PVsyst

PHOTOVOLTAIC SOFTWARE

PVsyst - Simulation report

Grid-Connected System

Project: Kopellis_ 1 Axis

Variant: 1 axis Vertical
Trackers single array
System power: 114 kWp
Thessaloniki/Livadákion - Greece

Author

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Project summary

Geographical Site
Thessaloniki/Livadákion
Greece

Situation
Latitude	40.52 °N
Longitude	22.97 °E
Altitude	4 m
Time zone	UTC+2

Project settings
Albedo	0.20

Meteo data
Thessaloniki/Livadákion
Meteonorm 8.0 (1994-2006), Sat=14% - Synthetic

System summary

Grid-Connected System

Trackers single array

PV Field Orientation
Orientation
Tracking plane, vertical axis
Plane tilt   25 °

Tracking algorithm
Astronomic calculation

Near Shadings
Linear shadings

System information
PV Array
Nb. of modules	216 units
Pnom total	114 kWp

Inverters
Nb. of units	1 unit
Pnom total	111 kWac
Pnom ratio	1.031

User's needs
Unlimited load (grid)

Results summary

Produced Energy	174.4 MWh/year	Specific production	1523 kWh/kWp/year	Perf. Ratio PR	73.25 %

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General parameters

Grid-Connected System

PV Field Orientation

Orientation
Tracking plane, vertical axis
Plane tilt   25 °

Trackers single array

Tracking algorithm
Astronomic calculation

Trackers configuration
Nb. of trackers   4 units
Sizes
Tracker Spacing   0.00 m
Collector width   31.1 m
Azimut min / max.   -/+ 120.0 °

Models used

Transposition   Perez
Diffuse   Perez, Meteonorm
Circumsolar   separate

Horizon
Average Height   7.4 °

Near Shadings
Linear shadings

User's needs
Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer   Generic
Model   JKM-530M-72HL4-V
    (Custom parameters definition)
Unit Nom. Power   530 Wp
Number of PV modules   216 units
Nominal (STC)   114 kWp
Modules   8 Strings x 27 In series

At operating cond. (50°C)
Pmpp   104 kWp
U mpp   1002 V
I mpp   104 A

Total PV power

Nominal (STC)   114 kWp
Total   216 modules
Module area   557 m²

Inverter

Manufacturer   Generic
Model   SG111-HV
    (Original PVsyst database)
Unit Nom. Power   111 kWac
Number of inverters   1 unit
Total power   111 kWac
Operating voltage   780-1450 V
Pnom ratio (DC:AC)   1.03

Total inverter power

Total power   111 kWac
Number of inverters   1 unit
Pnom ratio   1.03

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.   106 mΩ
Loss Fraction   1.0 % at STC

Module Quality Loss
Loss Fraction   0.0 %

Module mismatch losses
Loss Fraction   0.6 % at MPP

IAM loss factor
Incidence effect (IAM): Fresnel, AR coating, n(glass)=1.526, n(AR)=1.290

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.962	0.892	0.816	0.681	0.440	0.000

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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	540 Vac tri
Loss Fraction	0.21 % at STC

Inverter: SG111-HV

Wire section (1 Inv.)	Copper 1 x 3 x 240 mm²
Wires length	70 m

AC losses in transformers

MV transfo

Grid voltage	20 kV

Operating losses at STC

Nominal power at STC	113 kVA
Iron loss (24/24 Connexion)	0.11 kW
Loss Fraction	0.10 % at STC
Coils equivalent resistance	3 x 25.76 mΩ
Loss Fraction	1.00 % at STC

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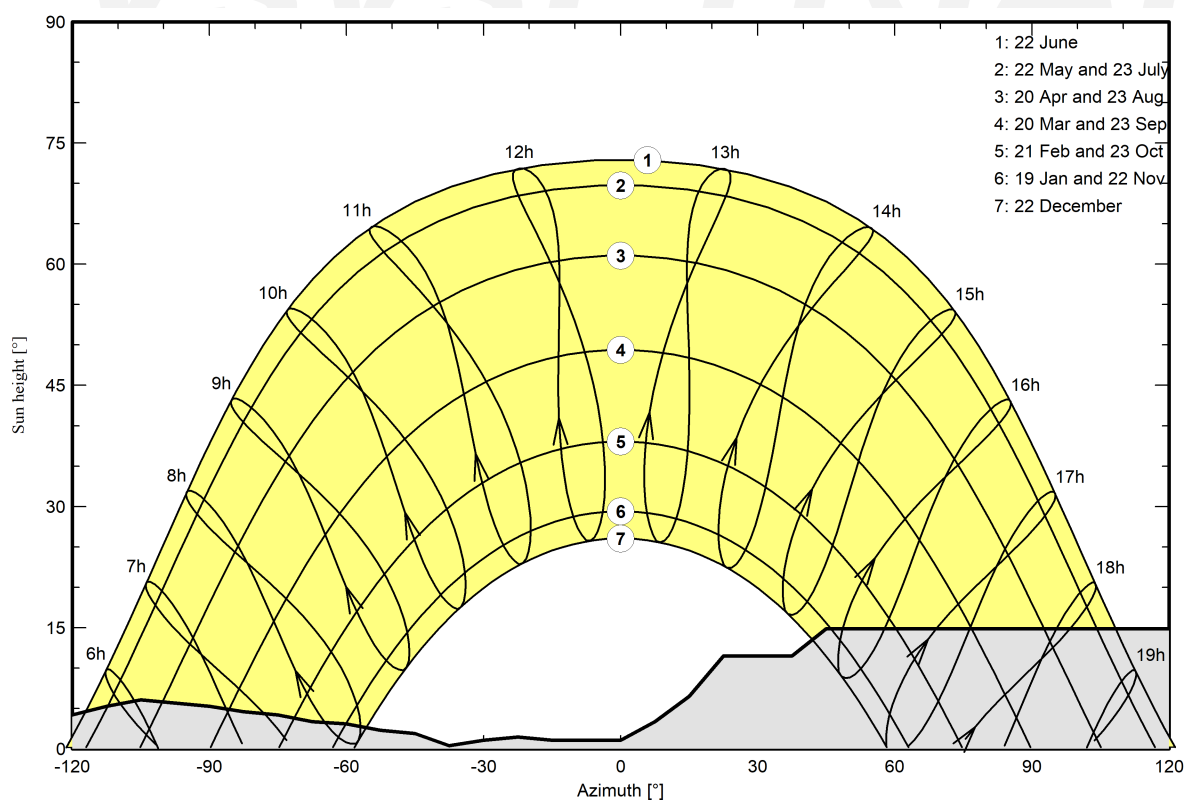20/06/22 04:13
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Horizon definition

Horizon from PVGIS website API, Lat=39°37"58', Long=22°13"41', Alt=153m

Average Height	7.4 °	Albedo Factor	0.40
Diffuse Factor	0.92	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-173	-165	-158	-143	-135	-128	-120	-113	-105	-98	-90
Height [°]	1.9	3.4	4.6	5.7	7.3	6.5	4.6	4.2	5.3	6.1	5.7	5.3
Azimuth [°]	-83	-75	-68	-60	-53	-45	-38	-30	-23	-15	0	8
Height [°]	4.6	4.2	3.4	3.1	2.3	1.9	0.4	1.1	1.5	1.1	1.1	3.4
Azimuth [°]	15	23	38	45	135	143	150	158	165	173	180	
Height [°]	6.5	11.5	11.5	14.9	14.9	8.0	8.0	5.3	1.9	1.5	1.9	

Sun Paths (Height / Azimuth diagram)

1: 22 June
2: 22 May and 23 July
3: 20 Apr and 23 Aug.
4: 20 Mar and 23 Sep
5: 21 Feb and 23 Oct
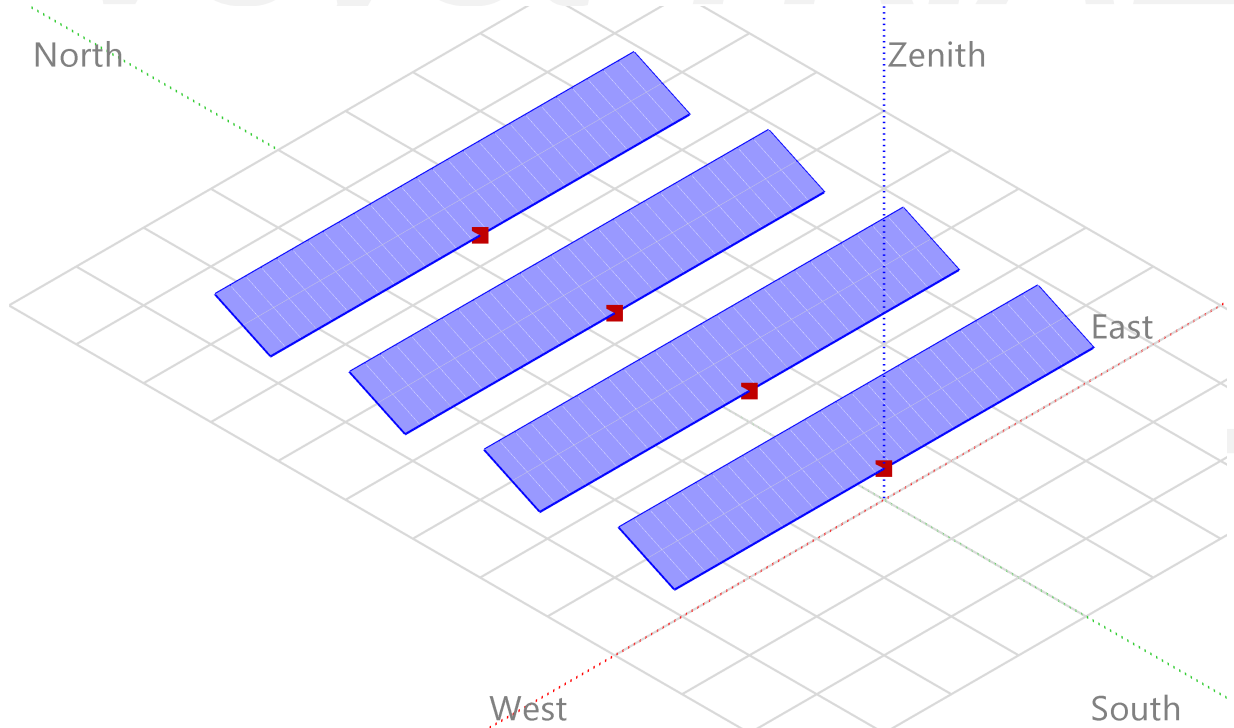6: 19 Jan and 22 Nov.
7: 22 December

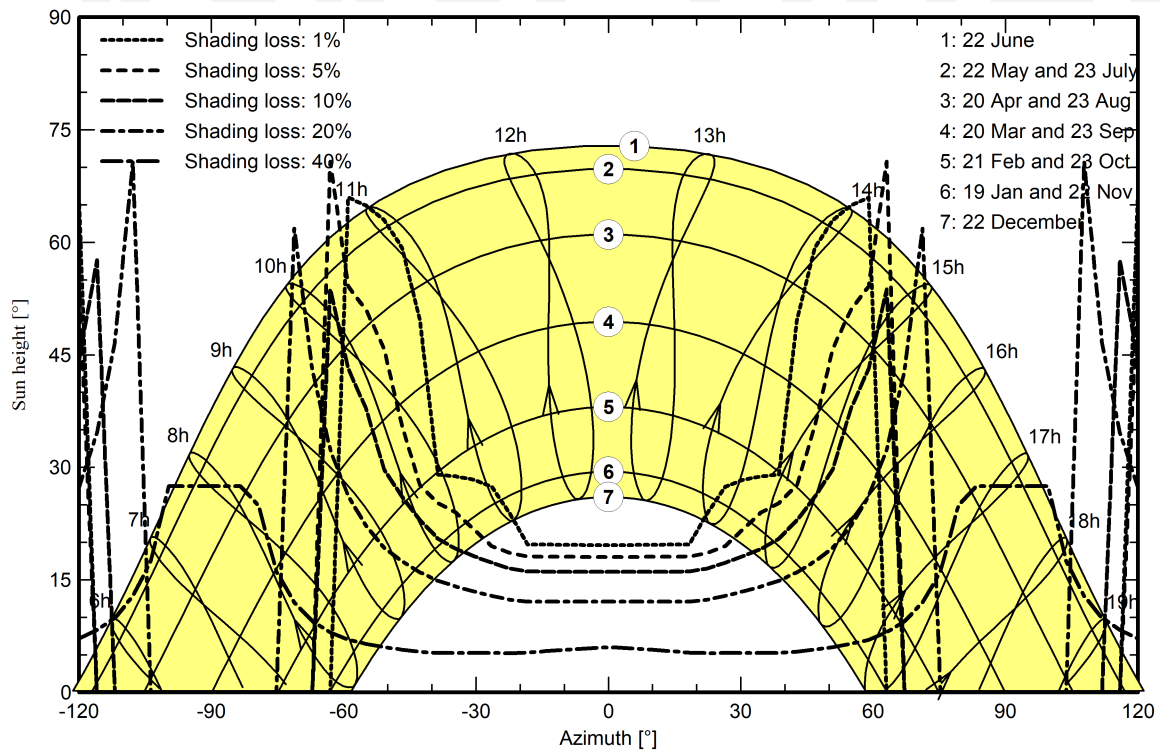**PVsyst V7.2.16**

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Near shadings parameter

Perspective of the PV-field and surrounding shading scene

Iso-shadings diagram

Orientation #1

Shading loss: 1%
Shading loss: 5%
Shading loss: 10%
Shading loss: 20%
Shading loss: 40%

1: 22 June
2: 22 May and 23 July
3: 20 Apr and 23 Aug
4: 20 Mar and 23 Sep
5: 21 Feb and 23 Oct
6: 19 Jan and 22 Nov
7: 22 December

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Main results

System Production

Produced Energy	174.4 MWh/year	Specific production	1523 kWh/kWp/year
		Performance Ratio PR	73.25 %

Normalized productions (per installed kWp)

Lc: Collection Loss (PV-array losses)   1.4 kWh/kWp/day
Ls: System Loss (inverter, ...)   0.13 kWh/kWp/day
Yf: Produced useful energy (inverter output)   4.17 kWh/kWp/day

Performance Ratio PR

PR: Performance Ratio (Yf / Yr) : 0.732
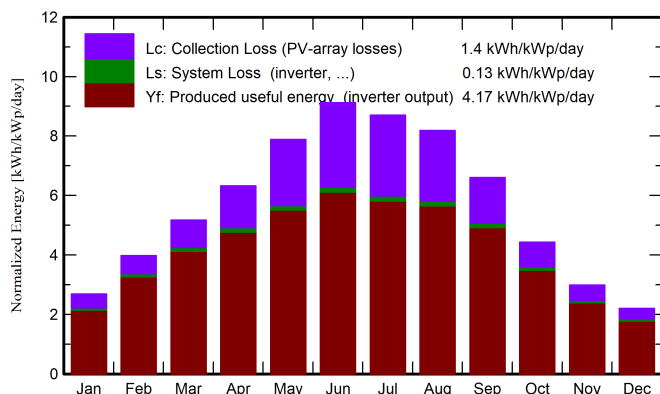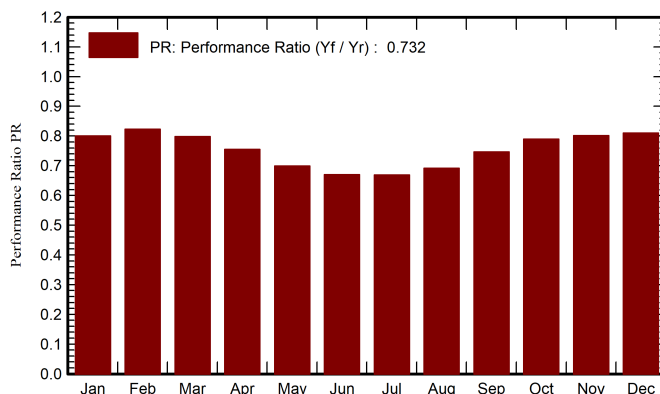
Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m²	kWh/m²	°C	kWh/m²	kWh/m²	MWh	MWh	ratio
January	52.6	29.21	4.95	83.1	69.2	7.89	7.62	0.801
February	76.4	39.36	6.71	111.4	95.8	10.82	10.49	0.822
March	118.0	57.36	9.91	160.5	135.9	15.11	14.67	0.798
April	150.3	77.02	13.73	189.9	154.3	16.90	16.41	0.755
May	195.0	84.41	19.52	244.4	188.2	20.12	19.56	0.699
June	218.4	75.24	24.54	273.8	206.6	21.61	21.01	0.670
July	214.7	82.15	27.83	269.7	205.7	21.25	20.66	0.669
August	194.0	76.29	27.71	253.8	199.9	20.64	20.08	0.691
September	144.2	53.93	21.67	198.1	164.7	17.42	16.92	0.746
October	94.1	43.87	16.53	137.2	117.4	12.79	12.41	0.790
November	57.9	29.79	11.46	89.6	76.5	8.51	8.22	0.802
December	43.4	24.96	6.66	68.2	58.1	6.58	6.33	0.811
Year	1559.1	673.58	15.99	2079.7	1672.4	179.64	174.39	0.732

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
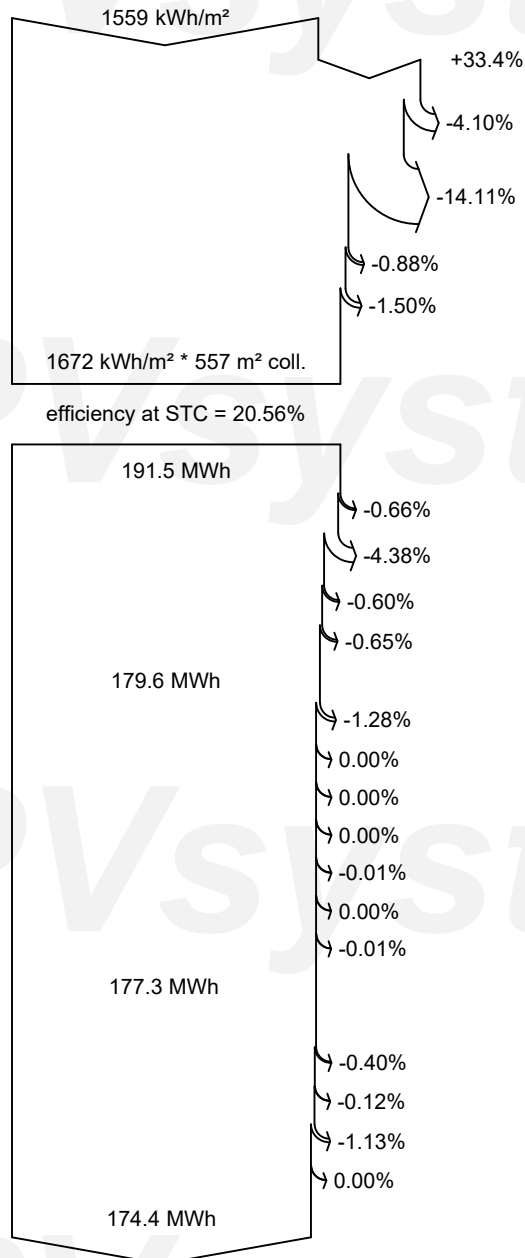
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1559 kWh/m²	**Global horizontal irradiation**
+33.4%	**Global incident in coll. plane**
-4.10%	Far Shadings / Horizon
-14.11%	Near Shadings: irradiance loss
-0.88%	IAM factor on global
-1.50%	Soiling loss factor
1672 kWh/m² * 557 m² coll.	**Effective irradiation on collectors**
efficiency at STC = 20.56%	PV conversion
191.5 MWh	**Array nominal energy (at STC effic.)**
-0.66%	PV loss due to irradiance level
-4.38%	PV loss due to temperature
-0.60%	Module array mismatch loss
-0.65%	Ohmic wiring loss
179.6 MWh	**Array virtual energy at MPP**
-1.28%	Inverter Loss during operation (efficiency)
0.00%	Inverter Loss over nominal inv. power
0.00%	Inverter Loss due to max. input current
0.00%	Inverter Loss over nominal inv. voltage
-0.01%	Inverter Loss due to power threshold
0.00%	Inverter Loss due to voltage threshold
-0.01%	Night consumption
177.3 MWh	**Available Energy at Inverter Output**
-0.40%	Auxiliaries (fans, other)
-0.12%	AC ohmic loss
-1.13%	Medium voltage transfo loss
0.00%	MV line ohmic loss
174.4 MWh	**Energy injected into grid**

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Special graphs

Daily Input/Output diagram
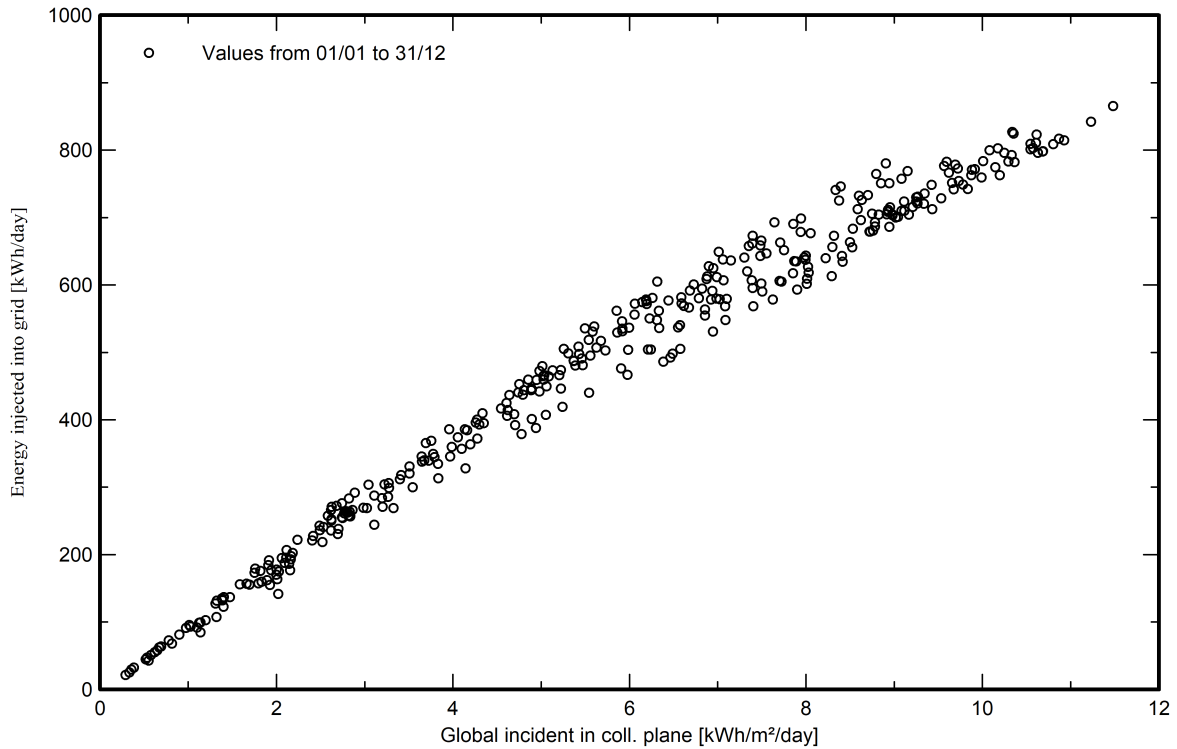
System Output Power Distribution