

Grid-Connected System: Simulation parameters

Project : PV PLANT 500KWp_ [REDACTED] engineering

Geographical Site	Sofades	Country	Greece	
Situation Time defined as	Latitude	39.36° N	Longitude	22.09° E
	Legal Time	Time zone UT+2	Altitude	99 m
	Albedo	0.20		
Meteo data:	Sofades Karditsas	PVGIS api TMY - TMY		

Simulation variant : JOLYWOOD 345_POLAR TRACKER

Simulation date 09/09/20 17h31

Simulation parameters	System type	Tracking system with backtracking		
Tracking plane, tilted Axis Rotation Limitations	Axis Tilt	0°	Axis Azimuth	0°
	Minimum Phi	-45°	Maximum Phi	45°
	Tracking algorithm	Astronomic calculation		
Backtracking strategy	Nb. of trackers	18	Identical arrays	
	Tracker Spacing	8.00 m	Collector width	3.78 m
Backtracking limit angle	Phi limits	+/- 61.7°	Ground cov. Ratio (GCR)	47.3 %
Models used	Transposition	Perez	Diffuse	Imported
Horizon	Average Height	1.2°		
Near Shadings	Linear shadings			
Bifacial system	Model	Unlimited trackers, 2D calculation		
	Tracker Spacing	8.00 m	Tracker width	3.78 m
	Backtracking limit angle	61.7°	GCR	47.3 %
	Ground albedo	20.0 %	Axis height above ground	1.80 m
	Module bifaciality factor	80 %	Rear shading factor	5.0 %
	Module transparency	0.0 %	Rear mismatch loss	10.0 %
User's needs :	Unlimited load (grid)			

PV Array Characteristics

PV module	Si-mono	Model	JW-HD120N-345(9BB Full Frame 158.75)		
Original PVsyst database		Manufacturer	Jolywood		
Number of PV modules		In series	22 modules	In parallel	66 strings
Total number of PV modules		Nb. modules	1452	Unit Nom. Power	345 Wp
Array global power		Nominal (STC)	501 kWp	At operating cond.	453 kWp (55°C)
Array operating characteristics (50°C)		U mpp	700 V	I mpp	647 A
Total area		Module area	2444 m²	Cell area	2180 m ²

Inverter

Inverter	Model	SUN2000-100KTL-M1-400Vac		
Original PVsyst database	Manufacturer	Huawei Technologies		
Characteristics	Operating Voltage	200-1000 V	Unit Nom. Power	100 kWac
			Max. power (=>30°C)	110 kWac
Inverter pack	Nb. of inverters	5 units	Total Power	500 kWac
			Pnom ratio	1.00

PV Array loss factors

Thermal Loss factor	Uc (const)	20.0 W/m ² K	Uv (wind)	0.0 W/m ² K / m/s
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Wiring Ohmic Loss	Global array res. 18 mOhm	Loss Fraction 1.5 % at STC
Module Quality Loss		Loss Fraction -0.8 %
Module Mismatch Losses		Loss Fraction 1.0 % at MPP
Strings Mismatch loss		Loss Fraction 0.10 %

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

Grid-Connected System: Horizon definition

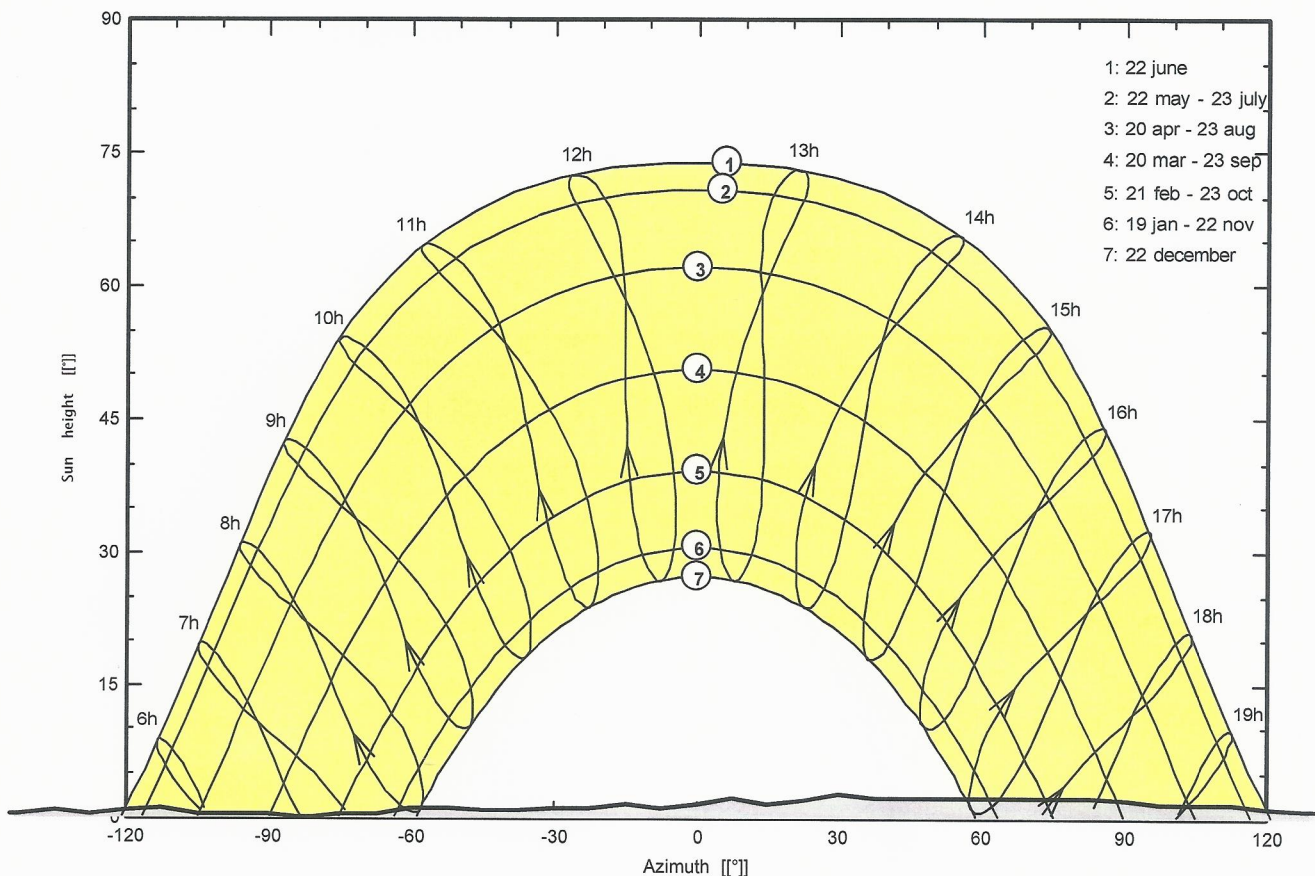
Project : PV PLANT 500KWp_ ~~XXXX~~ Engineering
Simulation variant : JOLYWOOD 345_POLAR TRACKER

Main system parameters	System type	Tracking system with backtracking	
Horizon	Average Height	1.2°	
Near Shadings	Linear shadings		
PV Field Orientation	tracking, tilted axis, Axis Tilt	0°	Axis Azimuth 0°
PV modules	JW-HD120N-345(9BB Full Frame 158.75)	Pnom	345 Wp
PV Array	Nb. of modules	1452	Pnom total 501 kWp
Inverter	Model	SUN2000-100KTL-M1-400Vac	100 kW ac
Inverter pack	Nb. of units	5.0	Pnom total 500 kW ac
User's needs	Unlimited load (grid)		

Horizon	Average Height	1.2°	Diffuse Factor	0.98
	Albedo Factor	100 %	Albedo Fraction	0.91

Height [°]	0.8	0.8	1.5	1.1	0.4	0.4	0.8	0.4	0.8	1.1	0.4	0.4	0.0	0.4
Azimuth [°]	-180	-173	-165	-158	-150	-143	-135	-128	-120	-113	-105	-90	-83	-75
Height [°]	0.4	1.1	1.1	0.8	0.8	1.1	1.1	1.5	1.1	1.5	2.3	1.5	1.9	2.7
Azimuth [°]	-68	-60	-53	-45	-38	-30	-23	-15	-8	0	8	15	23	30
Height [°]	2.3	2.3	1.9	1.5	1.5	1.1	0.8	0.8	0.4	0.8	1.1	1.1	0.4	0.8
Azimuth [°]	38	83	90	98	113	120	128	135	143	150	158	165	173	180

Horizon from PVGIS website API, Lat=39°21'51', Long=22°5'40', Alt=99m

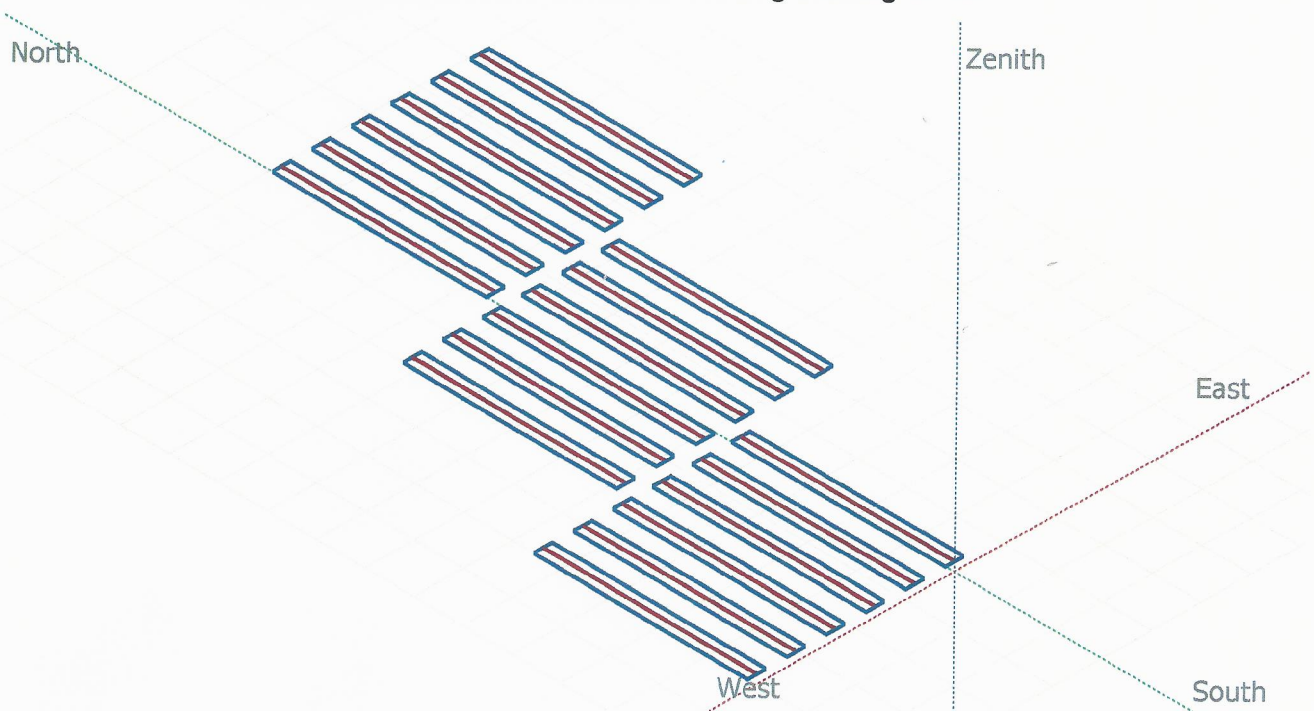


Grid-Connected System: Near shading definition

Project : PV PLANT 500KWp_PALEngineering
Simulation variant : JOLYWOOD 345_POLAR TRACKER

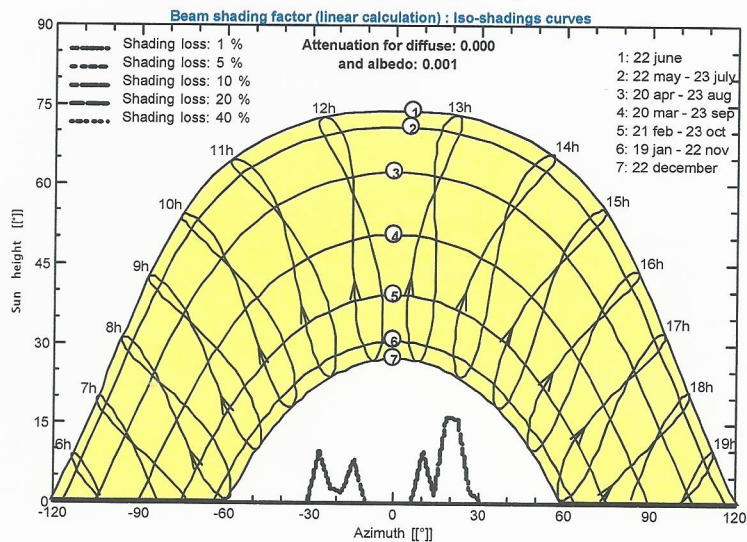
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Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

PV PLANT 500KWp_PALEngineering



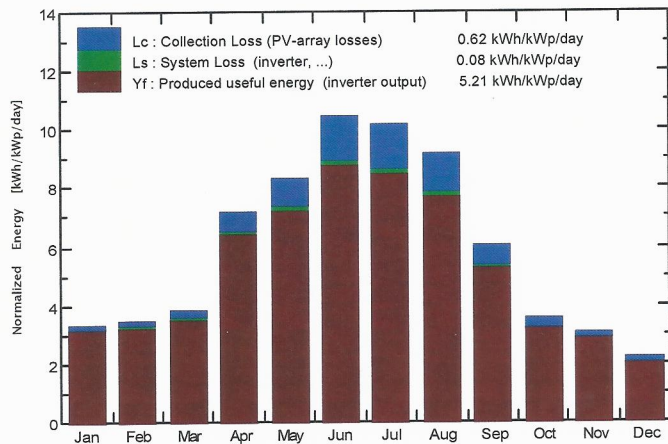
Grid-Connected System: Main results

Project : PV PLANT 500KWp_████████████████████ Engineering
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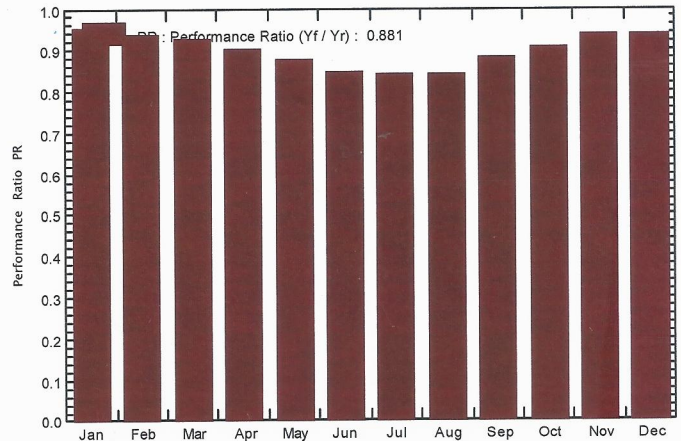
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Main simulation results	Produced Energy	953.1 MWh/year	Specific prod. 1903 kWh/kWp/year
System Production	Performance Ratio PR	88.11 %	

Normalized productions (per installed kWp): Nominal power 501 kWp



Performance Ratio PR



JOLYWOOD 345_POLAR TRACKER Balances and main results

	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray MWh	E_Grid MWh	PR
January	77.6	26.91	3.35	103.8	98.4	50.3	49.5	0.952
February	77.4	35.86	9.05	98.0	93.4	46.8	46.1	0.940
March	97.4	45.72	9.88	119.9	114.9	56.7	55.7	0.928
April	171.4	66.47	15.42	214.5	207.1	98.2	96.7	0.900
May	206.1	71.82	20.71	257.3	249.1	114.6	112.8	0.875
June	243.7	62.73	26.92	312.4	304.1	134.8	132.7	0.848
July	245.1	62.99	30.01	314.8	306.4	134.7	132.6	0.841
August	218.2	57.55	30.08	284.6	276.8	122.0	120.2	0.843
September	142.9	53.82	22.38	181.0	174.5	81.3	80.1	0.884
October	88.8	37.60	17.19	111.6	106.8	51.3	50.6	0.905
November	71.3	28.18	8.87	92.9	88.3	44.3	43.6	0.938
December	53.9	26.35	8.87	68.8	64.7	32.9	32.4	0.939
Year	1693.9	576.01	16.94	2159.5	2084.5	968.0	953.1	0.881

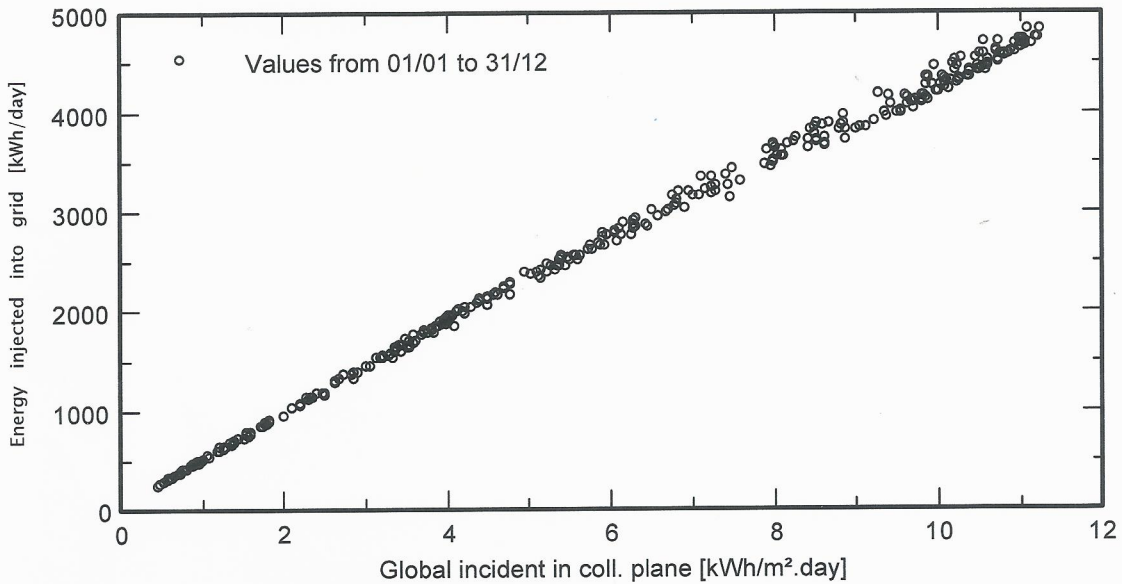
Legends:	GlobHor	Horizontal global irradiation	GlobEff	Effective Global, corr. for IAM and shadings
	DiffHor	Horizontal diffuse irradiation	EArray	Effective energy at the output of the array
	T_Amb	T amb.	E_Grid	Energy injected into grid
	GlobInc	Global incident in coll. plane	PR	Performance Ratio

Grid-Connected System: Special graphs

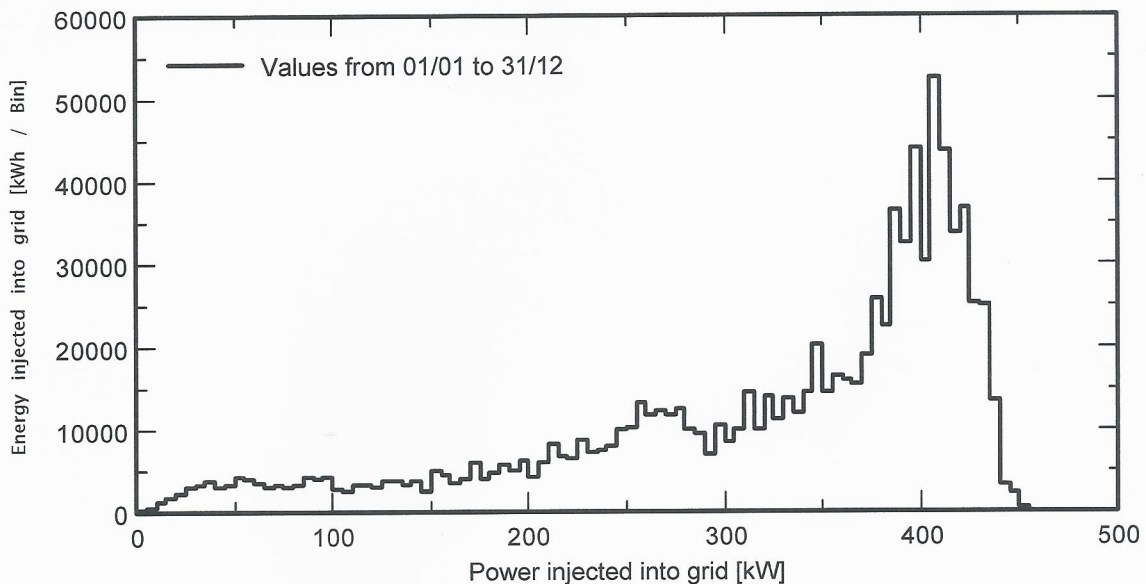
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Daily Input/Output diagram



System Output Power Distribution



Grid-Connected System: Loss diagram

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Loss diagram over the whole year

