

PVsyst - Simulation report

Grid-Connected System

Project: District Combined Hospital Chicholi 100 Bed New Auraiya

Variant: New simulation variant

Unlimited sheds

System power: 534 kWp

Auriya - India

Author

Jakson Limited (India)



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Project summary

Geographical Site

Auraiya
India

Situation

Latitude 26.52 °N
Longitude 79.55 °E
Altitude 124 m
Time zone UTC+5.5

Project settings

Albedo 0.20

Weather data

Auraiya
Meteonorm 8.2 (1996-2015), 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 921 units
Pnom total 534 kWp

Inverters

Nb. of units 8 units
Pnom total 450 kWac
Pnom ratio 1.187

Results summary

Produced Energy 814020 kWh/year Specific production 1524 kWh/kWp/year Perf. Ratio PR 91.89 %

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General parameters

Grid-Connected System

Orientation #1

Sheds

Tilt	10 °
Azimuth	32 °

Unlimited sheds

Sheds configuration

Nb. of sheds	10 units
Unlimited sheds	
Shading limit angle	
Limit profile angle	8.5 °

Sizes

Sheds spacing	6.50 m
Collector width	3.00 m
Average GCR	46.2 %
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	6.50 m
Sheds width	3.04 m
Limit profile angle	8.5 °
GCR	46.8 %
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	90 units
Nominal (STC)	52.2 kWp
Modules	9 string x 10 In series

At operating cond. (50°C)

Pmpp	48.4 kWp
U mpp	411 V
I mpp	118 A

Inverter

Manufacturer	Growatt New Energy
Model	MID 20KTL3-XL

(Original PVsyst database)

Unit Nom. Power	20.0 kWac
Number of inverters	2 units
Total power	40.0 kWac
Operating voltage	200-850 V
Pnom ratio (DC:AC)	1.31
Power sharing within this inverter	



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PV Array Characteristics

Array #2 - Sub-array #2

PV module

Manufacturer Panasonic Life Solutions India Pvt. Ltd
Model AE14T580VHC16B5R
(Custom parameters definition)
Unit Nom. Power 580 Wp
Number of PV modules 169 units
Nominal (STC) 98.0 kWp
Modules 13 string x 13 In series

At operating cond. (50°C)

Pmpp 90.9 kWp
U mpp 534 V
I mpp 170 A

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 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

PV module

Manufacturer Panasonic Life Solutions India Pvt. Ltd
Model AE14T580VHC16B5R
(Custom parameters definition)
Unit Nom. Power 580 Wp
Number of PV modules 165 units
Nominal (STC) 95.7 kWp
Modules 11 string x 15 In series

At operating cond. (50°C)

Pmpp 88.7 kWp
U mpp 616 V
I mpp 144 A

Array #5 - Sub-array #5

PV module

Manufacturer Panasonic Life Solutions India Pvt. Ltd
Model AE14T580VHC16B5R
(Custom parameters definition)
Unit Nom. Power 580 Wp
Number of PV modules 392 units
Nominal (STC) 227 kWp
Modules 28 string x 14 In series

At operating cond. (50°C)

Pmpp 211 kWp
U mpp 575 V
I mpp 367 A

Inverter

Manufacturer Growatt New Energy
Model MID 40KTL3-X
(Original PVsyst database)
Unit Nom. Power 40.0 kWac
Number of inverters 2 units
Total power 80.0 kWac
Operating voltage 200-1000 V
Pnom ratio (DC:AC) 1.23
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

Inverter

Manufacturer Growatt New Energy
Model MAX 80KTL3 LV
(Original PVsyst database)
Unit Nom. Power 80.0 kWac
Number of inverters 1 unit
Total power 80.0 kWac
Operating voltage 200-1000 V
Pnom ratio (DC:AC) 1.20
Power sharing within this inverter

Inverter

Manufacturer Growatt New Energy
Model MAX 100KTL3-X LV
(Original PVsyst database)
Unit Nom. Power 100 kWac
Number of inverters 2 units
Total power 200 kWac
Operating voltage 180-1000 V
Pnom ratio (DC:AC) 1.14
Power sharing within this inverter



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PV Array Characteristics

Total PV power

Nominal (STC)	534 kWp
Total	921 modules
Module area	2377 m ²

Total inverter power

Total power	450 kWac
Number of inverters	8 units
Pnom ratio	1.19

Array losses

Array Soiling Losses

Loss Fraction	2.0 %
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Thermal Loss factor

Module temperature according to irradiance	
Uc (const)	29.0 W/m ² K
Uv (wind)	0.0 W/m ² K/m/s

Series Diode Loss

Voltage drop	0.7 V
Loss Fraction	0.2 % at STC

LID - Light Induced Degradation

Loss Fraction	2.0 %
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Module Quality Loss

Loss Fraction	0.0 %
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Module mismatch losses

Array #1 - PV Array

Loss Fraction	1.0 % at MPP
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Array #2 - Sub-array #2

Loss Fraction	1.0 % at MPP
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Array #3 - Sub-array #3

Loss Fraction	1.0 % at MPP
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Array #4 - Sub-array #4

Loss Fraction	1.0 % at MPP
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Array #5 - Sub-array #5

Loss Fraction	1.0 % at MPP
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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.	57 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.	26 mΩ
Loss Fraction	1.5 % at STC

Array #2 - Sub-array #2

Global array res.	51 mΩ
Loss Fraction	1.5 % at STC

Array #4 - Sub-array #4

Global array res.	70 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 220 Vac tri
Loss Fraction 0.15 % at STC

Inverter: MID 20KTL3-XL

Wire section (2 Inv.) Alu 2 x 3 x 50 mm²
Average wires length 45 m

Inverter: MAX 50KTL3 LV

Wire section (1 Inv.) Alu 1 x 3 x 35 mm²
Wires length 0 m

Inverter: MAX 100KTL3-X LV

Wire section (2 Inv.) Alu 2 x 3 x 95 mm²
Average wires length 0 m

Inverter: MID 40KTL3-X

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

Inverter: MAX 80KTL3 LV

Wire section (1 Inv.) Alu 1 x 3 x 70 mm²
Wires length 0 m



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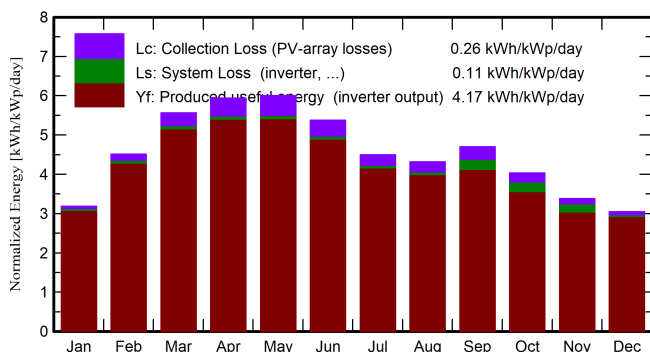
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Main results

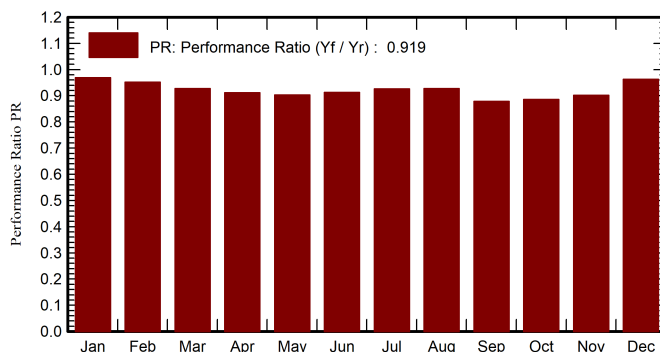
System Production

Produced Energy (P50)	814020 kWh/year	Specific production (P50)	1524 kWh/kWp/year	Perf. Ratio PR	91.89 %
Produced Energy (P90)	792502 kWh/year	Specific production (P90)	1484 kWh/kWp/year		
Produced Energy (P75)	802707 kWh/year	Specific production (P75)	1503 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	90.7	55.4	13.95	98.8	95.6	51972	51148	0.969
February	116.2	58.4	18.49	126.5	122.5	65255	64266	0.951
March	163.6	76.9	24.60	172.6	167.4	86852	85539	0.928
April	174.9	89.4	30.15	178.0	172.7	88007	86685	0.911
May	187.4	98.2	33.59	186.0	180.4	91179	89775	0.904
June	163.8	98.7	32.89	161.2	156.1	79817	78579	0.913
July	141.2	100.5	30.47	139.5	134.7	70104	69016	0.926
August	133.9	92.1	29.64	133.8	129.3	67350	66288	0.927
September	135.3	70.7	28.65	141.0	136.7	70344	66189	0.879
October	118.5	72.3	26.43	125.0	121.0	63153	59151	0.886
November	93.3	57.3	20.49	101.5	98.1	52241	48845	0.901
December	85.3	52.2	15.52	94.4	91.1	49294	48538	0.963
Year	1604.1	922.1	25.43	1658.3	1605.5	835566	814020	0.919

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		



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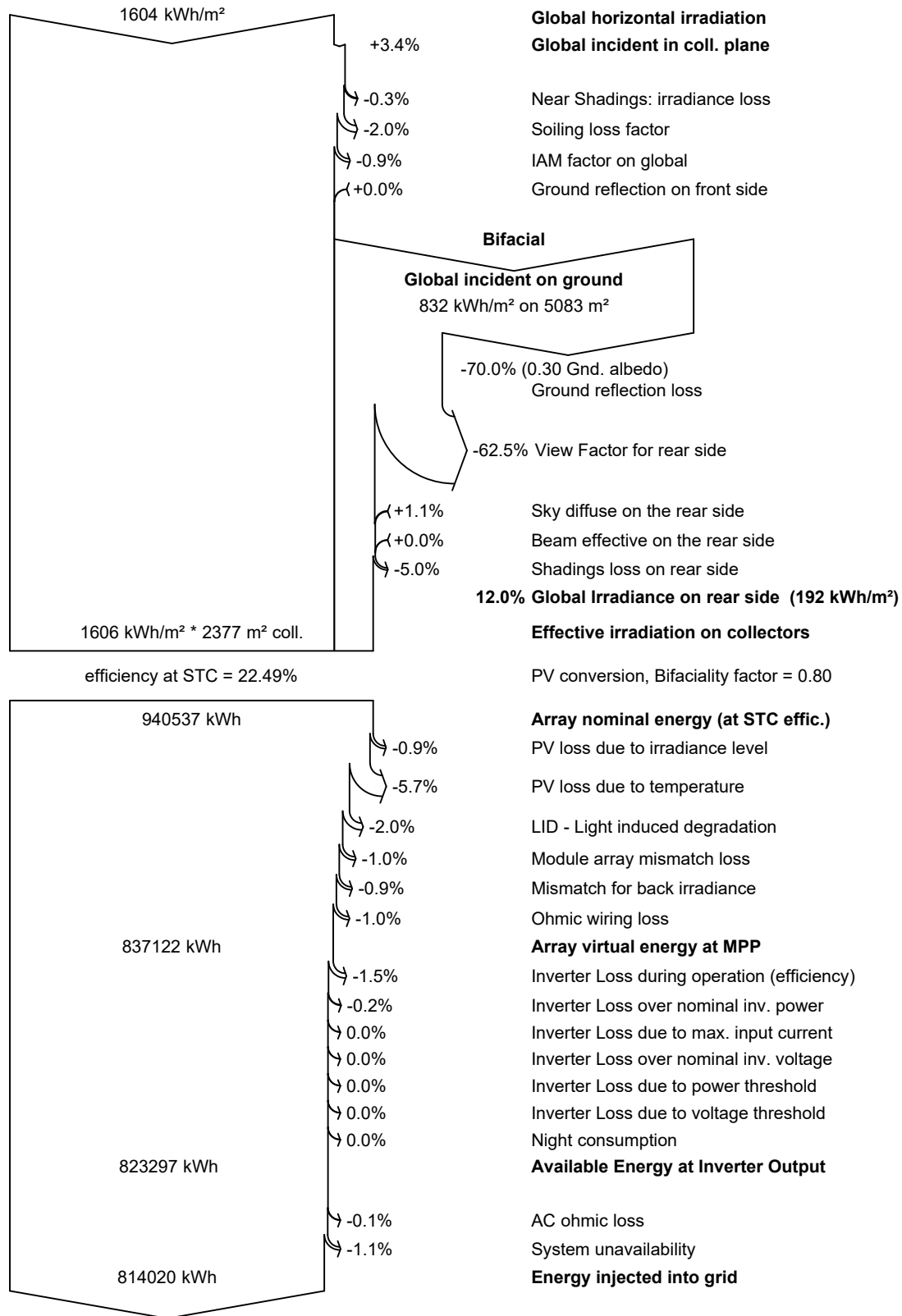
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Loss diagram





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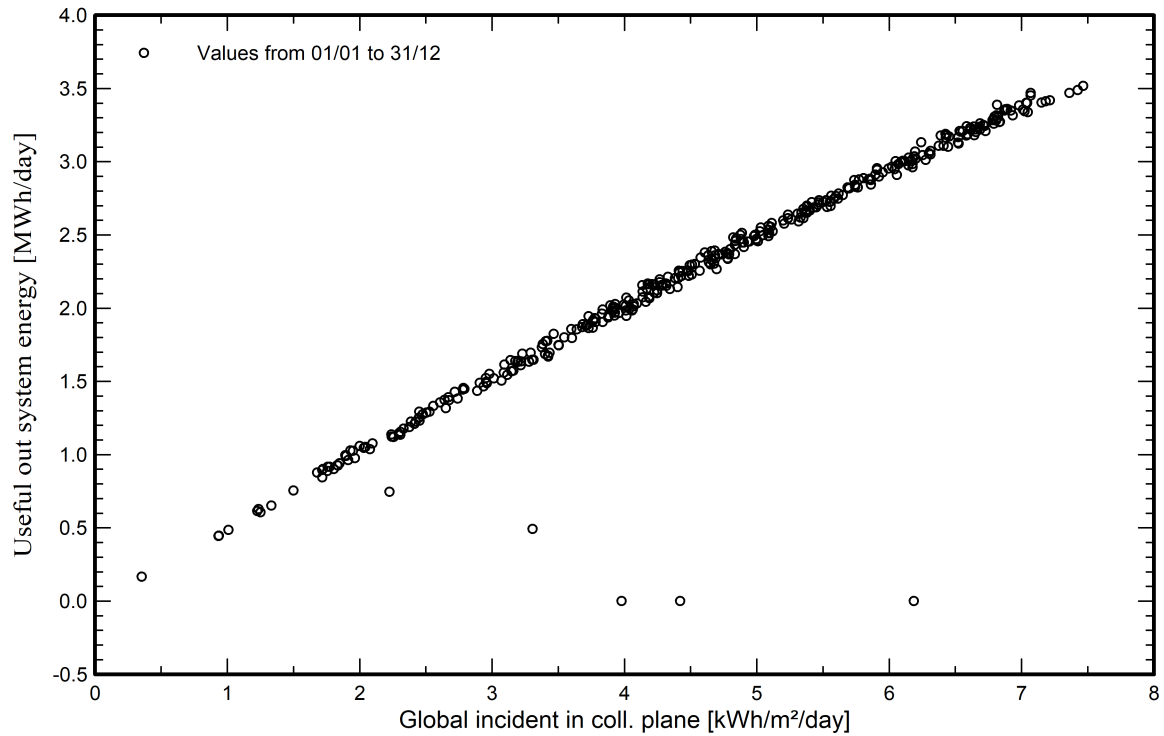
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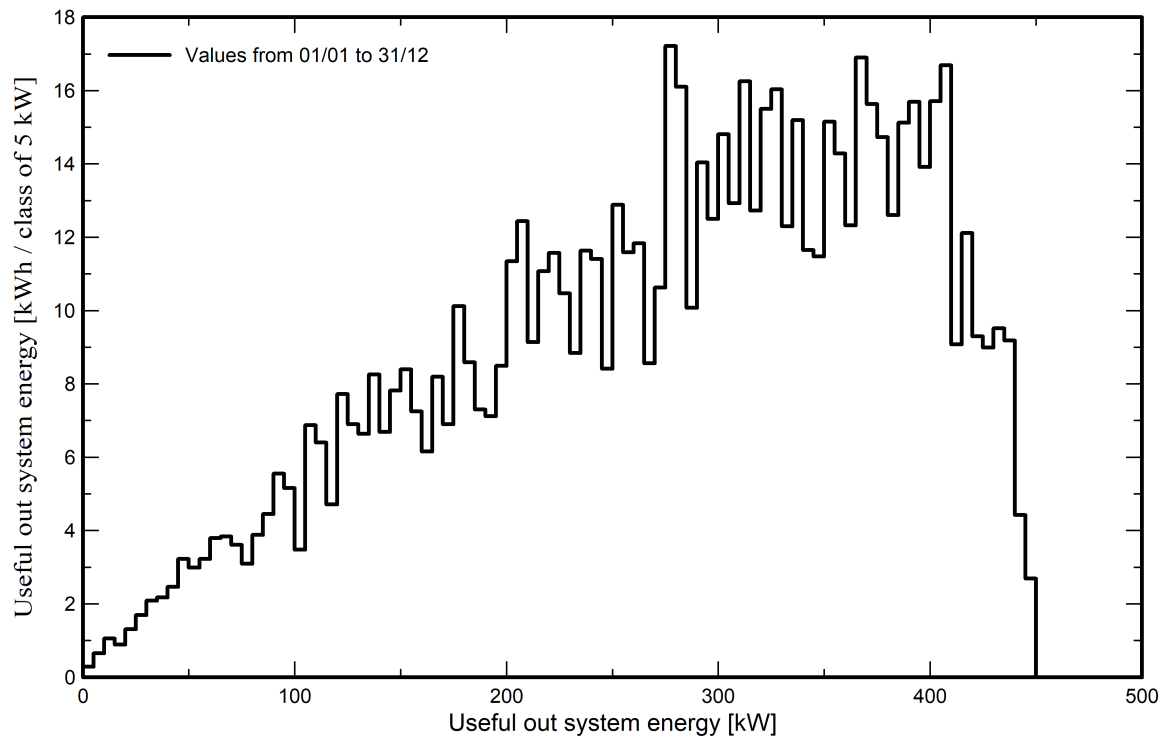
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Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





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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 16.8 MWh
P50 814.0 MWh
P90 792.5 MWh
P75 802.7 MWh

Probability distribution

