

PVsyst - Simulation report

Grid-Connected System

Project: Lalitpur Medical College

Variant: New simulation variant

Unlimited sheds

System power: 363 kWp

Amarpur - India

Author

Jakson Limited (India)



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PVsyst V8.0.2

VC0, Simulation date:
16/12/24 16:31
with V8.0.2

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Project summary

Geographical Site

Amarpur

India

Situation

Latitude 24.76 °N

Longitude 78.43 °E

Altitude 342 m

Time zone UTC+5.5

Project settings

Albedo 0.20

Weather data

Amarpur

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

626 units

Pnom total

363 kWp

Inverters

Nb. of units

5 units

Pnom total

300 kWac

Pnom ratio

1.210

Results summary

Produced Energy 555342 kWh/year Specific production 1530 kWh/kWp/year Perf. Ratio PR 84.29 %

Table of contents

| | |
|---|---|
| Project and results summary | 2 |
| General parameters, PV Array Characteristics, System losses | 3 |
| Main results | 6 |
| Loss diagram | 7 |
| Predef. graphs | 8 |
| P50 - P90 evaluation | 9 |



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General parameters

Grid-Connected System

Orientation #1

Sheds

| | |
|---------|------|
| Tilt | 10 ° |
| Azimuth | 0 ° |

Models used

| | |
|---------------|------------------|
| Transposition | Perez |
| Diffuse | Perez, Meteonorm |
| Circumsolar | separate |

User's needs

Unlimited load (grid)

Unlimited sheds

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 |

Horizon

Free Horizon

Near Shadings

Mutual shadings of sheds

PV Array Characteristics

Array #1 - PV Array

PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

| | |
|----------------------|-------------------------|
| Unit Nom. Power | 580 Wp |
| Number of PV modules | 84 units |
| Nominal (STC) | 48.7 kWp |
| Modules | 6 string x 14 In series |

At operating cond. (50°C)

| | |
|-------|----------|
| Pmpp | 45.2 kWp |
| U mpp | 575 V |
| I mpp | 79 A |

Array #2 - Sub-array #2

PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

| | |
|----------------------|--------------------------|
| Unit Nom. Power | 580 Wp |
| Number of PV modules | 304 units |
| Nominal (STC) | 176 kWp |
| Modules | 19 string x 16 In series |

At operating cond. (50°C)

| | |
|-------|---------|
| Pmpp | 164 kWp |
| U mpp | 657 V |
| I mpp | 249 A |

Inverter

Manufacturer

Growatt New Energy

Model

MID 40KTL3-X

(Original PVsyst database)

| | |
|------------------------------------|------------|
| Unit Nom. Power | 40.0 kWac |
| Number of inverters | 1 unit |
| Total power | 40.0 kWac |
| Operating voltage | 200-1000 V |
| Pnom ratio (DC:AC) | 1.22 |
| Power sharing within this inverter | |

Inverter

Manufacturer

Growatt New Energy

Model

MAX 50KTL3 LV

(Original PVsyst database)

| | |
|------------------------------------|------------|
| Unit Nom. Power | 50.0 kWac |
| Number of inverters | 3 units |
| Total power | 150 kWac |
| Operating voltage | 200-1000 V |
| Pnom ratio (DC:AC) | 1.18 |
| Power sharing within this inverter | |



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PV Array Characteristics

Array #3 - Sub-array #3

PV module

Manufacturer Panasonic Life Solutions India Pvt. Ltd
Model AE14T580VHC16B5R
(Custom parameters definition)

Unit Nom. Power 580 Wp
Number of PV modules 238 units
Nominal (STC) 138 kWp
Modules 14 string x 17 In series

At operating cond. (50°C)

Pmpp 128 kWp
U mpp 698 V
I mpp 183 A

Total PV power

Nominal (STC) 363 kWp
Total 626 modules
Module area 1616 m²

Inverter

Manufacturer Growatt New Energy
Model MAX 110KTL3-X LV
(Original PVsyst database)

Unit Nom. Power 110 kWac
Number of inverters 1 unit
Total power 110 kWac
Operating voltage 180-1000 V
Pnom ratio (DC:AC) 1.25
Power sharing within this inverter

Total inverter power

Total power 300 kWac
Number of inverters 5 units
Pnom ratio 1.21

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 2.0 %

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. 119 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sub-array #2

Global array res. 43 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sub-array #3

Global array res. 62 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 0.23 % at STC

Inverter: MID 40KTL3-X

Wire section (1 Inv.) Alu 1 x 3 x 25 mm²
Wires length 45 m

Inverter: MAX 110KTL3-X LV

Wire section (1 Inv.) Alu 1 x 3 x 120 mm²
Wires length 0 m

Inverter: MAX 50KTL3 LV

Wire section (3 Inv.) Alu 3 x 3 x 35 mm²
Average wires length 0 m



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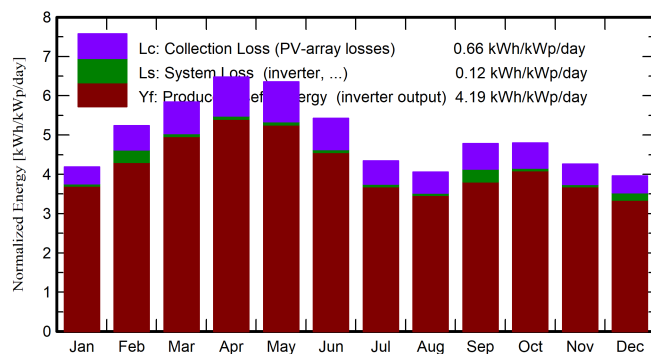
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Main results

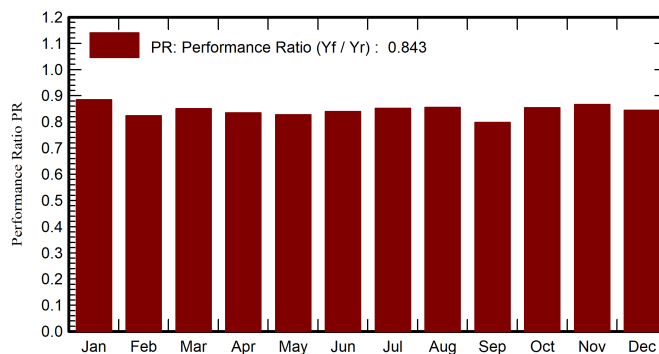
System Production

| | | | | | |
|-----------------------|-----------------|---------------------------|-------------------|----------------|---------|
| Produced Energy (P50) | 555342 kWh/year | Specific production (P50) | 1530 kWh/kWp/year | Perf. Ratio PR | 84.29 % |
| Produced Energy (P90) | 540662 kWh/year | Specific production (P90) | 1489 kWh/kWp/year | | |
| Produced Energy (P75) | 547624 kWh/year | Specific production (P75) | 1508 kWh/kWp/year | | |

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

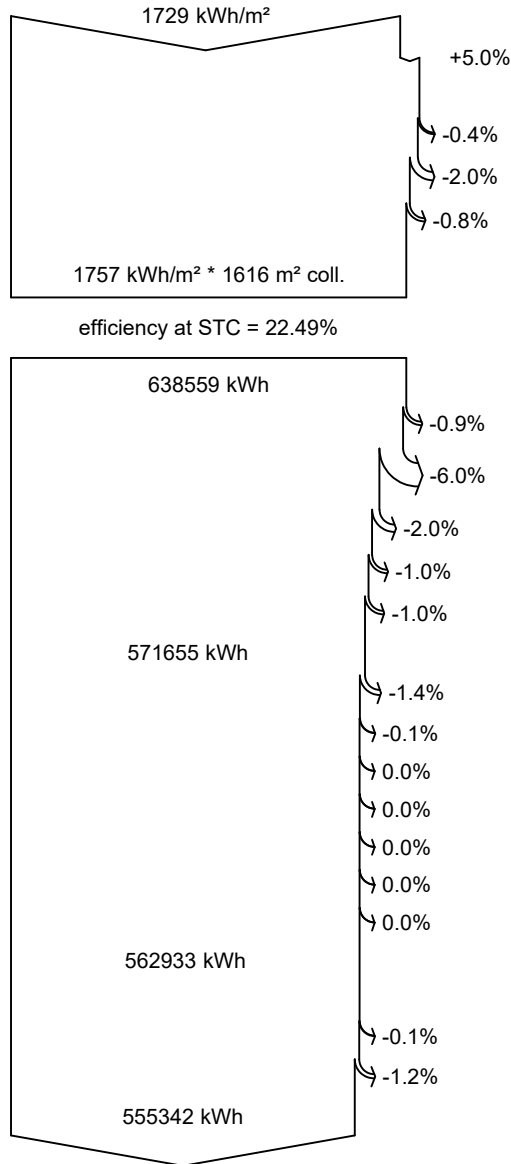
| | GlobHor kWh/m ² | DiffHor kWh/m ² | T_Amb °C | GlobInc kWh/m ² | GlobEff kWh/m ² | EArray kWh | E_Grid kWh | PR ratio |
|-----------|-------------------------------|-------------------------------|-------------|-------------------------------|-------------------------------|---------------|---------------|-------------|
| January | 113.8 | 48.04 | 16.43 | 129.8 | 125.9 | 42365 | 41698 | 0.885 |
| February | 132.2 | 52.55 | 20.21 | 146.6 | 142.1 | 47029 | 43814 | 0.823 |
| March | 170.4 | 72.11 | 26.07 | 180.9 | 175.4 | 56755 | 55887 | 0.851 |
| April | 190.0 | 77.21 | 30.83 | 194.4 | 188.6 | 59834 | 58906 | 0.835 |
| May | 198.5 | 94.17 | 34.94 | 197.0 | 191.0 | 60165 | 59225 | 0.828 |
| June | 166.1 | 94.41 | 32.34 | 162.9 | 157.5 | 50448 | 49663 | 0.840 |
| July | 136.8 | 89.42 | 28.44 | 134.5 | 129.7 | 42253 | 41573 | 0.851 |
| August | 125.6 | 85.25 | 27.05 | 125.8 | 121.4 | 39702 | 39052 | 0.855 |
| September | 138.9 | 78.80 | 27.41 | 143.4 | 138.7 | 45083 | 41547 | 0.798 |
| October | 137.6 | 67.41 | 26.79 | 148.7 | 144.1 | 46838 | 46095 | 0.854 |
| November | 112.9 | 48.11 | 22.04 | 127.8 | 123.8 | 40846 | 40229 | 0.867 |
| December | 106.3 | 46.72 | 17.90 | 122.8 | 118.8 | 39842 | 37655 | 0.845 |
| Year | 1729.0 | 854.19 | 25.89 | 1814.7 | 1757.2 | 571159 | 555342 | 0.843 |

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

Near Shadings: irradiance loss

Soiling loss factor

IAM factor on global

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

Module array mismatch loss

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

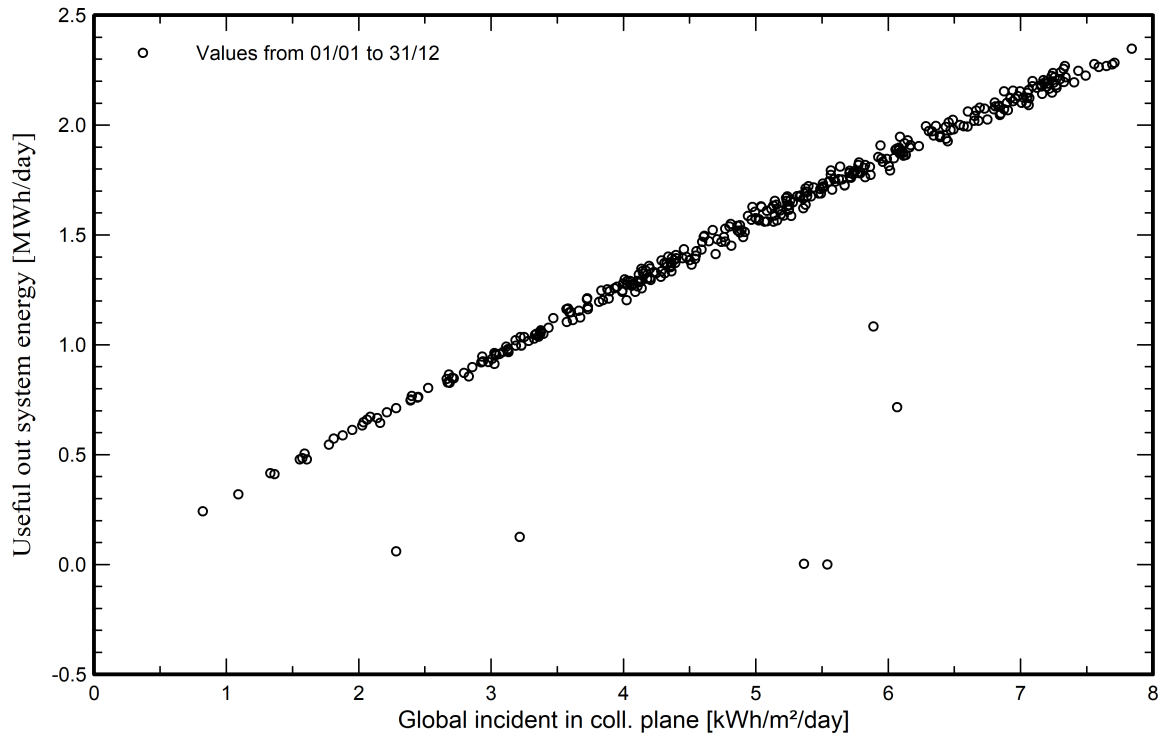
System unavailability

Energy injected into grid

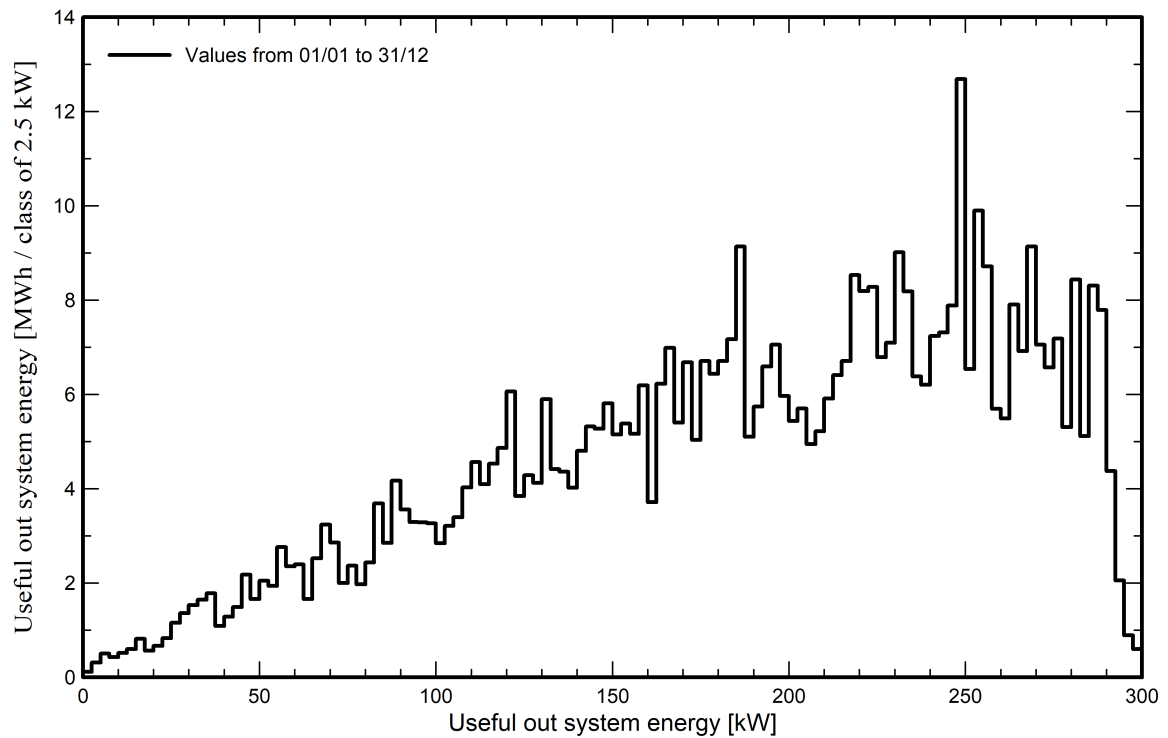


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





P50 - P90 evaluation

Weather data

Source Meteonorm 8.2 (1996-2015), Sat=100%
Kind Not defined
Year-to-year variability(Variance) -1.0 %

Specified Deviation

Global variability (weather data + system)

Variability (Quadratic sum) 2.1 %

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 11.4 MWh
P50 555.3 MWh
P90 540.7 MWh
P75 547.6 MWh

Probability distribution

