

# PVsyst - Simulation report

## Grid-Connected System

Project: Kopellis\_ 1 Axis

Variant:

Tracking system

System power: 114 kWp

Thessaloniki/Livadákion - Greece

Author

**PVsyst V7.2.16**

VC5, Simulation date:  
09/07/22 04:17  
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, vertical axis  
Plane tilt 25 °

**Tracking system****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 196.3 MWh/year Specific production 1715 kWh/kWp/year Perf. Ratio PR 82.45 %

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**General parameters****Grid-Connected System****PV Field Orientation****Orientation**

Tracking plane, vertical axis  
Plane tilt 25 °

**Models used**

Transposition Perez  
Diffuse Perez, Meteonorm  
Circumsolar separate

**Horizon**

Average Height 7.4 °

**Tracking system****Tracking algorithm**

Astronomic calculation

**Trackers configuration**

Nb. of trackers 12 units

**Sizes**

Tracker Spacing 0.00 m  
Collector width 10.4 m  
Azimut min / max. +/- 120.0 °

**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 mm<sup>2</sup>  
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

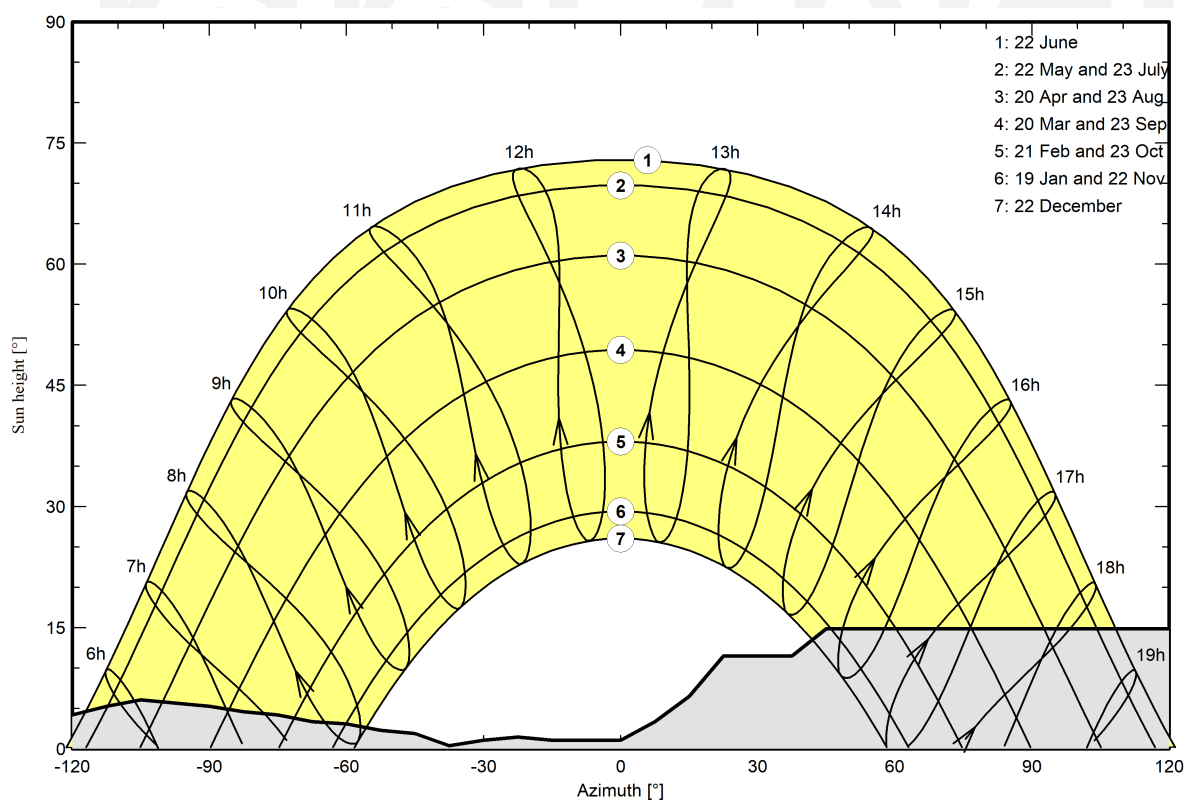
Horizon from PVGIS website API, Lat=39°37'58", Long=22°13'41", Alt=153m

Average Height 7.4 ° 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	

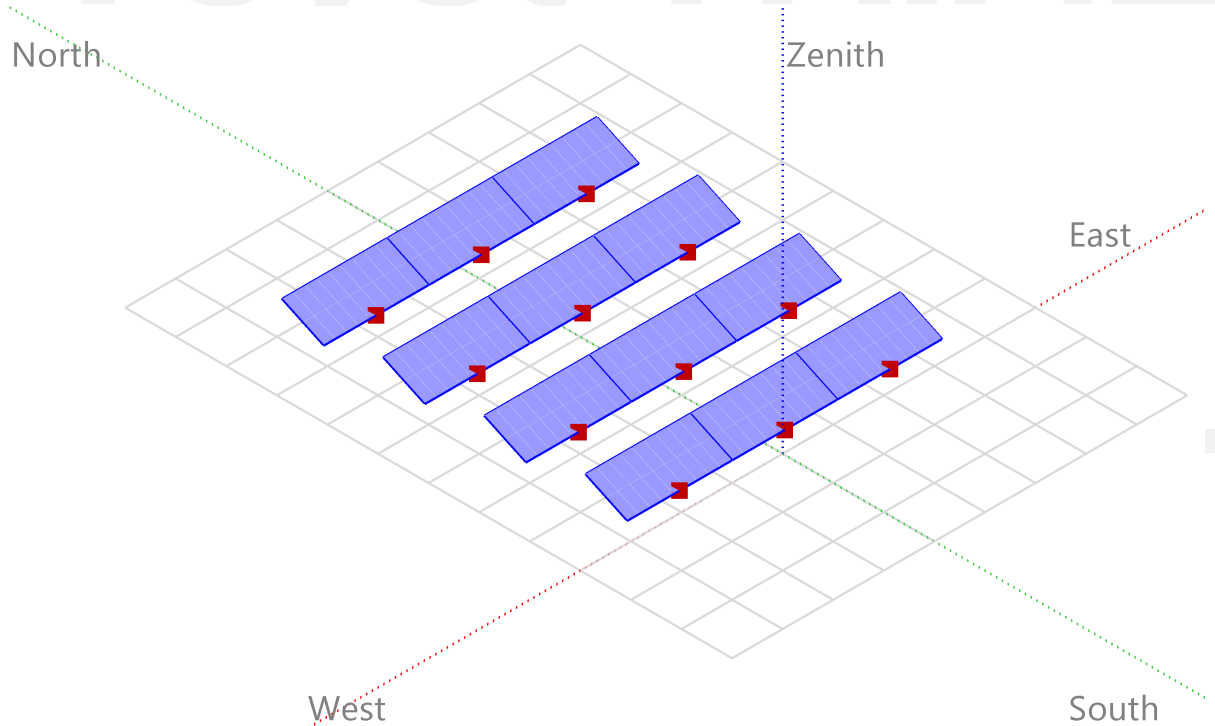
## Sun Paths (Height / Azimuth diagram)





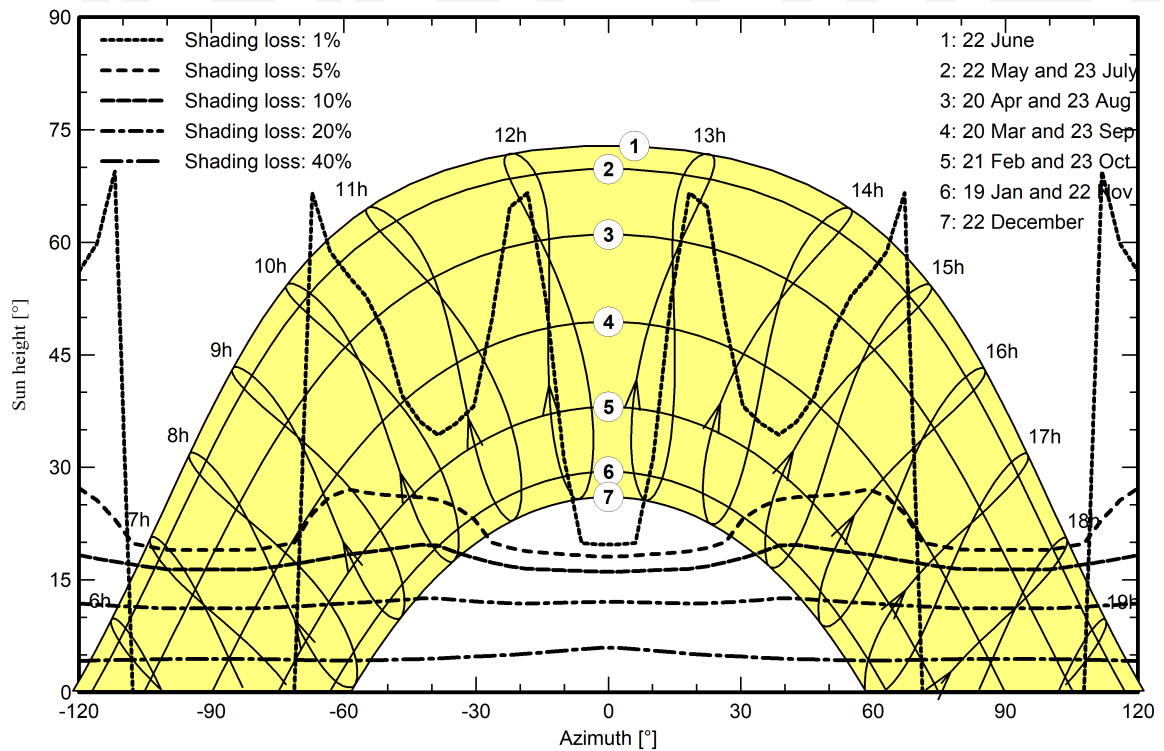
### Near shadings parameter

#### Perspective of the PV-field and surrounding shading scene



### Iso-shadings diagram

#### Orientation #1





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## Main results

## System Production

Produced Energy

196.3 MWh/year

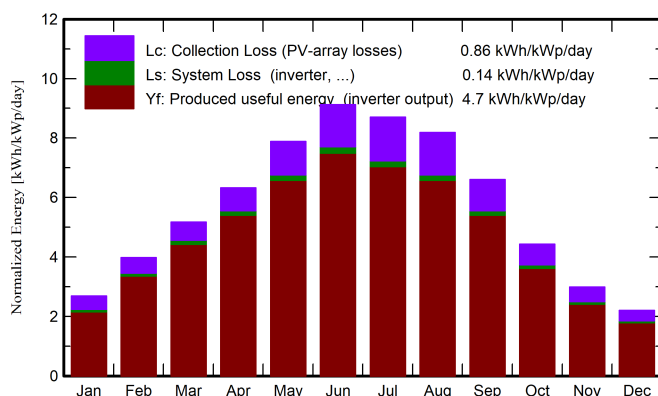
Specific production

1715 kWh/kWp/year

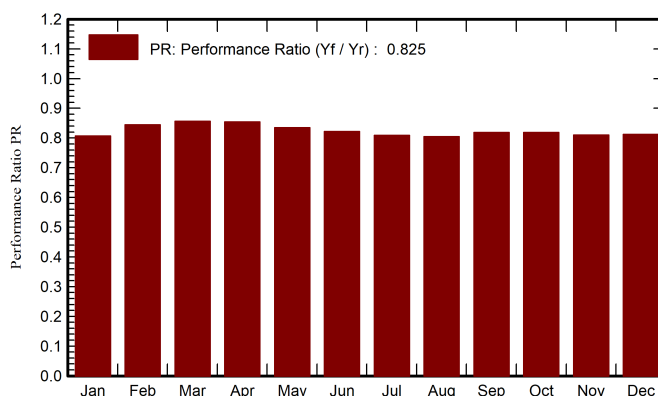
Performance Ratio PR

82.45 %

## Normalized productions (per installed kWp)



## Performance Ratio PR



## Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	°C	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	MWh	MWh	ratio
January	52.6	29.21	4.95	83.1	69.7	7.95	7.67	0.807
February	76.4	39.36	6.71	111.4	98.2	11.10	10.77	0.844
March	118.0	57.36	9.91	160.5	145.6	16.20	15.74	0.857
April	150.3	77.02	13.73	189.9	174.4	19.11	18.57	0.854
May	195.0	84.41	19.52	244.4	225.2	24.01	23.36	0.835
June	218.4	75.24	24.54	273.8	254.6	26.48	25.75	0.822
July	214.7	82.15	27.83	269.7	249.7	25.68	24.99	0.809
August	194.0	76.29	27.71	253.8	232.8	24.01	23.37	0.804
September	144.2	53.93	21.67	198.1	180.7	19.11	18.57	0.819
October	94.1	43.87	16.53	137.2	121.6	13.26	12.87	0.819
November	57.9	29.79	11.46	89.6	77.2	8.60	8.31	0.810
December	43.4	24.96	6.66	68.2	58.2	6.59	6.34	0.812
Year	1559.1	673.58	15.99	2079.7	1888.0	202.09	196.31	0.825

## 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

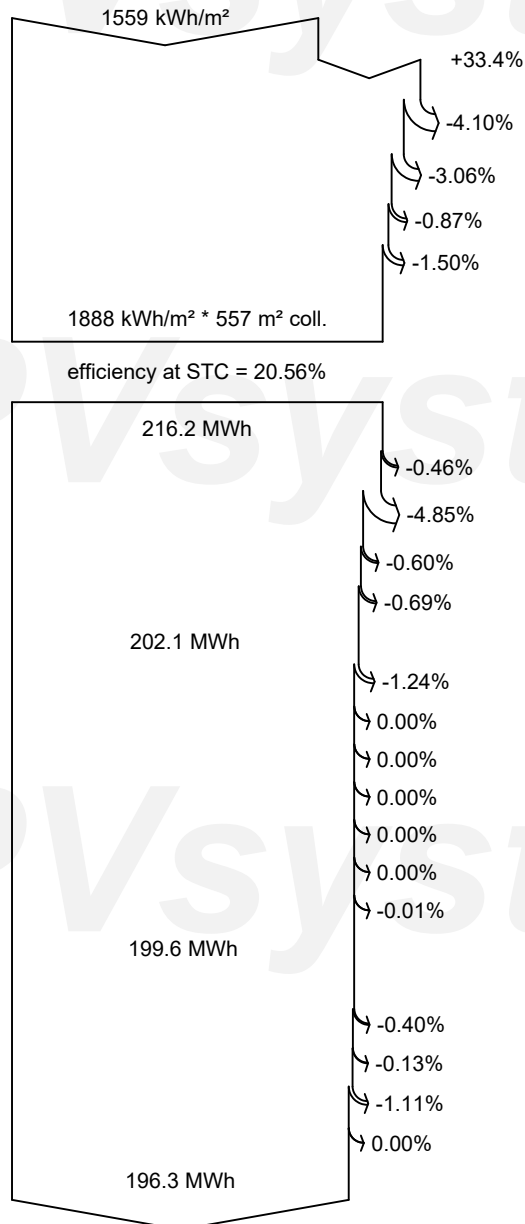
EArray Effective energy at the output of the array

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**



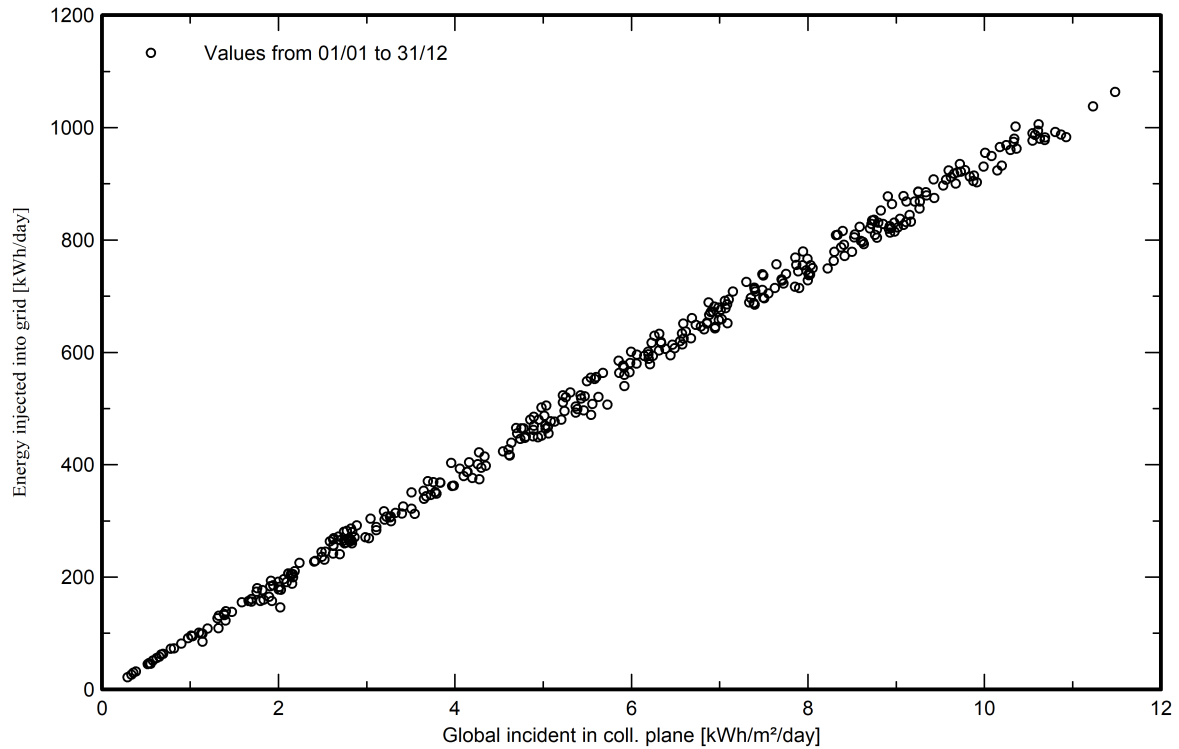


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**Special graphs**

**Daily Input/Output diagram**



**System Output Power Distribution**

