



**REGIONE
PUGLIA**



Provincia di Lecce



Comune di Nardo

Committente:

GRUPOTEC SOLAR ITALIA 3 SRL

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PROCEDIMENTO VIA NAZIONALE
ai sensi degli artt. 23-24-25 del D.Lgs. 152/06 e s.m.i.

Denominazione progetto:

**REALIZZAZIONE IMPIANTO AGRIVOLTAICO
"MASSERIA PALOMBI"**

Potenza nominale complessiva = 24.304,80 kWp

Sito in:

COMUNE DI NARDO' (LE)

Titolo elaborato:

**STIMA DELLA PRODUCIBILITA'
DELL'IMPIANTO**



Elaborato n.

EL08

Scala

Responsabile Coordinamento progetto : dott.ssa agr. Eliana Santoro

TIMBRI E FIRME:

Revisione progettuale : Ing. Nicodemo Agostino

Collaboratori : Ing. Marco Pignolo

REV.:	REDAZIONE:	CONTROLLO:	APPROVAZIONE :	DATA:
00	Maria Dolores Torregrosa	Ing. Nicodemo Agostino	Dott.ssa Eliana Santoro	20/01/2023
01				
02				

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THE CULTURE OF CLEAN ENERGY

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PVsyst - Simulation report

Grid-Connected System

Project: Palombi_Puglia_Flyren

Variant: VC6_Palombi_REV T-B-78M-55°-S-11-MN (AU)

Trackers single array, with backtracking

System power: 24.30 MWp

Palombi - Puglia - Italy

Author

Grupotec UK (United Kingdom)



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with v7.3.0

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Project summary

Geographical Site		Situation		Project settings	
Palombi - Puglia		Latitude	40.25 °N	Albedo	0.20
Italy		Longitude	18.00 °E		
		Altitude	43 m		
		Time zone	UTC+1		
Meteo data					
Palombi - Puglia					
Meteonorm 7.2, Sat=100% - Synthetic					

System summary

Grid-Connected System		Trackers single array, with backtracking			
Simulation for year no 1					
PV Field Orientation		Tracking algorithm		Near Shadings	
Orientation		Astronomic calculation		According to strings	
Tracking plane, horizontal N-S axis		Backtracking activated		Electrical effect	
Axis azimuth		0 °		100 %	
System information					
PV Array					
Nb. of modules	39520 units	Inverters		Nb. of units	
Pnom total	24.30 MWp			66 units	
				Pnom total	
				19.80 MWac	
				Grid power limit	
				18.00 MWac	
				Grid lim. Pnom ratio	
				1.350	
User's needs					
Unlimited load (grid)					

Results summary

Produced Energy	48947451 kWh/year	Specific production	2014 kWh/kWp/year	Perf. Ratio PR	84.68 %
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General parameters**Grid-Connected System****PV Field Orientation****Orientation**

Tracking plane, horizontal N-S axis
Axis azimuth 0 °

Models used

Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon

Free Horizon

Bifacial system

Model 2D Calculation
unlimited trackers

Bifacial model geometry

Tracker Spacing 11.00 m
Tracker width 4.99 m
GCR 45.4 %
Axis height above ground 2.00 m

Grid power limitation

Active Power 18.00 MWac
Pnom ratio 1.350

Trackers single array, with backtracking**Tracking algorithm**

Astronomic calculation
Backtracking activated

Near Shadings

According to strings
Electrical effect 100 %

Backtracking array

Nb. of trackers 130 units
Single array

Sizes

Tracker Spacing 11.0 m
Collector width 4.95 m
Ground Cov. Ratio (GCR) 45.0 %
Left inactive band 0.02 m
Right inactive band 0.02 m
Phi min / max. -/+ 55.0 °

Backtracking strategy

Phi limits for BT -/+ 62.9 °
Backtracking pitch 11.0 m
Backtracking width 4.95 m

User's needs

Unlimited load (grid)

Bifacial model definitions

Ground albedo 0.15
Bifaciality factor 80 %
Rear shading factor 5.0 %
Rear mismatch loss 5.0 %
Shed transparent fraction 0.0 %

PV Array Characteristics**PV module**

Manufacturer Jinkosolar
Model JKM615N-78HL4-BDV
(Custom parameters definition)

Unit Nom. Power 615 Wp
Number of PV modules 39520 units
Nominal (STC) 24.30 MWp
Modules 1520 Strings x 26 In series

At operating cond. (50°C)

Pmpp 22.48 MWp
U mpp 1096 V
I mpp 20513 A

Inverter

Manufacturer Huawei Technologies
Model SUN2000-330KTL-H1-Preliminary V0.2
(Custom parameters definition)

Unit Nom. Power 300 kWac
Number of inverters 66 units
Total power 19800 kWac
Operating voltage 500-1500 V
Max. power (=>30°C) 330 kWac
Pnom ratio (DC:AC) 1.23
Power sharing within this inverter



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PV Array Characteristics

Total PV power		Total inverter power	
Nominal (STC)	24305 kWp	Total power	19800 kWac
Total	39520 modules	Number of inverters	66 units
Module area	110471 m ²	Pnom ratio	1.23
Cell area	101786 m ²		

Array losses

Array Soiling Losses		Thermal Loss factor		DC wiring losses				
Loss Fraction	1.5 %	Module temperature according to irradiance		Global array res.	0.29 mΩ			
		Uc (const)	29.0 W/m ² K	Loss Fraction	0.5 % at STC			
		Uv (wind)	0.0 W/m ² K/m/s					
LID - Light Induced Degradation		Module Quality Loss		Module mismatch losses				
Loss Fraction	1.5 %	Loss Fraction	-0.8 %	Loss Fraction	0.9 % at MPP			
Strings Mismatch loss		Module average degradation						
Loss Fraction	0.1 %	Year no	1					
		Loss factor	0.5 %/year					
		Mismatch due to degradation						
		Imp RMS dispersion	0.4 %/year					
		Vmp RMS dispersion	0.4 %/year					
IAM loss factor								
Incidence effect (IAM): User defined profile								
0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	1.000	0.987	0.969	0.929	0.741	0.000

System losses

Unavailability of the system		Auxiliaries loss	
Time fraction	1.0 %	Proportionnal to Power	3.0 W/kW
	3.7 days, 3 periods	0.0 kW from Power thresh.	

AC wiring losses

Inv. output line up to MV transfo	
Inverter voltage	800 Vac tri
Loss Fraction	2.00 % at STC
Inverter: SUN2000-330KTL-H1-Preliminary V0.2	
Wire section (66 Inv.)	Copper 66 x 3 x 95 mm ²
Average wires length	179 m
MV line up to Injection	
MV Voltage	30 kV
Wires	Alu 3 x 300 mm ²
Length	1793 m
Loss Fraction	0.50 % at STC



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AC losses in transformers

MV transfo

Medium voltage 30 kV

Transformer parameters

Nominal power at STC 23.91 MVA

Iron Loss (night disconnect) 59.77 kVA

Iron loss fraction 0.25 % at STC

Copper loss 298.84 kVA

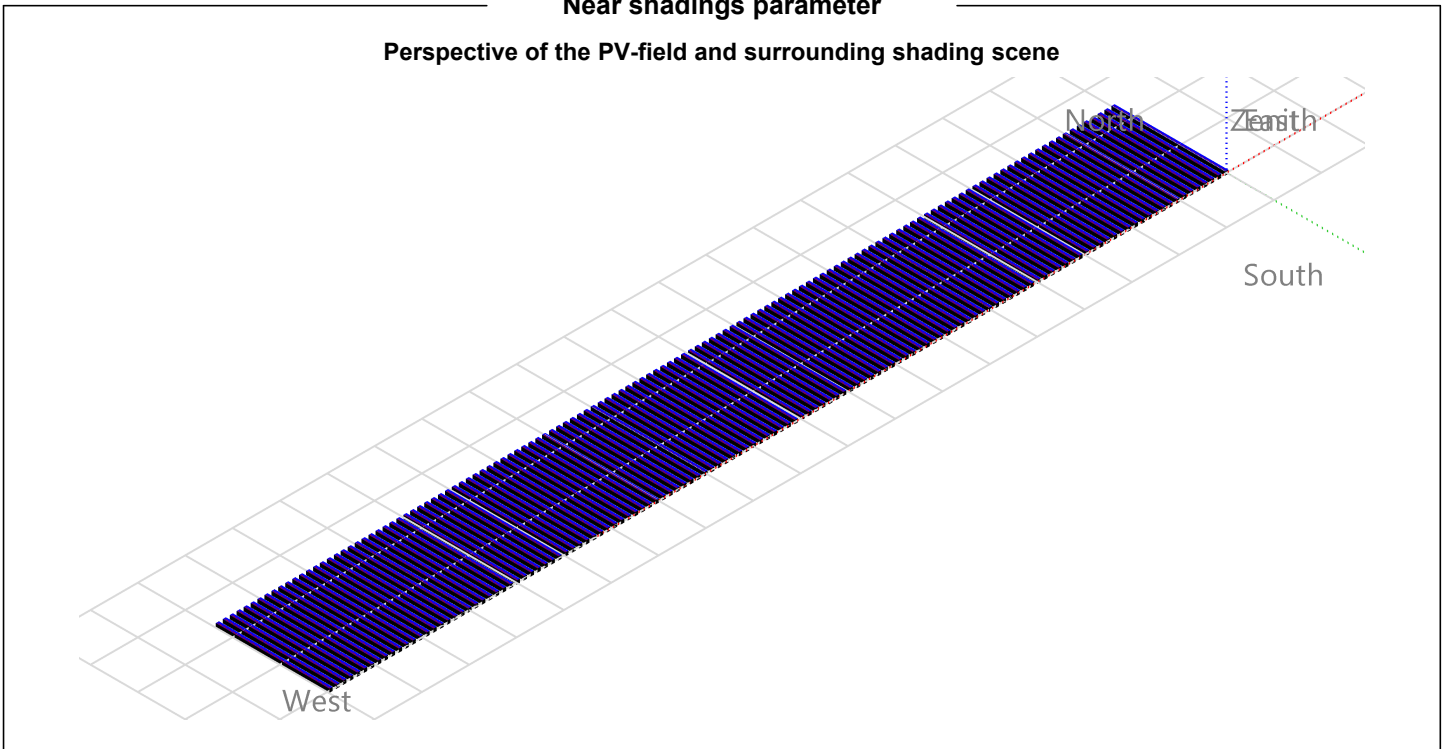
Copper loss fraction 1.25 % at STC

Coils equivalent resistance 3 x 0.33 mΩ



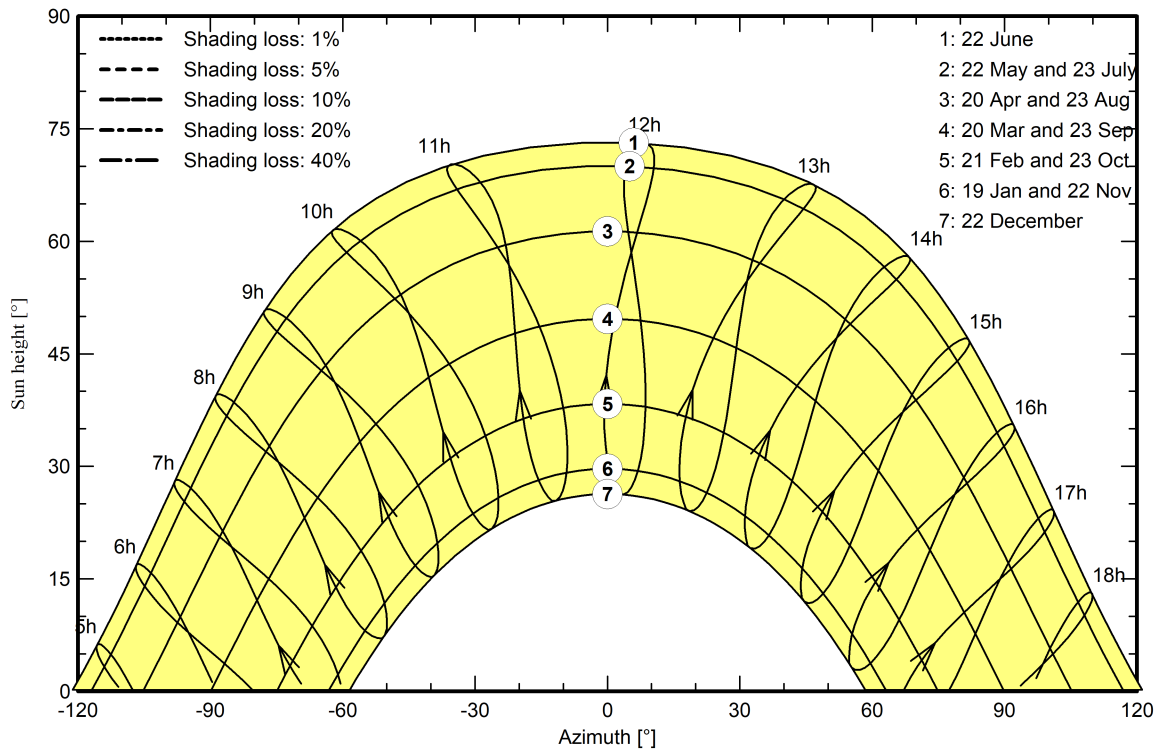
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1





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Main results

System Production

Produced Energy 48947451 kWh/year

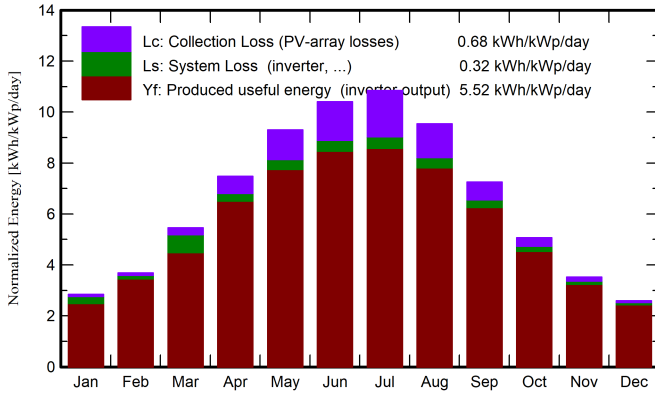
Specific production

2014 kWh/kWp/year

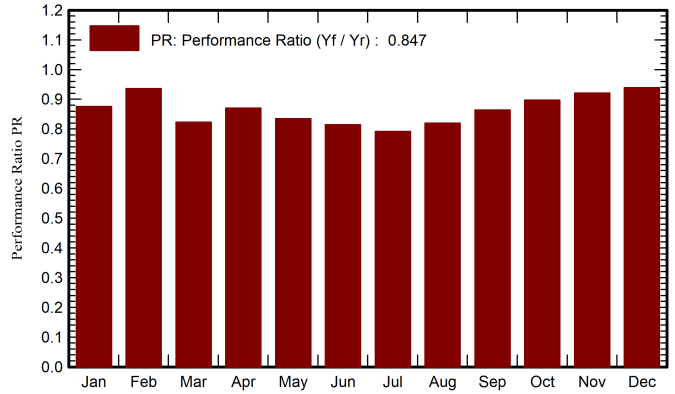
Performance Ratio PR

84.68 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

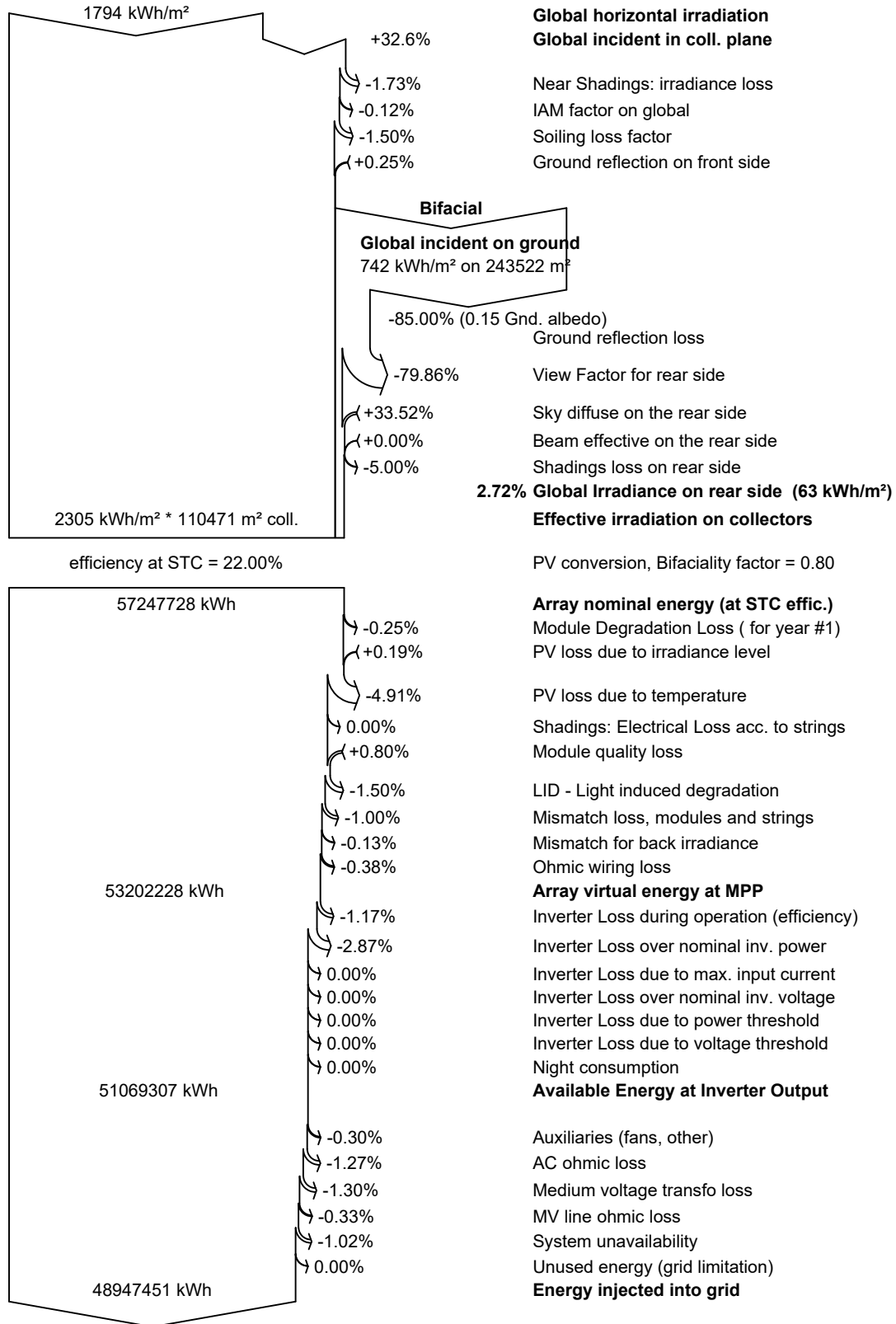
	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray kWh	E_Grid kWh	PR ratio
January	66.2	26.01	9.64	88.4	85.2	2090541	1881301	0.876
February	80.5	38.89	9.96	103.4	99.5	2445162	2352212	0.936
March	129.3	50.50	12.99	169.1	163.3	3910026	3382594	0.823
April	172.7	62.80	15.60	224.3	217.1	4972032	4744686	0.870
May	221.4	71.64	21.51	288.3	279.6	6136484	5847097	0.834
June	236.5	64.51	25.72	312.0	303.1	6491206	6177536	0.815
July	251.4	49.99	28.73	336.2	327.0	6806286	6471866	0.792
August	220.1	49.19	28.34	295.8	287.5	6196369	5893821	0.820
September	161.7	44.12	22.56	217.6	211.1	4787563	4568967	0.864
October	116.0	36.09	18.95	156.9	151.9	3572184	3422842	0.897
November	77.5	26.97	14.47	105.7	102.2	2461027	2367989	0.921
December	60.2	26.10	10.92	80.4	77.4	1905132	1836540	0.939
Year	1793.5	546.81	18.34	2378.2	2304.9	51774012	48947451	0.847

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		



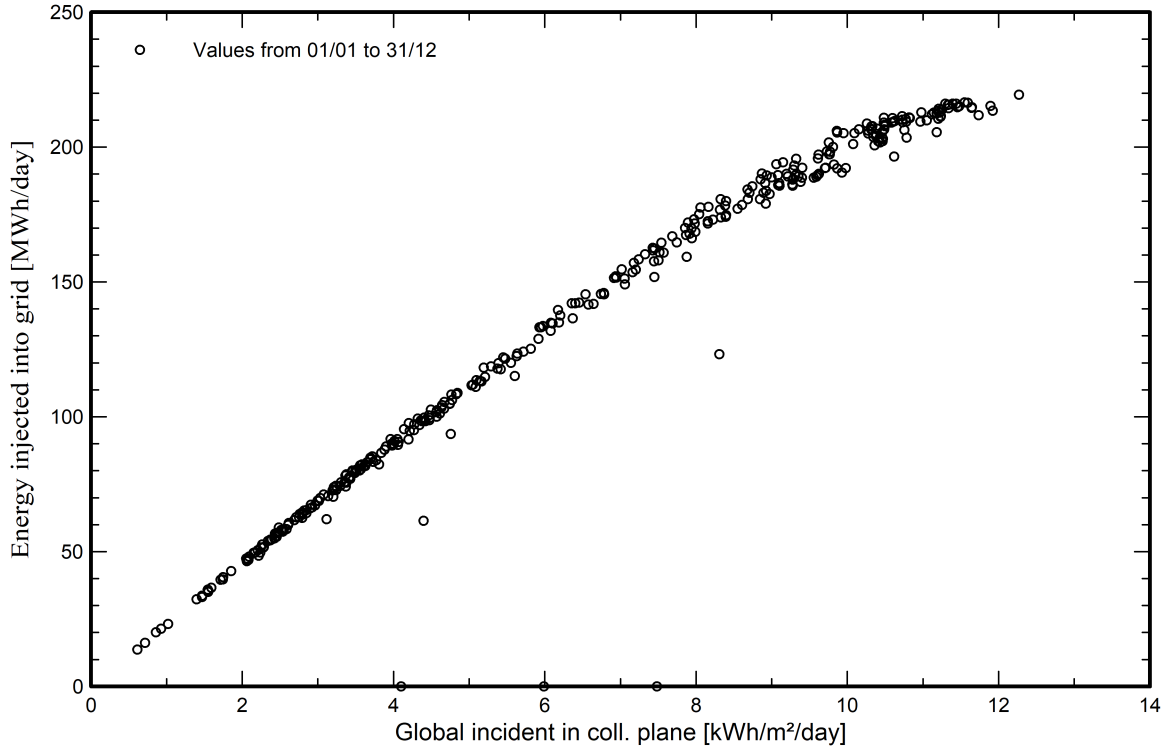
Loss diagram



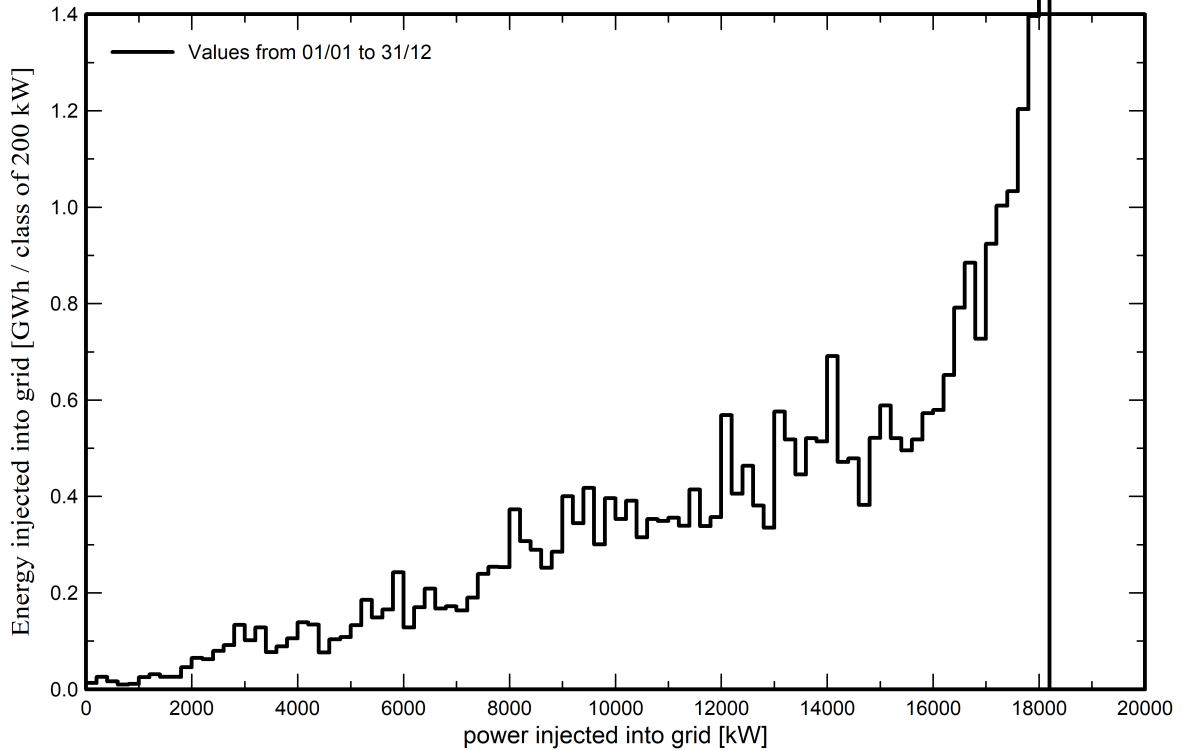


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





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P50 - P90 evaluation

Meteo data

Source Meteonorm 7.2, Sat=100%
Kind Not defined
Year-to-year variability(Variance) 2.5 %

Specified Deviation

Global variability (meteo + system)

Variability (Quadratic sum) 3.1 %

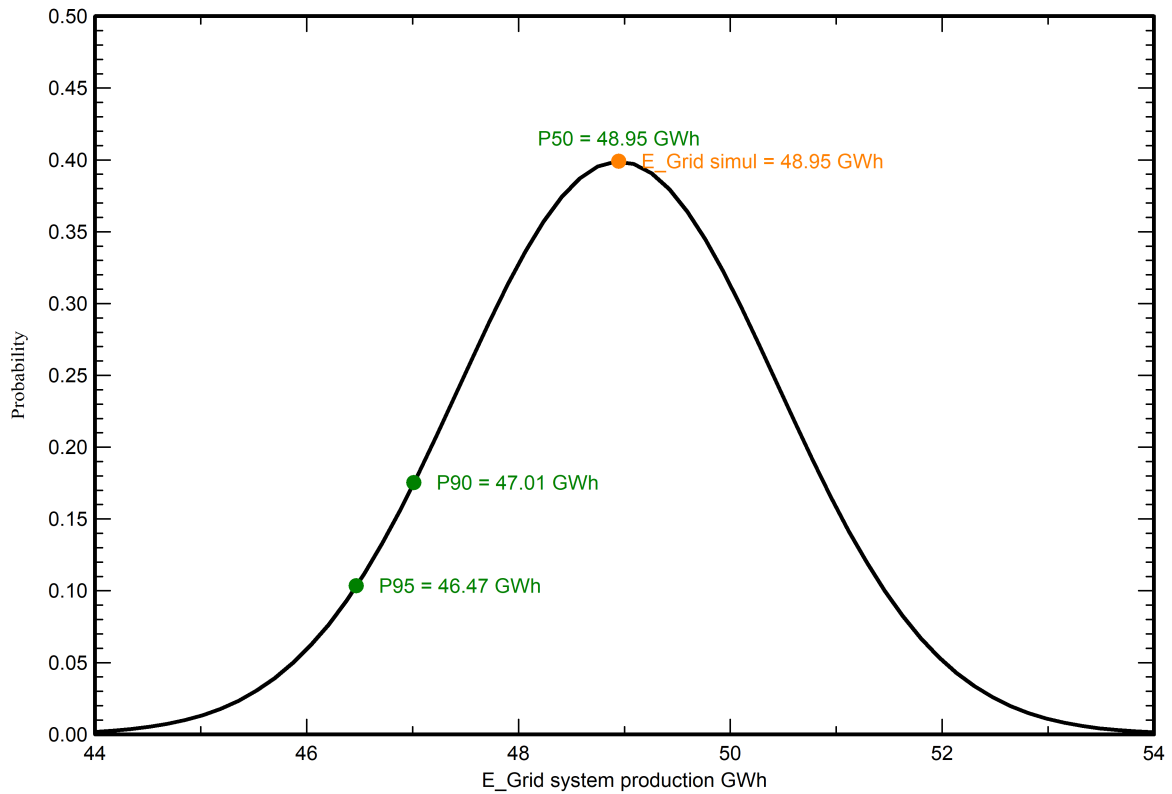
Simulation and parameters uncertainties

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 1.51 GWh
P50 48.95 GWh
P90 47.01 GWh
P95 46.47 GWh

Probability distribution

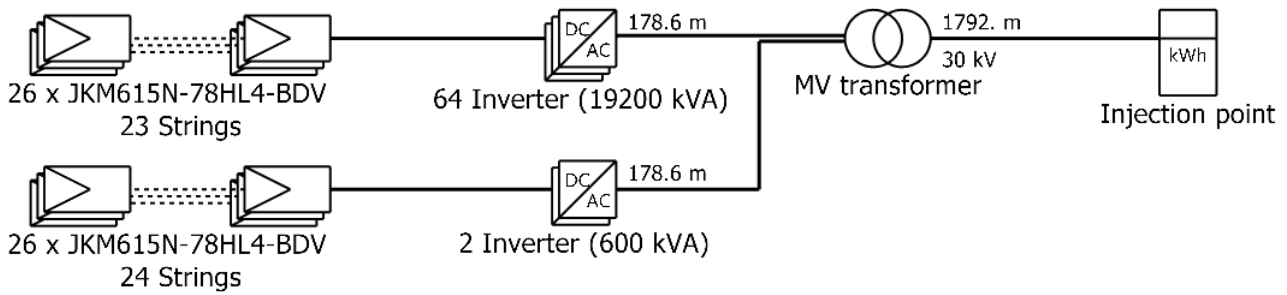




Single-line diagram

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PV module	JKM615N-78HL4-BDV
Inverter	SUN2000-330KTL-H1-Preliminary V0.2
String	26 x JKM615N-78HL4-BDV

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