

PVsyst - Simulation report

Grid-Connected System

Project: New Project

Variant: Adani_320Wp Module_Solis_659.84kWp With P90

Building system

System power: 660 kWp

Strides Pharma, Puducherry - India

Author

SunSource Energy (United States)



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PVsyst V7.2.21

VC8, Simulation date:
14/12/22 14:37
with v7.2.21

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Project summary

Geographical Site
Strides Pharma, Puducherry
India

Situation
Latitude 12.04 °N
Longitude 79.85 °E
Altitude 35 m
Time zone UTC+5.5

Project settings
Albedo 0.20

Meteo data

Strides Pharma, Puducherry
SolarGIS Monthly aver. , period not spec. - Synthetic

System summary

Grid-Connected System

PV Field Orientation

Fixed planes 8 orientations
Tilts/azimuths 8 / 13 °
8 / -167 °
17 / -167 °
17 / 13 °
2 / 13 °
5 / -77 °
5 / 103 °
15 / 13 °

Building system

Near Shadings

According to strings
Electrical effect 100 %

User's needs

Unlimited load (grid)

System information

PV Array

Nb. of modules 2062 units
Pnom total 660 kWp

Inverters

Nb. of units 6 units
Pnom total 490 kWac
Pnom ratio 1.347

Results summary

Produced Energy 951.9 MWh/year Specific production 1443 kWh/kWp/year Perf. Ratio PR 71.95 %

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General parameters

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Orientation

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8 / -167 °
17 / -167 °
17 / 13 °
2 / 13 °
5 / -77 °
5 / 103 °
15 / 13 °

Horizon

Free Horizon

Building system

Sheds configuration

Near Shadings

According to strings
Electrical effect 100 %

Models used

Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer MSPVL
Model ASP-7-320.PAN
(Custom parameters definition)
Unit Nom. Power 320 Wp
Number of PV modules 315 units
Nominal (STC) 101 kWp

Inverter

Manufacturer Ginlong Technologies
Model Solis-80K-5G
(Custom parameters definition)
Unit Nom. Power 80.0 kWac
Number of inverters 1 unit
Total power 80.0 kWac

Array #1 - PV Array

Orientation #5
Tilt/Azimuth 2/13 °
Number of PV modules 220 units
Nominal (STC) 70.4 kWp
Modules 11 Strings x 20 In series

Number of inverters 6 * MPPT 13% 0.8 unit
Total power 60.0 kWac

At operating cond. (40°C)

Pmpp 65.9 kWp
U mpp 684 V
I mpp 96 A

Operating voltage 180-1000 V
Max. power (=>40°C) 88.0 kWac
Pnom ratio (DC:AC) 1.17

Array #2 - Sub-array #2

Orientation #5
Tilt/Azimuth 2/13 °
Number of PV modules 95 units
Nominal (STC) 30.4 kWp
Modules 5 Strings x 19 In series

Number of inverters 2 * MPPT 13% 0.3 unit
Total power 20.0 kWac

At operating cond. (40°C)

Pmpp 28.47 kWp
U mpp 650 V
I mpp 44 A

Operating voltage 180-1000 V
Max. power (=>40°C) 88.0 kWac
Pnom ratio (DC:AC) 1.52

PV module

Manufacturer MSPVL
Model ASP-7-320.PAN
(Custom parameters definition)
Unit Nom. Power 320 Wp
Number of PV modules 117 units
Nominal (STC) 37.4 kWp

Inverter

Manufacturer Ginlong Technologies
Model Solis-30K
(Custom parameters definition)
Unit Nom. Power 30.0 kWac
Number of inverters 1 unit
Total power 30.0 kWac



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PV Array Characteristics

Array #3 - Sub-array #3

Orientation	#2		
Tilt/Azimuth	8/-167 °		
Number of PV modules	36 units	Number of inverters	1 * MPPT 25% 0.3 unit
Nominal (STC)	11.52 kWp	Total power	7.5 kWac
Modules	2 Strings x 18 In series		
At operating cond. (40°C)		Operating voltage	200-800 V
Pmpp	10.79 kWp	Max. power (=>25°C)	33.0 kWac
U mpp	615 V	Pnom ratio (DC:AC)	1.54
I mpp	18 A		

Array #4 - Sub-array #4

Orientation	#3		
Tilt/Azimuth	17/-167 °		
Number of PV modules	34 units	Number of inverters	1 * MPPT 25% 0.3 unit
Nominal (STC)	10.88 kWp	Total power	7.5 kWac
Modules	2 Strings x 17 In series		
At operating cond. (40°C)		Operating voltage	200-800 V
Pmpp	10.19 kWp	Max. power (=>25°C)	33.0 kWac
U mpp	581 V	Pnom ratio (DC:AC)	1.45
I mpp	18 A		

Array #5 - Sub-array #5

Orientation	#4		
Tilt/Azimuth	17/13 °		
Number of PV modules	28 units	Number of inverters	1 * MPPT 25% 0.3 unit
Nominal (STC)	8.96 kWp	Total power	7.5 kWac
Modules	2 Strings x 14 In series		
At operating cond. (40°C)		Operating voltage	200-800 V
Pmpp	8.39 kWp	Max. power (=>25°C)	33.0 kWac
U mpp	479 V	Pnom ratio (DC:AC)	1.19
I mpp	18 A		

Array #14 - Sub-array #14

Orientation	#2		
Tilt/Azimuth	8/-167 °		
Number of PV modules	19 units	Number of inverters	1 * MPPT 25% 0.3 unit
Nominal (STC)	6.08 kWp	Total power	7.5 kWac
Modules	1 String x 19 In series		
At operating cond. (40°C)		Operating voltage	200-800 V
Pmpp	5.69 kWp	Max. power (=>25°C)	33.0 kWac
U mpp	650 V	Pnom ratio (DC:AC)	0.81
I mpp	8.8 A		

PV module

Manufacturer	MSPVL
Model	ASP-7-320.PAN
(Custom parameters definition)	
Unit Nom. Power	320 Wp
Number of PV modules	1437 units
Nominal (STC)	460 kWp

Inverter

Manufacturer	Ginlong Technologies
Model	GCI-110K--5G
(Custom parameters definition)	
Unit Nom. Power	110 kWac
Number of inverters	3 units
Total power	330 kWac



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PV Array Characteristics

Array #6 - Sub-array #6

Orientation	#2		
Tilt/Azimuth	8/-167 °		
Number of PV modules	54 units	Number of inverters	2 * MPPT 10% 0.2 unit
Nominal (STC)	17.28 kWp	Total power	22.0 kWac
Modules	3 Strings x 18 In series		
At operating cond. (40°C)		Operating voltage	180-1000 V
Pmpp	16.18 kWp	Max. power (=>40°C)	121 kWac
U mpp	615 V	Pnom ratio (DC:AC)	0.79
I mpp	26 A		

Array #7 - Sub-array #7

Orientation	#1		
Tilt/Azimuth	8/13 °		
Number of PV modules	51 units	Number of inverters	1 * MPPT 10% 0.1 unit
Nominal (STC)	16.32 kWp	Total power	11.0 kWac
Modules	3 Strings x 17 In series		
At operating cond. (40°C)		Operating voltage	180-1000 V
Pmpp	15.28 kWp	Max. power (=>40°C)	121 kWac
U mpp	581 V	Pnom ratio (DC:AC)	1.48
I mpp	26 A		

Array #8 - Sub-array #8

Orientation	#8		
Tilt/Azimuth	15/13 °		
Number of PV modules	60 units	Number of inverters	1 * MPPT 10% 0.1 unit
Nominal (STC)	19.20 kWp	Total power	11.0 kWac
Modules	3 Strings x 20 In series		
At operating cond. (40°C)		Operating voltage	180-1000 V
Pmpp	17.98 kWp	Max. power (=>40°C)	121 kWac
U mpp	684 V	Pnom ratio (DC:AC)	1.75
I mpp	26 A		

Array #9 - Sub-array #9

Orientation	#7		
Tilt/Azimuth	5/103 °		
Number of PV modules	860 units	Number of inverters	17 * MPPT 10% 1.7 units
Nominal (STC)	275 kWp	Total power	187 kWac
Modules	43 Strings x 20 In series		
At operating cond. (40°C)		Operating voltage	180-1000 V
Pmpp	258 kWp	Max. power (=>40°C)	121 kWac
U mpp	684 V	Pnom ratio (DC:AC)	1.47
I mpp	377 A		

Array #10 - Sub-array #10

Orientation	#6		
Tilt/Azimuth	5/-77 °		
Number of PV modules	340 units	Number of inverters	7 * MPPT 10% 0.7 unit
Nominal (STC)	109 kWp	Total power	77.0 kWac
Modules	17 Strings x 20 In series		
At operating cond. (40°C)		Operating voltage	180-1000 V
Pmpp	102 kWp	Max. power (=>40°C)	121 kWac
U mpp	684 V	Pnom ratio (DC:AC)	1.41
I mpp	149 A		



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PV Array Characteristics

Array #11 - Sub-array #11

Orientation	#5		
Tilt/Azimuth	2/13 °		
Number of PV modules	72 units	Number of inverters	2 * MPPT 10% 0.2 unit
Nominal (STC)	23.04 kWp	Total power	22.0 kWac
Modules	4 Strings x 18 In series		
At operating cond. (40°C)		Operating voltage	180-1000 V
Pmpp	21.58 kWp	Max. power (=>40°C)	121 kWac
U mpp	615 V	Pnom ratio (DC:AC)	1.05
I mpp	35 A		

PV module

Manufacturer	MSPVL
Model	ASP-7-320.PAN
(Custom parameters definition)	
Unit Nom. Power	320 Wp
Number of PV modules	193 units
Nominal (STC)	61.8 kWp

Inverter

Manufacturer	Ginlong Technologies
Model	Solis-50K-HV-5G
(Custom parameters definition)	
Unit Nom. Power	50.0 kWac
Number of inverters	1 unit
Total power	50.0 kWac

Array #12 - Sub-array #12

Orientation	#8		
Tilt/Azimuth	15/13 °		
Number of PV modules	60 units	Number of inverters	1 * MPPT 25% 0.3 unit
Nominal (STC)	19.20 kWp	Total power	12.5 kWac
Modules	3 Strings x 20 In series		
At operating cond. (40°C)		Operating voltage	180-1000 V
Pmpp	17.98 kWp	Max. power (=>40°C)	55.0 kWac
U mpp	684 V	Pnom ratio (DC:AC)	1.54
I mpp	26 A		

Array #13 - Sub-array #13

Orientation	#2		
Tilt/Azimuth	8/-167 °		
Number of PV modules	133 units	Number of inverters	3 * MPPT 25% 0.8 unit
Nominal (STC)	42.6 kWp	Total power	37.5 kWac
Modules	7 Strings x 19 In series		
At operating cond. (40°C)		Operating voltage	180-1000 V
Pmpp	39.9 kWp	Max. power (=>40°C)	55.0 kWac
U mpp	650 V	Pnom ratio (DC:AC)	1.13
I mpp	61 A		

Total PV power

Nominal (STC)	660 kWp
Total	2062 modules
Module area	4161 m²
Cell area	7483 m²

Total inverter power

Total power	490 kWac
Number of inverters	6 units
Pnom ratio	1.35

Array losses

Array Soiling Losses

Average loss Fraction 3.1 %

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
2.5%	2.5%	4.0%	4.0%	4.0%	2.5%	2.5%	2.5%	2.5%	4.0%	4.0%	2.5%



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Array losses

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 18.0 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 2.5 %

Module Quality Loss

Loss Fraction 0.0 %

Module mismatch losses

Loss Fraction 1.0 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

IAM loss factor

Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	0.980	0.940	0.840	0.720	0.600	0.520	0.000

DC wiring losses

Global wiring resistance 10 mΩ
Loss Fraction 2.0 % at STC

Array #1 - PV Array

Global array res. 152 mΩ
Loss Fraction 2.0 % at STC

Array #3 - Sub-array #3

Global array res. 754 mΩ
Loss Fraction 2.0 % at STC

Array #5 - Sub-array #5

Global array res. 586 mΩ
Loss Fraction 2.0 % at STC

Array #7 - Sub-array #7

Global array res. 474 mΩ
Loss Fraction 2.0 % at STC

Array #9 - Sub-array #9

Global array res. 39 mΩ
Loss Fraction 2.0 % at STC

Array #11 - Sub-array #11

Global array res. 377 mΩ
Loss Fraction 2.0 % at STC

Array #13 - Sub-array #13

Global array res. 227 mΩ
Loss Fraction 2.0 % at STC

Array #2 - Sub-array #2

Global array res. 318 mΩ
Loss Fraction 2.0 % at STC

Array #4 - Sub-array #4

Global array res. 712 mΩ
Loss Fraction 2.0 % at STC

Array #6 - Sub-array #6

Global array res. 502 mΩ
Loss Fraction 2.0 % at STC

Array #8 - Sub-array #8

Global array res. 558 mΩ
Loss Fraction 2.0 % at STC

Array #10 - Sub-array #10

Global array res. 98 mΩ
Loss Fraction 2.0 % at STC

Array #12 - Sub-array #12

Global array res. 558 mΩ
Loss Fraction 2.0 % at STC

Array #14 - Sub-array #14

Global array res. 1591 mΩ
Loss Fraction 2.0 % 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 1.80 % at STC

Global System

Wire section Copper 3 x 700 mm²
Wires length 165 m



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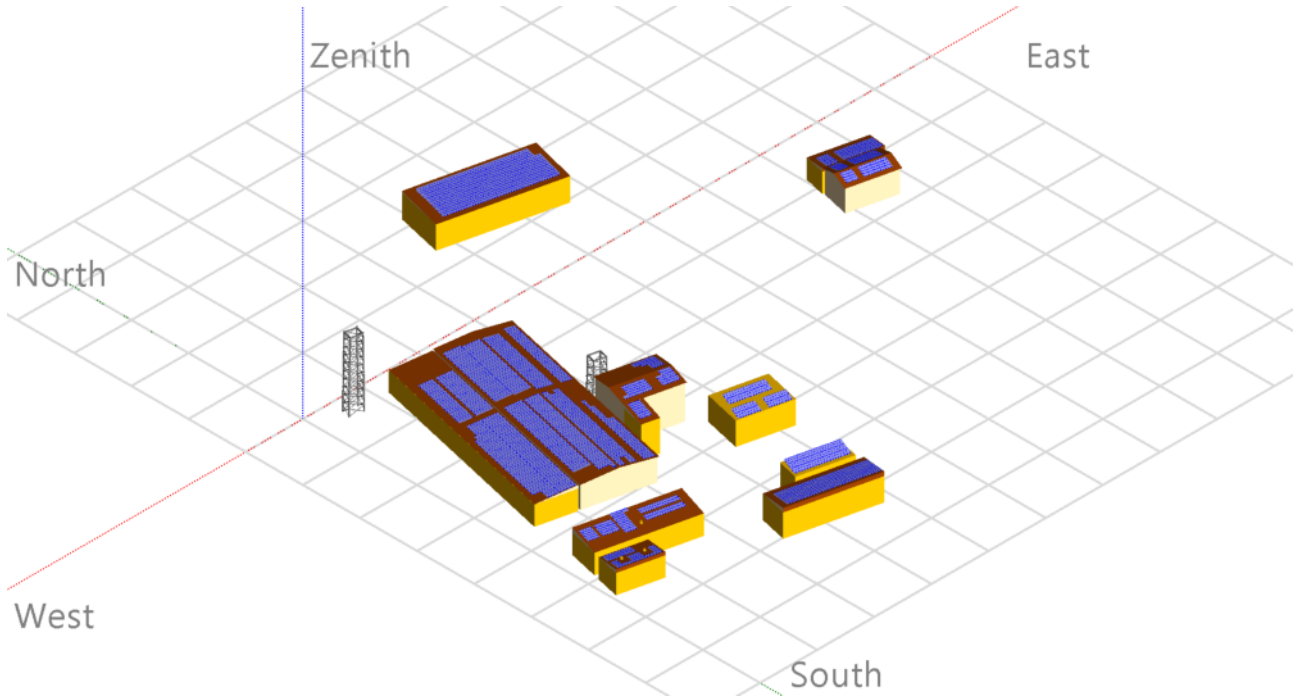
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Near shadings parameter

Perspective of the PV-field and surrounding shading scene





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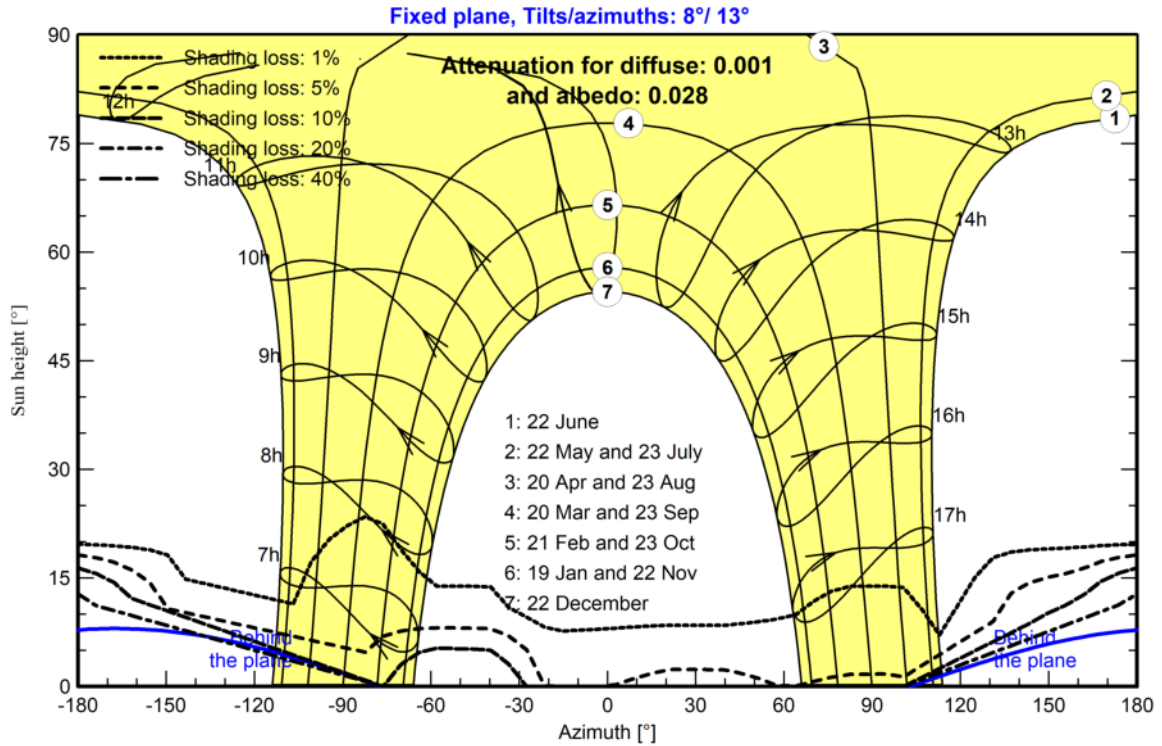
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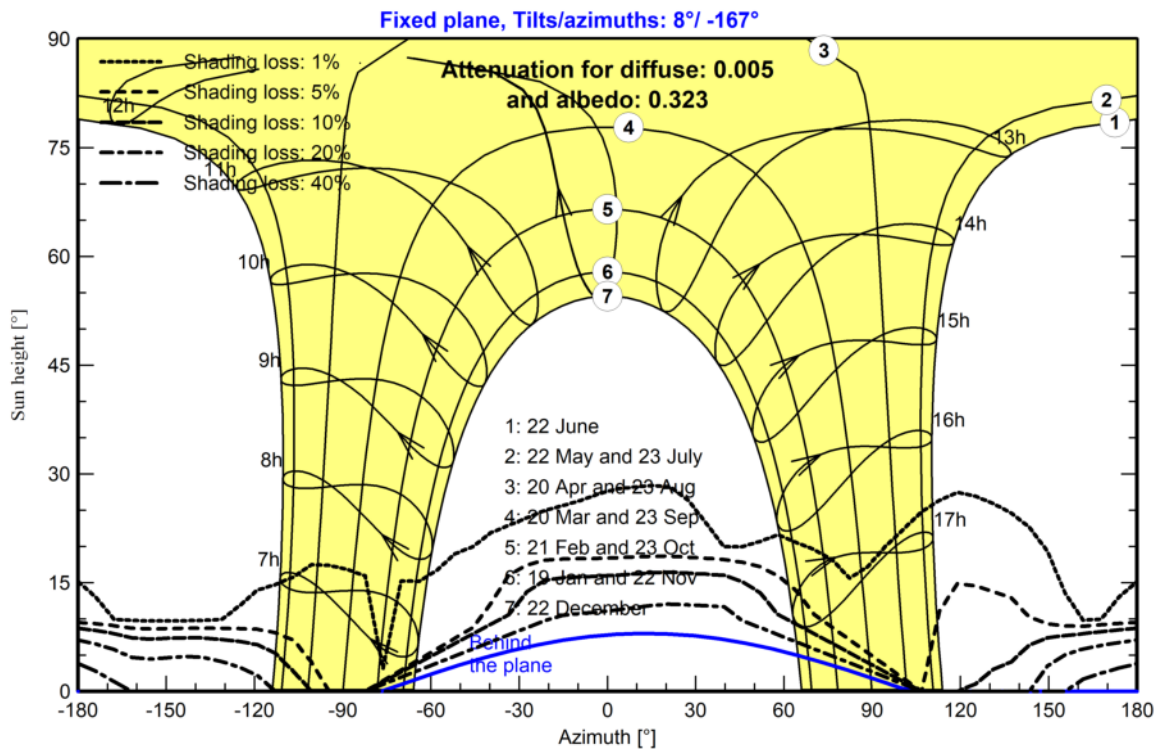
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Iso-shadings diagram

Orientation #1



Orientation #2





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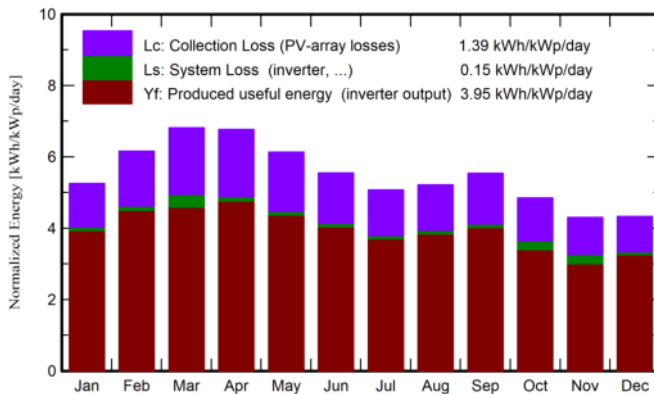
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Main results

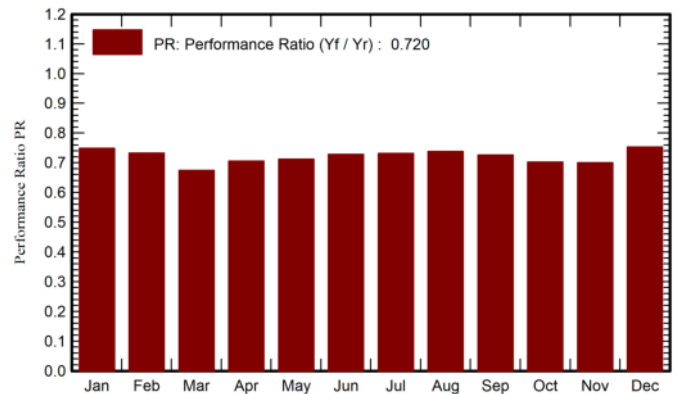
System Production

Produced Energy (P50)	951.9 MWh/year	Specific production (P50)	1443 kWh/kWp/year	Performance Ratio PR	71.95 %
Produced Energy (P90)	895 MWh/year	Specific production (P90)	1356 kWh/kWp/year		
Produced Energy (P75)	922 MWh/year	Specific production (P75)	1397 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	MWh	MWh	ratio
January	163.0	68.80	24.70	162.9	151.8	82.4	80.44	0.748
February	172.5	58.80	25.90	172.4	161.9	85.4	83.32	0.732
March	211.6	71.30	27.90	211.3	196.4	101.2	94.03	0.674
April	203.4	75.30	30.20	203.0	189.1	96.9	94.44	0.705
May	190.8	90.20	31.70	190.1	176.4	91.6	89.39	0.712
June	167.3	85.50	30.80	166.5	156.4	82.0	80.08	0.729
July	158.0	89.30	30.00	157.2	147.6	77.8	75.89	0.731
August	162.2	89.60	29.50	161.7	152.3	80.7	78.72	0.738
September	166.3	81.90	29.10	166.1	156.1	81.6	79.58	0.726
October	150.7	76.60	27.80	150.4	139.0	74.6	69.72	0.703
November	129.3	68.10	26.20	129.1	118.3	64.7	59.63	0.700
December	134.3	68.20	24.89	134.1	124.6	68.3	66.61	0.753
Year	2009.4	923.60	28.23	2004.9	1869.9	987.1	951.86	0.720

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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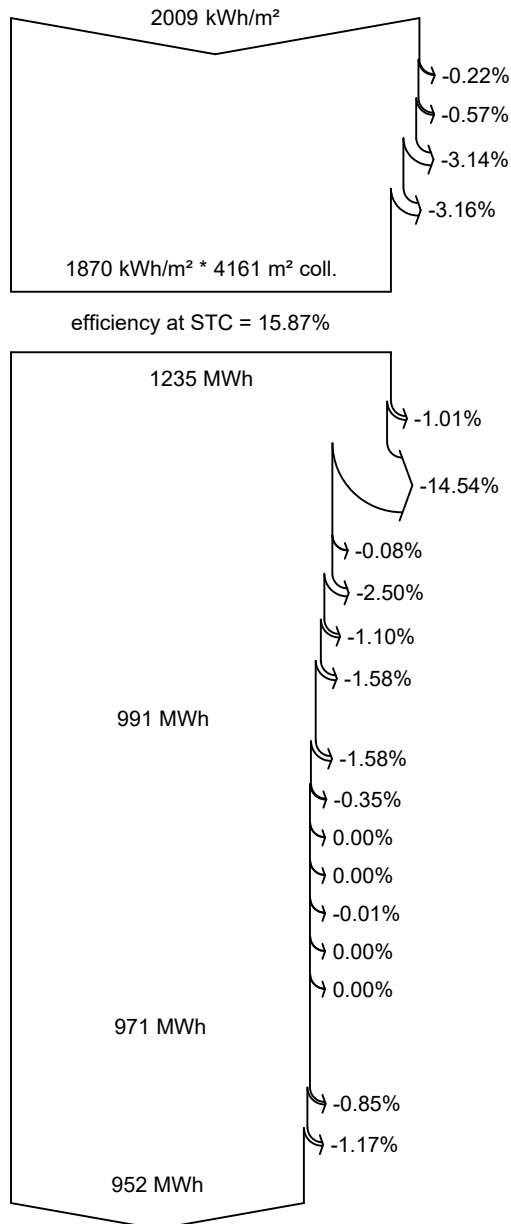
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Loss diagram



Global horizontal irradiation

Global incident in coll. plane

Near Shadings: irradiance loss

IAM factor on global

Soiling loss factor

Effective irradiation on collectors

PV conversion

Array nominal energy (at STC effic.)

PV loss due to irradiance level

PV loss due to temperature

Shadings: Electrical Loss acc. to strings

LID - Light induced degradation

Mismatch loss, modules and strings

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



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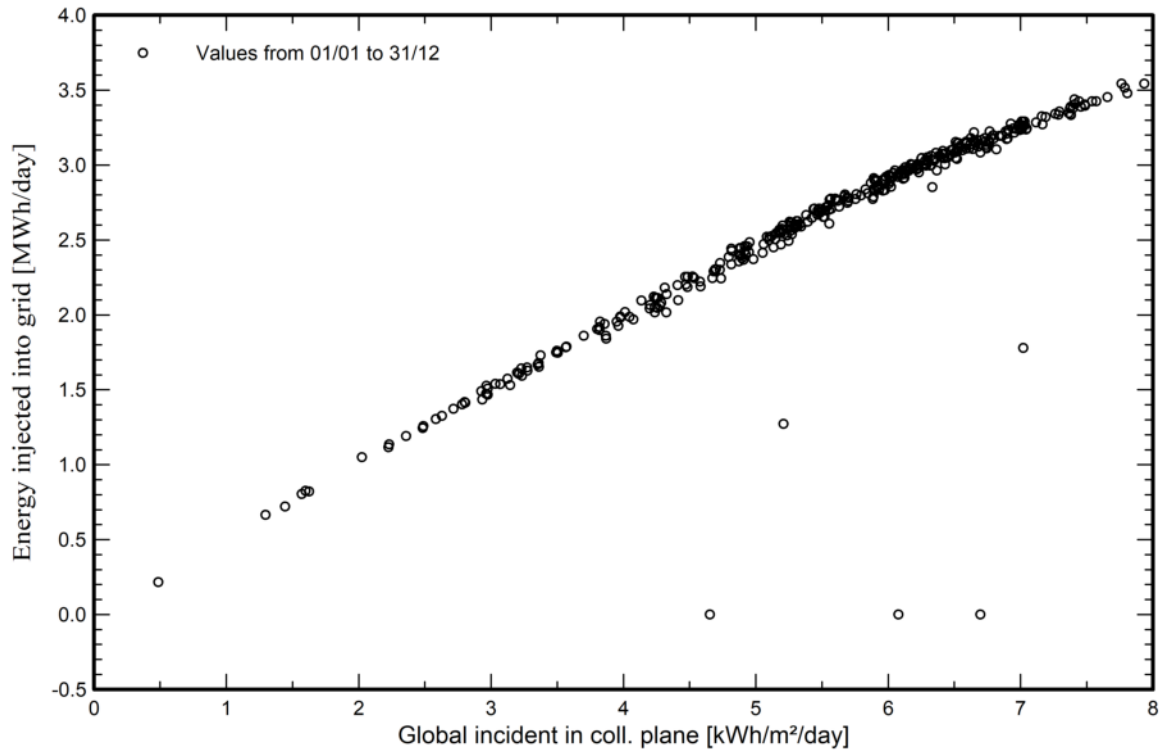
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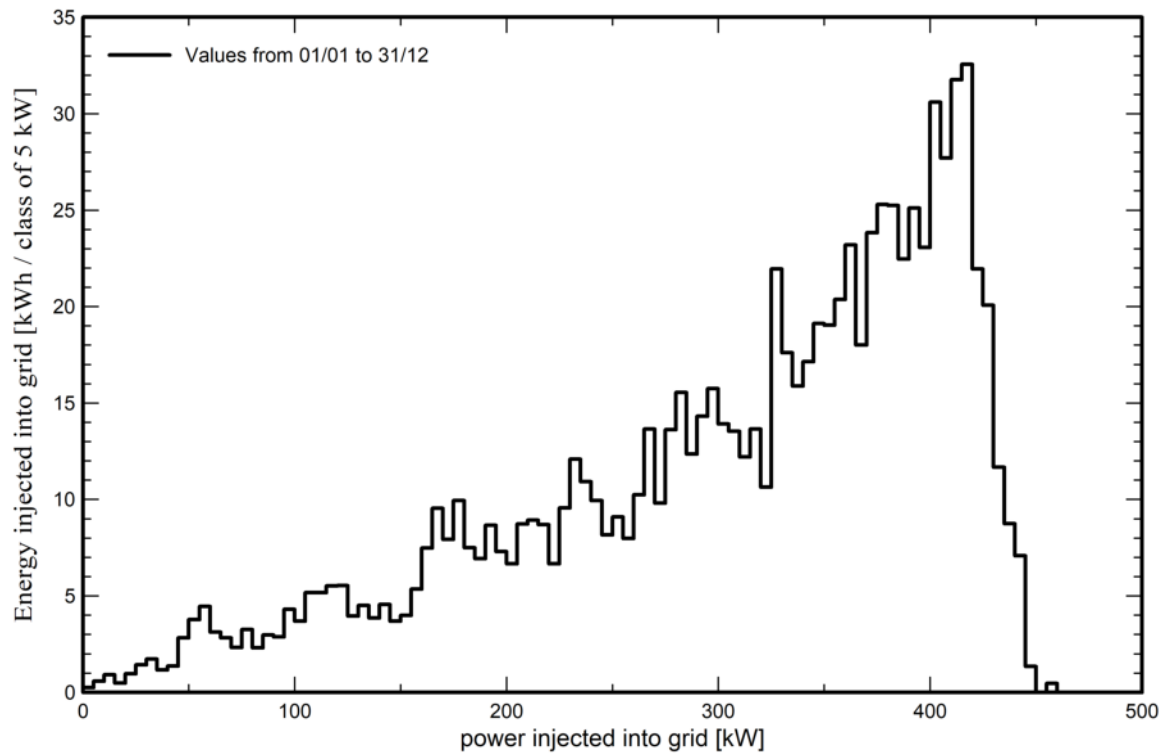
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Special graphs

Daily Input/Output diagram



System Output Power Distribution





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P50 - P90 evaluation

Meteo data

Source SolarGIS Monthly aver. , period not spec.
Kind Not defined
Year-to-year variability(Variance) 4.3 %

Specified Deviation

Global variability (meteo + system)

Variability (Quadratic sum) 4.7 %

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	44.4 MWh
P50	951.9 MWh
P90	894.9 MWh
P75	921.9 MWh

Probability distribution

