

Comune di Gavignano

Comune di Paliano

Comune di Anagni

Committente:

GRUPOTEC SOLAR ITALIA 15 SRL



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PROCEDIMENTO VIA NAZIONALE ai sensi degli artt. 23-24-25 del D.Lgs. 152/06 e s.m.i.

Denominazione progetto:

REALIZZAZIONE IMPIANTO AGRIVOLTAICO "GAVIGNANO"

Potenza nominale complessiva = 16.428,75 kWp

Sito in:

COMUNI DI GAVIGNANO (RM), PALIANO (FR) E ANAGNI (FR)

Titolo elaborato:

Stima di producibilità dell'impianto



Elaborato n. **EL10**

Scala -

Responsabile Coordinamento e revisione progetto : Ing. Nicodemo Agostino

TIMBRI E FIRME:

Progettisti : Grupotec Solar Italia 15 s.r.l.

Collaboratori : -



REV.:	REDAZIONE:	CONTROLLO:	APPROVAZIONE :	DATA:
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PVsyst - Simulation report

Grid-Connected System

Project: Gavignano - Lazio - Italy

Variant: VC2_Gavignano_REV T-B-S-72M-60°-5-SG (AU)

Trackers single array, with backtracking

System power: 16.43 MWp

Gavignano_Lazio - Italy

Author

Grupotec UK (United Kingdom)



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Variant: VC2_Gavignano_REV T-B-S-72M-60°-5-SG (AU)

PVsyst V7.2.12

VC2, Simulation date:
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with v7.2.12

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Project summary

Geographical Site Gavignano_Lazio Italy	Situation Latitude 41.72 °N Longitude 13.07 °E Altitude 211 m Time zone UTC+1	Project settings Albedo 0.20
Meteo data Gavignano_Lazio SolarGIS Monthly aver. , period not spec. - Synthetic		

System summary

Grid-Connected System Simulation for year no 1	Trackers single array, with backtracking		
PV Field Orientation Tracking plane, horizontal N-S axis Axis azimuth 0 °	Near Shadings According to strings Electrical effect 100 %	User's needs Unlimited load (grid)	
System information			
PV Array		Inverters	
Nb. of modules 26286 units		Nb. of units 84 units	
Pnom total 16.43 MWp		Pnom total 14.70 MWac	
		Pnom ratio 1.118	

Results summary

Produced Energy 29298642 kWh/year	Specific production 1783 kWh/kWp/year	Perf. Ratio PR 88.70 %
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General parameters

Grid-Connected System		Trackers single array, with backtracking	
PV Field Orientation		Backtracking strategy	
Orientation		Nb. of trackers	110 units
Tracking plane, horizontal N-S axis		Single array	
Axis azimuth	0 °	Sizes	
		Tracker Spacing	5.00 m
		Collector width	2.47 m
		Ground Cov. Ratio (GCR)	49.3 %
		Left inactive band	0.02 m
		Right inactive band	0.02 m
		Phi min / max.	-/+ 55.0 °
		Backtracking limit angle	
		Phi limits	+/- 59.8 °
Horizon		Near Shadings	
Average Height	3.4 °	According to strings	
		Electrical effect	100 %
Bifacial system		User's needs	
Model	2D Calculation unlimited trackers	Unlimited load (grid)	
Bifacial model geometry		Bifacial model definitions	
Tracker Spacing	5.00 m	Ground albedo	0.15
Tracker width	2.51 m	Bifaciality factor	80 %
GCR	50.1 %	Rear shading factor	10.0 %
Axis height above ground	1.00 m	Rear mismatch loss	2.5 %
		Shed transparent fraction	0.0 %

PV Array Characteristics

PV module		Inverter	
Manufacturer	Jinkosolar	Manufacturer	Huawei Technologies
Model	JKM625N-78HL4-BDV	Model	SUN2000-185KTL-H1@40C
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	625 Wp	Unit Nom. Power	175 kWac
Number of PV modules	26286 units	Number of inverters	84 units
Nominal (STC)	16.43 MWp	Total power	14700 kWac
Modules	1011 Strings x 26 In series	Operating voltage	500-1500 V
At operating cond. (50°C)		Max. power (=>30°C)	185 kWac
Pmpp	15.20 MWp	Pnom ratio (DC:AC)	1.12
U mpp	1101 V		
I mpp	13799 A		
Total PV power		Total inverter power	
Nominal (STC)	16429 kWp	Total power	14700 kWac
Total	26286 modules	Number of inverters	84 units
Module area	73478 m²	Pnom ratio	1.12
Cell area	67701 m²		



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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. 0.43 mΩ

Loss Fraction 0.5 % at STC

LID - Light Induced Degradation

Loss Fraction 1.5 %

Module Quality Loss

Loss Fraction -0.8 %

Module mismatch losses

Loss Fraction 0.9 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

Module average degradation

Year no 1

Loss factor 0.5 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

Vmp RMS dispersion 0.4 %/year

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	0.987	0.969	0.929	0.741	0.000

System losses

Unavailability of the system

Time fraction 1.0 %
3.7 days,
3 periods

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 1.91 % at STC

Inverter: SUN2000-185KTL-H1@40C

Wire section (84 Inv.) Copper 84 x 3 x 10000 mm²

Average wires length 33770 m

MV line up to Injection

MV Voltage 20 kV

Wires Copper 3 x 500 mm²

Length 3300 m

Loss Fraction 0.50 % at STC

AC losses in transformers

MV transfo

Grid voltage 20 kV

Operating losses at STC

Nominal power at STC 16135 kVA

Iron loss (night disconnect) 16.13 kW

Loss Fraction 0.10 % at STC

Coils equivalent resistance 3 x 0.40 mΩ

Loss Fraction 1.00 % at STC



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Horizon definition

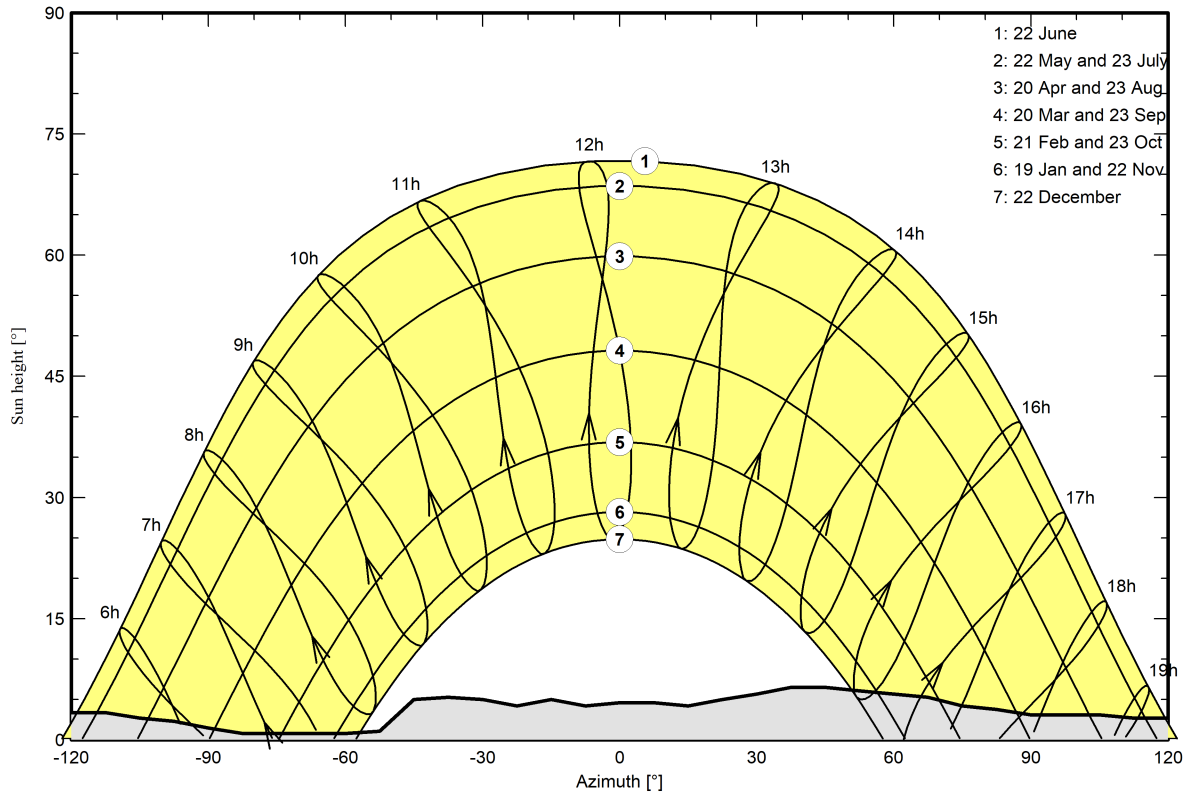
Horizon from PVGIS website API, Lat=41°43'7", Long=13°4'4", Alt=211m

Average Height	3.4 °	Albedo Factor	0.80
Diffuse Factor	0.95	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-173	-165	-158	-150	-143	-135	-128	-120	-113	-105	-98	-90	-83
Height [°]	1.9	3.1	4.2	3.8	3.4	3.4	3.1	3.1	3.4	3.4	2.7	2.3	1.5	0.8
Azimuth [°]	-60	-53	-45	-38	-30	-23	-15	-8	0	8	15	23	30	38
Height [°]	0.8	1.1	5.0	5.3	5.0	4.2	5.0	4.2	4.6	4.6	4.2	5.0	5.7	6.5
Azimuth [°]	45	53	60	68	75	83	90	105	113	143	158	173	180	
Height [°]	6.5	6.1	5.7	5.3	4.2	3.8	3.1	3.1	2.7	2.7	1.5	1.5	1.9	

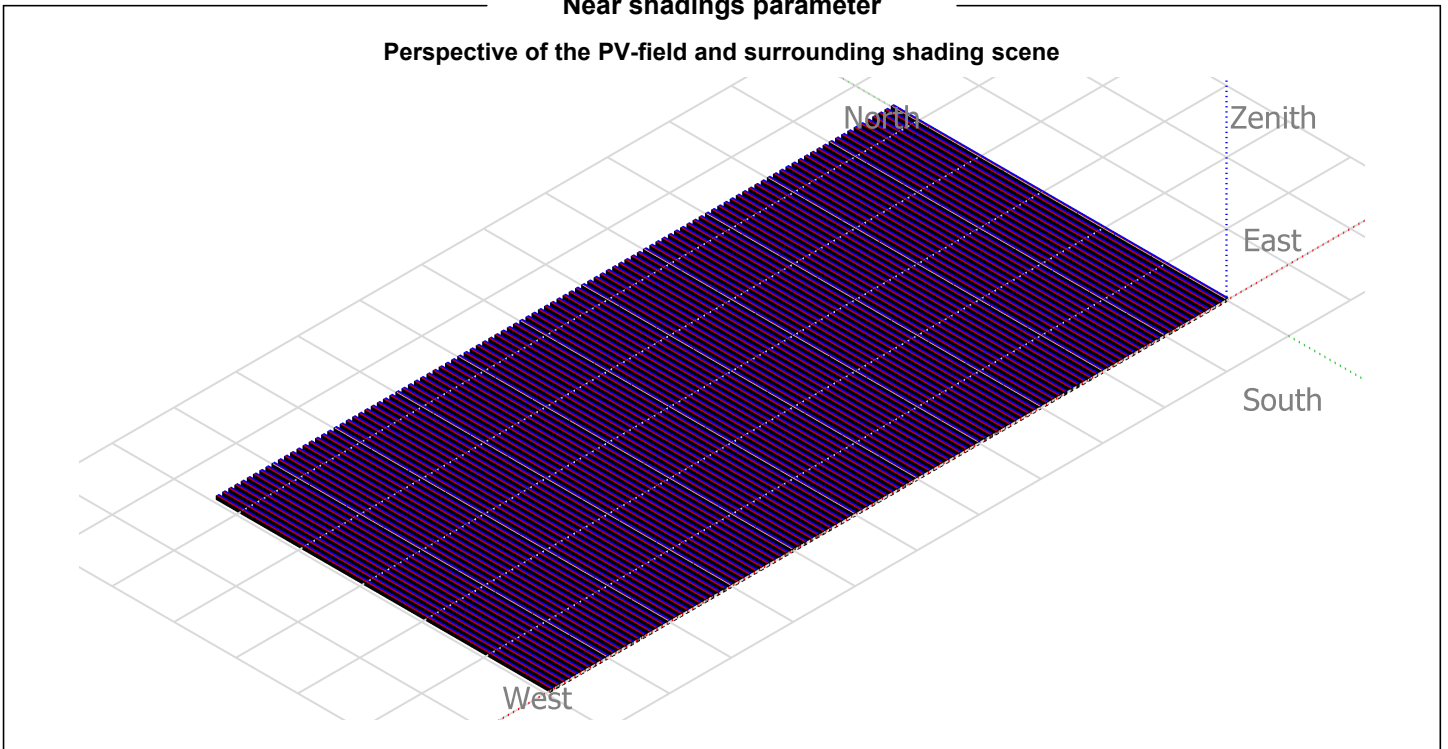
Sun Paths (Height / Azimuth diagram)





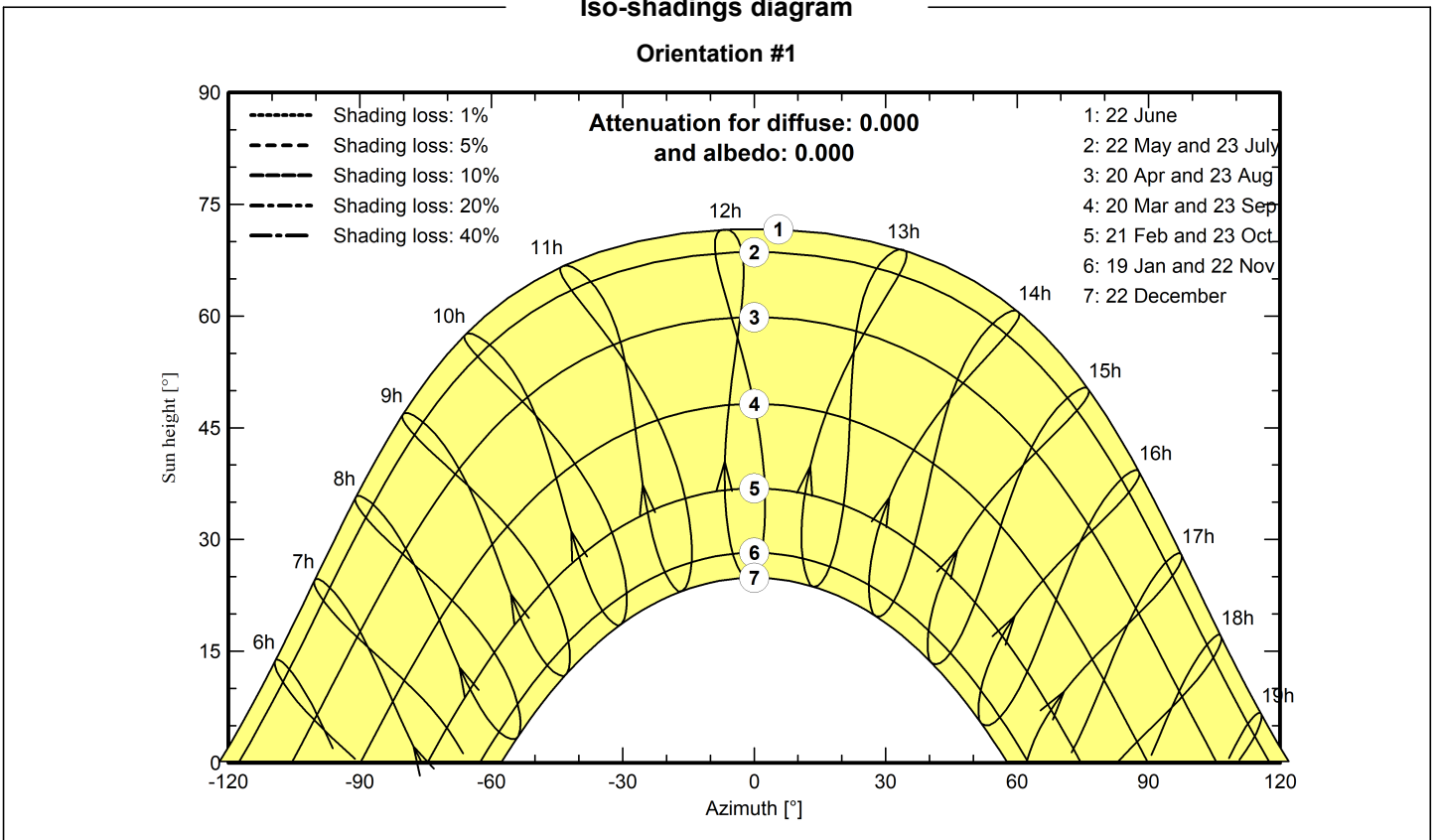
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1





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Main results

System Production

Produced Energy 29298642 kWh/year

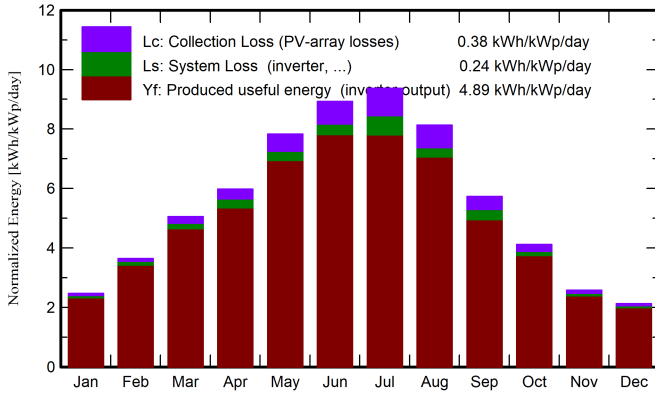
Specific production

1783 kWh/kWp/year

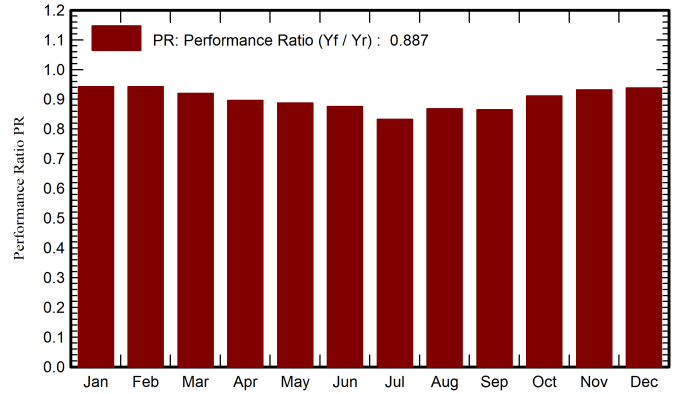
Performance Ratio PR

88.70 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

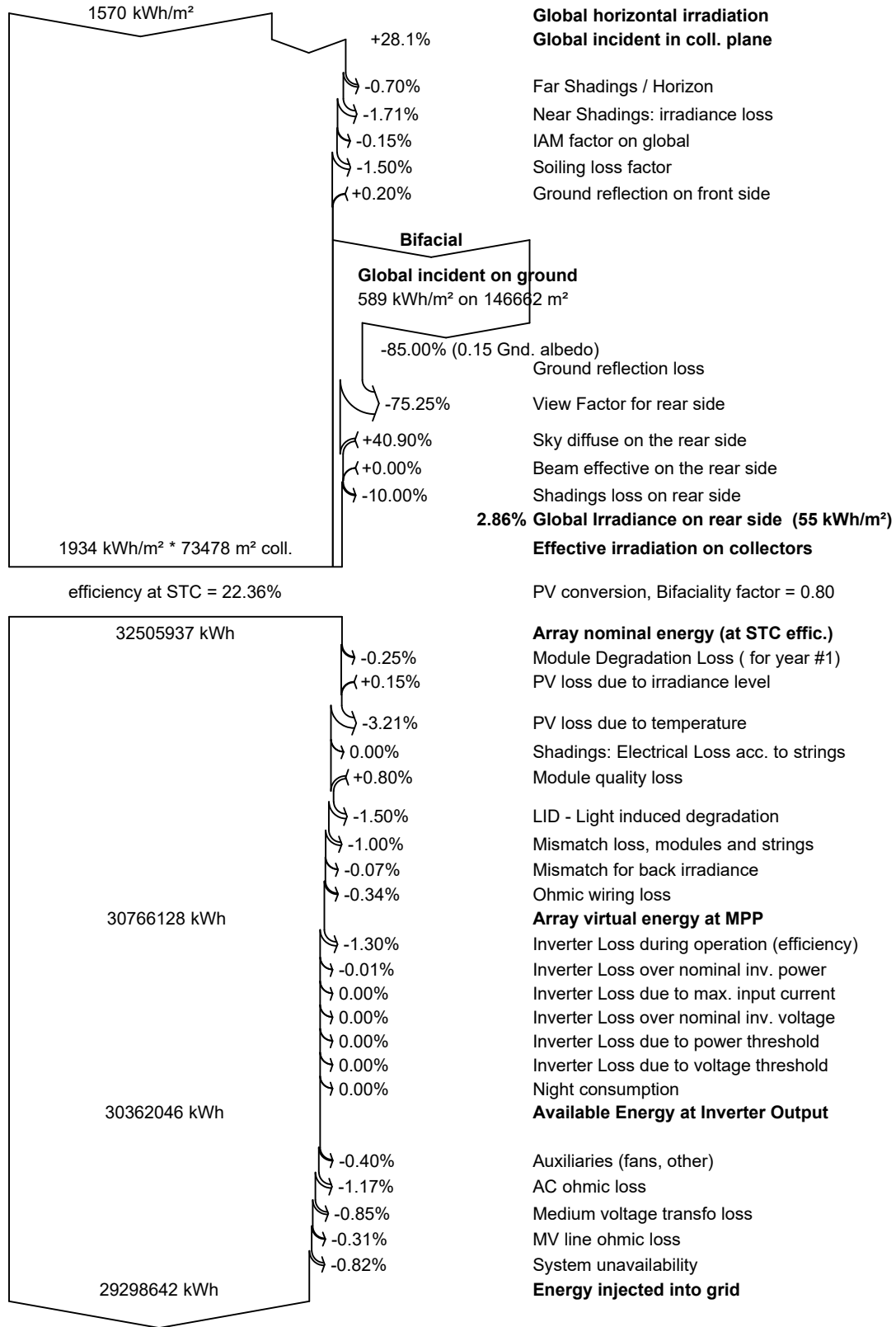
	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray kWh	E_Grid kWh	PR ratio
January	58.0	25.00	6.30	76.7	73.1	1226598	1187445	0.942
February	78.0	31.00	6.40	102.0	97.9	1635640	1579601	0.943
March	123.0	51.00	8.80	156.7	150.5	2465098	2368872	0.920
April	145.0	64.00	11.40	179.3	172.1	2786092	2640295	0.896
May	191.0	77.00	16.60	242.8	233.6	3696647	3540801	0.888
June	209.0	76.00	21.10	267.8	258.6	4027365	3854873	0.876
July	225.0	72.00	24.20	290.5	280.7	4305547	3975562	0.833
August	195.0	68.00	23.80	252.1	243.5	3757144	3598299	0.869
September	136.0	57.00	19.00	172.0	165.1	2611461	2444401	0.865
October	100.0	43.00	15.30	127.7	122.4	1982791	1911989	0.912
November	60.0	28.00	10.60	77.2	73.8	1221597	1181368	0.931
December	50.0	22.00	7.40	65.9	62.7	1047869	1015137	0.938
Year	1570.0	614.00	14.29	2010.6	1933.9	30763850	29298642	0.887

Legends

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



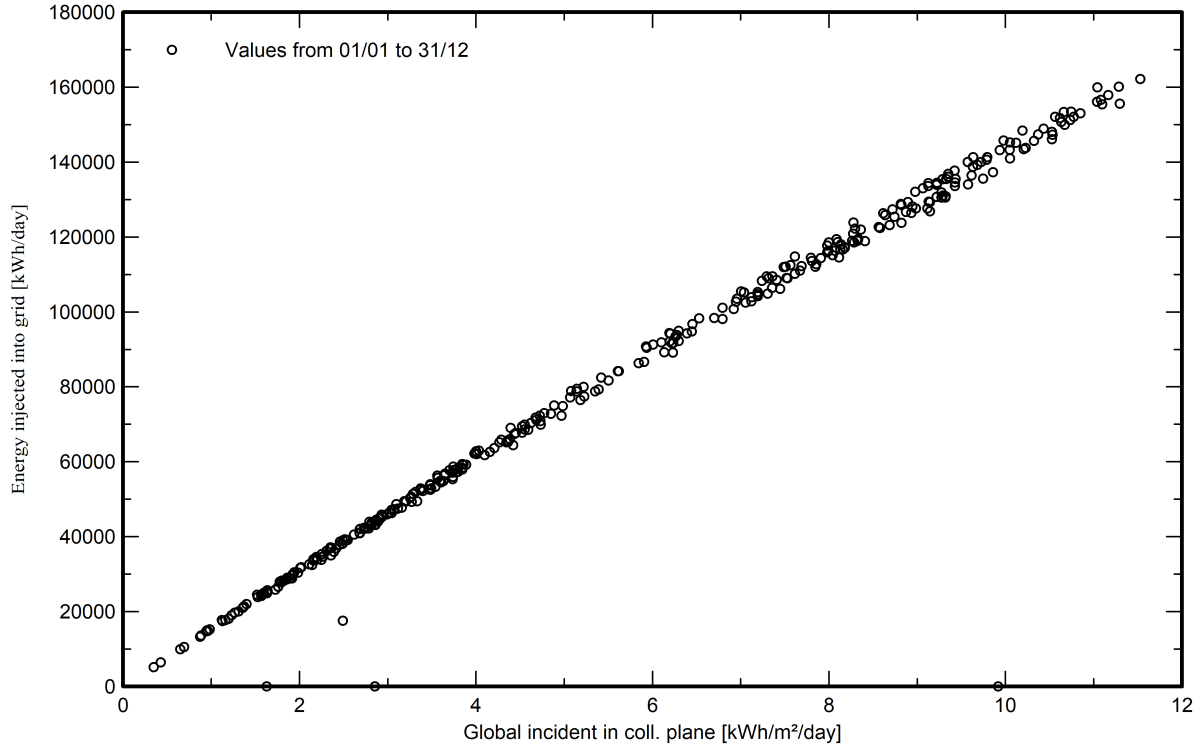
Loss diagram





Special graphs

Daily Input/Output diagram



System Output Power Distribution

