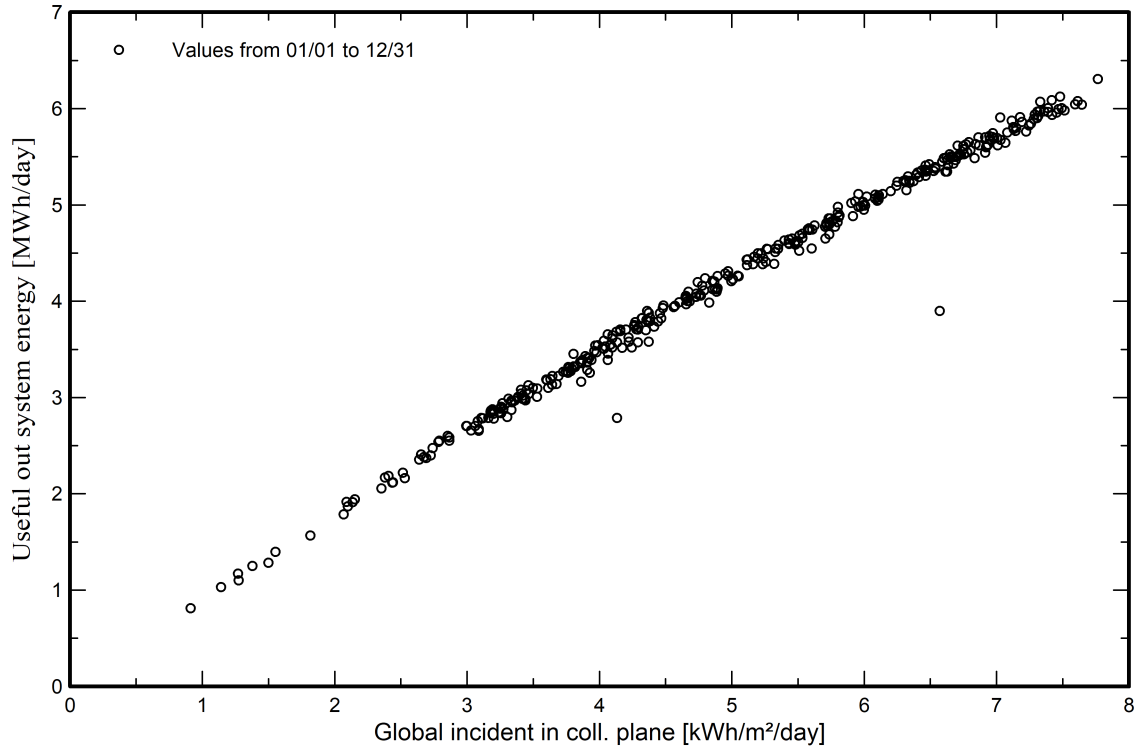
#### Energy injected into grid



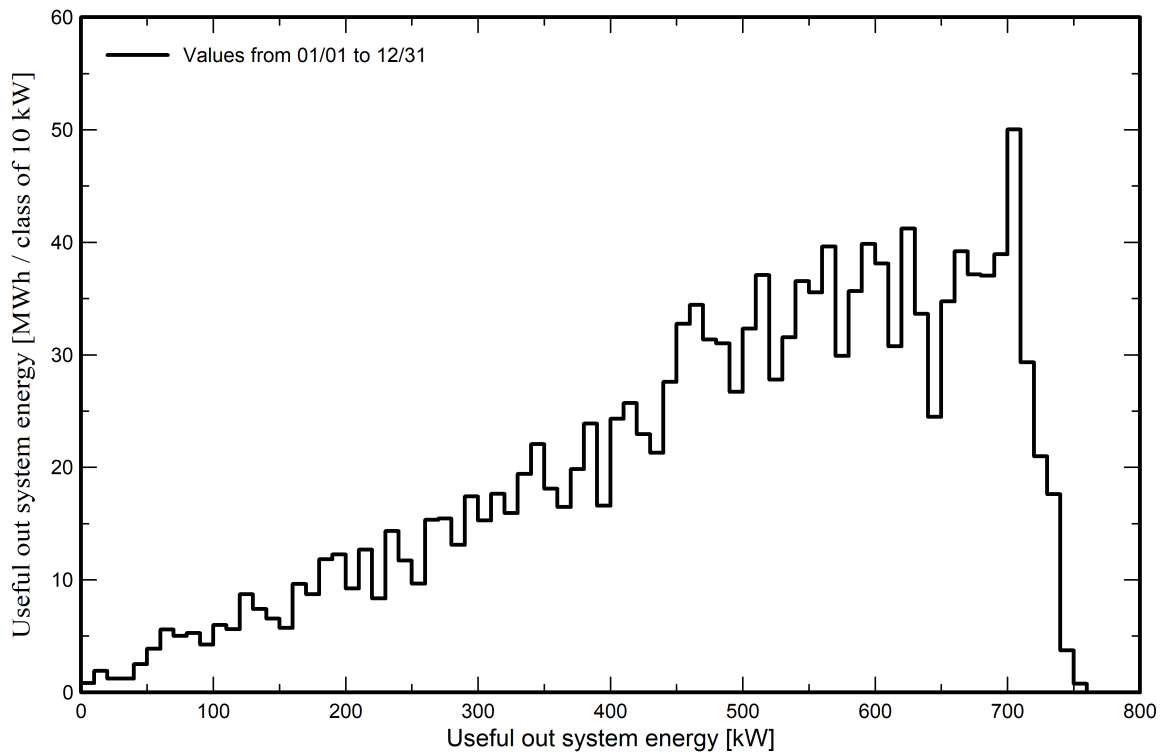


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





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**P50 - P90 evaluation**

**Weather data**

Source SolarGIS Monthly aver. , period not spec.  
Kind Specific year  
Year Synthetic  
Year-to-year variability(Variance) 0.5 %

**Specified Deviation**

Year deviation from average 0.0 %

**Global variability (weather data + system)**

Variability (Quadratic sum) 0.9 %

**Simulation and parameters uncertainties**

PV module modelling/parameters 0.6 %  
Inverter efficiency uncertainty 0.3 %  
Soiling and mismatch uncertainties 0.2 %  
Degradation uncertainty 0.4 %

**Annual production probability**

Variability 14.0 MWh  
P50 1528.1 MWh  
P90 1510.1 MWh  
P75 1518.6 MWh

**Probability distribution**

