Version 7.2.8

PVsyst - Simulation report

Grid-Connected System

Project: IT22TR_Troina

Variant: Troina_Tracker 1P(15-30)_670Wp_Pitch5.5_3DM

Tracking system with backtracking

System power: 36.50 MWp

Casa Pettinato - Italy

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Project summary

Geographical Site
Casa Pettinato
Italy

Situation

Latitude	37.73 °N
Longitude	14.64 °E
Altitude	655 m
Time zone	UTC+1

Project settings
Albedo 0.20

Meteo data
Casa Pettinato
Meteonorm 8.0 (1986-2005), Sat=100% - Sintético

System summary

Grid-Connected System
Simulation for year no 1

Tracking system with backtracking

PV Field Orientation
Orientation

Tracking plane, tilted axis	
Avg axis tilt	-6.3 °
Avg axis azim.	0.0 °

Tracking algorithm
Irradiance optimization
Backtracking activated

Near Shadings
Linear shadings

System information
PV Array

Nb. of modules	54480 units
Pnom total	36.50 MWp

Inverters

Nb. of units	108 units
Pnom total	35.64 MWac
Grid power limit	27.50 MWac
Grid lim. Pnom ratio	1.327

User's needs
Unlimited load (grid)

Results summary

Produced Energy	62675 MWh/year	Specific production	1717 kWh/kWp/year	Perf. Ratio PR	85.26 %

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General parameters

Grid-Connected System

Tracking system with backtracking

PV Field Orientation

Orientation	
Tracking plane, tilted axis	
Avg axis tilt	-6.3 °
Avg axis azim.	0.0 °

Tracking algorithm
Irradiance optimization
Backtracking activated

Backtracking strategy

Nb. of trackers	1926 units

Sizes

Tracker Spacing	5.50 m
Collector width	2.38 m
Ground Cov. Ratio (GCR)	43.3 %
Phi min / max.	-/+ 60.0 °

Backtracking limit angle

Phi limits	+/- 64.1 °

Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon

Average Height	6.1 °

Near Shadings
Linear shadings

User's needs
Unlimited load (grid)

Bifacial system

Model	2D Calculation unlimited trackers

Bifacial model geometry

Tracker Spacing	5.50 m
Tracker width	2.38 m
GCR	43.3 %
Axis height above ground	2.10 m

Bifacial model definitions

Ground albedo	0.20
Bifaciality factor	70 %
Rear shading factor	5.0 %
Rear mismatch loss	10.0 %
Shed transparent fraction	0.0 %

Grid power limitation

Active Power	27.50 MWac
Pnom ratio	1.327

PV Array Characteristics

PV module

Manufacturer	Trina Solar
Model	TSM-670DEG21C.20
(Custom parameters definition)	
Unit Nom. Power	670 Wp
Number of PV modules	54480 units
Nominal (STC)	36.50 MWp
Modules	1816 Strings x 30 In series
At operating cond. (41°C)	
Pmpp	34.55 MWp
U mpp	1079 V
I mpp	32031 A

Inverter

Manufacturer	Huawei Technologies
Model	SUN2000-330KTL-H1-Preliminary V0.1
(Custom parameters definition)	
Unit Nom. Power	330 kWac
Number of inverters	108 units
Total power	35640 kWac
Operating voltage	500-1500 V
Pnom ratio (DC:AC)	1.02

Total PV power

Nominal (STC)	36502 kWp
Total	54480 modules
Module area	169234 m²
Cell area	158569 m²

Total inverter power

Total power	35640 kWac
Nb. of inverters	108 units
Pnom ratio	1.02

Array losses

Array Soiling Losses
Loss Fraction 1.5 %

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 0.53 mΩ
Loss Fraction 1.5 % at STC

Serie Diode Loss
Voltage drop 0.7 V
Loss Fraction 0.1 % at STC

LID - Light Induced Degradation
Loss Fraction 0.5 %

Module Quality Loss
Loss Fraction -0.8 %

Module mismatch losses
Loss Fraction 2.0 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

Module average degradation
Year no 1
Loss factor 0.4 %/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	0.999	0.994	0.969	0.929	0.830	0.589	0.000

AC wiring losses

Inv. output line up to MV transfo
Inverter voltage 800 Vac tri
Loss Fraction 1.23 % at STC
Inverter: SUN2000-330KTL-H1-Preliminary V0.1
Wire section (108 Inv.) Alu 108 x 3 x 240 mm²
Average wires length 180 m

MV line up to Injection
MV Voltage 36 kV
Wires Alu 3 x 1000 mm²
Length 3000 m
Loss Fraction 0.26 % at STC

AC losses in transformers

MV transfo
Grid voltage 36 kV
Operating losses at STC
Nominal power at STC 35858 kVA
Iron loss (24/24 Connexion) 35.86 kW
Loss Fraction 0.10 % at STC
Coils equivalent resistance 3 x 0.18 mΩ
Loss Fraction 1.00 % at STC

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Horizon definition

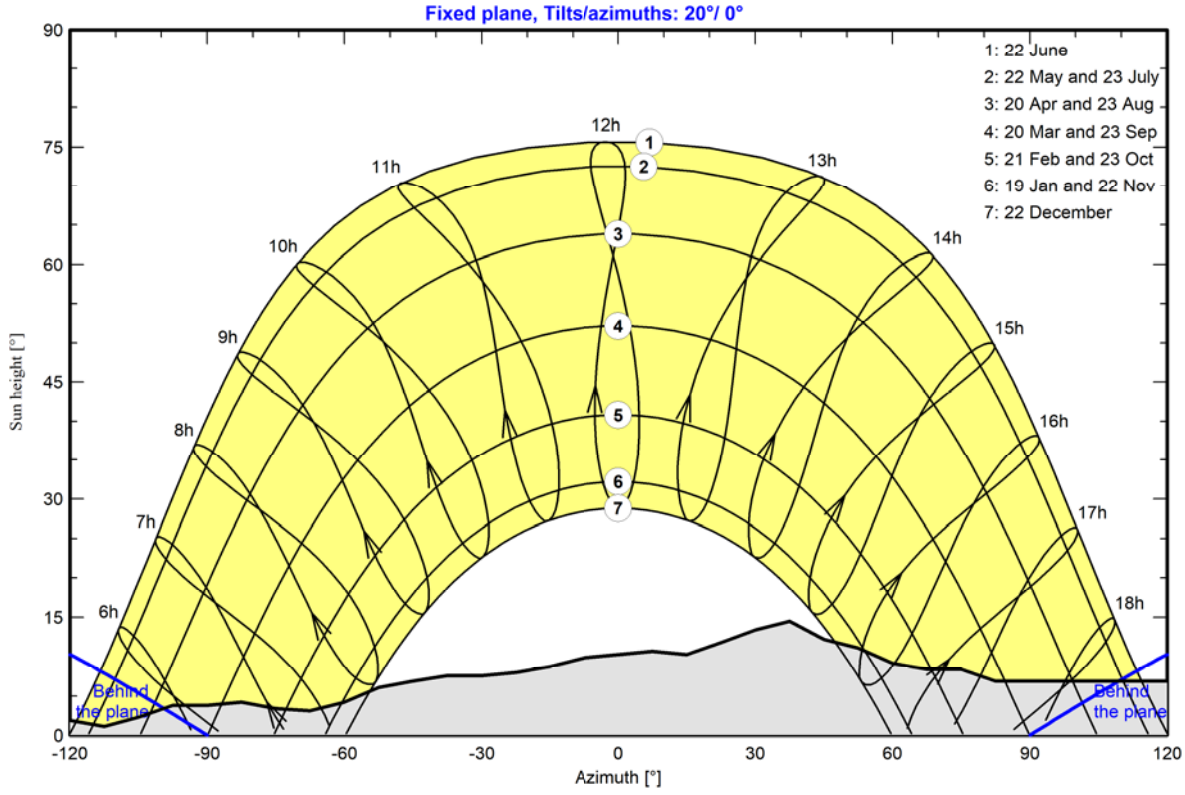
Horizon from PVGIS website API, Lat=37°44"3', Long=14°38"6', Alt=655m

Average Height	6.1 °	Albedo Factor	0.61
Diffuse Factor	0.90	Albedo Fraction	100 %

Horizon profile

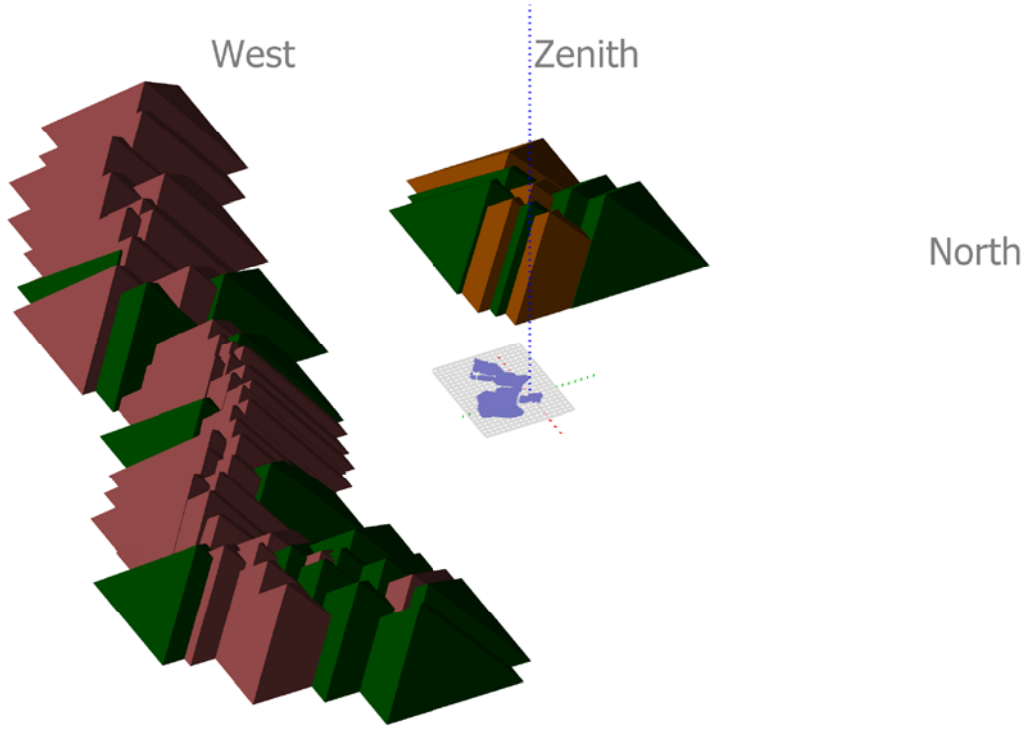
Azimuth [°]	-180	-165	-158	-150	-143	-135	-128	-120	-113	-105	-98	-90	-83	-75
Height [°]	2.7	2.7	2.3	1.9	1.9	2.7	2.3	1.9	1.1	2.3	3.8	3.8	4.2	3.4
Azimuth [°]	-68	-60	-53	-45	-38	-30	-23	-15	-8	0	8	15	23	30
Height [°]	3.1	4.2	6.1	6.9	7.6	7.6	8.0	8.8	9.9	10.3	10.7	10.3	11.8	13.4
Azimuth [°]	38	45	53	60	68	75	83	135	143	150	158	165	173	180
Height [°]	14.5	12.2	11.1	9.2	8.4	8.4	6.9	6.9	3.4	3.8	3.4	3.1	2.7	2.7

Sun Paths (Height / Azimuth diagram)



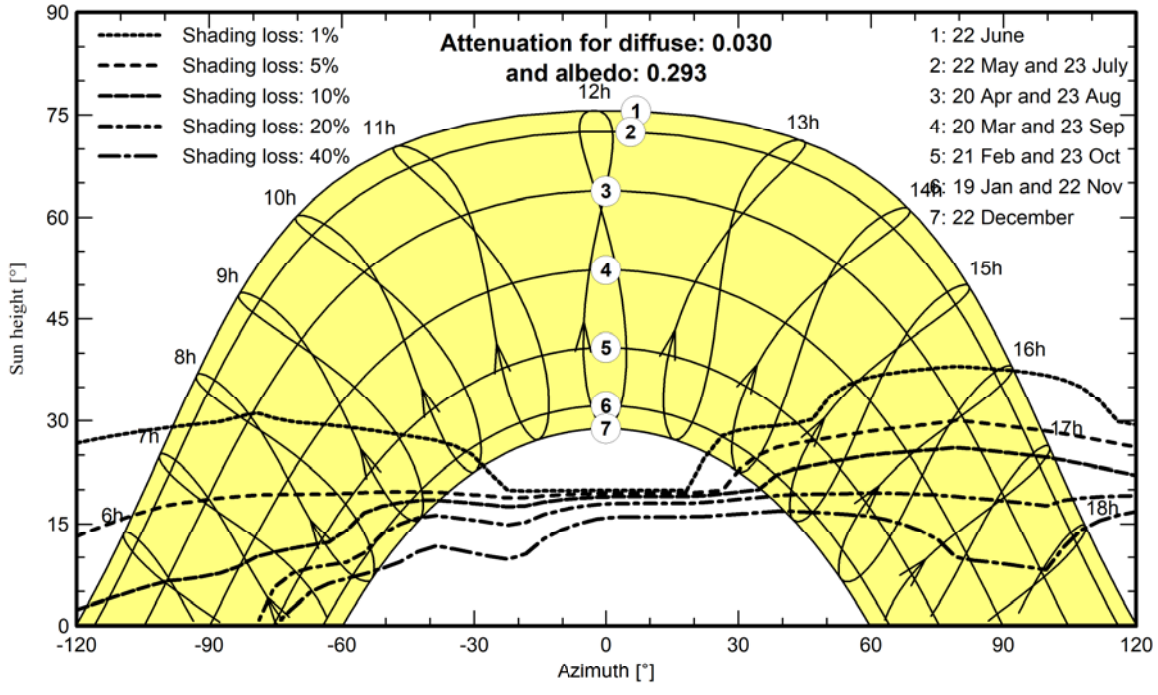
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

IT22TR_Troina - Legal Time



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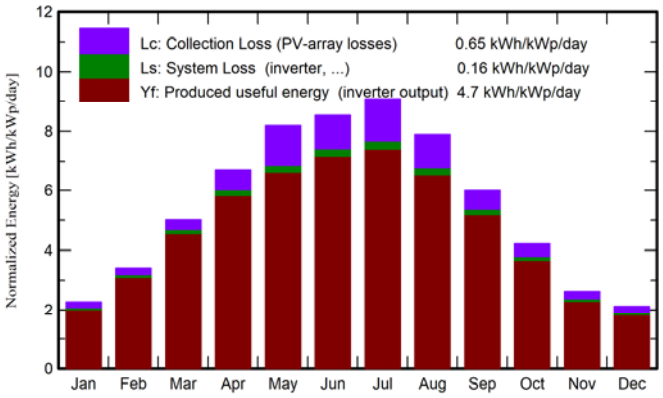
Main results

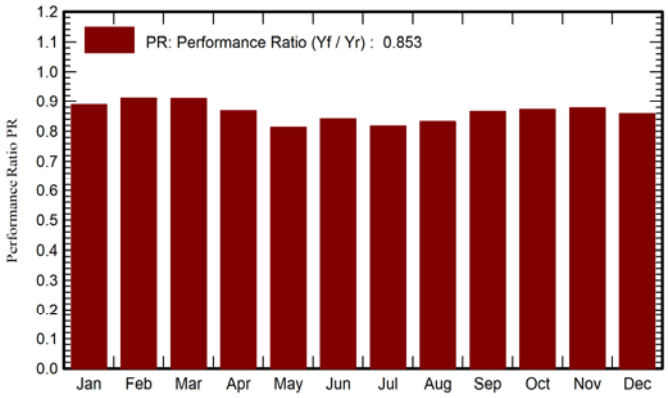
System Production

Produced Energy	62675 MWh/year	Specific production	1717 kWh/kWp/year
		Performance Ratio PR	85.26 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	61.0	27.07	8.08	70.3	62.1	2360	2280	0.889
February	80.0	34.23	8.07	95.4	87.1	3277	3172	0.911
March	127.9	61.97	10.45	155.2	143.7	5322	5154	0.910
April	161.9	65.62	12.81	201.8	189.3	6607	6393	0.868
May	197.9	67.30	17.09	254.0	239.3	7794	7536	0.813
June	200.9	82.84	21.21	256.3	240.9	8144	7872	0.842
July	215.8	74.55	24.55	281.3	263.9	8700	8402	0.818
August	191.2	66.01	24.71	244.6	231.3	7699	7435	0.833
September	145.4	62.65	20.96	180.0	167.4	5883	5688	0.866
October	106.9	42.49	17.68	130.6	119.5	4301	4160	0.873
November	68.4	31.77	13.17	78.8	70.1	2609	2523	0.877
December	56.3	24.55	9.62	65.7	56.4	2134	2061	0.859
Year	1613.6	641.06	15.75	2013.8	1871.0	64829	62675	0.853

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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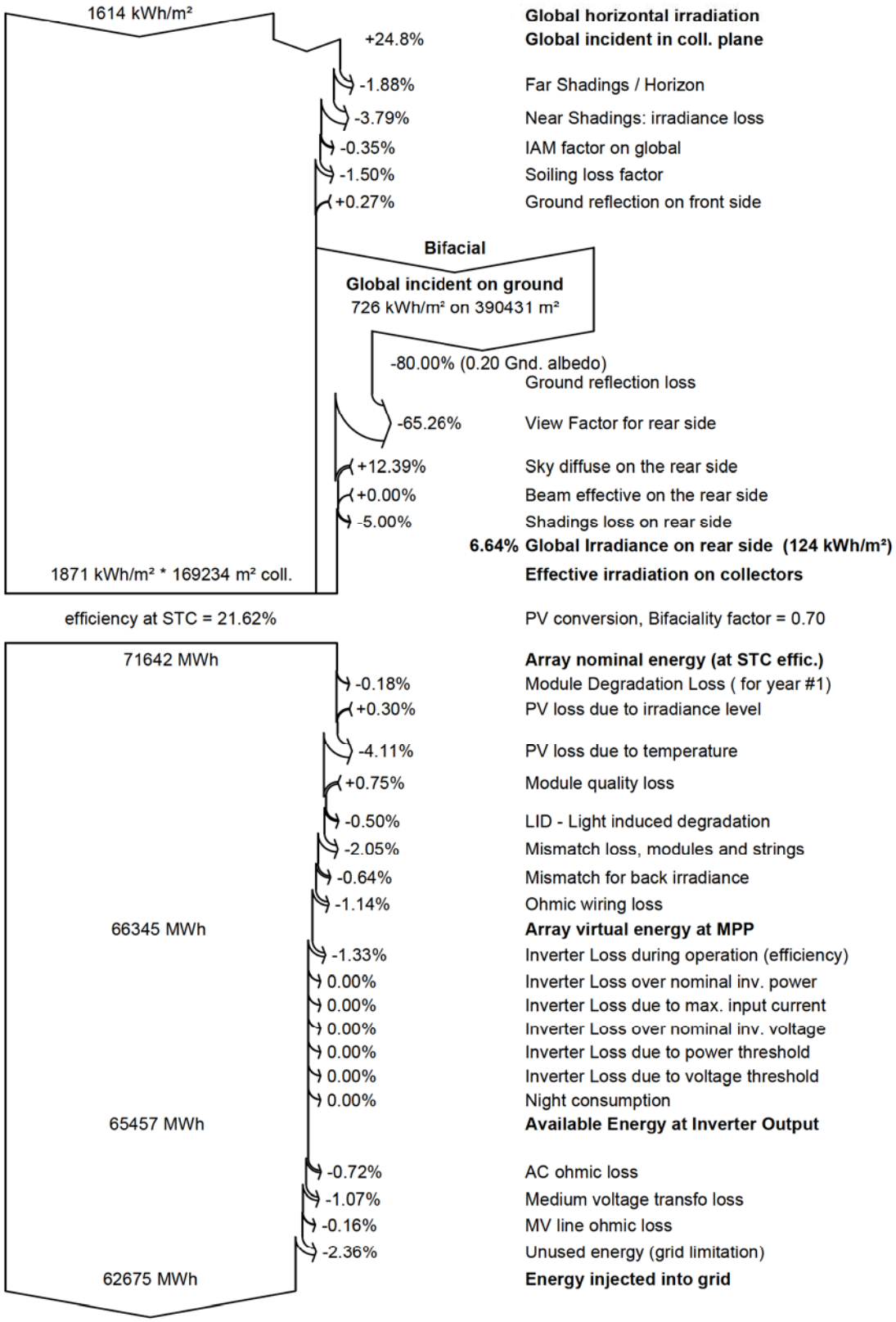
Loss diagram



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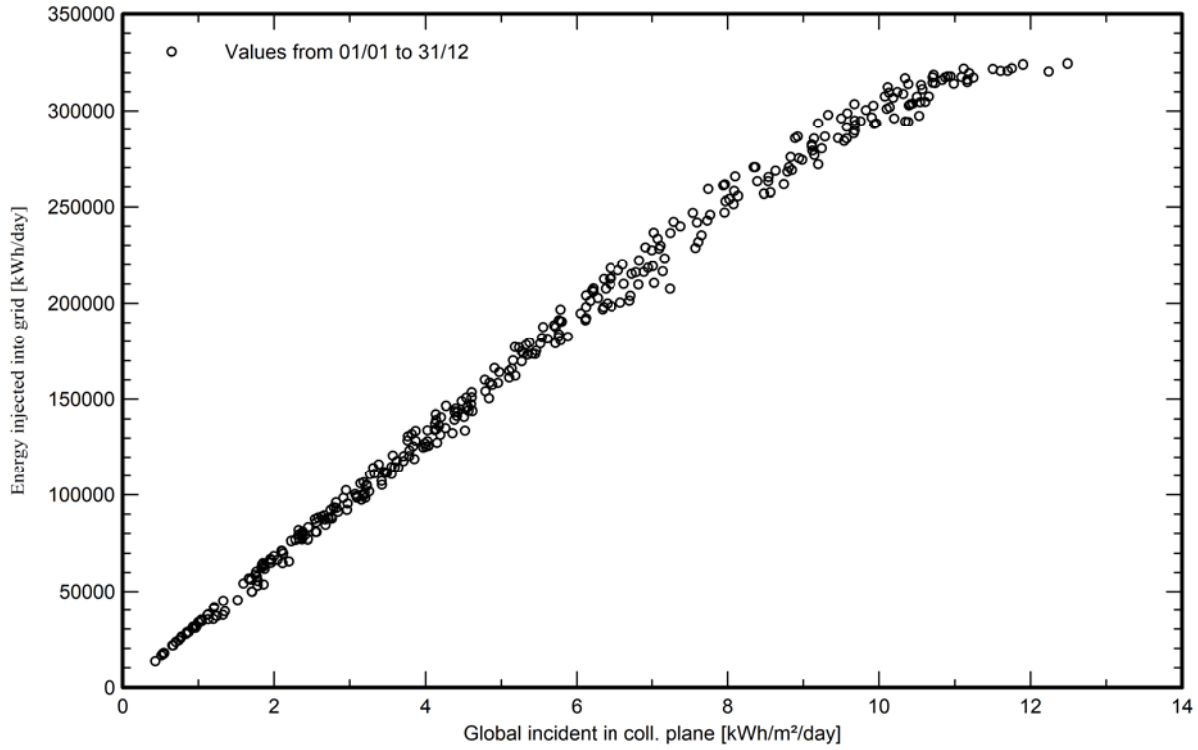
Special graphs

Diagrama entrada/salida diaria



Distribución de potencia de salida del sistema