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NOME COMMESSA:

**COSTRUZIONE ED ESERCIZIO
IMPIANTO AGROVOLTAICO AVENTE POTENZA
NOMINALE PARI A 8.120 kW E POTENZA MODULI PARI A
10.150,14 kWp, CON RELATIVO COLLEGAMENTO ALLA
RETE ELETTRICA, SITO IN BRINDISI (BR) AL FG.179
PART.N.77-78-79-125-126-127- IMPIANTO 12**

STATO DI AVANZAMENTO COMMESSA:

PROGETTO DEFINITIVO PER AUTORIZZAZIONE UNICA

CODICE COMMESSA:

HE.19.0091

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OGGETTO:

09 IMPIANTO DI PRODUZIONE DI ENERGIA
Analisi della risorsa solare e stima di produzione energia

SCALA:

-

NOME FILE:

NGIC505_AnalisiRisorsaSolare.pdf

DATA:

MARZO 2021

TAVOLA:

DPE.RE01

N. REV.	DATA	REVISIONE
0	07.2021	Emissione

ELABORATO

A.Albuzzi

VERIFICATO

responsabile commessa
A.Albuzzi

VALIDATO

direttore tecnico
N.Zuech

PVsyst - Simulation report

Grid-Connected System

Project: HE.19.0024 HEPV SV 12

Variant: SV 12 PVGYS SARAH 2005-2016

Tracking system

System power: 10.15 MWp

Brindisi Sv. 12 PVGYS SARAH 2005-2016 - Italy

Author

Heliopolis spa (Italy)



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Project summary

Geographical Site		Situation		Project settings	
Brindisi Sv. 12 PVGYS SARAH 2005-2016		Latitude	40.52 °N	Albedo	0.20
Italy		Longitude	17.88 °E		
		Altitude	68 m		
		Time zone	UTC+1		
Meteo data					
Brindisi Sv. 11 PVGYS SARAH 2005-2016					
PVGIS TMY: SARAH, COSMO or NSRDB - Synthetic					

System summary

Grid-Connected System		Tracking system			
Simulation for year no 1					
PV Field Orientation		Near Shadings		User's needs	
Tracking plane, horizontal N-S axis		Linear shadings		Unlimited load (grid)	
Axis azimuth 0 °					
System information					
PV Array					
Nb. of modules	22308 units	Inverters		3 units	
Pnom total	10.15 MWp	Nb. of units		8120 kWac	
		Pnom total		1.250	
		Pnom ratio			

Results summary

Produced Energy	19149 MWh/year	Specific production	1887 kWh/kWp/year	Perf. Ratio PR	84.88 %
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General parameters

Grid-Connected System	Tracking system		Models used	
PV Field Orientation	Backtracking strategy			
Orientation	Nb. of trackers	597 units	Transposition	Perez
Tracking plane, horizontal N-S axis	Sizes		Diffuse	Perez, Meteonorm
Axis azimuth	Tracker Spacing	5.50 m	Circumsolar	separate
	Collector width	2.11 m		
	Ground Cov. Ratio (GCR)	38.4 %		
	Phi min / max	-/+ 60.0 °		
	Backtracking limit angle			
	Phi limits	+/- 67.3 °		
Horizon	Near Shadings		User's needs	
Free Horizon	Linear shadings		Unlimited load (grid)	

PV Array Characteristics

PV module		Inverter	
Manufacturer	JA Solar	Manufacturer	SMA
Model	JAM72S20-455/MR_1stMarch2021	Model	Sunny Central 2660 UP (Preliminary)
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	455 Wp	Unit Nom. Power	2660 kWac
Number of PV modules	14560 units	Number of inverters	2 units
Nominal (STC)	6625 kWp	Total power	5320 kWac
Array #1 - SC 1 Str. 281			
Number of PV modules	7306 units	Number of inverters	1 Unit
Nominal (STC)	3324 kWp	Total power	2660 kWac
Modules	281 Strings x 26 In series		
At operating cond. (50°C)		Operating voltage	880-1325 V
Pmpp	3046 kWp	Pnom ratio (DC:AC)	1.25
U mpp	990 V		
I mpp	3076 A		
Array #2 - SC 2 Str. 279			
Number of PV modules	7254 units	Number of inverters	1 Unit
Nominal (STC)	3301 kWp	Total power	2660 kWac
Modules	279 Strings x 26 In series		
At operating cond. (50°C)		Operating voltage	880-1325 V
Pmpp	3025 kWp	Pnom ratio (DC:AC)	1.24
U mpp	990 V		
I mpp	3054 A		



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PV Array Characteristics

Array #3 - SC 3 Str. 298

PV module

Manufacturer JA Solar
 Model JAM72S20-455/MR_1stMarch2021
 (Custom parameters definition)

Unit Nom. Power 455 Wp
 Number of PV modules 7748 units
 Nominal (STC) 3525 kWp
 Modules 298 Strings x 26 In series

At operating cond. (50°C)

Pmpp 3231 kWp
 U mpp 990 V
 I mpp 3262 A

Total PV power

Nominal (STC) 10150 kWp
 Total 22308 modules
 Module area 49564 m²
 Cell area 44523 m²

Inverter

Manufacturer SMA
 Model Sunny Central 2800 UP (Preliminary)
 (Custom parameters definition)

Unit Nom. Power 2800 kWac
 Number of inverters 1 Unit
 Total power 2800 kWac
 Operating voltage 921-1325 V
 Pnom ratio (DC:AC) 1.26

Total inverter power

Total power 8120 kWac
 Nb. of inverters 3 units
 Pnom ratio 1.25



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Array losses

Array Soiling Losses

Loss Fraction 1.0 %

Thermal Loss factor

Module temperature according to irradiance
 U_c (const) 29.0 W/m²K
 U_v (wind) 0.0 W/m²K/m/s

LID - Light Induced Degradation

Loss Fraction 1.0 %

Module Quality Loss

Loss Fraction -0.3 %

Module mismatch losses

Loss Fraction 0.7 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

Module average degradation

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	1.000	0.985	0.943	0.840	0.000

DC wiring losses

Global wiring resistance 1.6 mΩ
 Loss Fraction 1.4 % at STC

Array #1 - SC 1 Str. 281

Global array res. 5.0 mΩ
 Loss Fraction 1.4 % at STC

Array #2 - SC 2 Str. 279

Global array res. 5.0 mΩ
 Loss Fraction 1.4 % at STC

Array #3 - SC 3 Str. 298

Global array res. 4.7 mΩ
 Loss Fraction 1.4 % at STC

System losses

Auxiliaries loss

Proportionnal to Power 4.0 W/kW
 0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage 600 Vac tri
 Loss Fraction 0.4 % at STC

Inverters: Sunny Central 2660 UP (Preliminary), Sunny Central 2800 UP (Preliminary)

Wire section (3 Inv.) Alu 3 x 3 x 2500 mm²
 Average wires length 36 m



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AC losses in transformers

MV transfo

Grid voltage 20 kV

Operating losses at STC

Nominal power at STC (PNomac) 9918 kVA

Iron loss (24/24 Connexion) 9.92 kW

Loss Fraction 0.1 % at STC

Coils equivalent resistance 3 x 0.36 mΩ

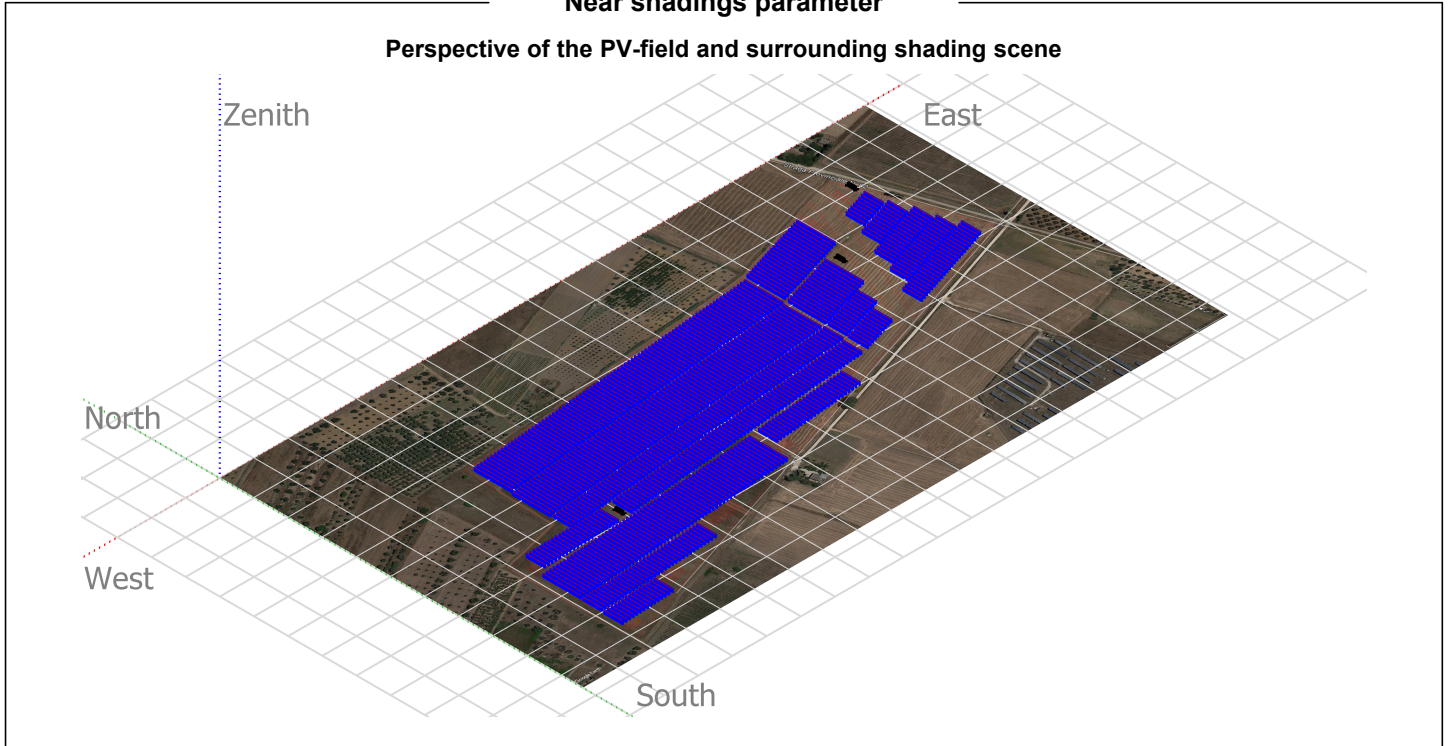
Loss Fraction 1.0 % at STC



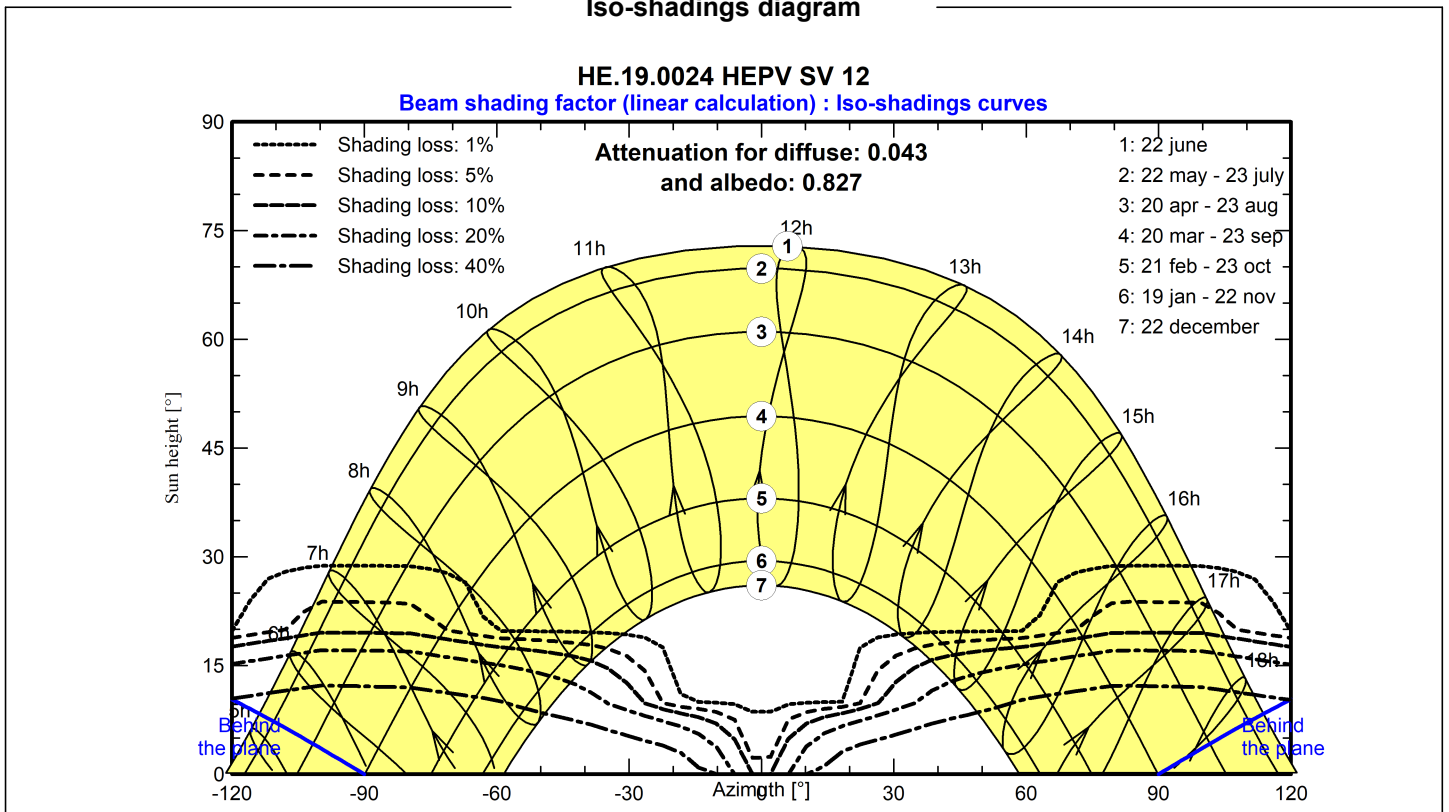
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Near shadings parameter



Iso-shadings diagram





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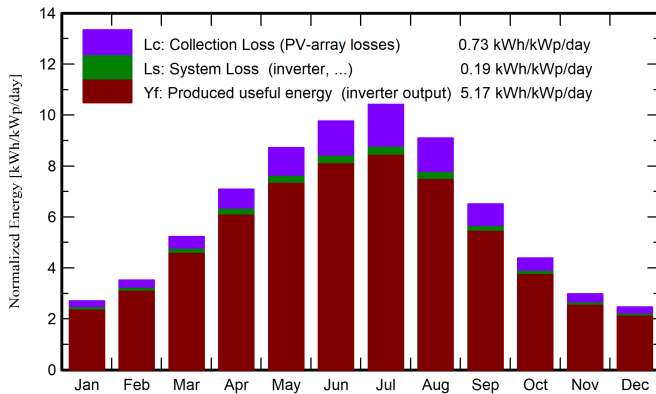
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Main results

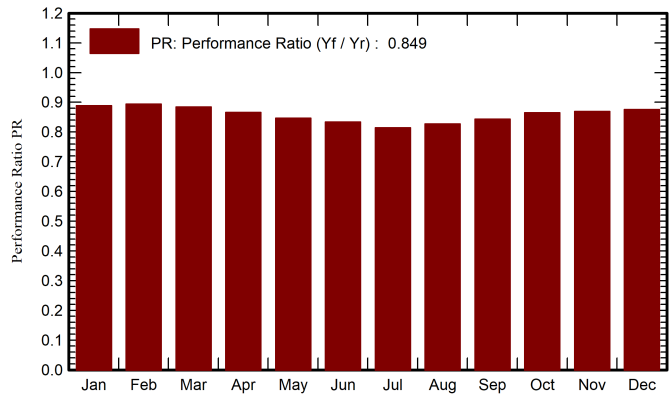
System Production

Produced Energy 19149 MWh/year Specific production 1887 kWh/kWp/year
 Performance Ratio PR 84.88 %

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 MWh	E_Grid MWh	PR ratio
January	62.1	28.70	10.18	83.8	79.4	783	756	0.888
February	75.4	36.20	10.23	98.6	94.2	927	895	0.894
March	124.1	53.10	12.10	162.0	155.8	1507	1455	0.885
April	161.9	64.90	14.79	212.6	204.4	1936	1868	0.866
May	205.1	70.50	18.55	270.3	260.7	2407	2322	0.846
June	221.2	70.80	22.64	293.0	283.0	2571	2481	0.834
July	237.9	62.70	25.65	323.0	311.1	2768	2670	0.814
August	208.7	59.70	25.67	282.0	271.6	2454	2367	0.827
September	145.4	54.80	22.35	195.2	186.8	1731	1672	0.844
October	102.9	45.00	18.38	136.1	130.0	1236	1194	0.865
November	66.5	31.40	14.73	89.4	84.3	817	789	0.869
December	56.1	25.50	11.07	76.7	71.7	707	681	0.875
Year	1667.3	603.29	17.24	2222.6	2133.2	19848	19149	0.849

Legends

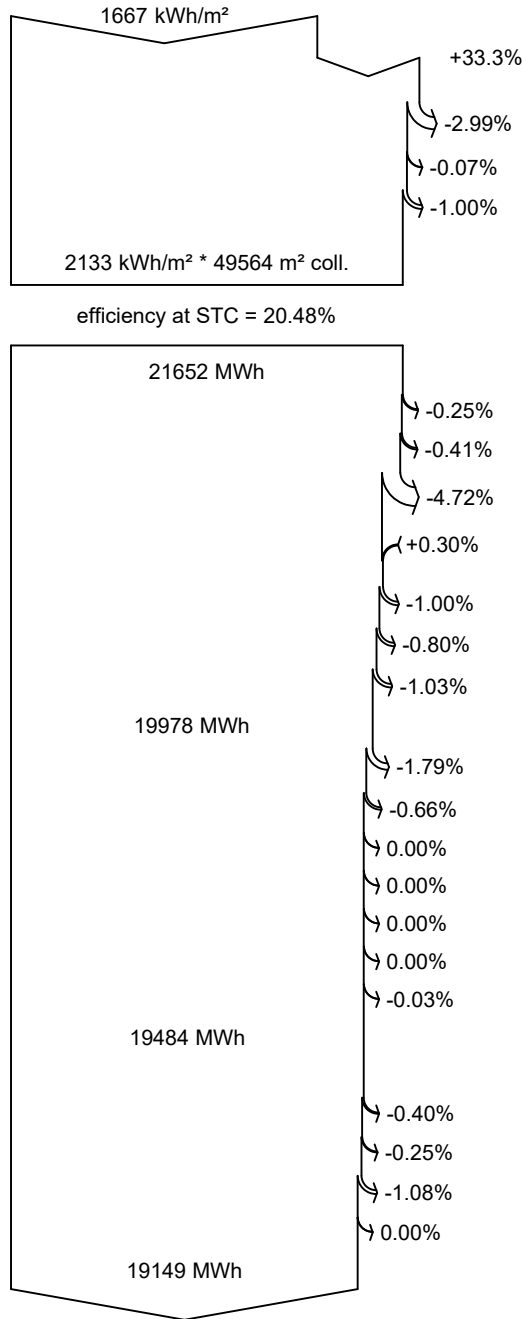
- GlobHor Global horizontal irradiation
- DiffHor Horizontal diffuse irradiation
- T_Amb Ambient Temperature
- GlobInc Global incident in coll. plane
- GlobEff Effective Global, corr. for IAM and shadings
- EArray Effective energy at the output of the array
- E_Grid Energy injected into grid
- PR Performance Ratio



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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.)**
- Module Degradation Loss (for year #1)
- PV loss due to irradiance level
- PV loss due to temperature
- Module quality loss
- 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**
- Auxiliaries (fans, other)
- AC ohmic loss
- Medium voltage transfo loss
- MV line ohmic loss
- Energy injected into grid**

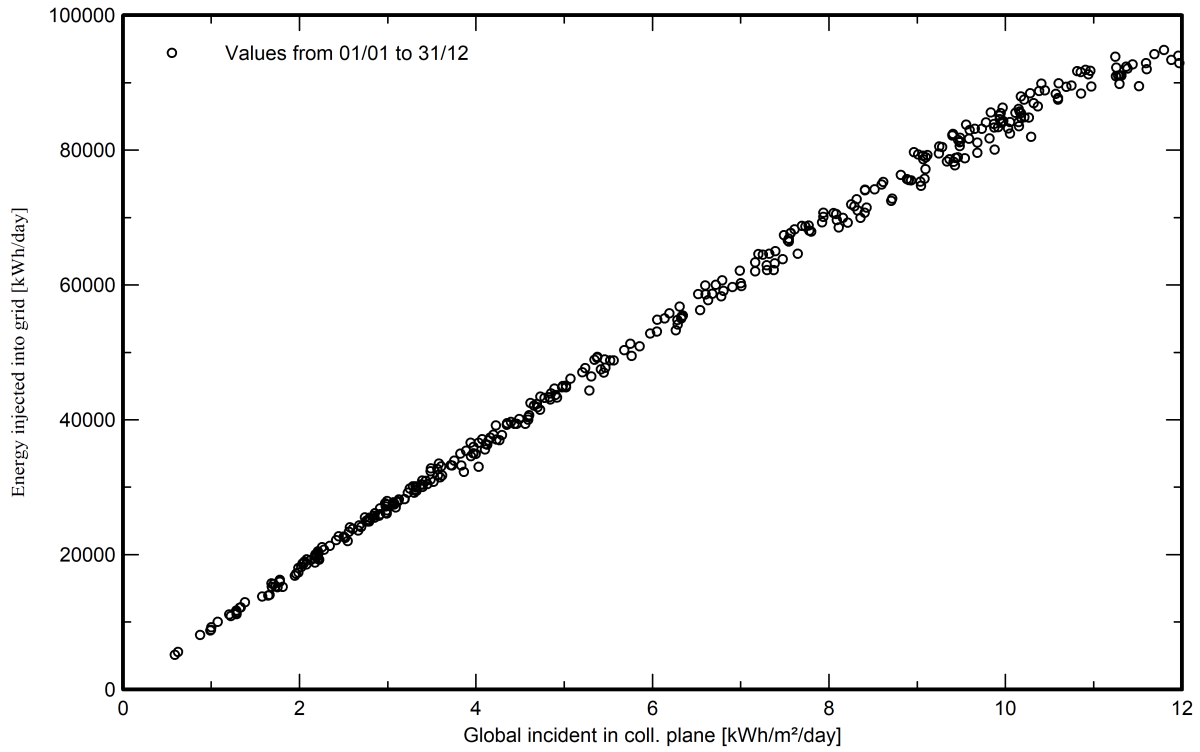


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Special graphs

Daily Input/Output diagram



System Output Power Distribution

