

PVsyst - Simulation report

Grid-Connected System

Project: Kopellis_ 1 Axis

Variant: 114 kW 1 axis tilt

Trackers single array, with backtracking

System power: 114 kWp

Thessaloniki/Livadákion - Greece

**PVsyst V7.2.16**

VC4, Simulation date:
20/06/22 03:55
with v7.2.16

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****PV Field Orientation****Orientation**

Tracking plane, tilted axis

Axis Tilt 25 °

Azimuth 0 °

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

Astronomic calculation

Backtracking activated

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 206.8 MWh/year Specific production 1806 kWh/kWp/year Perf. Ratio PR 84.23 %

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General parameters

Grid-Connected System

PV Field Orientation

Orientation

Tracking plane, tilted axis

Axis Tilt 25 °

Azimuth 0 °

Models used

Transposition Perez

Diffuse Perez, Meteonorm

Circumsolar separate

Horizon

Average Height 7.4 °

Trackers single array, with backtracking

Tracking algorithm

Astronomic calculation

Backtracking activated

Backtracking array

Nb. of trackers 18 units

Single array

Sizes

Tracker Spacing 10.00 m

Collector width 4.57 m

Ground Cov. Ratio (GCR) 45.7 %

Phi min / max. +/- 60.0 °

Backtracking strategy

Phi limits +/- 62.7 °

Backtracking pitch 10.00 m

Backtracking width 4.57 m

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer

Model

Generic

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

Model

Generic

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/m²KUv (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

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Array losses**IAM loss factor**

Incidence effect (IAM): Fresnel, AR coating, $n(\text{glass})=1.526$, $n(\text{AR})=1.290$

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

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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Horizon definition

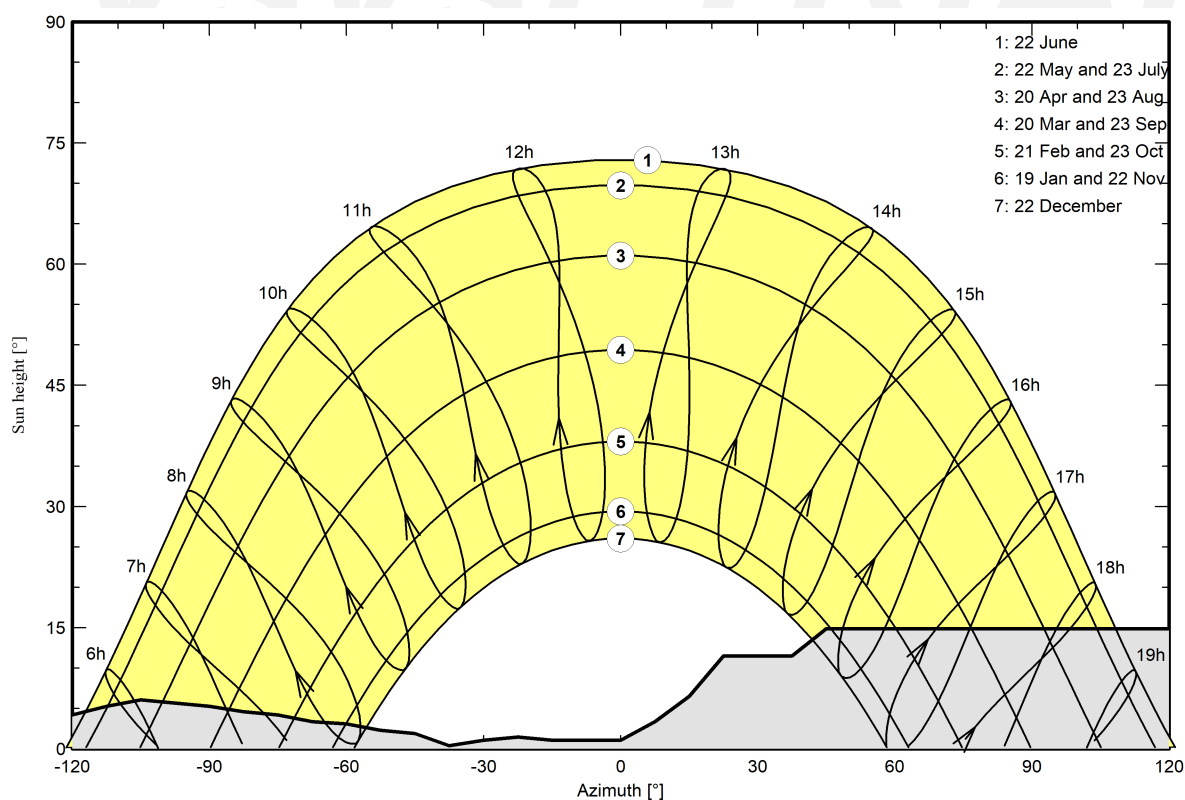
Horizon from PVGIS website API, Lat=39°37'58", Long=22°13'41", Alt=153m

Average Height 7.4 °
Diffuse Factor 0.81Albedo Factor 0.31
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)



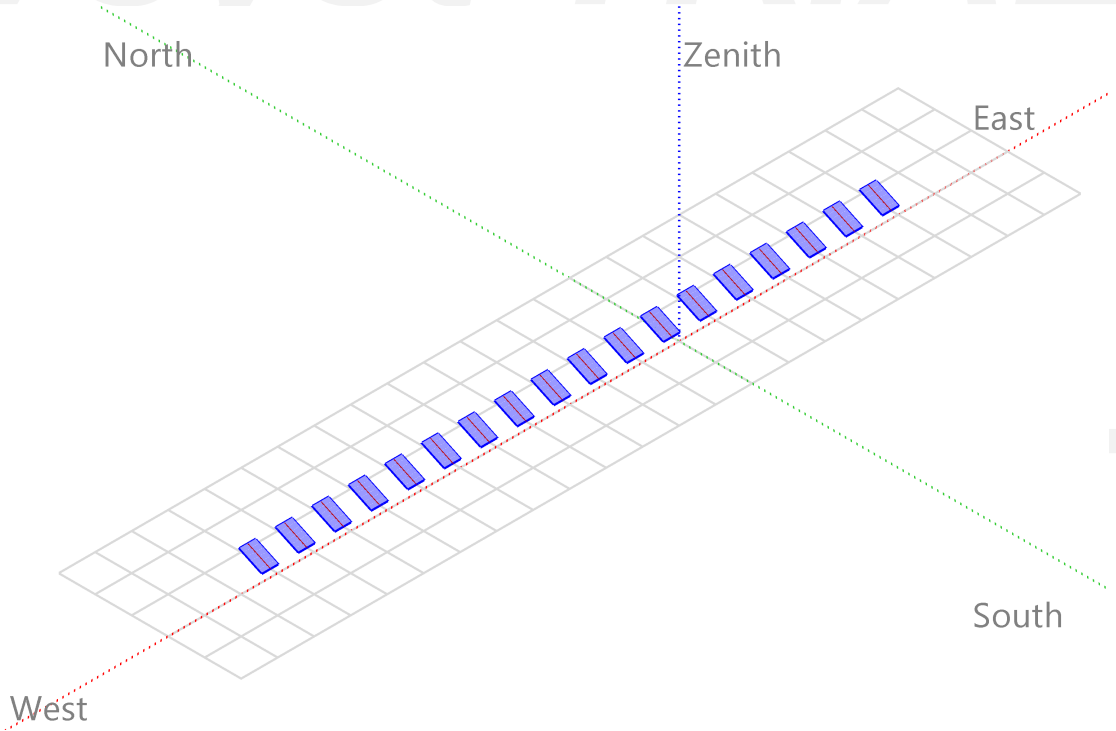


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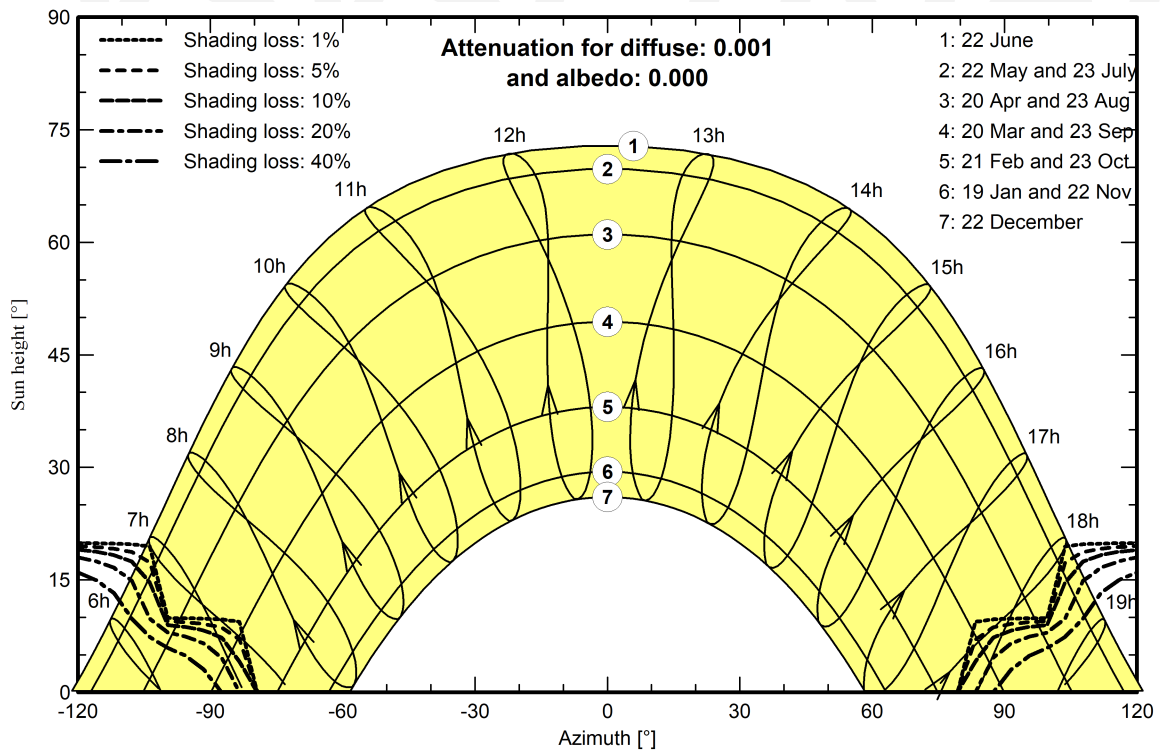
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1





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Main results

System Production

Produced Energy

206.8 MWh/year

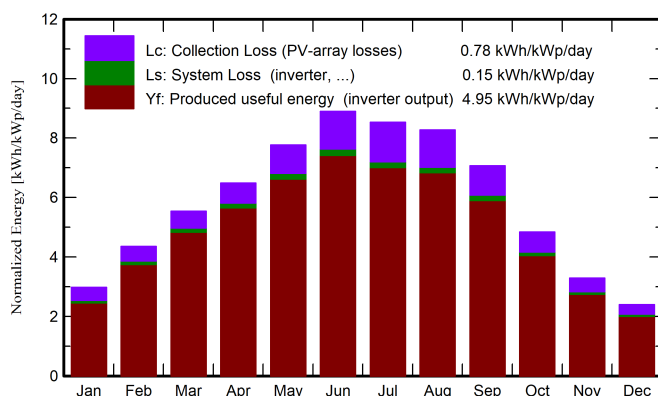
Specific production

1806 kWh/kWp/year

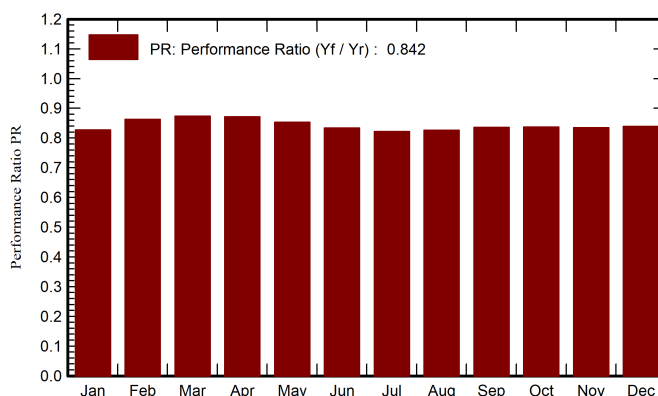
Performance Ratio PR

84.23 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	MWh	MWh	ratio
January	52.6	29.21	4.95	92.2	79.3	9.03	8.73	0.827
February	76.4	39.36	6.71	121.9	110.1	12.41	12.04	0.863
March	118.0	57.36	9.91	171.8	159.5	17.68	17.17	0.873
April	150.3	77.02	13.73	194.7	183.2	19.99	19.43	0.872
May	195.0	84.41	19.52	240.9	227.9	24.19	23.52	0.853
June	218.4	75.24	24.54	267.1	253.3	26.22	25.49	0.834
July	214.7	82.15	27.83	264.3	250.0	25.59	24.88	0.822
August	194.0	76.29	27.71	256.3	243.0	24.93	24.26	0.827
September	144.2	53.93	21.67	212.1	198.8	20.89	20.30	0.836
October	94.1	43.87	16.53	150.0	136.3	14.81	14.38	0.837
November	57.9	29.79	11.46	98.8	87.9	9.76	9.44	0.835
December	43.4	24.96	6.66	74.4	65.4	7.41	7.14	0.839
Year	1559.1	673.58	15.99	2144.4	1994.6	212.91	206.78	0.842

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

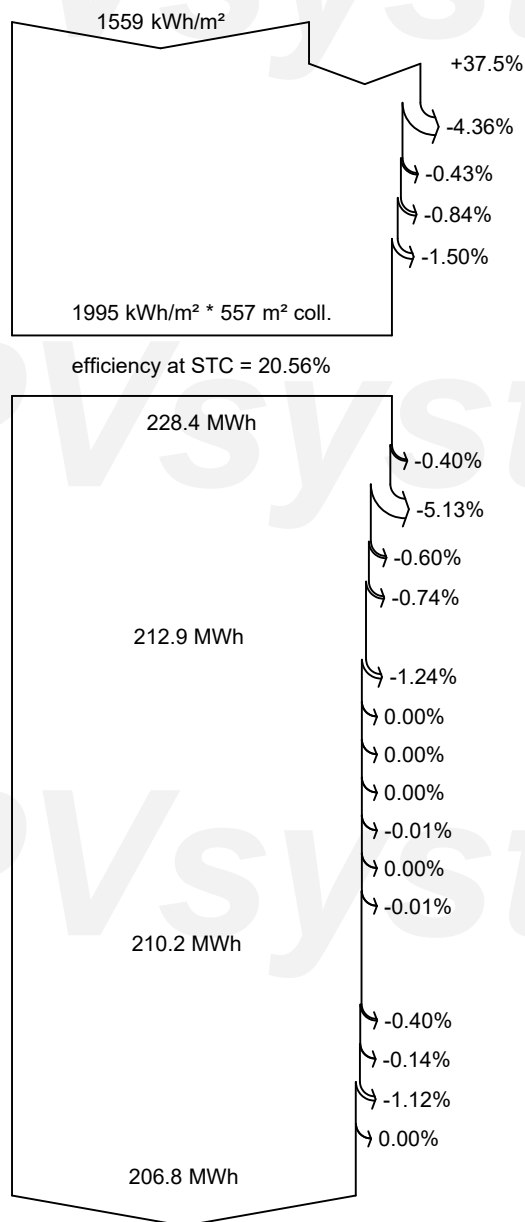
PR Performance Ratio



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Loss diagram



Global horizontal irradiation

Global incident in coll. plane

Far Shadings / Horizon

Near Shadings: irradiance loss

IAM factor on global

Soiling loss factor

Effective irradiation on collectors

PV conversion

Array nominal energy (at STC effic.)

PV loss due to irradiance level

PV loss due to temperature

Module array mismatch loss

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

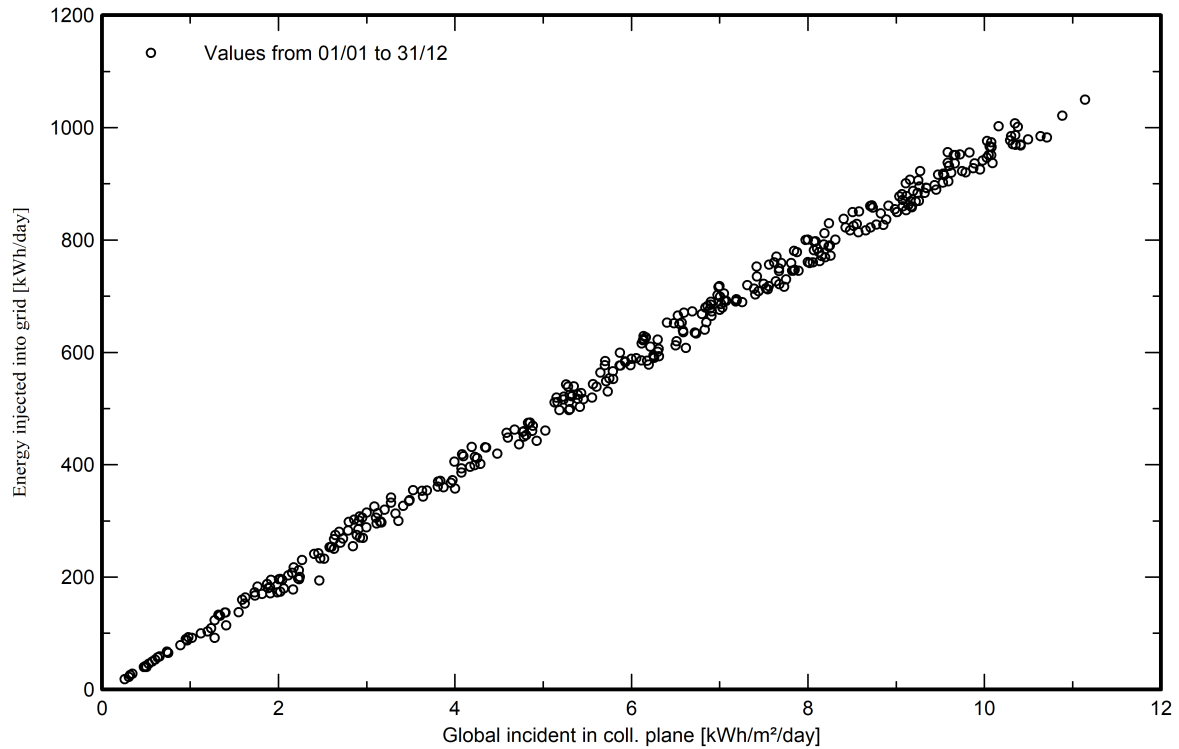


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Special graphs

Daily Input/Output diagram



System Output Power Distribution

