

# PVsyst - Simulation report

## Grid-Connected System

Project: District Combined Hospital Amroha

Variant: New simulation variant

Unlimited sheds

System power: 480 kWp

Rāmpur Ghana - India

**Author**

Jakson Limited (India)



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## PVsyst V8.0.2

VC0, Simulation date:  
25/12/24 07:48  
with V8.0.2

Jakson Limited (India)

### Project summary

#### Geographical Site

Rāmpur Ghana

India

#### Situation

Latitude 28.86 °N

Longitude 78.47 °E

Altitude 210 m

Time zone UTC+5.5

#### Project settings

Albedo 0.20

#### Weather data

Rāmpur Ghana

Meteonorm 8.2 (1996-2015), Sat=100% - Synthetic

### System summary

#### Grid-Connected System

#### Orientation #1

##### Sheds

Tilt 10 °

Azimuth 0 °

#### Unlimited sheds

#### Near Shadings

Mutual shadings of sheds

#### User's needs

Unlimited load (grid)

#### System information

##### PV Array

Nb. of modules 828 units

Pnom total 480 kWp

##### Inverters

Nb. of units 5 units

Pnom total 420 kWac

Pnom ratio 1.143

### Results summary

Produced Energy 717871 kWh/year Specific production 1495 kWh/kWp/year Perf. Ratio PR 93.35 %

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## General parameters

## Grid-Connected System

## Orientation #1

## Sheds

Tilt	10 °
Azimuth	0 °

## Unlimited sheds

## Sheds configuration

Nb. of sheds	10 units
Unlimited sheds	
Shading limit angle	
Limit profile angle	9.5 °

## Sizes

Sheds spacing	6.10 m
Collector width	3.00 m
Average GCR	49.2 %
Top inactive band	0.02 m
Bottom inactive band	0.02 m

## Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

## Horizon

Free Horizon

## Near Shadings

Mutual shadings of sheds

## Bifacial system definition

## Orientation #1

## Bifacial system

Model	Unlimited Sheds 2D Model
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## Bifacial model geometry

Sheds spacing	6.10 m
Sheds width	3.04 m
Limit profile angle	9.5 °
GCR	49.8 %
Height above ground	1.50 m
Nb. of sheds	10 units

## Bifacial model definitions

Ground albedo	0.30
Bifaciality factor	80 %
Rear shading factor	5.0 %
Rear mismatch loss	10.0 %
Shed transparent fraction	0.0 %

## User's needs

Unlimited load (grid)

## PV Array Characteristics

## Array #1 - PV Array

## PV module

Manufacturer	Panasonic Life Solutions India Pvt. Ltd
Model	AE14T580VHC16B5R
(Custom parameters definition)	
Unit Nom. Power	580 Wp
Number of PV modules	42 units
Nominal (STC)	24.36 kWp
Modules	3 string x 14 In series

## At operating cond. (50°C)

Pmpp	22.59 kWp
U mpp	575 V
I mpp	39 A

## Inverter

Manufacturer	Growatt New Energy
Model	MID 20KTL3-X
(Original PVsyst database)	
Unit Nom. Power	20.0 kWac
Number of inverters	1 unit
Total power	20.0 kWac
Operating voltage	160-1000 V
Pnom ratio (DC:AC)	1.22
Power sharing within this inverter	



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## PV Array Characteristics

## Array #2 - Sub-array #2

## PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp  
Number of PV modules84 units  
Nominal (STC)48.7 kWp  
Modules6 string x 14 In series

## At operating cond. (50°C)

Pmpp45.2 kWp  
U mpp575 V  
I mpp79 A

## Array #3 - Sub-array #3

## PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp  
Number of PV modules216 units  
Nominal (STC)125 kWp  
Modules12 string x 18 In series

## At operating cond. (50°C)

Pmpp116 kWp  
U mpp739 V  
I mpp157 A

## Array #4 - Sub-array #4

## PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp  
Number of PV modules486 units  
Nominal (STC)282 kWp  
Modules27 string x 18 In series

## At operating cond. (50°C)

Pmpp261 kWp  
U mpp739 V  
I mpp354 A

## Total PV power

Nominal (STC)480 kWp  
Total828 modules  
Module area2137 m²

## Inverter

Manufacturer

Growatt New Energy

Model

MID 40KTL3-X

(Original PVsyst database)

Unit Nom. Power40.0 kWac  
Number of inverters1 unit  
Total power40.0 kWac  
Operating voltage200-1000 V  
Pnom ratio (DC:AC)1.22  
Power sharing within this inverter

## Inverter

Manufacturer

Growatt New Energy

Model

MAX 110KTL3-X LV

(Original PVsyst database)

Unit Nom. Power110 kWac  
Number of inverters1 unit  
Total power110 kWac  
Operating voltage180-1000 V  
Pnom ratio (DC:AC)1.14  
Power sharing within this inverter

## Inverter

Manufacturer

Growatt New Energy

Model

MAX 125KTL3-X LV

(Original PVsyst database)

Unit Nom. Power125 kWac  
Number of inverters2 units  
Total power250 kWac  
Operating voltage180-1000 V  
Pnom ratio (DC:AC)1.13  
Power sharing within this inverter

## Total inverter power

Total power420 kWac  
Number of inverters5 units  
Pnom ratio1.14

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**Array losses****Array Soiling Losses**

Loss Fraction 2.0 %

**Thermal Loss factor**

Module temperature according to irradiance  
Uc (const) 29.0 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 0.3 %

**Module Quality Loss**

Loss Fraction 0.0 %

**Module mismatch losses**

Loss Fraction 1.0 % at MPP

**IAM loss factor**

Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	0.998	0.992	0.963	0.917	0.812	0.567	0.000

**DC wiring losses**

Global wiring resistance 10 mΩ  
Loss Fraction 1.5 % at STC

**Array #1 - PV Array**

Global array res. 238 mΩ  
Loss Fraction 1.5 % at STC

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

Global array res. 119 mΩ  
Loss Fraction 1.5 % at STC

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

Global array res. 77 mΩ  
Loss Fraction 1.5 % at STC

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

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

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

Time fraction 1.0 %  
3.7 days,  
3 periods

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

Inverter voltage 400 Vac tri  
Loss Fraction 0.02 % at STC

**Inverter: MID 20KTL3-X**

Wire section (1 Inv.) Alu 1 x 3 x 70 mm<sup>2</sup>  
Wires length 60 m

**Inverter: MAX 110KTL3-X LV**

Wire section (1 Inv.) Alu 1 x 3 x 95 mm<sup>2</sup>  
Wires length 0 m

**Inverter: MID 40KTL3-X**

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

**Inverter: MAX 125KTL3-X LV**

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



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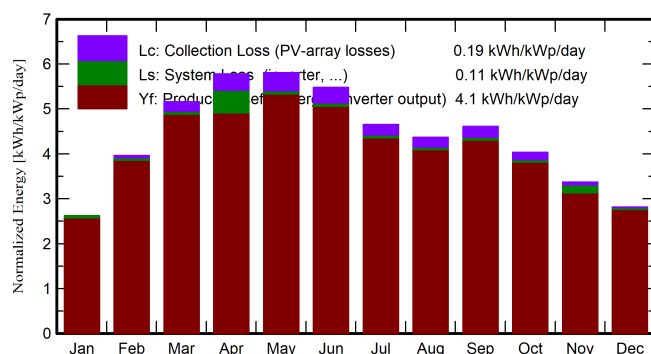
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## Main results

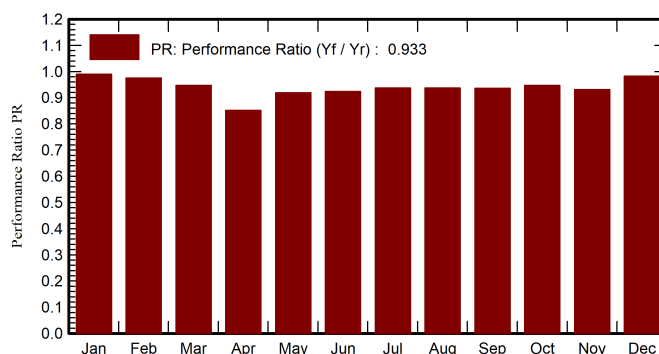
### System Production

Produced Energy (P50)	717871 kWh/year	Specific production (P50)	1495 kWh/kWp/year	Perf. Ratio PR	93.35 %
Produced Energy (P90)	701276 kWh/year	Specific production (P90)	1460 kWh/kWp/year		
Produced Energy (P75)	709146 kWh/year	Specific production (P75)	1477 kWh/kWp/year		

### Normalized productions (per installed kWp)



### Performance Ratio PR



## Balances and main results

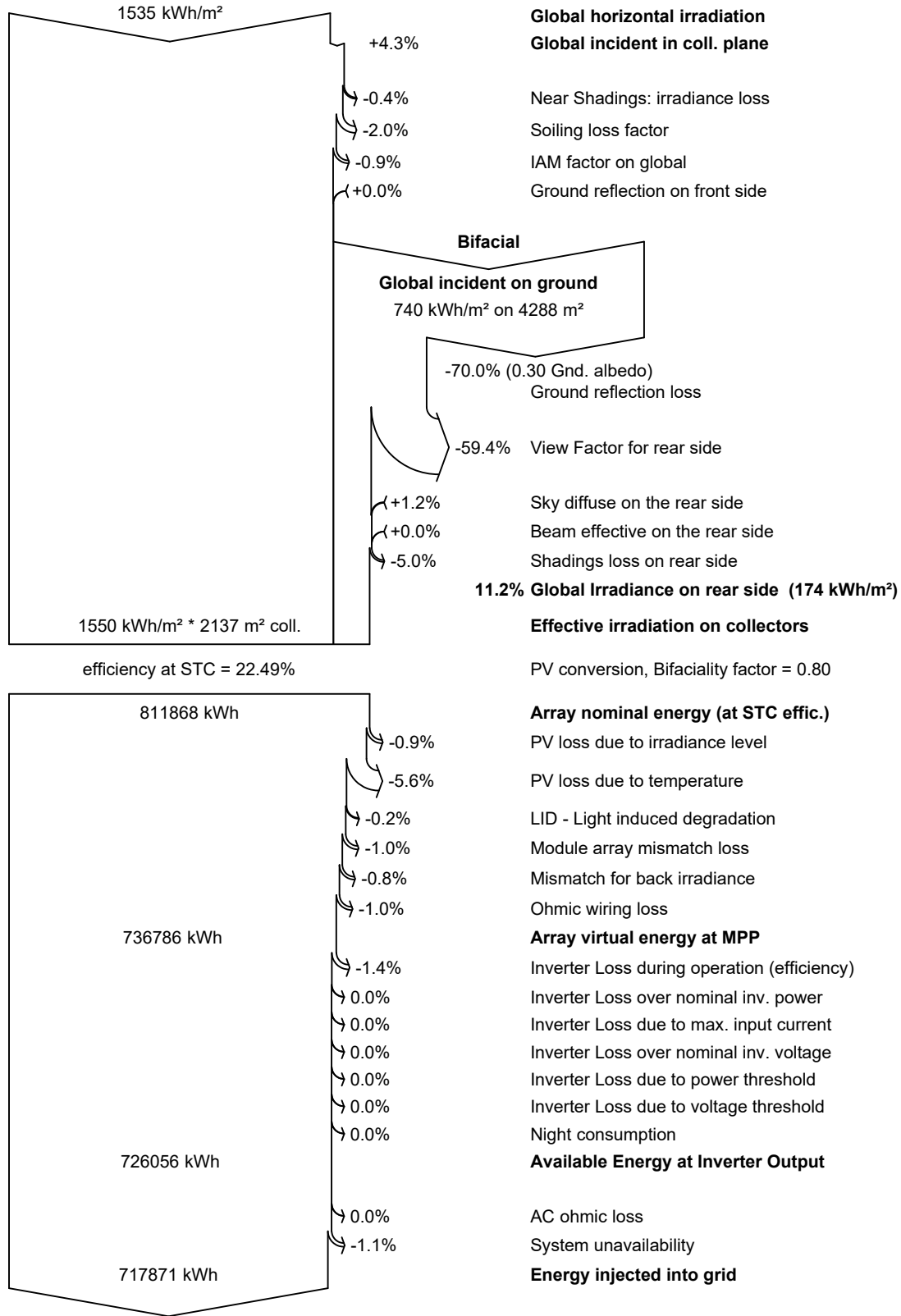
	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	°C	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	kWh	kWh	ratio
January	72.7	44.2	13.54	81.0	78.2	39057	38456	0.989
February	100.7	54.8	17.55	111.0	107.5	52730	51977	0.975
March	150.1	72.3	23.55	160.1	155.2	73797	72767	0.947
April	168.6	86.6	29.51	173.3	168.0	78178	70862	0.851
May	180.2	100.6	33.47	180.1	174.5	80584	79445	0.919
June	166.0	98.2	33.04	164.5	159.3	74030	72967	0.924
July	145.8	102.8	31.32	144.4	139.4	65881	64957	0.937
August	134.7	91.8	30.28	135.4	130.8	61870	60975	0.937
September	132.6	76.2	28.98	138.3	133.8	63084	62169	0.936
October	116.1	68.7	26.37	125.1	121.2	57746	56912	0.947
November	90.7	55.3	20.16	101.1	97.7	47790	45222	0.931
December	76.9	47.0	15.10	87.2	84.3	41780	41163	0.983
Year	1535.0	898.3	25.27	1601.4	1549.9	736527	717871	0.933

### 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		



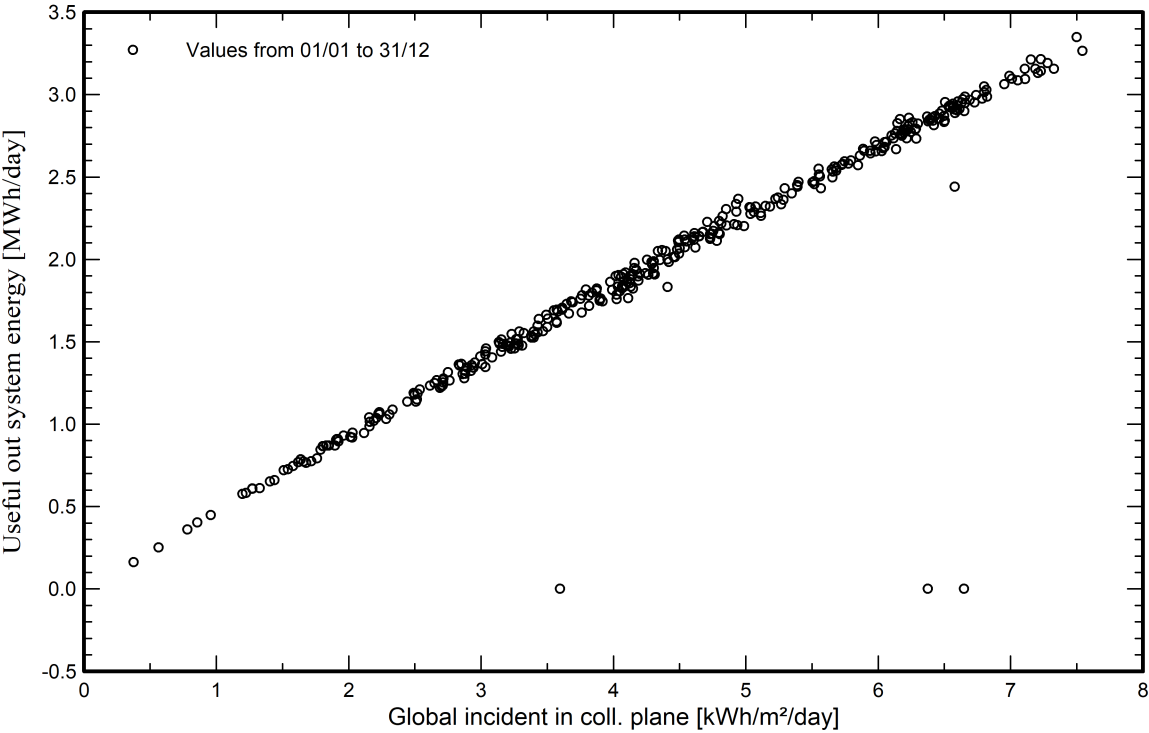
### Loss diagram



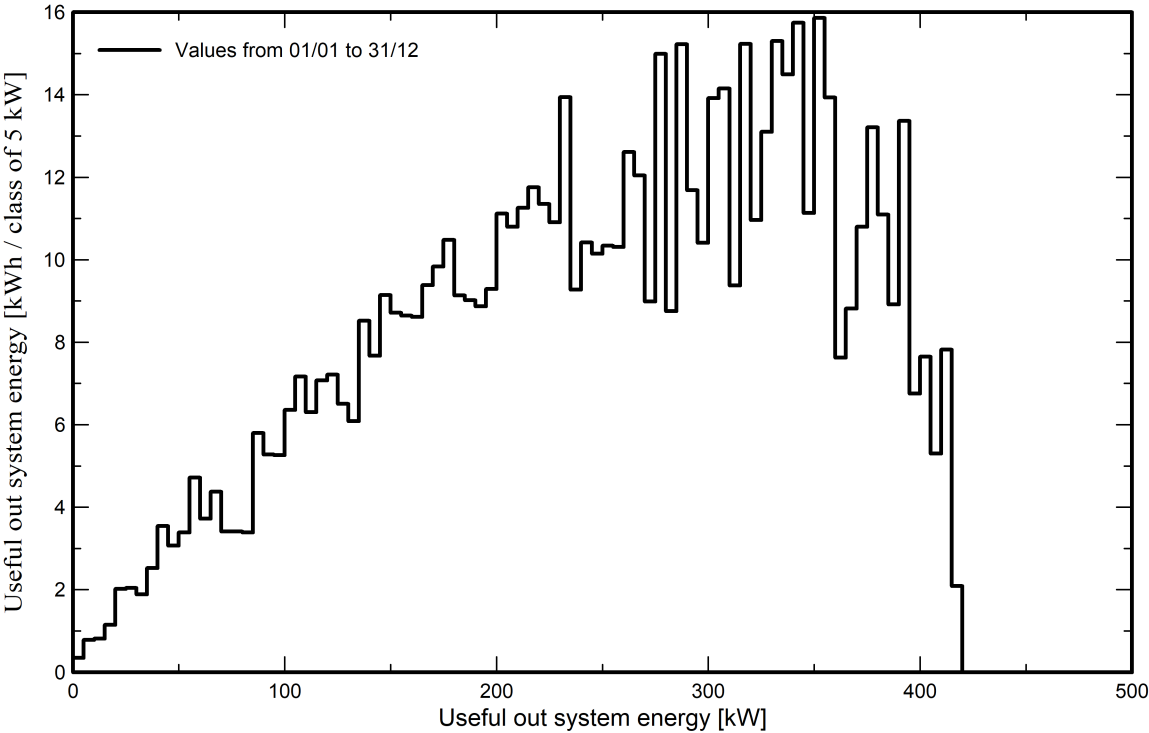


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution







### P50 - P90 evaluation

#### Weather data

Source Meteonorm 8.2 (1996-2015), Sat=100%  
Kind Not defined  
Year-to-year variability(Variance) 0.0 %

#### Specified Deviation

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

Variability (Quadratic sum) 1.8 %

#### Simulation and parameters uncertainties

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

#### Annual production probability

Variability 12.9 MWh  
P50 717.9 MWh  
P90 701.3 MWh  
P75 709.1 MWh

### Probability distribution

