PVsyst

PHOTOVOLTAIC SOFTWARE

PVsyst - Simulation report

Grid-Connected System

Project: Kopellis_ 2 Axis

Variant: 100KW 2 axes

Tracking system

System power: 100 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

Tracking system

PV Field Orientation
Orientation

Tracking two axis, frame N-S

Tracking algorithm

Astronomic calculation

Near Shadings
According to strings

Electrical effect	100 %

System information

PV Array		Inverters	
Nb. of modules	189 units	Nb. of units	1 unit
Pnom total	100 kWp	Pnom total	111 kWac
		Pnom ratio	0.902

User's needs
Unlimited load (grid)

Results summary

Produced Energy	90.88 MWh/year	Specific production	907 kWh/kWp/year	Perf. Ratio PR	38.93 %

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General parameters

Grid-Connected System

Tracking system

PV Field Orientation

Orientation	Tracking algorithm	Trackers configuration	
Tracking two axis, frame N-S	Astronomic calculation	Nb. of trackers	108 units
		Sizes	
		Tracker Spacing	1.14 m
		Collector width	1.13 m
		Ground Cov. Ratio (GCR)	99.5 %
		Phi on frame min / max	10.0 / 80.0 °
		Frame Phi min./ max	-/+ 60.0 °
		Shading limit angles	
		Phi limits	+/- 79.9 °

Models used
Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon
Average Height   7.4 °

Near Shadings
According to strings
Electrical effect   100 %

User's needs
Unlimited load (grid)

PV Array Characteristics

PV module
Manufacturer	Generic
Model	JKM530M-72HL4-BDVP
(Custom parameters definition)	
Unit Nom. Power	530 Wp
Number of PV modules	189 units
Nominal (STC)	100 kWp
Modules	7 Strings x 27 In series

At operating cond. (50°C)
Pmpp	91.5 kWp
U mpp	995 V
I mpp	92 A

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)	0.90

Total PV power
Nominal (STC)	100 kWp
Total	189 modules
Module area	487 m²
Cell area	449 m²

Total inverter power
Total power	111 kWac
Number of inverters	1 unit
Pnom ratio	0.90

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.	119 mΩ
Loss Fraction	1.0 % at STC

Module Quality Loss
Loss Fraction   0.0 %

Module mismatch losses
Loss Fraction   0.6 % at MPP

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Array losses

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	0.989	0.967	0.924	0.729	0.000

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   0.19 % 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   99 kVA
Iron loss (24/24 Connexion)   0.10 kW
Loss Fraction   0.10 % at STC
Coils equivalent resistance   3 x 29.43 mΩ
Loss Fraction   1.00 % at STC

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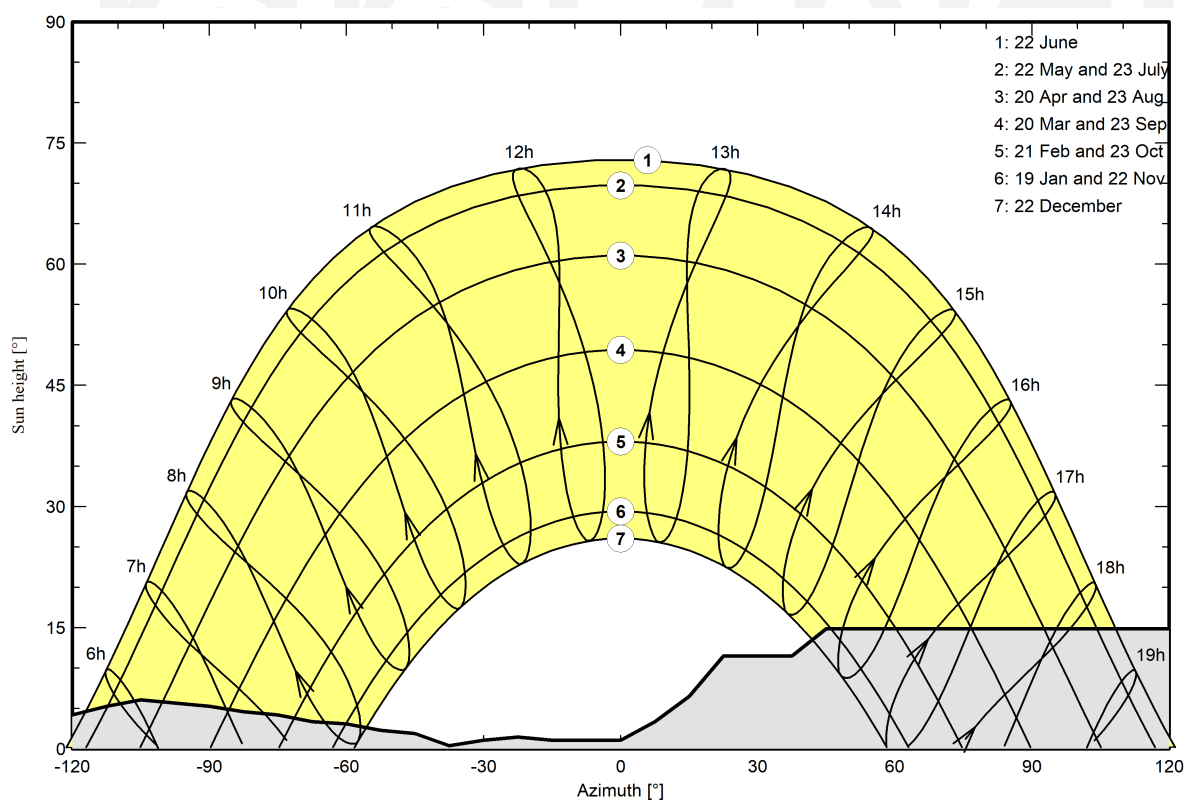07/06/22 06:59
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Horizon definition

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

Average Height	7.4 °	Albedo Factor	0.33
Diffuse Factor	0.73	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
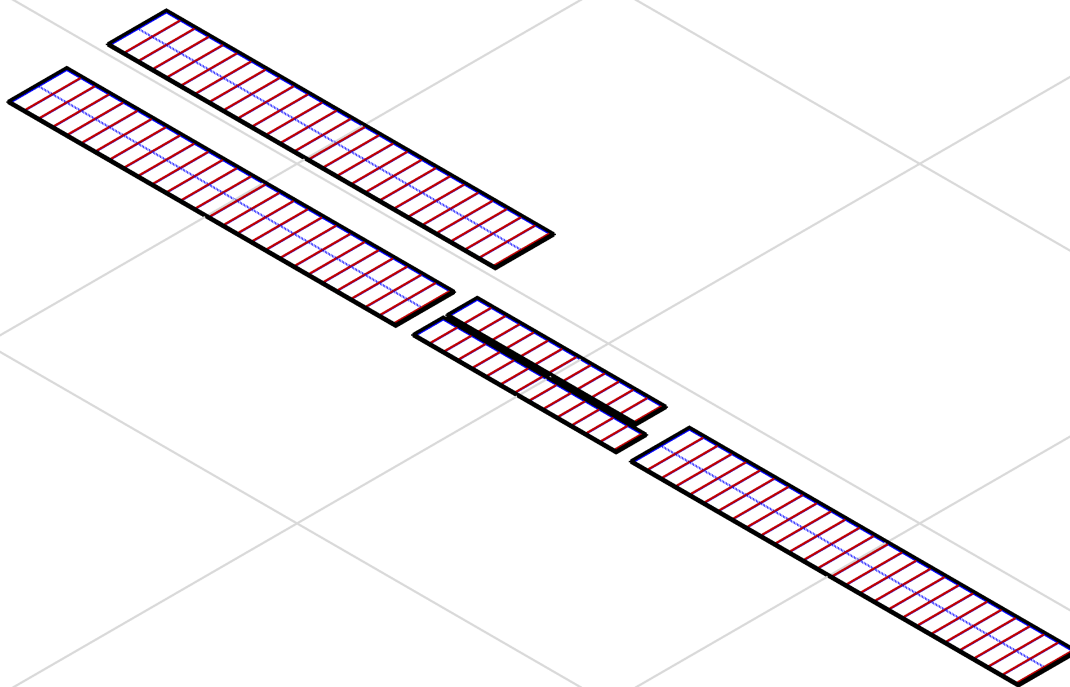6: 19 Jan and 22 Nov.
7: 22 December

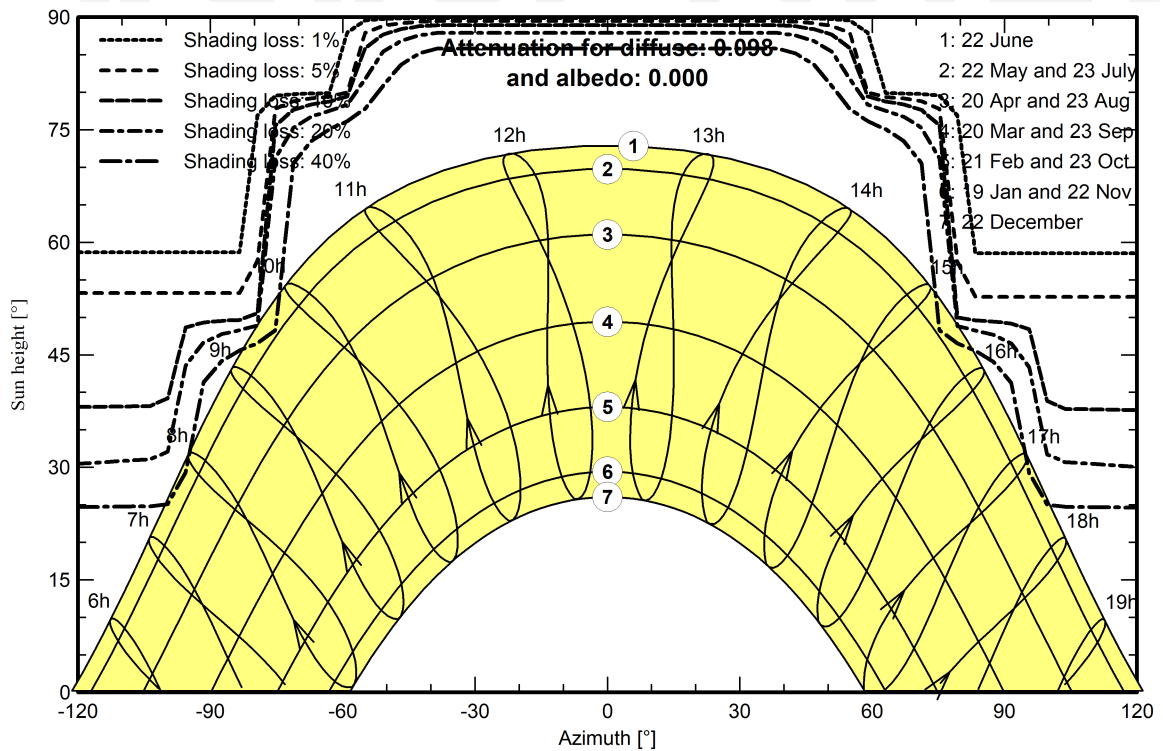**PVsyst V7.2.15**
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Near shadings parameter

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%

Attenuation for diffuse: 0.098
and albedo: 0.000

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

Sun height [°]

Azimuth [°]

Project: Kopellis_ 2 Axis

Variant: 100KW 2 axes

Main results

System Production

Produced Energy	90.88 MWh/year	Specific production	907 kWh/kWp/year
		Performance Ratio PR	38.93 %

Normalized productions (per installed kWp)

Lc: Collection Loss (PV-array losses)   3.82 kWh/kWp/day
Ls: System Loss (inverter, ...)   0.08 kWh/kWp/day
Yf: Produced useful energy (inverter output)   2.49 kWh/kWp/day

Performance Ratio PR

PR: Performance Ratio (Yf / Yr) : 0.389
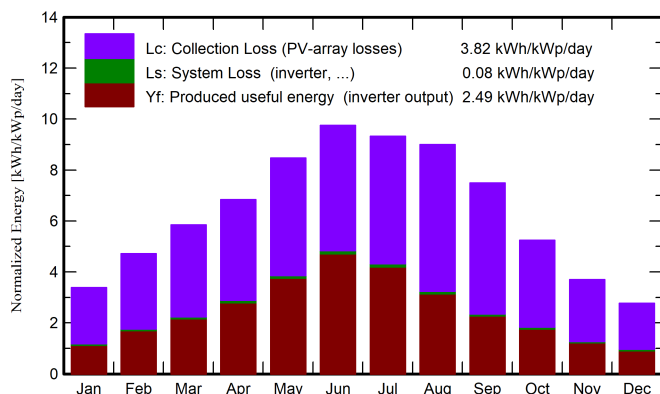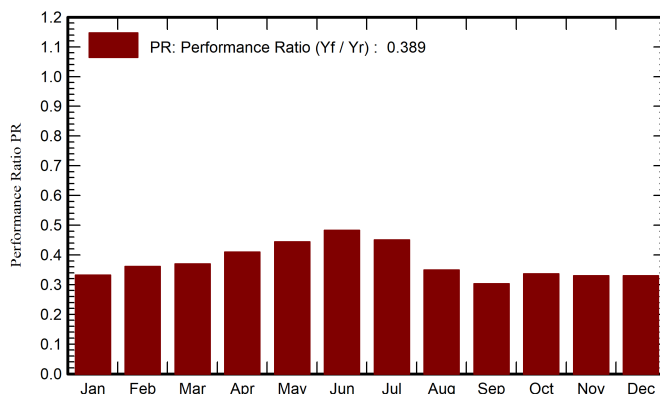
Balances and main results

	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	104.8	56.2	3.67	3.49	0.333
February	76.4	39.36	6.71	132.1	84.5	4.96	4.77	0.361
March	118.0	57.36	9.91	181.4	134.9	6.95	6.72	0.370
April	150.3	77.02	13.73	205.1	169.5	8.69	8.41	0.410
May	195.0	84.41	19.52	262.5	229.1	12.01	11.67	0.444
June	218.4	75.24	24.54	292.5	263.3	14.57	14.16	0.483
July	214.7	82.15	27.83	289.2	256.9	13.44	13.06	0.451
August	194.0	76.29	27.71	279.0	235.5	10.07	9.78	0.350
September	144.2	53.93	21.67	224.8	174.5	7.07	6.84	0.304
October	94.1	43.87	16.53	162.6	108.3	5.70	5.48	0.337
November	57.9	29.79	11.46	111.0	63.3	3.85	3.67	0.330
December	43.4	24.96	6.66	85.9	44.4	3.01	2.83	0.329
Year	1559.1	673.58	15.99	2330.9	1820.3	93.97	90.88	0.389

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
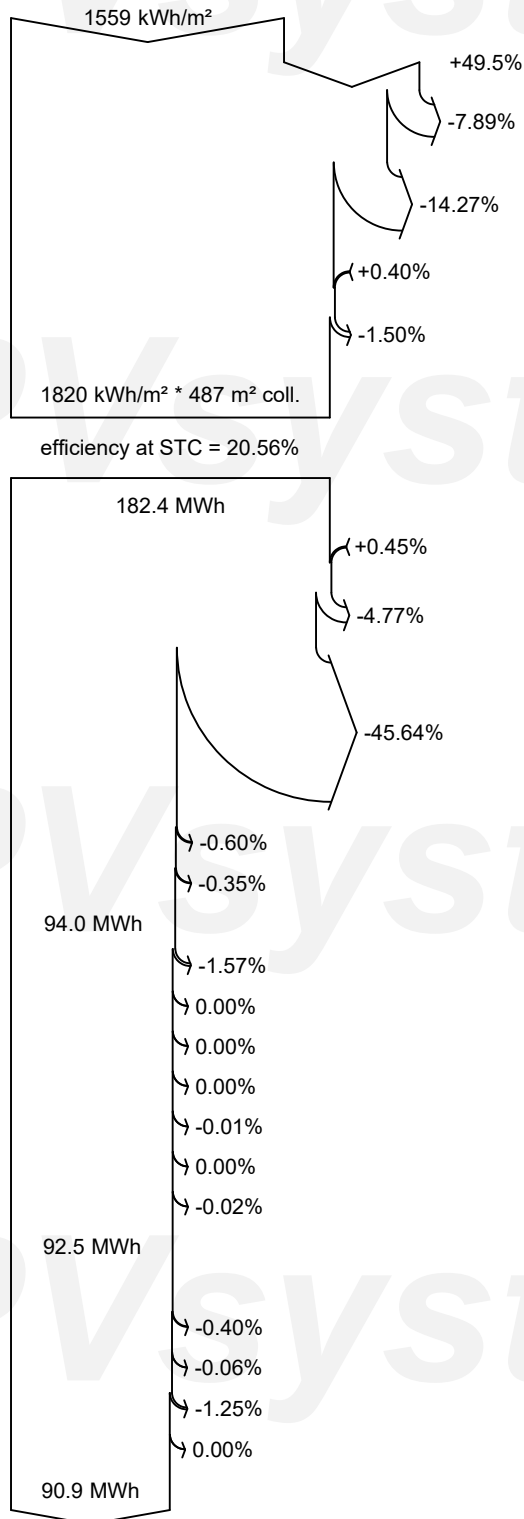
|	
1559 kWh/m²	**Global horizontal irradiation**
+49.5%	**Global incident in coll. plane**
-7.89%	Far Shadings / Horizon
-14.27%	Near Shadings: irradiance loss
+0.40%	IAM factor on global
-1.50%	Soiling loss factor
1820 kWh/m² * 487 m² coll.	**Effective irradiation on collectors**
efficiency at STC = 20.56%	PV conversion
182.4 MWh	**Array nominal energy (at STC effic.)**
+0.45%	PV loss due to irradiance level
-4.77%	PV loss due to temperature
-45.64%	Shadings: Electrical Loss acc. to strings
-0.60%	Module array mismatch loss
-0.35%	Ohmic wiring loss
94.0 MWh	**Array virtual energy at MPP**
-1.57%	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
-0.02%	Night consumption
92.5 MWh	**Available Energy at Inverter Output**
-0.40%	Auxiliaries (fans, other)
-0.06%	AC ohmic loss
-1.25%	Medium voltage transfo loss
0.00%	MV line ohmic loss
90.9 MWh	**Energy injected into grid**

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Special graphs

Daily Input/Output diagram
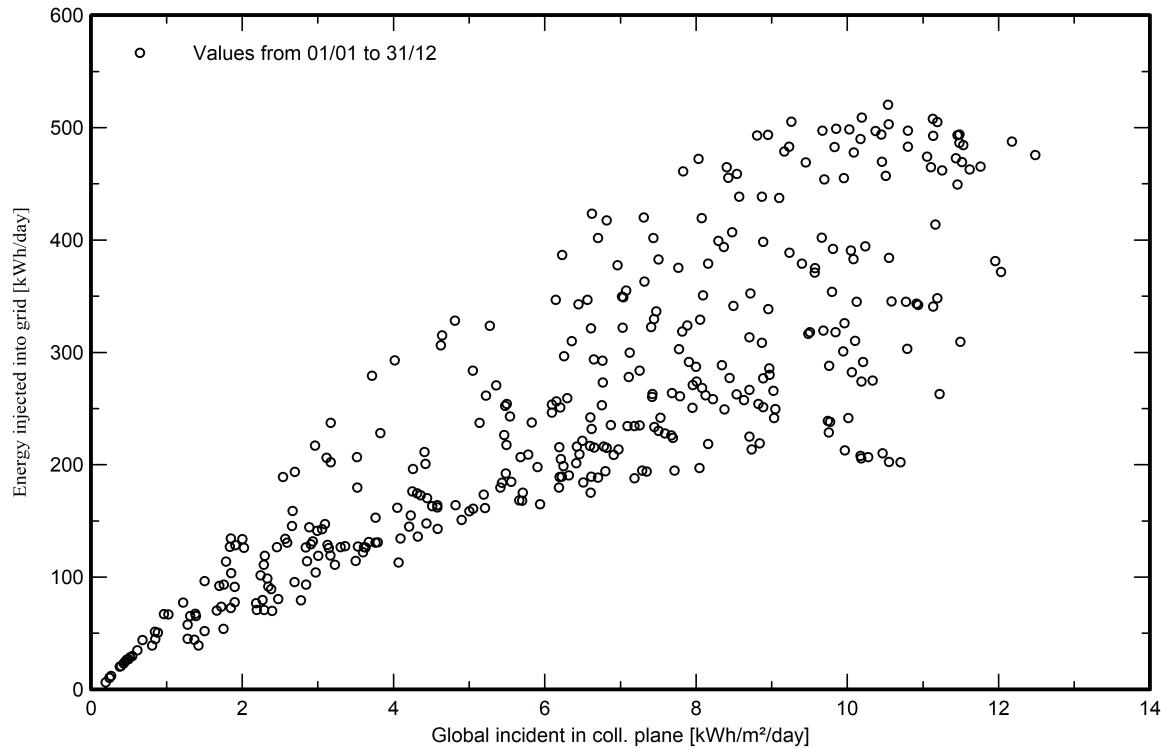
System Output Power Distribution