

PVsyst - Simulation report

Grid-Connected System

Project: ASMC Sonbhadra

Variant: New simulation variant

Unlimited sheds

System power: 501 kWp

Chhapka - India

Author

Jakson Limited (India)

**PVsyst V8.0.2**

VC0, Simulation date:
17/12/24 10:43
with V8.0.2

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Project summary**Geographical Site****Chhapka**

India

Situation

Latitude 24.65 °N

Longitude 83.06 °E

Altitude 323 m

Time zone UTC+5.5

Project settings

Albedo 0.20

Weather data

Chhapka

Meteonorm 8.2 (2001-2020), 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

864 units

Pnom total

501 kWp

Inverters

Nb. of units

7 units

Pnom total

450 kWac

Pnom ratio

1.114

Results summary

Produced Energy 790641 kWh/year Specific production 1578 kWh/kWp/year Perf. Ratio PR 93.32 %

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 |



General parameters

Grid-Connected System

Orientation #1

Sheds

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

Models used

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

Bifacial system definition

Orientation #1

Bifacial system

| | |
|-------|--------------------------|
| Model | Unlimited Sheds 2D Model |
|-------|--------------------------|

Bifacial model geometry

| | |
|---------------------|----------|
| Sheds spacing | 6.20 m |
| Sheds width | 3.04 m |
| Limit profile angle | 9.2 ° |
| GCR | 49.0 % |
| 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 % |

Unlimited sheds

Sheds configuration

| | |
|---------------------|----------|
| Nb. of sheds | 10 units |
| Unlimited sheds | |
| Shading limit angle | |
| Limit profile angle | 9.2 ° |

Sizes

| | |
|----------------------|--------|
| Sheds spacing | 6.20 m |
| Collector width | 3.00 m |
| Average GCR | 48.4 % |
| Top inactive band | 0.02 m |
| Bottom inactive band | 0.02 m |

Near Shadings

Mutual shadings of sheds

User's needs

Unlimited load (grid)

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 | 380 units |
| Nominal (STC) | 220 kWp |
| Modules | 20 string x 19 In series |

At operating cond. (50°C)

| | |
|-------|---------|
| Pmpp | 204 kWp |
| U mpp | 780 V |
| I mpp | 262 A |

Inverter

ManufacturerGrowatt New Energy
ModelMAC 50KTL3-X LV

(Custom parameters definition)

| | |
|------------------------------------|------------|
| Unit Nom. Power | 50.0 kWac |
| Number of inverters | 4 units |
| Total power | 200 kWac |
| Operating voltage | 200-1000 V |
| Pnom ratio (DC:AC) | 1.10 |
| 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 modules144 units
Nominal (STC)83.5 kWp
Modules9 string x 16 In series

At operating cond. (50°C)

Pmpp77.4 kWp
U mpp657 V
I mpp118 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 modules144 units
Nominal (STC)83.5 kWp
Modules8 string x 18 In series

At operating cond. (50°C)

Pmpp77.4 kWp
U mpp739 V
I mpp105 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 modules196 units
Nominal (STC)114 kWp
Modules14 string x 14 In series

At operating cond. (50°C)

Pmpp105 kWp
U mpp575 V
I mpp183 A

Total PV power

Nominal (STC)501 kWp
Total864 modules
Module area2230 m²

Inverter

Manufacturer

Growatt New Energy

Model

MAX 70KTL3 LV

(Original PVsyst database)

Unit Nom. Power70.0 kWac
Number of inverters1 unit
Total power70.0 kWac
Operating voltage200-1000 V
Pnom ratio (DC:AC)1.19
Power sharing within this inverter

Inverter

Manufacturer

Growatt New Energy

Model

MAX 80KTL3 LV

(Original PVsyst database)

Unit Nom. Power80.0 kWac
Number of inverters1 unit
Total power80.0 kWac
Operating voltage200-1000 V
Pnom ratio (DC:AC)1.04
Power sharing within this inverter

Inverter

Manufacturer

Growatt New Energy

Model

MAX 100KTL3-X LV

(Original PVsyst database)

Unit Nom. Power100 kWac
Number of inverters1 unit
Total power100 kWac
Operating voltage180-1000 V
Pnom ratio (DC:AC)1.14
Power sharing within this inverter

Total inverter power

Total power450 kWac
Number of inverters7 units
Pnom ratio1.11

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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/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

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. 49 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sub-array #2

Global array res. 91 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sub-array #3

Global array res. 115 mΩ
Loss Fraction 1.5 % at STC

Array #4 - Sub-array #4

Global array res. 51 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 0.42 % at STC

Inverters: MAC 50KTL3-X LV, MAX 70KTL3 LV, MAX 80KTL3 LV

Wire section (6 Inv.) Alu 6 x 3 x 50 mm²
Average wires length 30 m

Inverter: MAX 100KTL3-X LV

Wire section (1 Inv.) Alu 1 x 3 x 95 mm²
Wires length 0 m



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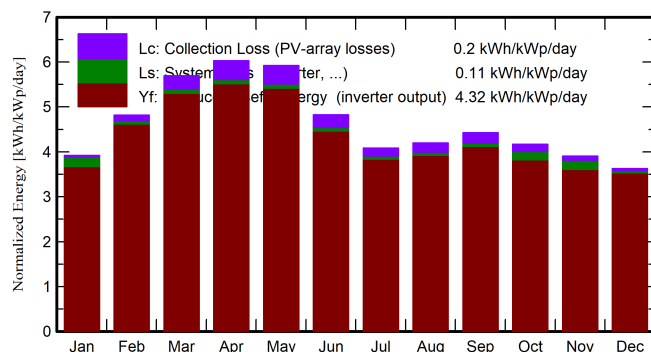
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Main results

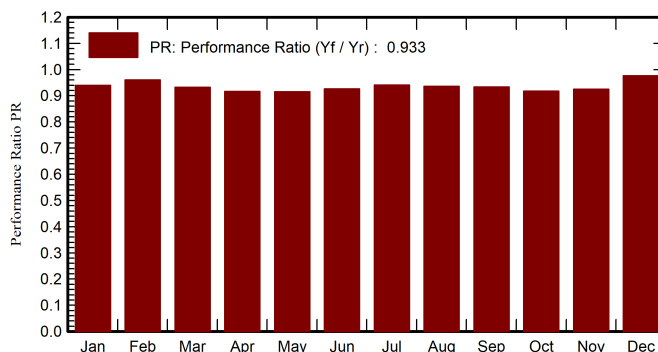
System Production

| | | | | | |
|-----------------------|-----------------|---------------------------|-------------------|----------------|---------|
| Produced Energy (P50) | 790641 kWh/year | Specific production (P50) | 1578 kWh/kWp/year | Perf. Ratio PR | 93.32 % |
| Produced Energy (P90) | 772363 kWh/year | Specific production (P90) | 1541 kWh/kWp/year | | |
| Produced Energy (P75) | 781031 kWh/year | Specific production (P75) | 1559 kWh/kWp/year | | |

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

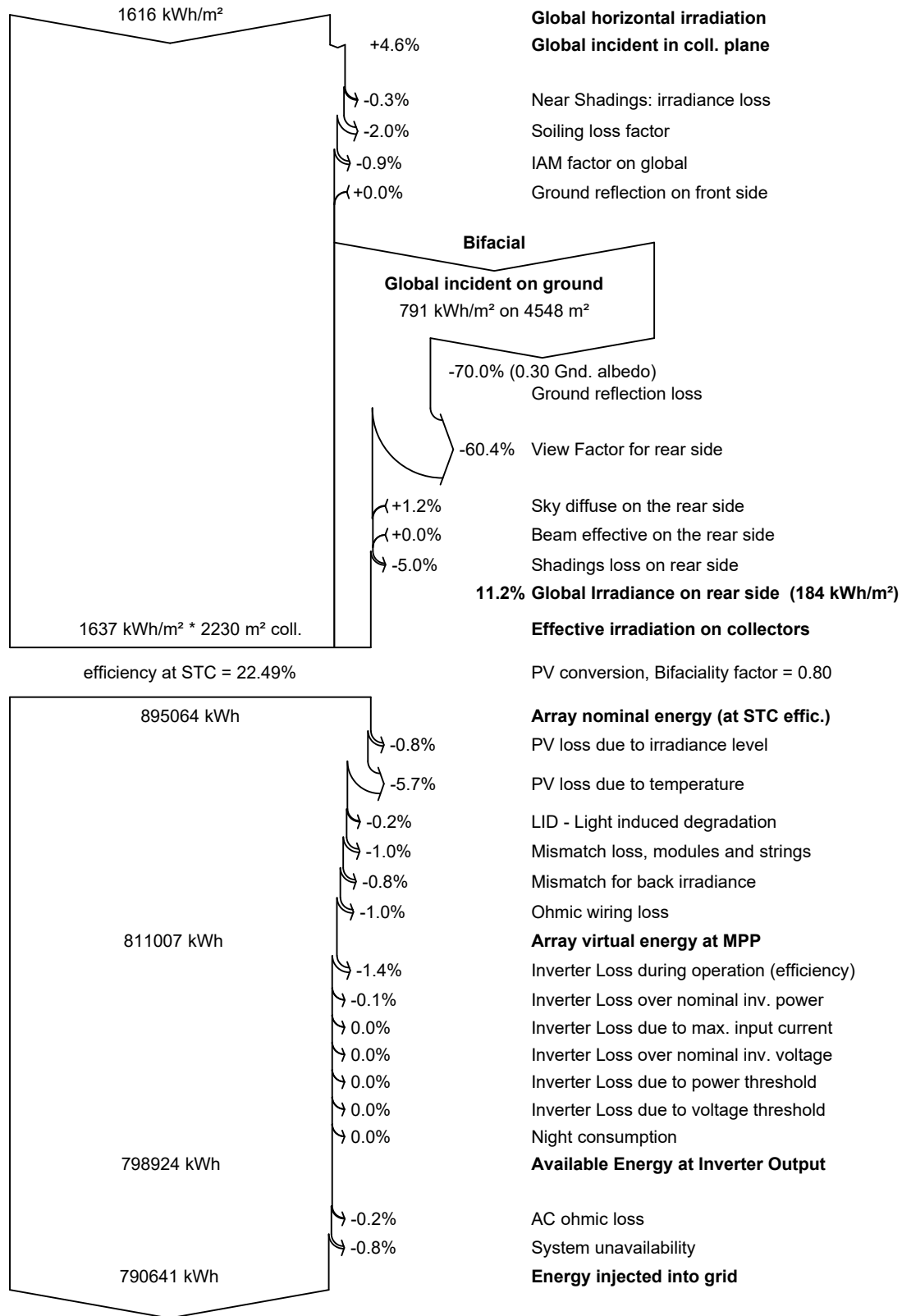
| | GlobHor | DiffHor | T_Amb | GlobInc | GlobEff | EArray | E_Grid | PR |
|-----------|--------------------|--------------------|-------|--------------------|--------------------|--------|--------|-------|
| | kWh/m ² | kWh/m ² | °C | kWh/m ² | kWh/m ² | kWh | kWh | ratio |
| January | 106.7 | 48.31 | 15.63 | 121.5 | 117.6 | 60584 | 57194 | 0.939 |
| February | 122.3 | 53.15 | 19.84 | 134.9 | 130.9 | 65992 | 64905 | 0.960 |
| March | 166.0 | 69.31 | 25.59 | 176.6 | 171.4 | 83916 | 82503 | 0.932 |
| April | 177.1 | 80.77 | 30.63 | 180.9 | 175.3 | 84392 | 83006 | 0.916 |
| May | 185.3 | 97.42 | 33.87 | 183.6 | 177.9 | 85679 | 84257 | 0.916 |
| June | 147.4 | 90.05 | 32.32 | 144.7 | 140.1 | 68396 | 67203 | 0.927 |
| July | 128.6 | 89.50 | 29.64 | 126.7 | 122.3 | 60754 | 59714 | 0.941 |
| August | 130.1 | 79.55 | 28.97 | 130.2 | 125.8 | 62140 | 61069 | 0.936 |
| September | 128.1 | 68.64 | 28.27 | 132.7 | 128.5 | 63167 | 62068 | 0.933 |
| October | 120.7 | 68.88 | 26.22 | 129.3 | 125.2 | 62305 | 59445 | 0.917 |
| November | 105.2 | 55.72 | 21.19 | 117.2 | 113.5 | 57421 | 54320 | 0.925 |
| December | 98.3 | 48.33 | 16.86 | 112.4 | 108.8 | 55852 | 54956 | 0.976 |
| Year | 1615.8 | 849.63 | 25.78 | 1690.7 | 1637.2 | 810598 | 790641 | 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 | | |



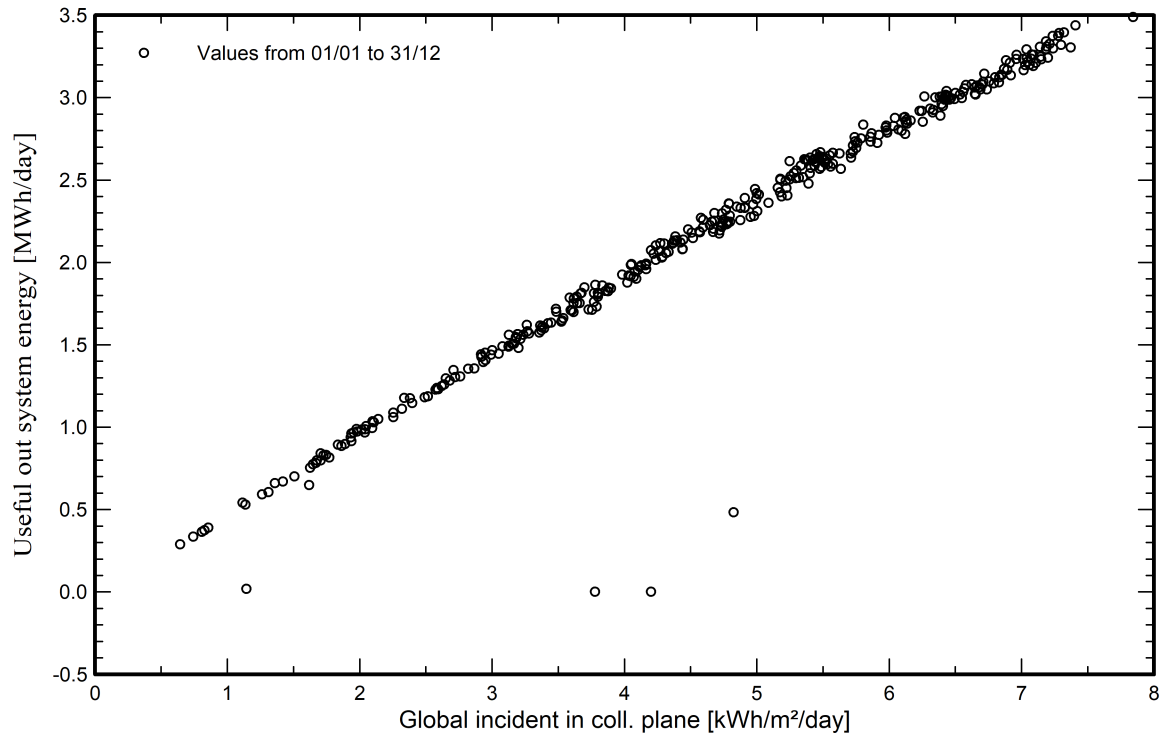
Loss diagram



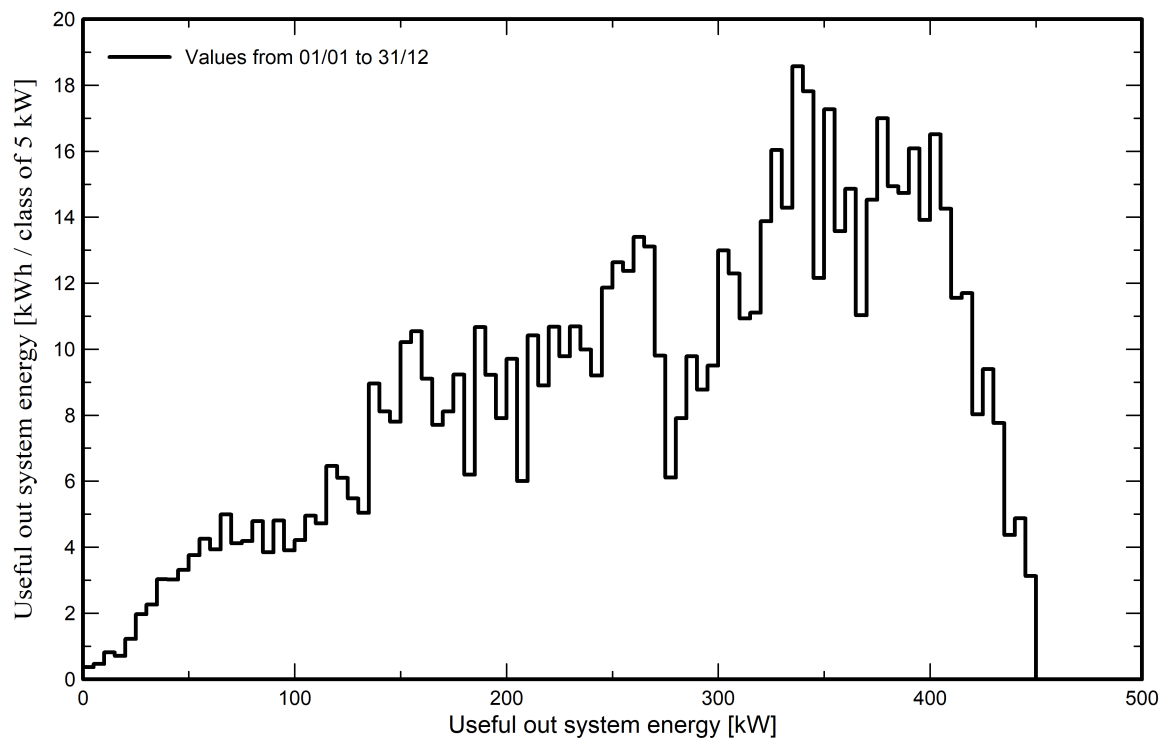


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





P50 - P90 evaluation

Weather data

Source Meteonorm 8.2 (2001-2020), 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 14.3 MWh
P50 790.6 MWh
P90 772.4 MWh
P75 781.0 MWh

Probability distribution

