

PVsyst - Simulation report

Grid-Connected System

Project: Seth Baldev Das District Hospital Saharanpu

Variant: New simulation variant

Unlimited sheds

System power: 375 kWp

Khan Alampura - India

Author

Jakson Limited (India)



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PVsyst V8.0.2

VC0, Simulation date:
25/12/24 08:09
with V8.0.2

Jakson Limited (India)

Project summary

Geographical Site

Khan Alampura

India

Situation

Latitude 29.96 °N

Longitude 77.56 °E

Altitude 281 m

Time zone UTC+5.5

Project settings

Albedo 0.20

Weather data

Khan Alampura

Meteonorm 8.2 (1991-2000), Sat=100% - Synthetic

System summary

Grid-Connected System

Orientation #1

Sheds

Tilt 10 °

Azimuth -32 °

Unlimited sheds

Near Shadings

Mutual shadings of sheds

User's needs

Unlimited load (grid)

System information

PV Array

Nb. of modules

647 units

Pnom total

375 kWp

Inverters

Nb. of units

8 units

Pnom total

320 kWac

Pnom ratio

1.173

Results summary

Produced Energy 567791 kWh/year Specific production 1513 kWh/kWp/year Perf. Ratio PR 93.15 %

Table of contents

Project and results summary	2
General parameters, PV Array Characteristics, System losses	3
Main results	7
Loss diagram	8
Predef. graphs	9
P50 - P90 evaluation	10



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General parameters

Grid-Connected System

Unlimited sheds

Orientation #1

Sheds

Tilt 10 °
Azimuth -32 °

Sheds configuration

Nb. of sheds 10 units
Unlimited sheds
Shading limit angle
Limit profile angle 11.7 °

Sizes

Sheds spacing 5.50 m
Collector width 3.00 m
Average GCR 54.5 %
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

Bifacial model geometry

Sheds spacing 5.50 m
Sheds width 3.04 m
Limit profile angle 11.7 °
GCR 55.3 %
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 modules135 units
Nominal (STC)78.3 kWp
Modules9 string x 15 In series

At operating cond. (50°C)

Pmpp72.6 kWp
U mpp616 V
I mpp118 A

Inverter

Manufacturer

Growatt New Energy

Model

MID 30KTL3-X

(Original PVsyst database)

Unit Nom. Power30.0 kWac
Number of inverters2 units
Total power60.0 kWac
Operating voltage200-1000 V
Pnom ratio (DC:AC)1.31
Power sharing within this inverter

Array #3 - Sub-array #3

PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp
Number of PV modules165 units
Nominal (STC)95.7 kWp
Modules11 string x 15 In series

At operating cond. (50°C)

Pmpp88.7 kWp
U mpp616 V
I mpp144 A

Inverter

Manufacturer

Growatt New Energy

Model

MID 40KTL3-X

(Original PVsyst database)

Unit Nom. Power40.0 kWac
Number of inverters2 units
Total power80.0 kWac
Operating voltage200-1000 V
Pnom ratio (DC:AC)1.20
Power sharing within this inverter

Array #4 - Sub-array #4

PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp
Number of PV modules195 units
Nominal (STC)113 kWp
Modules13 string x 15 In series

At operating cond. (50°C)

Pmpp105 kWp
U mpp616 V
I mpp170 A

Inverter

Manufacturer

Growatt New Energy

Model

MAX 50KTL3 LV

(Original PVsyst database)

Unit Nom. Power50.0 kWac
Number of inverters2 units
Total power100 kWac
Operating voltage200-1000 V
Pnom ratio (DC:AC)1.13
Power sharing within this inverter

Array #5 - Sub-array #5

PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp
Number of PV modules110 units
Nominal (STC)63.8 kWp
Modules10 string x 11 In series

At operating cond. (50°C)

Pmpp59.2 kWp
U mpp452 V
I mpp131 A

Inverter

Manufacturer

Growatt New Energy

Model

MAX 60KTL3 LV

(Original PVsyst database)

Unit Nom. Power60.0 kWac
Number of inverters1 unit
Total power60.0 kWac
Operating voltage200-1000 V
Pnom ratio (DC:AC)1.06
Power sharing within this inverter



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PV Array Characteristics

Total PV power

Nominal (STC) 375 kWp
Total 647 modules
Module area 1670 m²

Total inverter power

Total power 320 kWac
Number of inverters 8 units
Pnom ratio 1.17

Array losses

Array Soiling Losses

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/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

Array #1 - PV Array

Loss Fraction 1.0 % at MPP

Array #2 - Sub-array #2

Loss Fraction 1.0 % at MPP

Array #3 - Sub-array #3

Loss Fraction 1.0 % at MPP

Array #4 - Sub-array #4

Loss Fraction 1.0 % at MPP

Array #5 - Sub-array #5

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 #3 - Sub-array #3

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

Array #5 - Sub-array #5

Global array res. 56 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sub-array #2

Global array res. 85 mΩ
Loss Fraction 1.5 % at STC

Array #4 - Sub-array #4

Global array res. 59 mΩ
Loss Fraction 1.5 % at STC

System losses

Unavailability of the system

Time fraction 1.0 %
3.7 days,
3 periods



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AC wiring losses

Inv. output line up to injection point

Inverter voltage 400 Vac tri
Loss Fraction 0.04 % at STC

Inverters: MID 20KTL3-X, MAX 50KTL3 LV, MAX 60KTL3 LV

Wire section (4 Inv.) Alu 4 x 3 x 35 mm²
Average wires length 13 m

Inverter: MID 40KTL3-X

Wire section (2 Inv.) Alu 2 x 3 x 25 mm²
Average wires length 0 m

Inverter: MID 30KTL3-X

Wire section (2 Inv.) Alu 2 x 3 x 16 mm²
Average wires length 0 m



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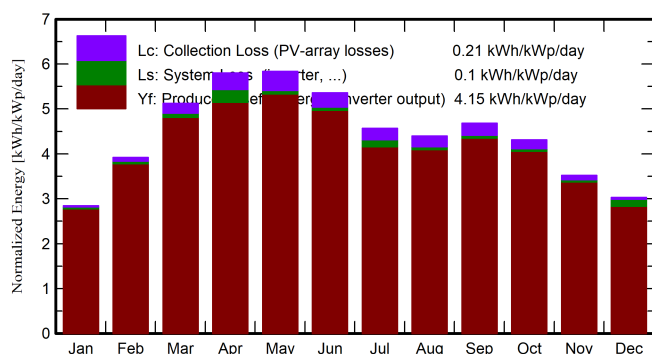
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Main results

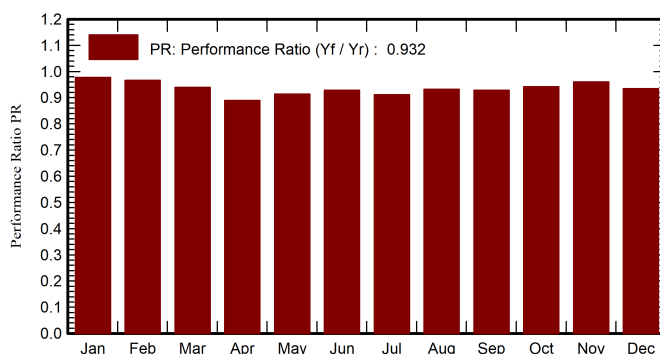
System Production

Produced Energy (P50)	567791 kWh/year	Specific production (P50)	1513 kWh/kWp/year	Perf. Ratio PR	93.15 %
Produced Energy (P90)	554666 kWh/year	Specific production (P90)	1478 kWh/kWp/year		
Produced Energy (P75)	560890 kWh/year	Specific production (P75)	1495 kWh/kWp/year		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

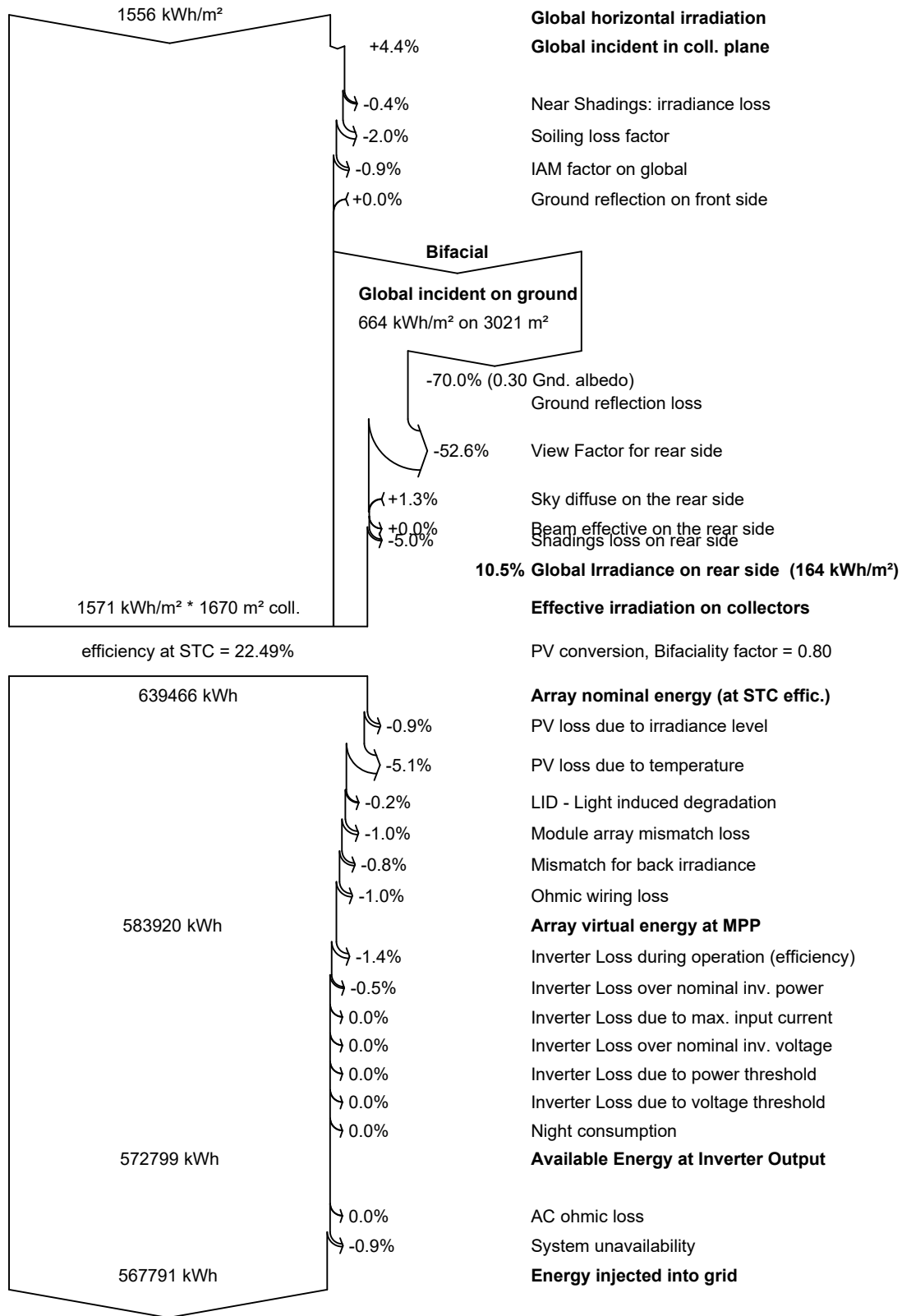
	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	kWh	kWh	ratio
January	78.5	41.4	12.23	88.1	85.2	32852	32346	0.978
February	101.1	54.4	15.82	109.7	106.1	40398	39806	0.967
March	150.2	71.0	21.47	158.9	153.9	57098	56056	0.940
April	169.0	83.0	27.18	174.0	168.6	61205	58041	0.889
May	180.5	99.5	31.46	181.0	175.4	63007	62095	0.914
June	162.2	107.9	31.27	160.8	155.5	56848	56040	0.929
July	142.4	93.2	29.99	141.7	136.9	50267	48441	0.911
August	134.6	87.6	29.06	136.2	131.6	48390	47661	0.932
September	135.3	67.5	27.49	140.5	136.0	49744	49000	0.929
October	125.2	67.6	24.44	133.6	129.3	47961	47267	0.943
November	94.8	52.4	18.58	105.6	101.9	38596	38049	0.960
December	82.6	42.2	13.83	94.0	90.8	34816	32989	0.935
Year	1556.3	867.6	23.60	1624.3	1571.1	581183	567791	0.932

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		



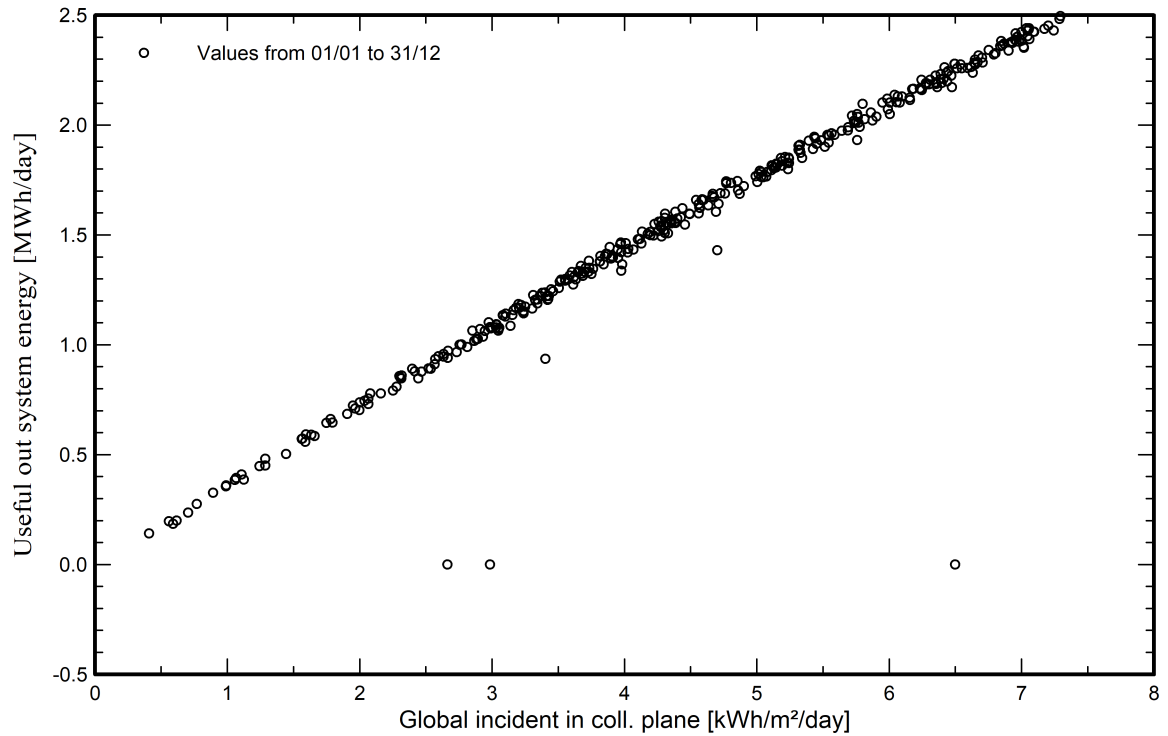
Loss diagram



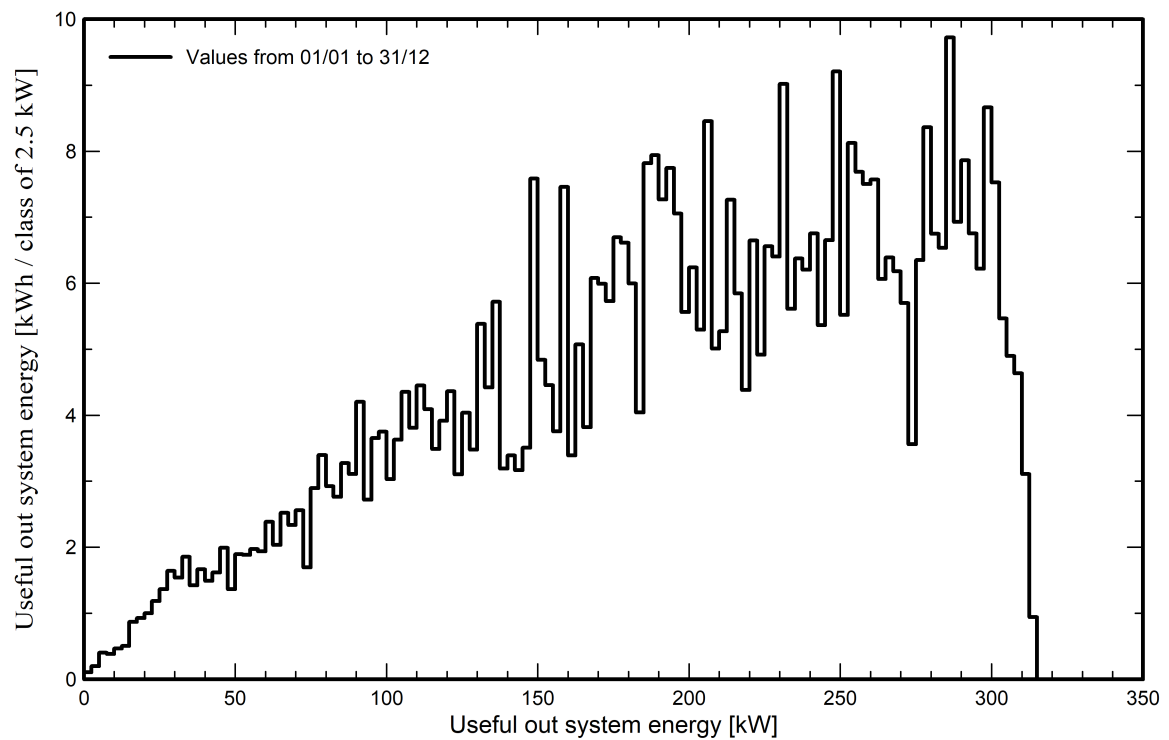


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





P50 - P90 evaluation

Weather data

Source Meteonorm 8.2 (1991-2000), 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 10.2 MWh
P50 567.8 MWh
P90 554.7 MWh
P75 560.9 MWh

Probability distribution

