



Progetto definitivo impianto fotovoltaico a terra di potenza pari 3,5 MWp Gulfa 1
Virgo Gamma S.r.l.

Contrada Gulfa Grande snc - 92018 Santa Margherita di Belice (AG)
Istanza di PAS art.6 D.Lgs 28/2011 e Regolamento di cui al D.P. Regione Sicilia n.48/2012

I professionisti

Maggia P.I. Filippo

Ordine dei Periti Industriali delle Province
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n. 1169A

Numero elaborato

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Commessa

G1588F

Scala

-

Nome file

RS12REL0005A0

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Titolo

Calcolo di produzione fotovoltaica

N.rev	Nota di revisione	Dis.	Contr.	Aprr.	Data
00	Prima emissione	-	-	-	Aprile 2024

PVsyst - Simulation report

Grid-Connected System

Project: GF_IT_02_Gulfa 3

Variant: FT_area available

Ground system (tables) on a hill

System power: 3522 kWp

Sambuca di Sicilia - Italy

Author

Obton Austria GmbH (Austria)



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Project summary

Geographical Site		Situation		Project settings	
Sambuca di Sicilia		Latitude	37.68 °N	Albedo	0.20
Italy		Longitude	13.07 °E		
		Altitude	241 m		
		Time zone	UTC+1		
Meteo data					
Santa Margherita di Belice					
Solcast TMY					

System summary

Grid-Connected System		Ground system (tables) on a hill		User's needs	
PV Field Orientation		Near Shadings		Unlimited load (grid)	
Fixed plane		According to strings : Fast (table)			
Tilt/Azimuth	28.1 / -12.2 °	Electrical effect	100 %		
System information					
PV Array					
Nb. of modules		5068 units	Inverters	Nb. of units	14 units
Pnom total		3522 kWp		Pnom total	2725 kWac
				Pnom ratio	1.293

Results summary

Produced Energy	5947340 kWh/year	Specific production	1689 kWh/kWp/year	Perf. Ratio PR	89.22 %
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General parameters

Grid-Connected System		Ground system (tables) on a hill	
PV Field Orientation		Sheds configuration	
Orientation		Nb. of sheds	100 units
Fixed plane		Identical arrays	
Tilt/Azimuth	28.1 / -12.2 °	Sizes	
		Sheds spacing	10.0 m
		Collector width	4.79 m
		Ground Cov. Ratio (GCR)	47.9 %
		Shading limit angle	
		Limit profile angle	21.3 °
Horizon		Near Shadings	
Average Height	4.3 °	According to strings : Fast (table)	
		Electrical effect	100 %
Bifacial system		User's needs	
Model	2D Calculation unlimited sheds	Unlimited load (grid)	
Bifacial model geometry		Bifacial model definitions	
Sheds spacing	10.00 m	Ground albedo	0.20
Sheds width	4.79 m	Bifaciality factor	85 %
Limit profile angle	21.3 °	Rear shading factor	15.0 %
GCR	47.9 %	Rear mismatch loss	5.0 %
Height above ground	0.50 m	Shed transparent fraction	0.0 %

PV Array Characteristics

Array #1 - PV Array			
PV module			
Manufacturer	Risen Energy Co., Ltd	Inverter	
Model	RSM132-8-695BHDG	Manufacturer	Huawei Technologies
(Custom parameters definition)		Model	SUN2000-215KTL-H0
		(Original PVsyst database)	
Unit Nom. Power	695 Wp	Unit Nom. Power	200 kWac
Number of PV modules	4088 units	Number of inverters	11 units
Nominal (STC)	2841 kWp	Total power	2200 kWac
Modules	146 string x 28 In series	Operating voltage	550-1500 V
At operating cond. (50°C)		Max. power (=>30°C)	215 kWac
Pmpp	2678 kWp	Pnom ratio (DC:AC)	1.29
U mpp	1078 V	Power sharing within this inverter	
I mpp	2483 A		
Array #2 - Sub-array #2			
PV module			
Manufacturer	Risen Energy Co., Ltd	Inverter	
Model	RSM132-8-695BHDG	Manufacturer	Huawei Technologies
(Custom parameters definition)		Model	SUN2000-185KTL-H1
		(Original PVsyst database)	
Unit Nom. Power	695 Wp	Unit Nom. Power	175 kWac
Number of PV modules	980 units	Number of inverters	3 units
Nominal (STC)	681 kWp	Total power	525 kWac
Modules	35 string x 28 In series	Operating voltage	550-1500 V
At operating cond. (50°C)		Max. power (=>30°C)	185 kWac
Pmpp	642 kWp	Pnom ratio (DC:AC)	1.30
U mpp	1078 V	Power sharing within this inverter	
I mpp	595 A		



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PV Array Characteristics

Total PV power

Nominal (STC) 3522 kWp
Total 5068 modules
Module area 15743 m²
Cell area 14751 m²

Total inverter power

Total power 2725 kWac
Max. power 2920 kWac
Number of inverters 14 units
Pnom ratio 1.29

Array losses

Array Soiling Losses

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

LID - Light Induced Degradation

Loss Fraction 0.4 %

Module Quality Loss

Loss Fraction -0.4 %

Module mismatch losses

Loss Fraction 1.0 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

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

DC wiring losses

Global wiring resistance 2.6 mΩ
Loss Fraction 0.7 % at STC

Array #1 - PV Array

Global array res. 3.3 mΩ
Loss Fraction 0.7 % at STC

Array #2 - Sub-array #2

Global array res. 14 mΩ
Loss Fraction 0.7 % at STC

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 2.00 % at STC

Inverters: SUN2000-215KTL-H0, SUN2000-185KTL-H1

Wire section (14 Inv.) Copper 14 x 3 x 95 mm²
Average wires length 261 m

MV line up to Injection

MV Voltage 20 kV
Wires Alu 3 x 185 mm²
Length 500 m
Loss Fraction 0.07 % at STC



AC losses in transformers

MV transfo

Medium voltage 20 kV

Transformer parameters

Nominal power at STC 3.48 MVA

Iron Loss (night disconnect) 3.45 kVA

Iron loss fraction 0.10 % at STC

Copper loss 34.82 kVA

Copper loss fraction 1.00 % at STC

Coils equivalent resistance 3 x 1.84 mΩ



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Horizon definition

Horizon from PVGIS website API, Lat=37°40'31', Long=13°4'20', Alt=241m

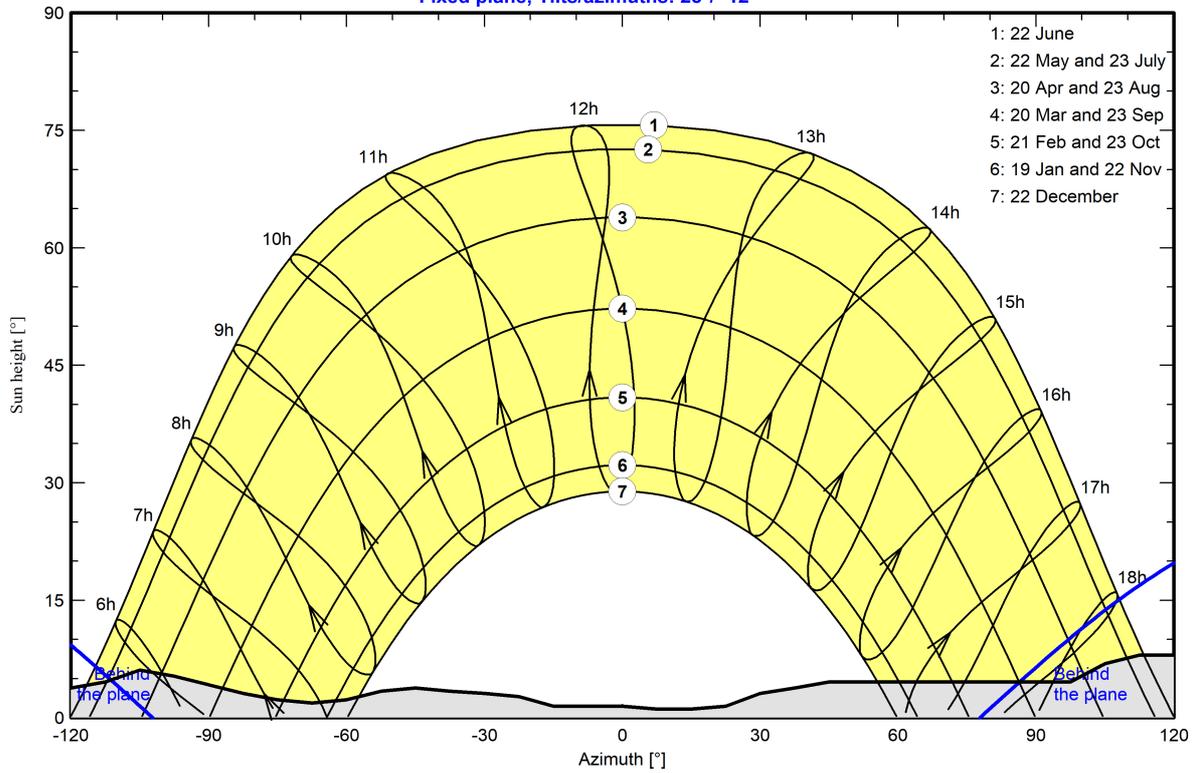
Average Height	4.3 °	Albedo Factor	0.88
Diffuse Factor	0.98	Albedo Fraction	100 %

Horizon profile

Azimuth [°]	-180	-143	-135	-128	-120	-113	-105	-98	-90	-83	-75	-68	-60
Height [°]	3.8	3.8	4.2	4.2	3.8	4.6	6.1	5.3	4.2	3.1	2.3	1.9	2.3
Azimuth [°]	-53	-45	-38	-30	-23	-15	0	8	15	23	30	38	45
Height [°]	3.4	3.8	3.4	3.1	2.7	1.5	1.5	1.1	1.1	1.5	3.1	3.8	4.6
Azimuth [°]	98	105	113	120	128	135	150	158	165	173	180		
Height [°]	4.6	6.9	8.0	8.0	8.4	8.8	8.8	7.3	5.3	4.6	3.8		

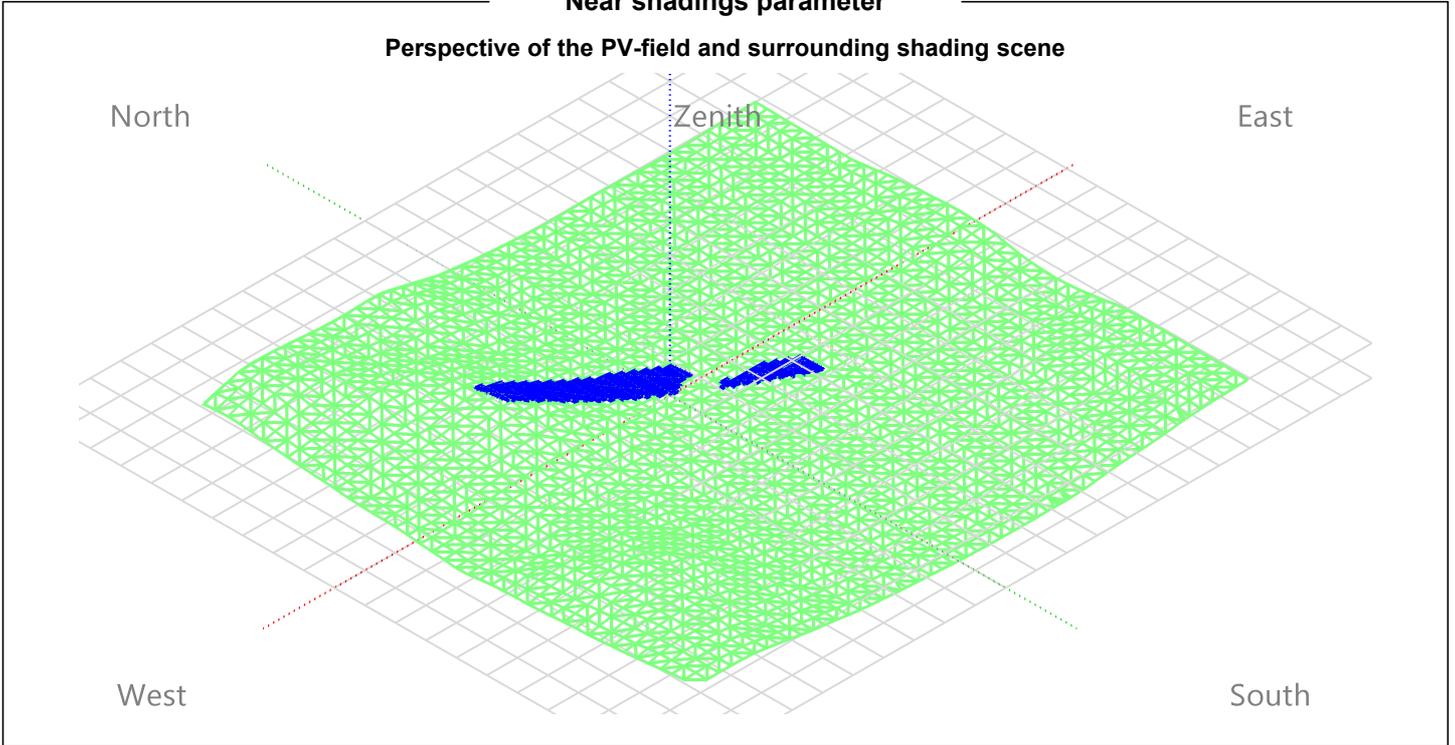
Sun Paths (Height / Azimuth diagram)

Fixed plane, Tilts/azimuths: 28°/-12°





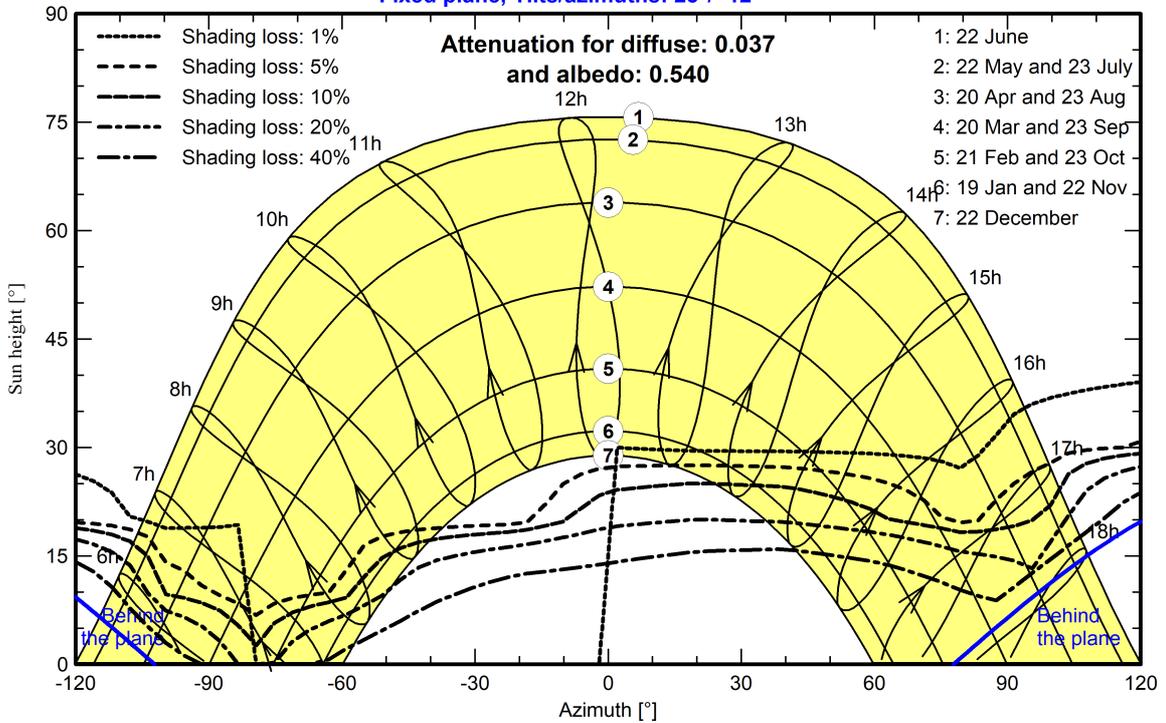
Near shadings parameter



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 28°/-12°





Main results

System Production

Produced Energy 5947340 kWh/year

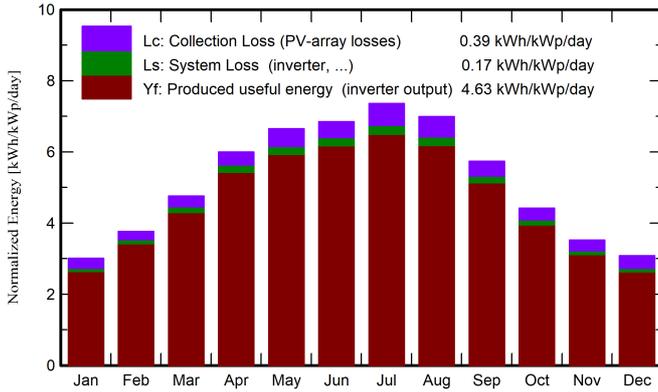
Specific production

1689 kWh/kWp/year

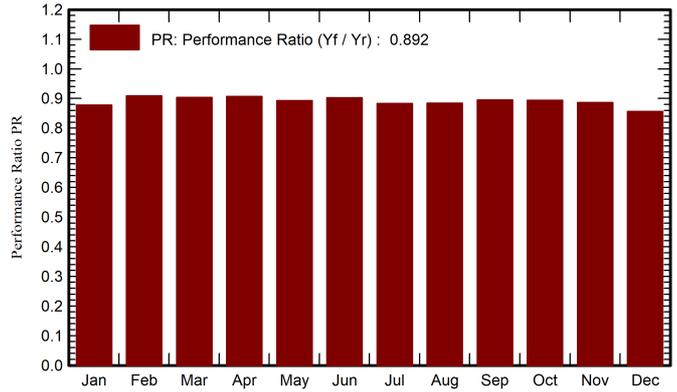
Perf. Ratio PR

89.22 %

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	60.9	30.24	10.80	93.2	85.3	298146	288325	0.878
February	77.4	37.76	11.79	105.4	98.4	349476	337589	0.909
March	124.3	56.15	12.35	147.7	139.0	487565	470148	0.904
April	166.7	64.74	14.89	179.8	170.0	595902	574263	0.907
May	209.4	74.25	18.59	206.1	194.6	672895	648260	0.893
June	216.1	56.20	22.77	205.4	194.6	677445	652543	0.902
July	235.7	58.01	24.86	228.1	216.4	737405	709765	0.883
August	206.1	52.11	25.13	216.8	205.9	701704	675190	0.884
September	147.8	60.50	23.29	172.1	162.4	562483	542580	0.895
October	105.2	48.75	18.50	136.9	128.3	446963	431273	0.894
November	71.0	33.48	15.80	105.6	97.7	340809	329605	0.887
December	59.6	27.95	11.99	95.5	86.7	297867	287797	0.856
Year	1680.1	600.14	17.59	1892.5	1779.3	6168661	5947340	0.892

Legends

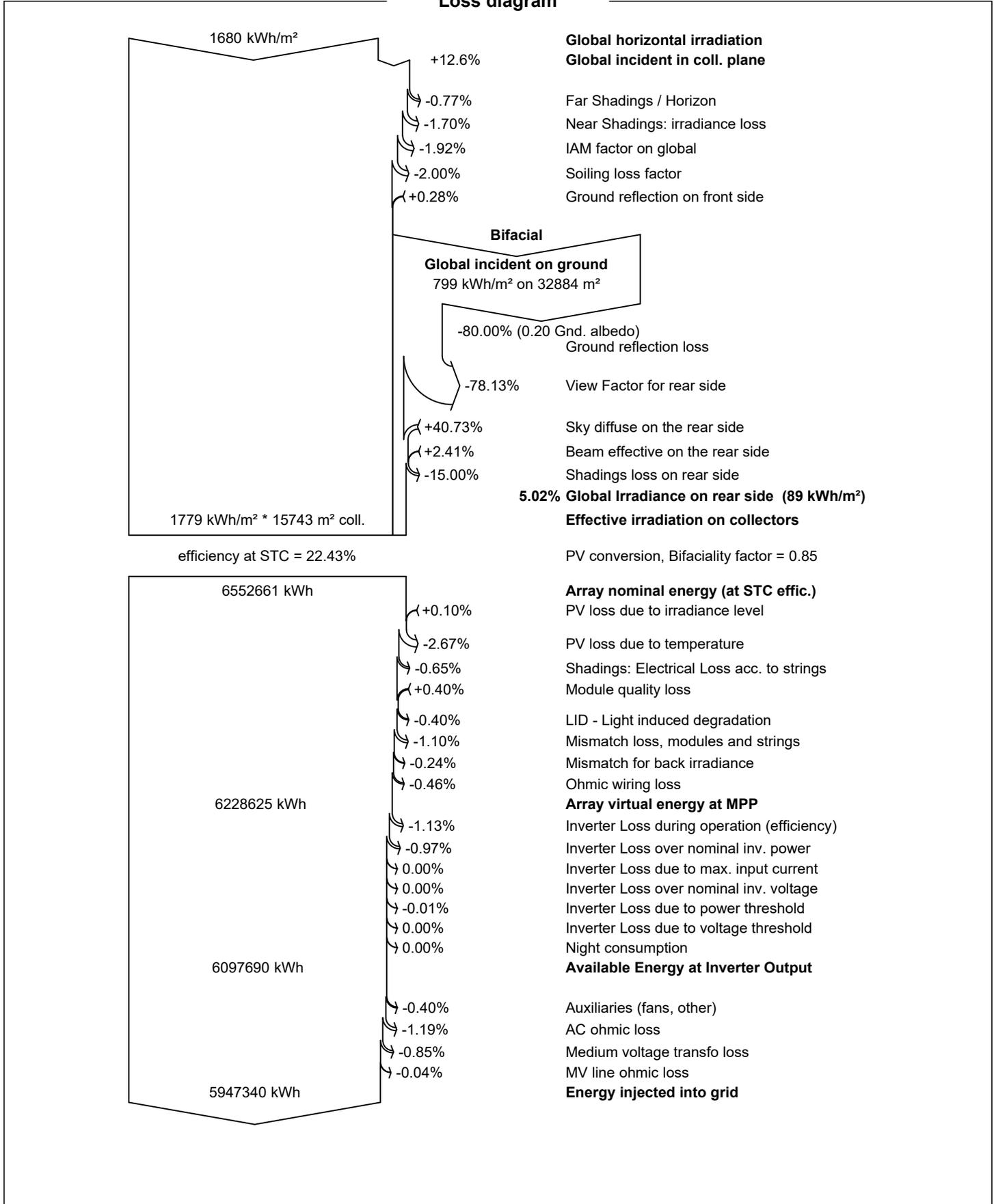
- GlobHor Global horizontal irradiation
- DiffHor Horizontal diffuse irradiation
- T_Amb Ambient Temperature
- GlobInc Global incident in coll. plane
- GlobEff Effective Global, corr. for IAM and shadings
- EArray Effective energy at the output of the array
- E_Grid Energy injected into grid
- PR Performance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



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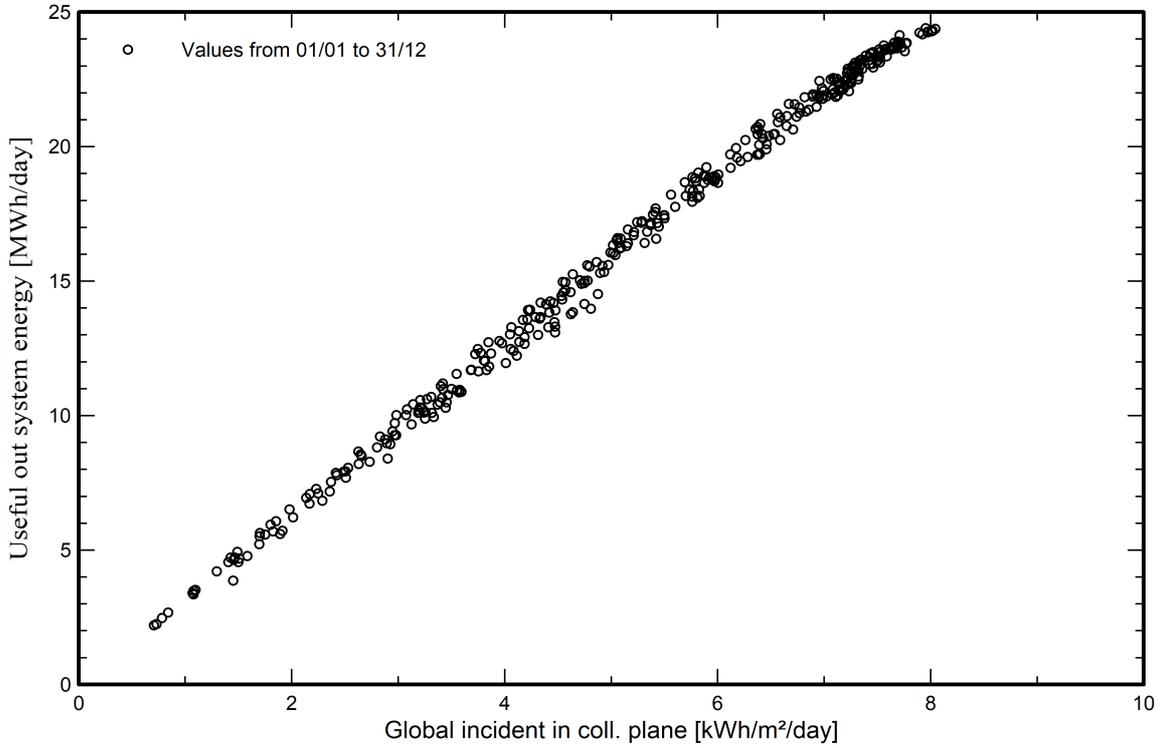
Loss diagram



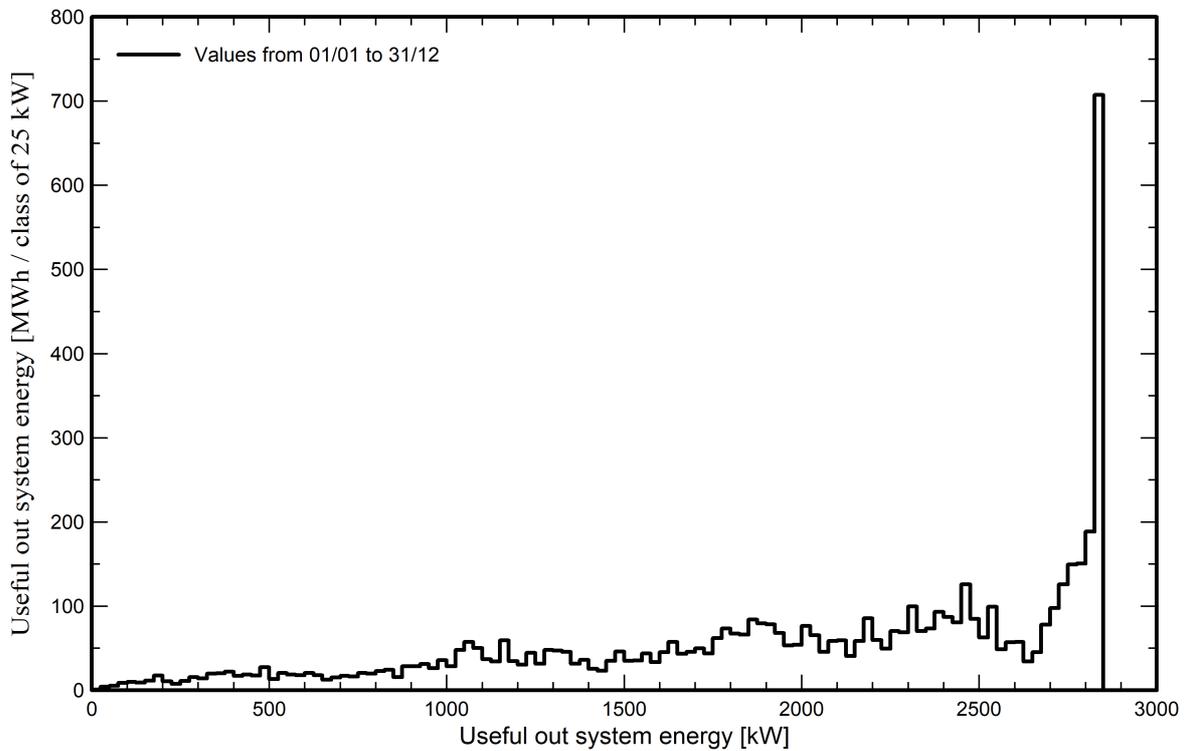


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution

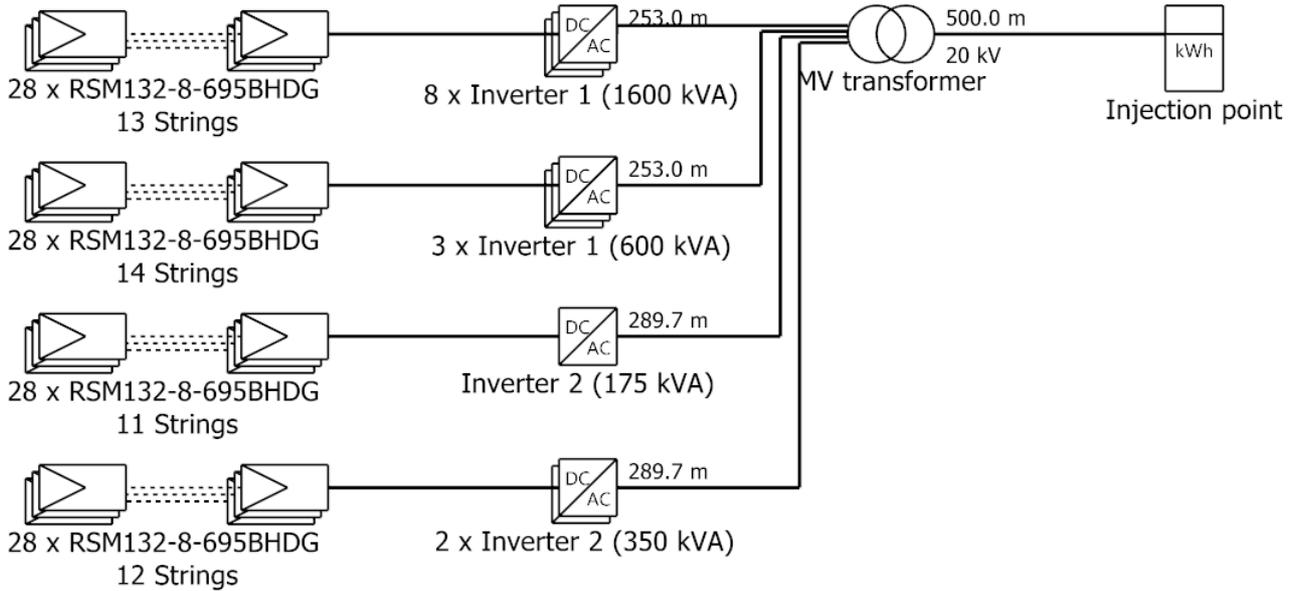




Single-line diagram

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PV module	RSM132-8-695BHDG
Inverter 1	SUN2000-215KTL-H0
Inverter 2	SUN2000-185KTL-H1
String	28 x RSM132-8-695BHDG

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VC9 : FT_area available

11/11/23