

# PVsyst - Simulation report

## Grid-Connected System

Project: Kopellis\_ 2 Axis

Variant: 114 kW pitch 10m

Trackers single array

System power: 114 kWp

Thessaloniki/Livadákion - Greece

**PVsyst V7.2.16**

VC0, Simulation date:  
05/07/22 19:32  
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 two axis, frame E-W

**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 223.2 MWh/year Specific production 1949 kWh/kWp/year Perf. Ratio PR 83.29 %

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**General parameters****Grid-Connected System****Trackers single array****PV Field Orientation****Orientation**

Tracking two axis, frame E-W

**Tracking algorithm**

Astronomic calculation

**Trackers configuration**

Nb. of trackers 4 units

Single array

**Sizes**

Tracker Spacing 10.00 m

Collector width 4.57 m

Ground Cov. Ratio (GCR) 45.7 %

Phi on frame min / max 0.0 / 80.0 °

Frame tilt min./ max -/+ 60.0 °

**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

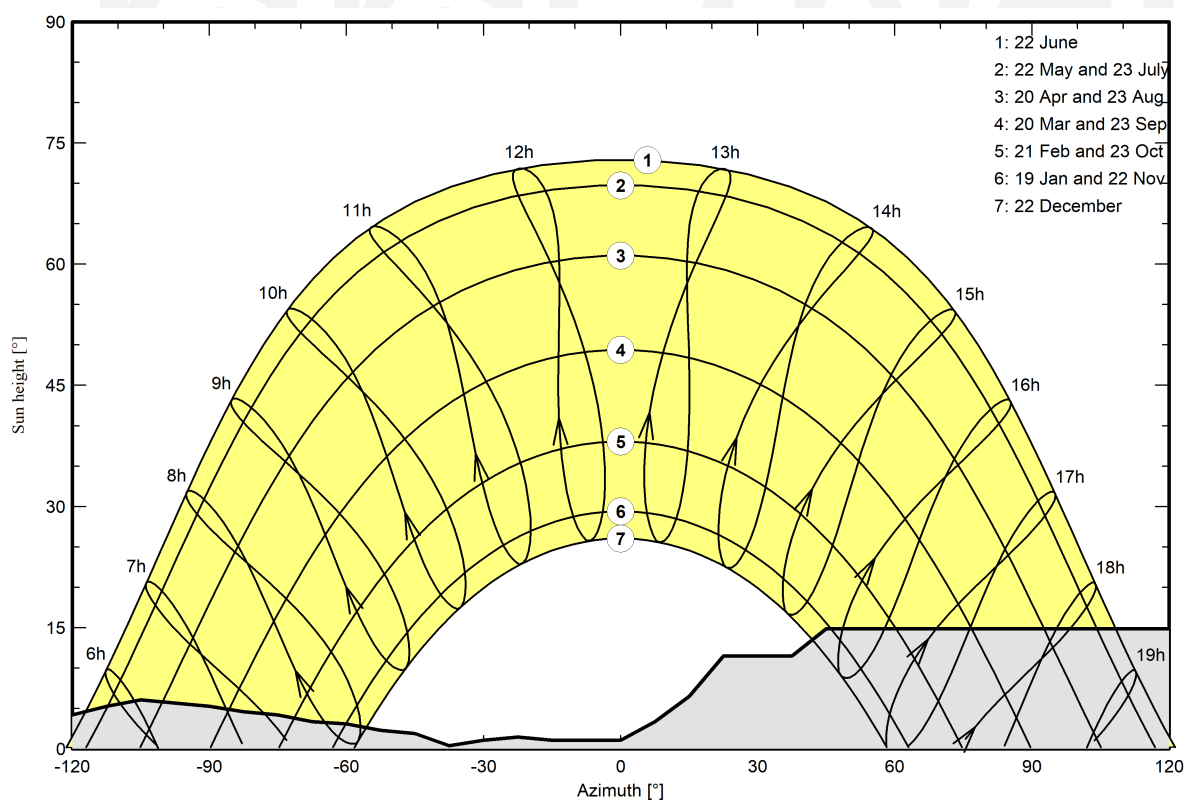
Horizon from PVGIS website API, Lat=39°37'58", Long=22°13'41", Alt=153m

Average Height	7.4 °	Albedo Factor	0.38
Diffuse Factor	0.75	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**



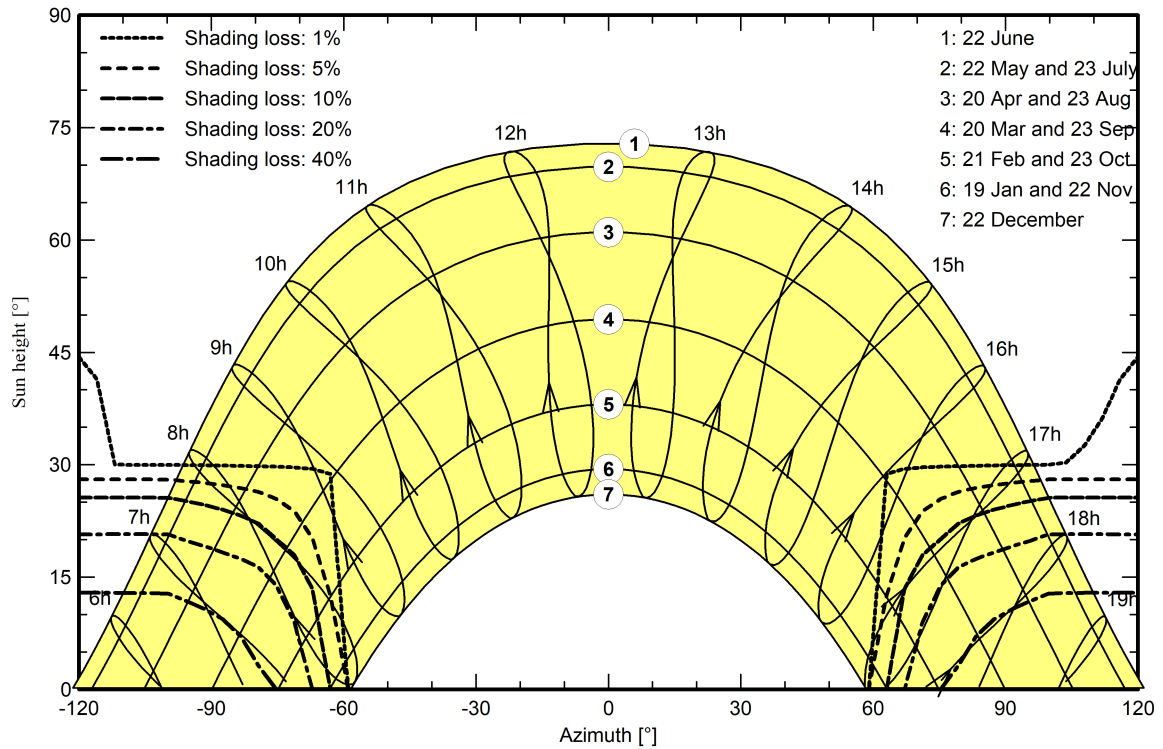


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**Iso-shadings diagram**

**Orientation #1**





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## Main results

## System Production

Produced Energy

223.2 MWh/year

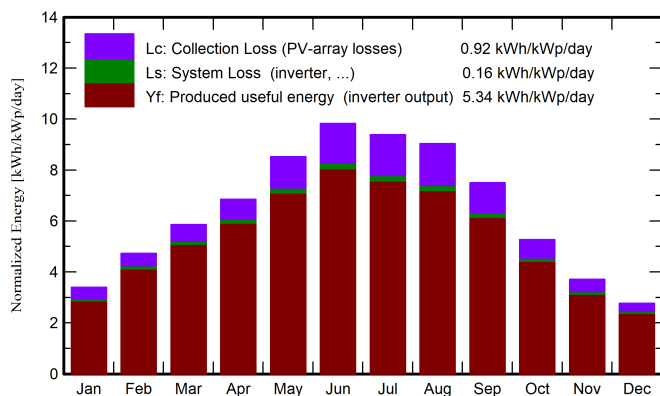
Specific production

1949 kWh/kWp/year

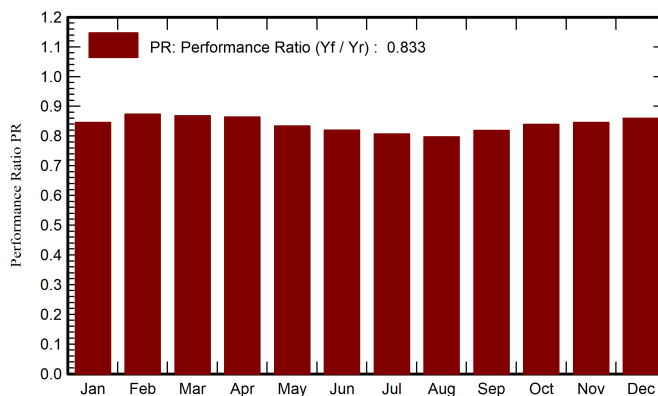
Performance Ratio PR

83.29 %

## 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	93.1	10.53	10.19	0.846
February	76.4	39.36	6.71	132.5	121.6	13.64	13.24	0.873
March	118.0	57.36	9.91	181.6	168.1	18.58	18.05	0.868
April	150.3	77.02	13.73	205.4	191.7	20.91	20.32	0.864
May	195.0	84.41	19.52	264.0	244.2	25.91	25.21	0.834
June	218.4	75.24	24.54	294.7	275.0	28.46	27.67	0.820
July	214.7	82.15	27.83	291.2	270.1	27.64	26.89	0.807
August	194.0	76.29	27.71	280.0	256.2	26.27	25.56	0.797
September	144.2	53.93	21.67	225.2	207.0	21.70	21.09	0.818
October	94.1	43.87	16.53	163.3	149.6	16.17	15.69	0.839
November	57.9	29.79	11.46	111.4	101.0	11.13	10.78	0.845
December	43.4	24.96	6.66	86.0	77.9	8.76	8.46	0.860
Year	1559.1	673.58	15.99	2340.5	2155.4	229.69	223.17	0.833

## 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

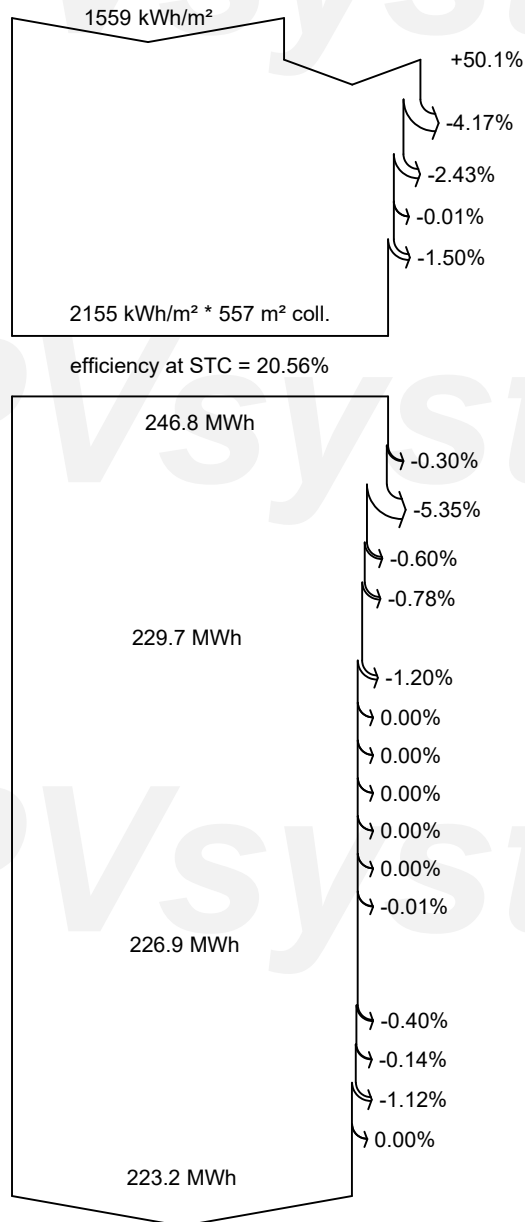




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## Loss diagram



## 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

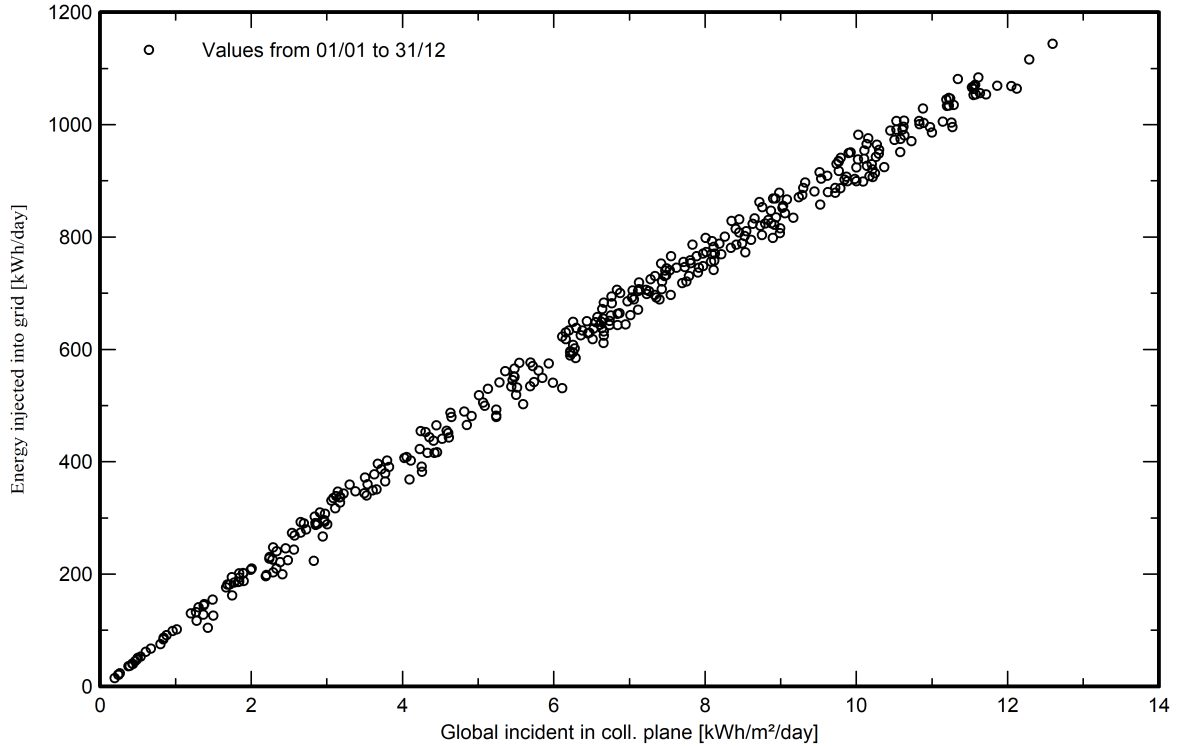


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**Special graphs**

**Daily Input/Output diagram**



**System Output Power Distribution**

