

PVsyst - Simulation report

Grid-Connected System

Project: Medical College Siddharthnagar

Variant: New simulation variant

Unlimited sheds

System power: 752 kWp

Tetari - India

Author

Jakson Limited (India)



Project: Medical College Siddharthnagar

Variant: New simulation variant

PVsyst V8.0.2

VC0, Simulation date:
17/12/24 10:57
with V8.0.2

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Project summary

Geographical Site

Tetari

India

Situation

Latitude 27.27 °N

Longitude 83.07 °E

Altitude 108 m

Time zone UTC+5.5

Project settings

Albedo 0.20

Weather data

Tetari

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

System summary

Grid-Connected System

Orientation #1

Sheds

Tilt 10 °

Azimuth 31 °

Unlimited sheds

Orientation #2

Sheds

Tilt 10 °

Azimuth -11 °

Near Shadings

Mutual shadings of sheds

System information

PV Array

Nb. of modules

1296 units

Pnom total

752 kWp

Inverters

Nb. of units

10 units

Pnom total

650 kWac

Pnom ratio

1.156

User's needs

Unlimited load (grid)

Results summary

Produced Energy 1088377 kWh/year Specific production 1448 kWh/kWp/year Perf. Ratio PR 94.17 %

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General parameters

Grid-Connected System

Unlimited sheds

Orientation #1

Sheds

Tilt	10 °
Azimuth	31 °

Sheds configuration

Nb. of sheds	10 units
Unlimited sheds	

Shading limit angle

Limit profile angle	7.8 °
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Sizes

Sheds spacing	6.80 m
Collector width	3.00 m
Average GCR	44.1 %
Top inactive band	0.02 m
Bottom inactive band	0.02 m

Orientation #2

Sheds

Tilt	10 °
Azimuth	-11 °

Sheds configuration

Nb. of sheds	3 units
Unlimited sheds	

Shading limit angle

Limit profile angle	7.8 °
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Sizes

Sheds spacing	6.80 m
Collector width	3.00 m
Average GCR	44.1 %
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	6.80 m
Sheds width	3.04 m
Limit profile angle	7.8 °
GCR	44.7 %
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)

Orientation #2

Bifacial system

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

Bifacial model geometry

Sheds spacing	6.80 m
Sheds width	3.04 m
Limit profile angle	7.8 °
GCR	44.7 %
Height above ground	1.50 m
Nb. of sheds	3 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 %

PV Array Characteristics

Array #1 - PV Array

Orientation	#1
Tilt/Azimuth	10/31 °



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PV Array Characteristics

PV module

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

Unit Nom. Power 580 Wp
Number of PV modules 60 units
Nominal (STC) 34.8 kWp
Modules 4 string x 15 In series

At operating cond. (50°C)

Pmpp 32.3 kWp
U mpp 616 V
I mpp 52 A

Array #2 - Sub-array #2

Orientation #1
Tilt/Azimuth 10/31 °

PV module

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

Unit Nom. Power 580 Wp
Number of PV modules 75 units
Nominal (STC) 43.5 kWp
Modules 5 string x 15 In series

At operating cond. (50°C)

Pmpp 40.3 kWp
U mpp 616 V
I mpp 65 A

Array #3 - Sub-array #3

Orientation #1
Tilt/Azimuth 10/31 °

PV module

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

Unit Nom. Power 580 Wp
Number of PV modules 105 units
Nominal (STC) 60.9 kWp
Modules 7 string x 15 In series

At operating cond. (50°C)

Pmpp 56.5 kWp
U mpp 616 V
I mpp 92 A

Array #4 - Sub-array #4

Orientation #1
Tilt/Azimuth 10/31 °

Inverter

Manufacturer Growatt New Energy
Model MID 30KTL3-X
(Original PVsyst database)

Unit Nom. Power 30.0 kWac
Number of inverters 1 unit
Total power 30.0 kWac
Operating voltage 200-1000 V
Pnom ratio (DC:AC) 1.16
Power sharing within this inverter

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) 1.09
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 1 unit
Total power 50.0 kWac
Operating voltage 200-1000 V
Pnom ratio (DC:AC) 1.22
Power sharing within this inverter



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PV Array Characteristics

PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp
Number of PV modules240 units
Nominal (STC)139 kWp
Modules16 string x 15 In series

At operating cond. (50°C)

Pmpp129 kWp
U mpp616 V
I mpp210 A

Array #5 - Sub-array #5

Orientation#1

Tilt/Azimuth10/31 °

PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp
Number of PV modules285 units
Nominal (STC)165 kWp
Modules19 string x 15 In series

At operating cond. (50°C)

Pmpp153 kWp
U mpp616 V
I mpp249 A

Array #6 - Sub-array #6

Orientation#1

Tilt/Azimuth10/31 °

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

Array #7 - Sub-array #7

Orientation#1

Tilt/Azimuth10/31 °

Inverter

Manufacturer

Growatt New Energy

Model

MAX 60KTL3 LV

(Original PVsyst database)

Unit Nom. Power60.0 kWac
Number of inverters2 units
Total power120 kWac

Operating voltage200-1000 V

Pnom ratio (DC:AC)1.16

Power sharing within this inverter

Inverter

Manufacturer

Growatt New Energy

Model

MAX 70KTL3 LV

(Original PVsyst database)

Unit Nom. Power70.0 kWac
Number of inverters2 units
Total power140 kWac

Operating voltage200-1000 V

Pnom ratio (DC:AC)1.18

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)1.13

Power sharing within this inverter



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PV Array Characteristics

PV module

Manufacture Panasonic Life Solutions India Pvt. Ltd

Model AE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power 580 Wp
Number of PV modules 224 units
Nominal (STC) 130 kWp
Modules 16 string x 14 In series

At operating cond. (50°C)

Pmpp 120 kWp
U mpp 575 V
I mpp 210 A

Array #8 - Sub-array #8

Orientation #2

Tilt/Azimuth 10/-11 °

PV module

Manufacture Panasonic Life Solutions India Pvt. Ltd

Model AE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power 580 Wp
Number of PV modules 112 units
Nominal (STC) 65.0 kWp
Modules 8 string x 14 In series

At operating cond. (50°C)

Pmpp 60.2 kWp
U mpp 575 V
I mpp 105 A

Total PV power

Nominal (STC) 752 kWp
Total 1296 modules
Module area 3345 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) 1.18

Power sharing within this inverter

Inverter

Manufacturer

Growatt New Energy

Model

MAC 60KTL3-X LV

(Original PVsyst database)

Unit Nom. Power 60.0 kWac
Number of inverters 1 unit
Total power 60.0 kWac

Operating voltage 200-1000 V

Pnom ratio (DC:AC) 1.08

Power sharing within this inverter

Total inverter power

Total power 650 kWac
Number of inverters 10 units
Pnom ratio 1.16

Array losses

Array Soiling Losses

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance

Uc (const) 29.0 W/m²KUv (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

Array #6 - Sub-array #6

Loss Fraction 1.0 % at MPP

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Array losses**Module mismatch losses****Array #7 - Sub-array #7**

Loss Fraction 1.0 % at MPP

Array #8 - Sub-array #8

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 8.5 mΩ
Loss Fraction 1.5 % at STC

Array #1 - PV Array

Global array res. 192 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sub-array #3

Global array res. 109 mΩ
Loss Fraction 1.5 % at STC

Array #5 - Sub-array #5

Global array res. 40 mΩ
Loss Fraction 1.5 % at STC

Array #7 - Sub-array #7

Global array res. 45 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sub-array #2

Global array res. 153 mΩ
Loss Fraction 1.5 % at STC

Array #4 - Sub-array #4

Global array res. 48 mΩ
Loss Fraction 1.5 % at STC

Array #6 - Sub-array #6

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

Array #8 - Sub-array #8

Global array res. 89 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 0.06 % at STC

Inverters: MID 30KTL3-X, MAX 50KTL3 LV, MAC 60KTL3-X LV

Wire section (3 Inv.) Alu 3 x 3 x 35 mm²
Average wires length 22 m

Inverters: MAX 60KTL3 LV, MAX 70KTL3 LV

Wire section (4 Inv.) Alu 4 x 3 x 50 mm²
Average wires length 0 m

Inverter: MAX 110KTL3-X LV

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

Inverter: MID 40KTL3-X

Wire section (1 Inv.) Alu 1 x 3 x 25 mm²
Wires length 0 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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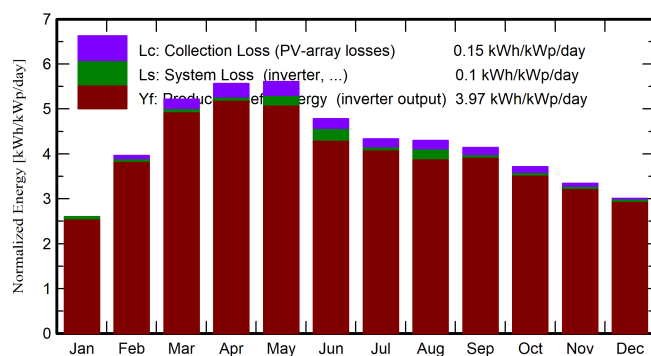
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Main results

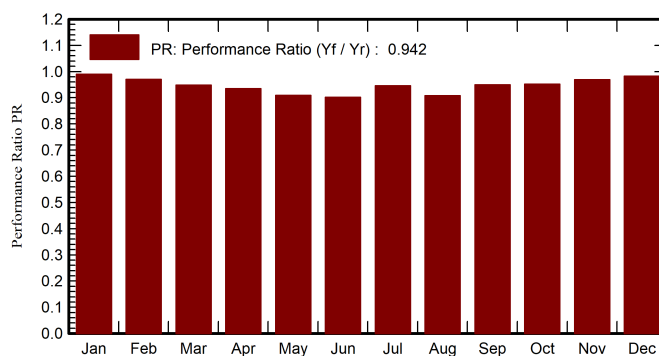
System Production

Produced Energy (P50)	1088377 kWh/year	Specific production (P50)	1448 kWh/kWp/year	Perf. Ratio PR	94.17 %
Produced Energy (P90)	1063217 kWh/year	Specific production (P90)	1414 kWh/kWp/year		
Produced Energy (P75)	1075149 kWh/year	Specific production (P75)	1430 kWh/kWp/year		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

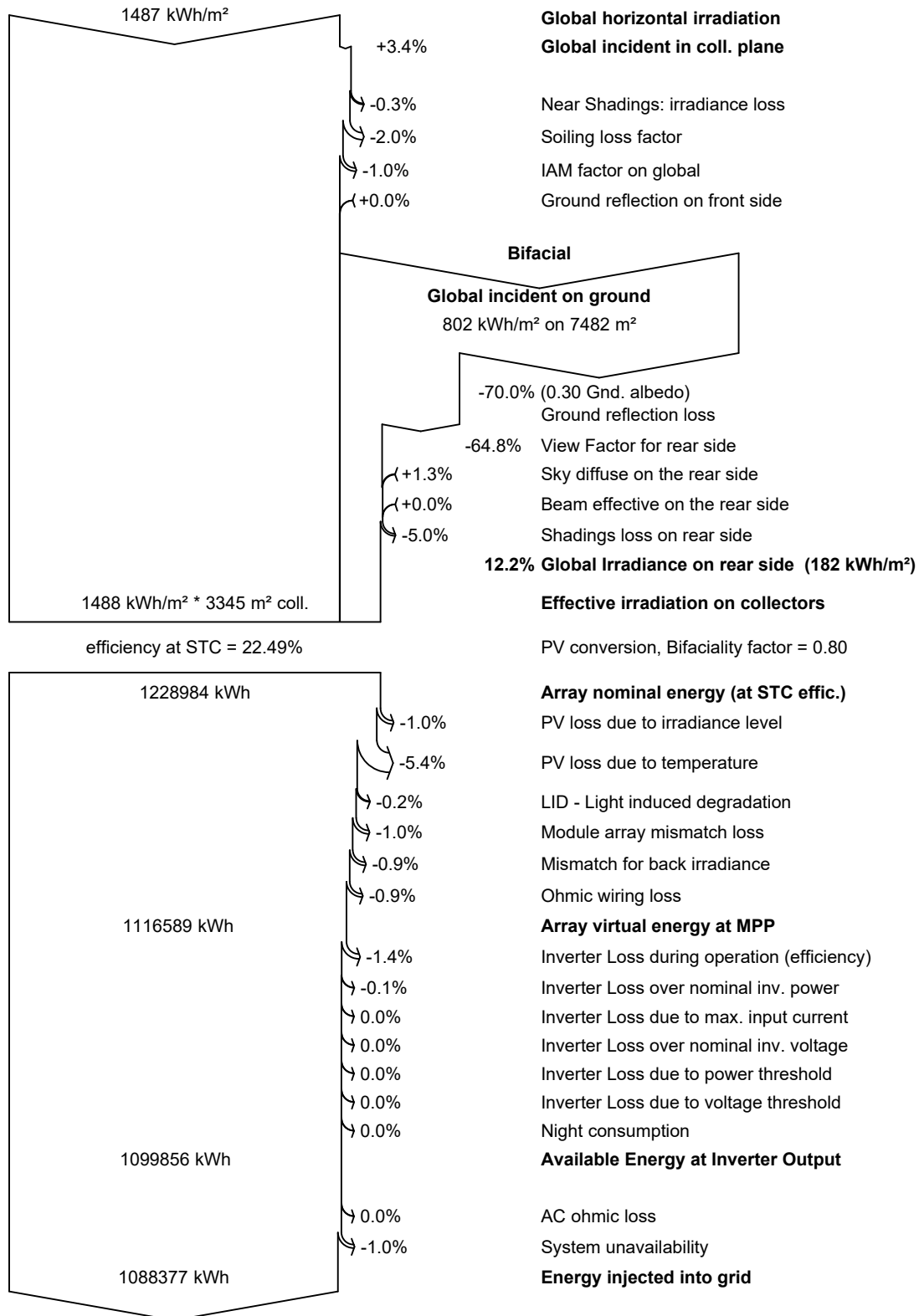
	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	kWh	kWh	ratio
January	73.2	48.6	14.58	80.1	77.3	60579	59634	0.990
February	103.2	56.4	19.26	110.9	107.4	82055	80860	0.970
March	152.9	76.1	24.78	161.6	156.8	116950	115261	0.949
April	163.8	91.6	29.43	167.0	161.8	118946	117270	0.934
May	174.5	100.1	31.14	173.8	168.4	123707	118686	0.908
June	145.8	98.1	30.71	143.5	138.8	103117	97261	0.902
July	136.0	89.3	29.54	134.4	129.9	97028	95535	0.946
August	132.9	85.0	29.35	133.2	128.8	95932	90893	0.908
September	121.3	77.1	28.39	124.3	120.0	89972	88659	0.949
October	108.5	66.6	26.22	115.2	111.5	83675	82417	0.952
November	91.8	57.0	21.05	100.3	97.0	74137	73057	0.969
December	83.5	49.1	16.49	93.2	90.1	69874	68844	0.983
Year	1487.3	894.9	25.10	1537.6	1487.8	1115972	1088377	0.942

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		



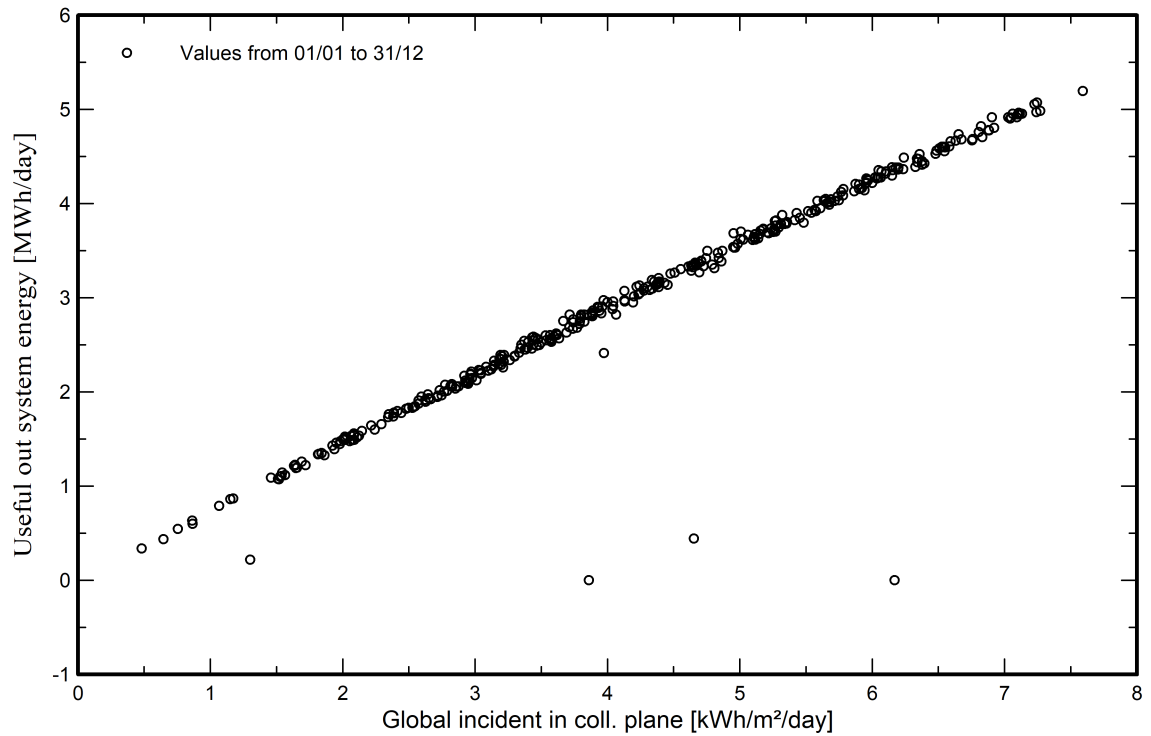
Loss diagram



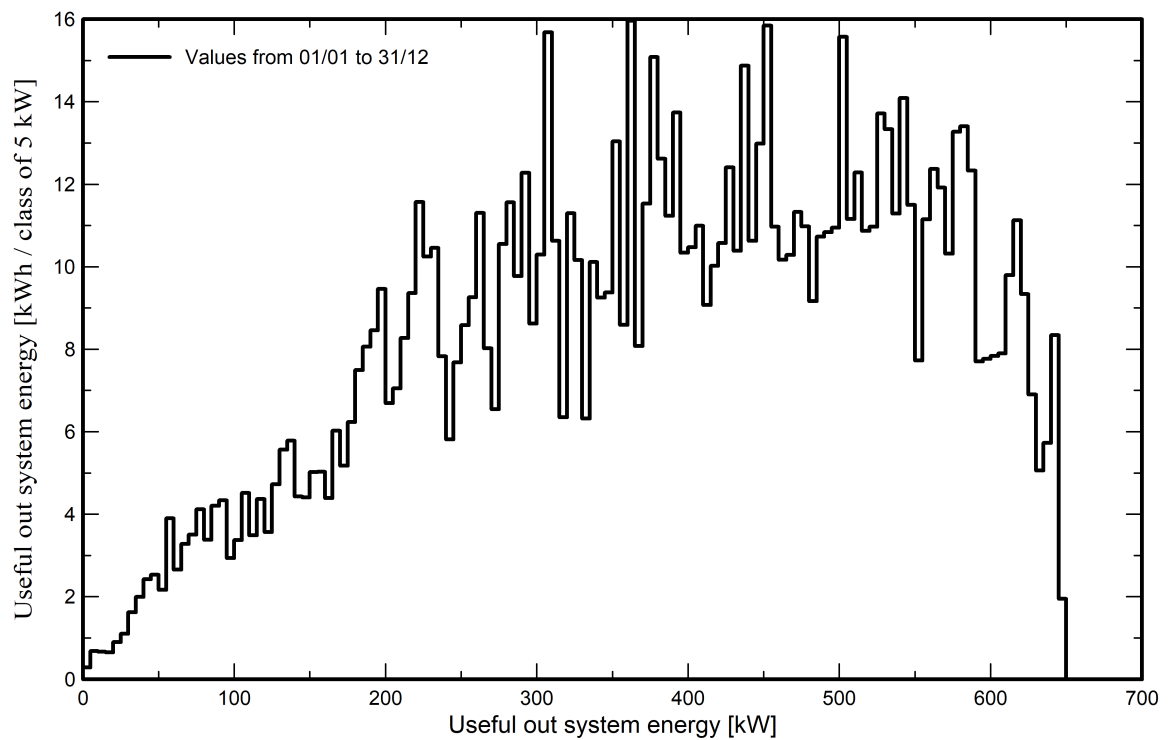


Predef. graphs

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 19.6 MWh
P50 1088.4 MWh
P90 1063.2 MWh
P75 1075.1 MWh

Probability distribution

