

# PVsyst - Simulation report

## Grid-Connected System

Project: Kopellis\_1

Variant: 500KW|JKM525-545M-72HL4-BDVP-F3.1-EN|SG250HX-IN-20

Tracking system with backtracking

System power: 501 kWp

Thessaloniki/Livadákion - Greece

Author

**PVsyst V7.2.15**

VC0, Simulation date:  
07/06/22 04:24  
with v7.2.15

**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, horizontal N-S axis  
Axis azimuth 0 °

**Tracking system with backtracking****Tracking algorithm**

Astronomic calculation  
Backtracking activated

**Near Shadings**

According to strings  
Electrical effect 100 %

**System information****PV Array**

Nb. of modules 945 units  
Pnom total 501 kWp

**Inverters**

Nb. of units 2 units  
Pnom total 450 kWac  
Pnom ratio 1.113

**User's needs**

Unlimited load (grid)

**Results summary**

Produced Energy 803.2 MWh/year Specific production 1604 kWh/kWp/year Perf. Ratio PR 83.88 %

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

Tracking plane, horizontal N-S axis

Axis azimuth 0 °

**Models used**

Transposition Perez

Diffuse Perez, Meteonorm

Circumsolar separate

**Horizon**

Average Height 7.4 °

**Tracking system with backtracking****Tracking algorithm**

Astronomic calculation

Backtracking activated

**Backtracking array**

Nb. of trackers 25 units

**Sizes**

Tracker Spacing 7.54 m

Collector width 4.24 m

Ground Cov. Ratio (GCR) 56.2 %

Phi min / max. +/- 60.0 °

**Near Shadings**

According to strings

Electrical effect 100 %

**User's needs**

Unlimited load (grid)

**PV Array Characteristics****PV module**

Manufacturer

Model

Generic

JKM530M-72HL4-BDVP

(Custom parameters definition)

Unit Nom. Power

530 Wp

Number of PV modules

945 units

Nominal (STC)

501 kWp

Modules

35 Strings x 27 In series

**At operating cond. (50°C)**

Pmpp

457 kWp

U mpp

995 V

I mpp

460 A

**Total PV power**

Nominal (STC)

501 kWp

Total

945 modules

Module area

2437 m<sup>2</sup>

Cell area

2247 m<sup>2</sup>**Inverter**

Manufacturer

Model

Generic

SG250HX

(Custom parameters definition)

Unit Nom. Power

225 kWac

Number of inverters

2 units

Total power

450 kWac

Operating voltage

500-1500 V

Max. power (=&gt;30°C)

250 kWac

Pnom ratio (DC:AC)

1.11

**Total inverter power**

Total power

450 kWac

Number of inverters

2 units

Pnom ratio

1.11

**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>KUv (wind) 0.0 W/m<sup>2</sup>K/m/s**DC wiring losses**

Global array res. 24 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): 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

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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 800 Vac tri  
Loss Fraction 0.21 % at STC

**Inverter: SG250HX**

Wire section (2 Inv.) Copper 2 x 3 x 240 mm<sup>2</sup>  
Average wires length 70 m

**AC losses in transformers****MV transfo**

Grid voltage 20 kV

**Operating losses at STC**

Nominal power at STC 493 kVA  
Iron loss (24/24 Connexion) 0.49 kW  
Loss Fraction 0.10 % at STC  
Coils equivalent resistance 3 x 12.98 mΩ  
Loss Fraction 1.00 % at STC



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## Horizon definition

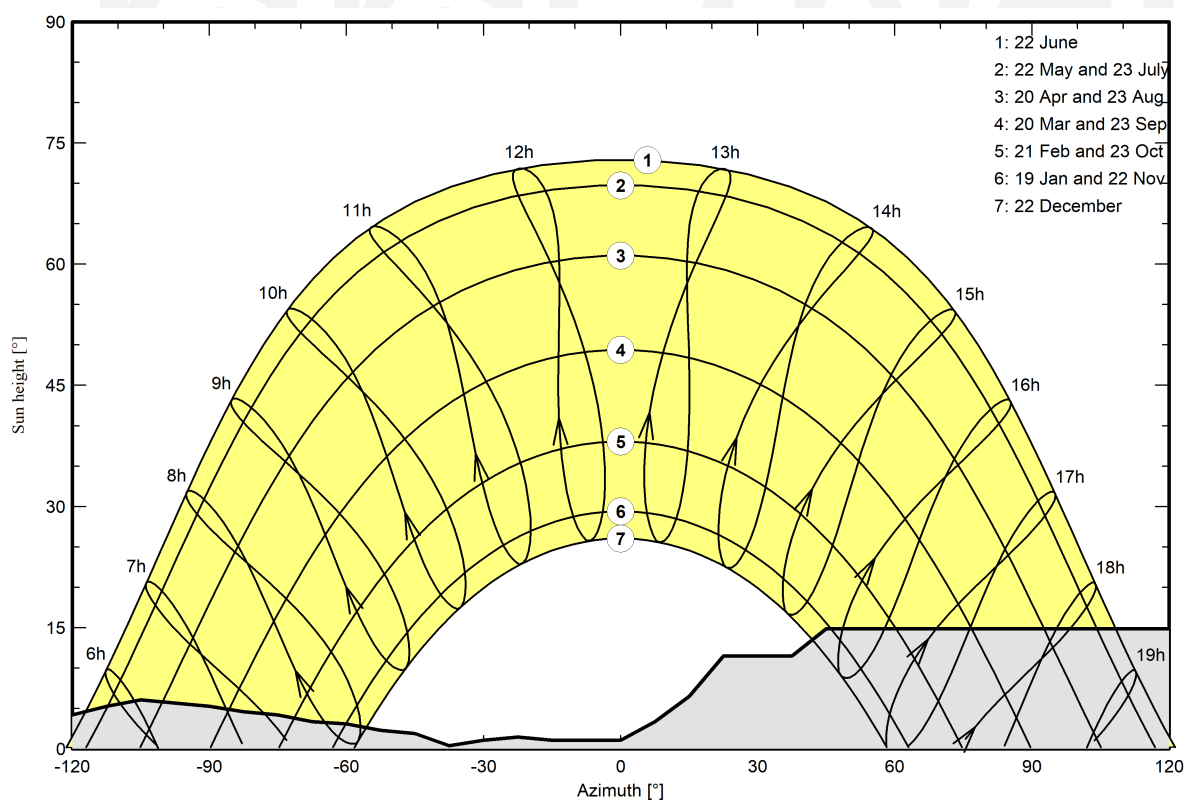
Horizon from PVGIS website API, Lat=39°37'58", Long=22°13'41", Alt=153m

Average Height	7.4 °	Albedo Factor	0.31
Diffuse Factor	0.82	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**



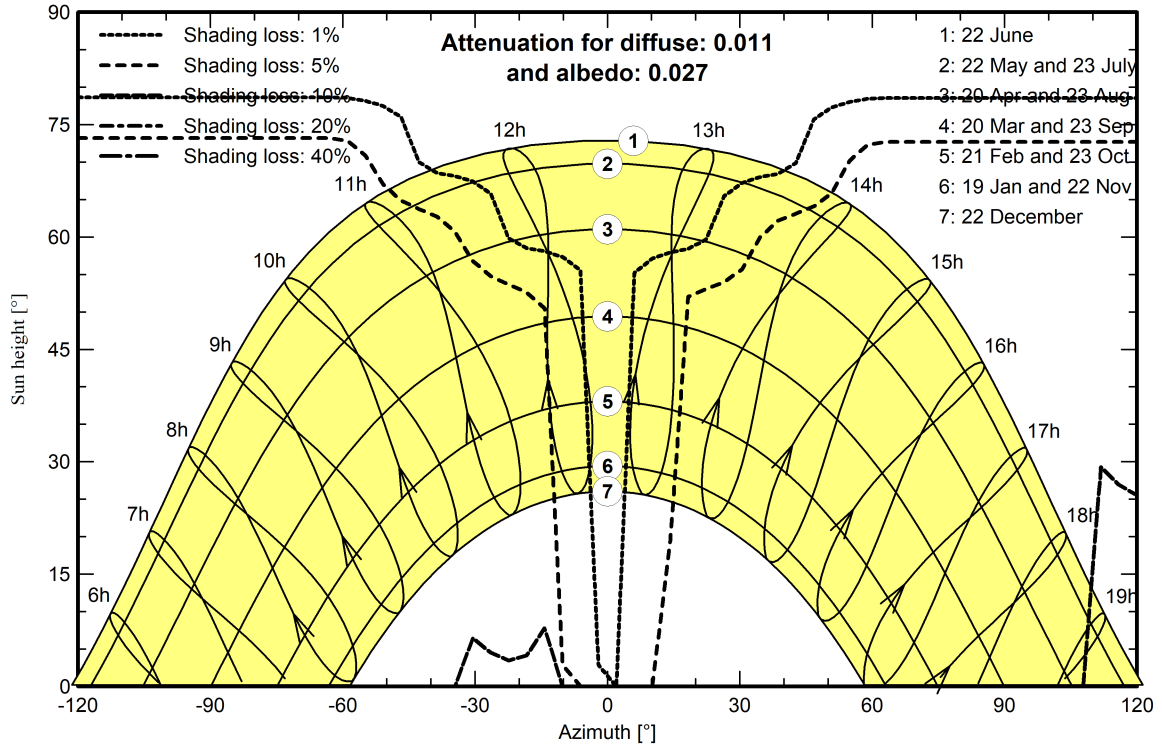


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**Iso-shadings diagram**

Orientation #1





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## Main results

## System Production

Produced Energy 803.2 MWh/year

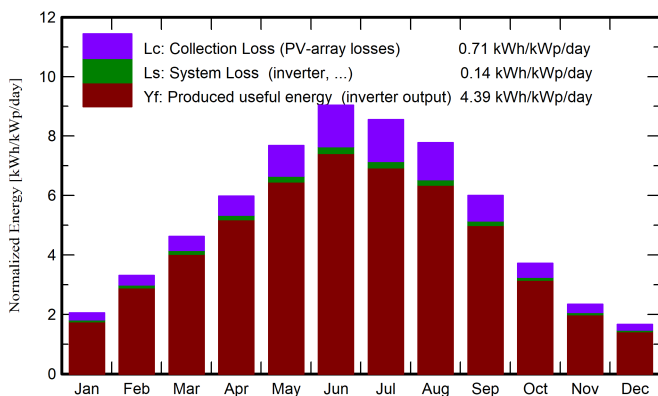
Specific production

1604 kWh/kWp/year

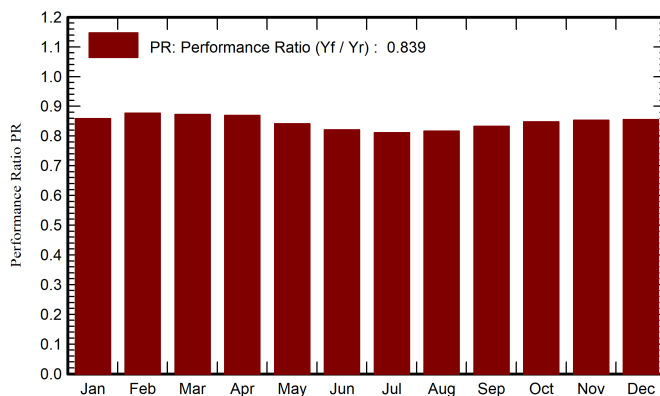
Performance Ratio PR

83.88 %

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	63.4	56.3	28.3	27.3	0.859
February	76.4	39.36	6.71	92.7	84.6	42.0	40.7	0.876
March	118.0	57.36	9.91	143.4	132.8	64.5	62.7	0.873
April	150.3	77.02	13.73	179.2	167.5	80.4	78.1	0.869
May	195.0	84.41	19.52	238.1	223.2	103.4	100.4	0.842
June	218.4	75.24	24.54	271.2	255.8	115.0	111.5	0.821
July	214.7	82.15	27.83	265.2	249.2	111.1	107.8	0.811
August	194.0	76.29	27.71	241.2	226.2	101.6	98.6	0.816
September	144.2	53.93	21.67	180.0	167.7	77.4	75.1	0.833
October	94.1	43.87	16.53	115.4	105.7	50.5	49.0	0.847
November	57.9	29.79	11.46	70.2	63.4	31.1	30.0	0.853
December	43.4	24.96	6.66	51.6	46.0	23.1	22.1	0.856
Year	1559.1	673.58	15.99	1911.9	1778.4	828.2	803.2	0.839

## 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

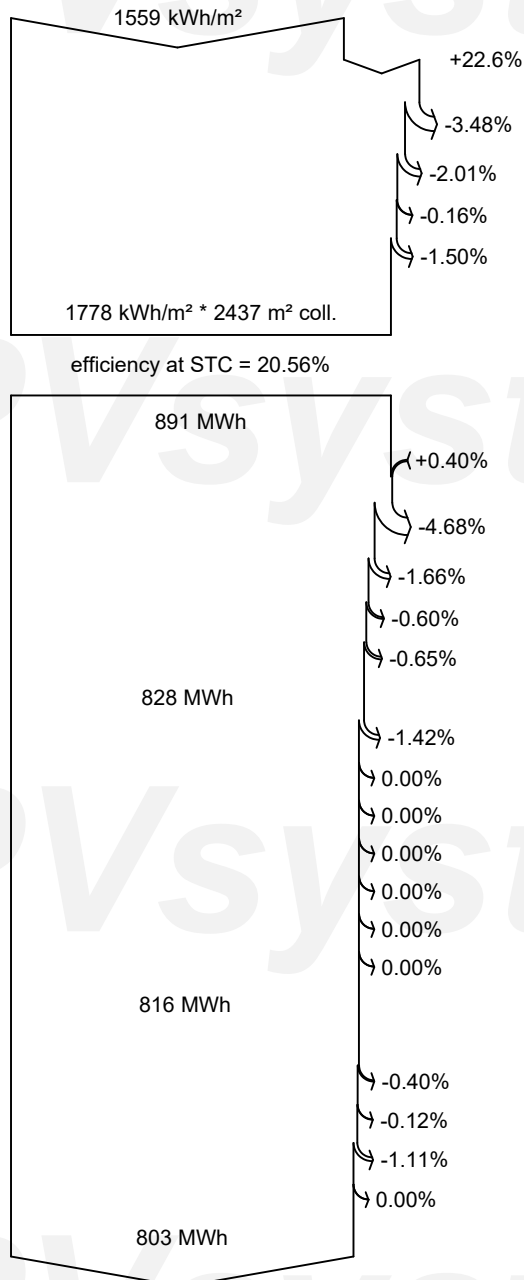
E\_Grid Energy injected into grid

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

Shadings: Electrical Loss acc. to strings

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**

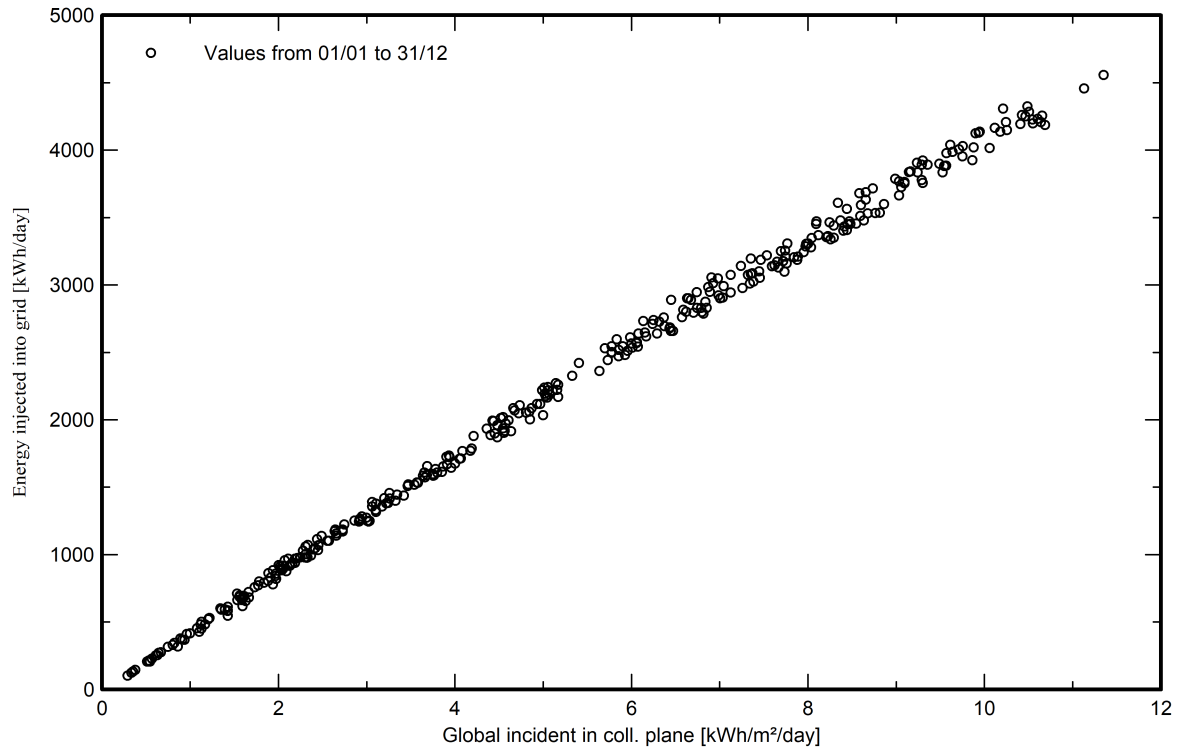


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**Special graphs**

**Daily Input/Output diagram**



**System Output Power Distribution**

