

# PVsyst - Simulation report

## Grid-Connected System

Project: Kopellis\_ 2 Axis

Variant: 114 kW pitch 10m vertical, ew

Trackers single array

System power: 114 kWp

Thessaloniki/Livadákion - Greece

**PVsyst V7.2.16**

VC0, Simulation date:  
05/07/22 21:18  
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, two axis

**Trackers single array****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 183.3 MWh/year Specific production 1601 kWh/kWp/year Perf. Ratio PR 68.02 %

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## General parameters

## Grid-Connected System

## Trackers single array

## PV Field Orientation

## Orientation

Tracking plane, two axis

## Tracking algorithm

Astronomic calculation

## Trackers configuration

Nb. of trackers 4 units

Single array

## Sizes

Tracker Spacing 10.00 m

Collector width 31.1 m

Ground Cov. Ratio (GCR) 311.4 %

Tilt min / max. 0.0 / 80.0 °

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 m<sup>2</sup>

## 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/m<sup>2</sup>K

Uv (wind)

0.0 W/m<sup>2</sup>K/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

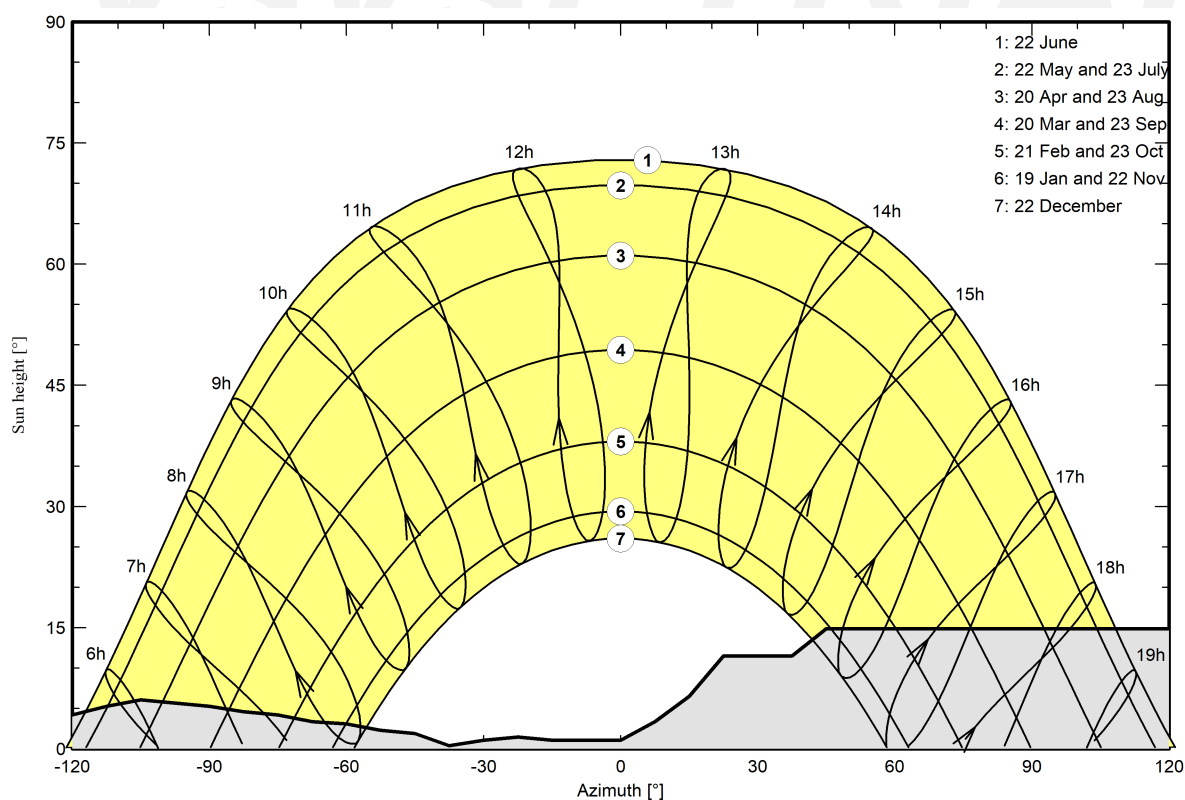
Horizon from PVGIS website API, Lat=39°37'58", Long=22°13'41", Alt=153m

Average Height 7.4 °  
Diffuse Factor 0.78Albedo Factor 0.42  
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	

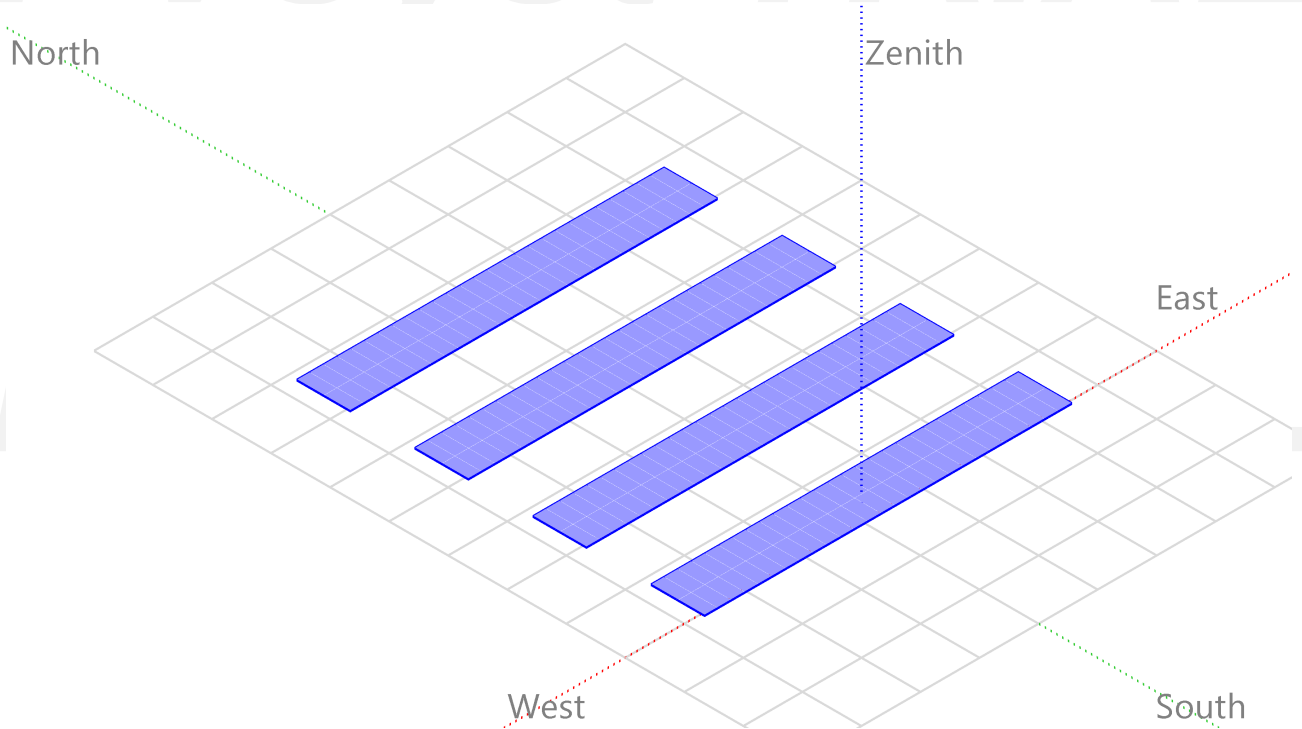
## Sun Paths (Height / Azimuth diagram)





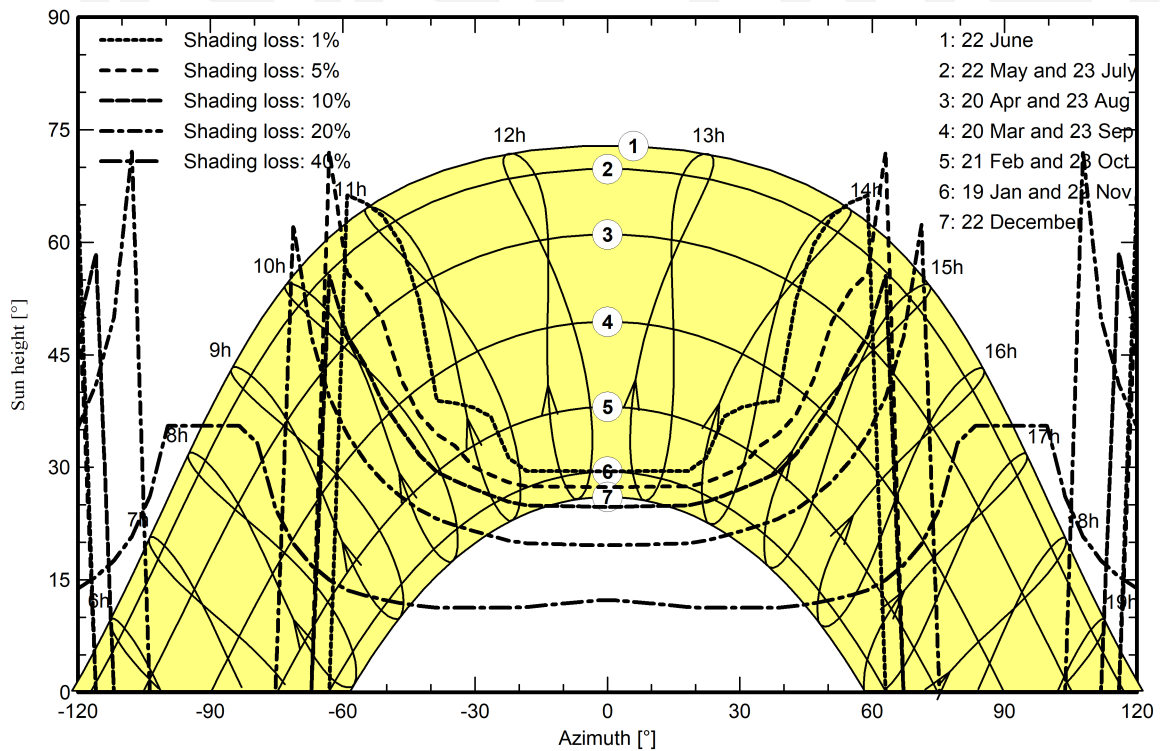
### Near shadings parameter

Perspective of the PV-field and surrounding shading scene



### Iso-shadings diagram

Orientation #1





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## Main results

## System Production

Produced Energy

183.3 MWh/year

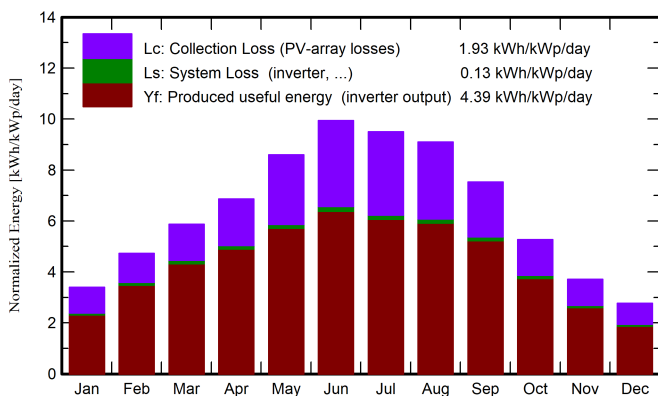
Specific production

1601 kWh/kWp/year

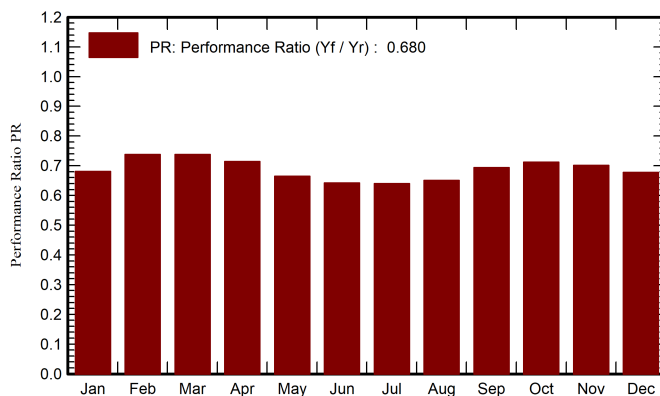
Performance Ratio PR

68.02 %

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	105.2	74.9	8.50	8.20	0.681
February	76.4	39.36	6.71	132.5	102.6	11.54	11.19	0.737
March	118.0	57.36	9.91	182.0	142.8	15.84	15.38	0.738
April	150.3	77.02	13.73	206.0	158.3	17.33	16.84	0.714
May	195.0	84.41	19.52	266.5	194.9	20.85	20.28	0.665
June	218.4	75.24	24.54	298.3	215.5	22.56	21.95	0.643
July	214.7	82.15	27.83	294.4	214.2	22.15	21.55	0.640
August	194.0	76.29	27.71	282.2	209.0	21.60	21.01	0.650
September	144.2	53.93	21.67	225.9	175.1	18.47	17.95	0.694
October	94.1	43.87	16.53	163.4	126.6	13.73	13.32	0.712
November	57.9	29.79	11.46	111.4	83.7	9.25	8.94	0.701
December	43.4	24.96	6.66	86.0	61.5	6.94	6.68	0.678
Year	1559.1	673.58	15.99	2353.7	1759.1	188.76	183.28	0.680

## 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

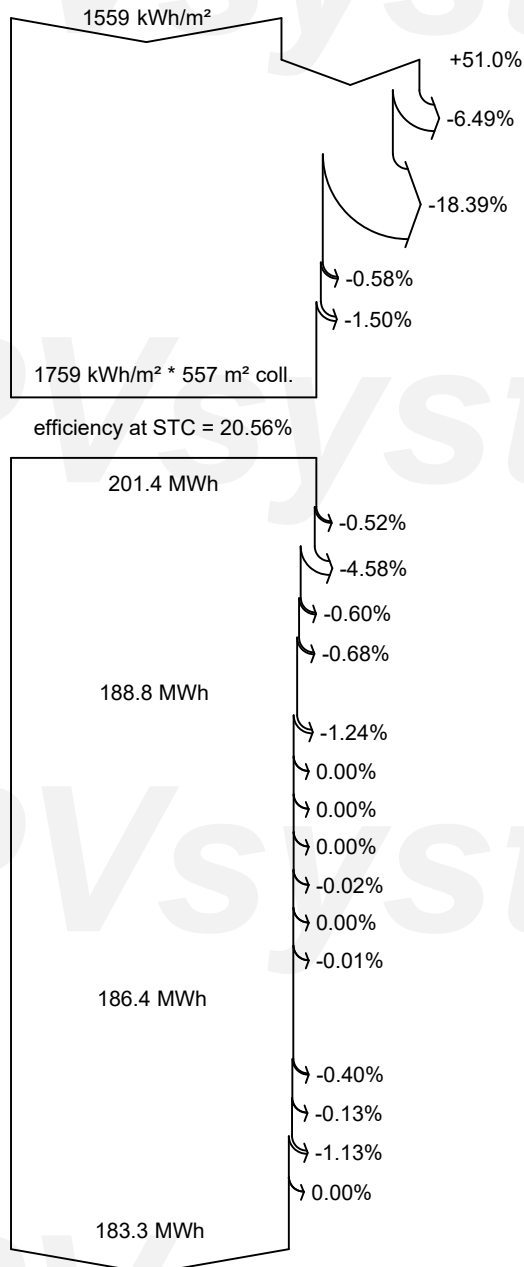
PR Performance Ratio



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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**



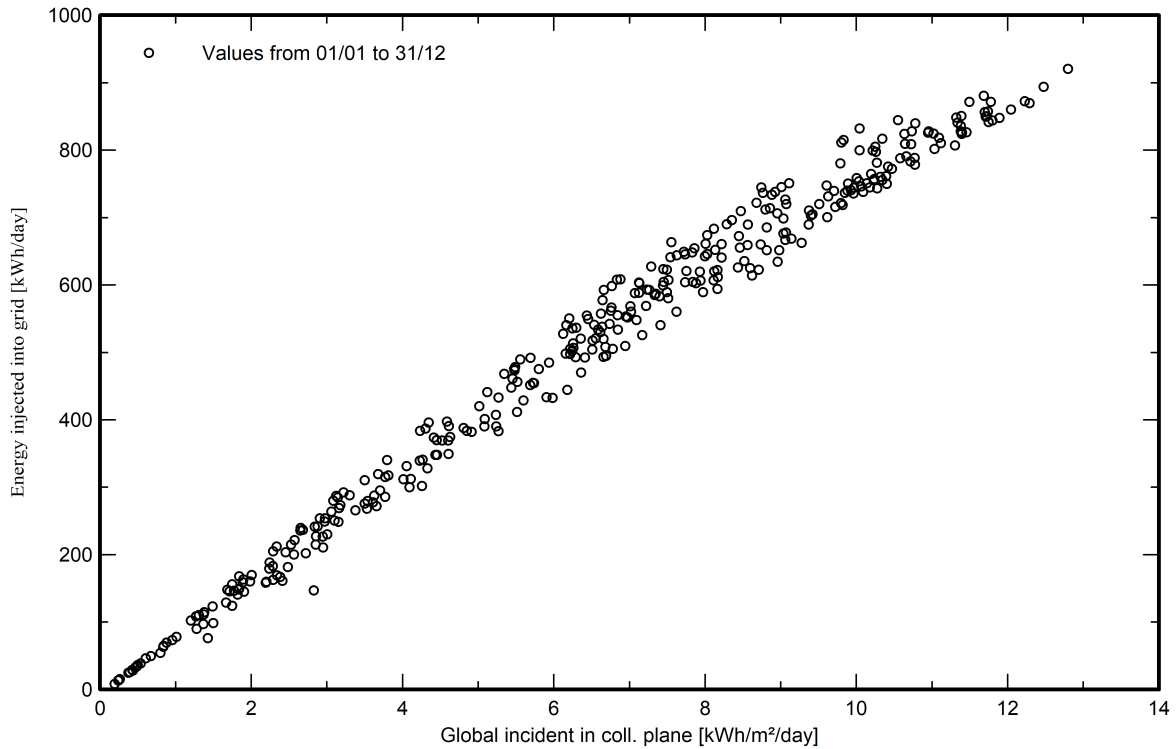


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**Special graphs**

**Daily Input/Output diagram**



**System Output Power Distribution**

