



CITTA' DI SAN SEVERO



CITTA' DI FOGGIA



COMUNE DI LUCERA

**prov. di Foggia
REGIONE PUGLIA**

Impianto Agrivoltaico "SAN SEVERO"

della potenza di 32,642 MW in DC ubicato nel Comune di San Severo e relative opere di connessione ricadenti anche nei territori di Foggia e Lucera

PROGETTO DEFINITIVO

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IL PRESIDENTE
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PD

PROGETTO DEFINITIVO

RELAZIONE DI PRODUCIBILITA' DELL'IMPIANTO

Tavola: **RE18**

Filename:
TKA999-PD-SSR San Severo_Project\VC1-Report.pdf

Data 1°emissione: Marzo 2024	Redatto: G.PISANI	Verificato: G.PERTOSO	Approvato: R.PERTOSO	Scala:	Protocollo Tekne:
n° revisione					TKA999
1					
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3					
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PVsyst - Simulation report

Grid-Connected System

Project: SSR San Severo

Variant: SSR-1P Agri PV-01

Tracking system with backtracking

System power: 32.64 MWp

SSR_MN7_SolarGIS - Italy

Author

GroenLeven (Germany)



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Project summary

Geographical Site SSR_MN7_SolarGIS Italy	Situation Latitude 41.58 °N Longitude 15.47 °E Altitude 49 m Time zone UTC+1	Project settings Albedo 0.20
Meteo data SSR_MN7_SolarGIS MN7_SolarGIS - Synthetic		

System summary

Grid-Connected System	Tracking system with backtracking	
PV Field Orientation Orientation Tracking plane, tilted axis Avg axis tilt -0.1 ° Avg axis azim. 0 °	Tracking algorithm Astronomic calculation Backtracking activated	Near Shadings According to strings : Fast (table) Electrical effect 100 % Diffuse shading Automatic
System information PV Array Nb. of modules 51813 units Pnom total 32.64 MWp	Inverters Nb. of units 97 units Pnom total 27.90 MWac Grid power limit 27.90 MWac Grid lim. Pnom ratio 1.170	
User's needs Unlimited load (grid)		

Results summary

Produced Energy 59704238 kWh/year	Specific production 1829 kWh/kWp/year	Perf. Ratio PR 90.26 %
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General parameters

Grid-Connected System		Tracking system with backtracking	
PV Field Orientation		Tracking algorithm	Backtracking array
Orientation		Astronomic calculation	Nb. of trackers 727 units
Tracking plane, tilted axis		Backtracking activated	Sizes
Avg axis tilt -0.1 °			Tracker Spacing 10.6 m
Avg axis azim. 0 °			Collector width 2.38 m
			Ground Cov. Ratio (GCR) 22.5 %
			Phi min / max. +/- 50.0 °
			Backtracking strategy
			Phi limits for BT +/- 77.0 °
			Backtracking pitch 10.6 m
			Backtracking width 2.38 m
			Mode Automatic
Models used		Near Shadings	User's needs
Transposition Perez		According to strings : Fast (table)	Unlimited load (grid)
Diffuse Perez, Meteonorm		Electrical effect 100 %	
Circumsolar separate		Diffuse shading Automatic	
Horizon			
Average Height 1.0 °			
Bifacial system			
Model 2D Calculation			
	unlimited trackers		
Bifacial model geometry		Bifacial model definitions	
Tracker Spacing 10.60 m		Ground albedo 0.15	
Tracker width 2.38 m		Bifaciality factor 78 %	
GCR 22.5 %		Rear shading factor 5.0 %	
Axis height above ground 2.10 m		Rear mismatch loss 10.0 %	
		Shed transparent fraction 5.0 %	
Grid power limitation			
Active power 27.90 MWac			
Pnom ratio 1.170			

PV Array Characteristics

Array #1 - PV Array 300kW inverters			
PV module		Inverter	
Manufacturer JA Solar		Manufacturer huawei technologies	
Model JAM66D45-630/LB		Model SUN2000-330KTL-H1	
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power 630 Wp		Unit Nom. Power 300 kWac	
Number of PV modules 47493 units		Number of inverters 85 units	
Nominal (STC) 29.92 MWp		Total power 25500 kWac	
Modules 1759 string x 27 In series		Operating voltage 500-1500 V	
At operating cond. (50°C)		Max. power (=>25°C) 330 kWac	
Pmpp 27.69 MWp		Pnom ratio (DC:AC) 1.17	
U mpp 1011 V		Power sharing within this inverter	
I mpp 27384 A			



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PV Array Characteristics

Array #2 - PV Array 200kW inverters		Inverter	
PV module		Manufacturer	Huawei Technologies
Manufacturer	JA Solar	Model	SUN2000-215KTL-H0
Model	JAM66D45-630/LB		
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	630 Wp	Unit Nom. Power	200 kWac
Number of PV modules	4320 units	Number of inverters	12 units
Nominal (STC)	2722 kWp	Total power	2400 kWac
Modules	160 string x 27 In series	Operating voltage	500-1500 V
At operating cond. (50°C)		Max. power (=>25°C)	215 kWac
Pmpp	2519 kWp	Pnom ratio (DC:AC)	1.13
U mpp	1011 V	Power sharing within this inverter	
I mpp	2491 A		
Total PV power		Total inverter power	
Nominal (STC)	32642 kWp	Total power	27900 kWac
Total	51813 modules	Max. power	30630 kWac
Module area	139957 m ²	Number of inverters	97 units
		Pnom ratio	1.17

Array losses

Array Soiling Losses		Thermal Loss factor		Serie Diode Loss			
Loss Fraction	3.0 %	Module temperature according to irradiance		Voltage drop	0.7 V		
		Uc (const)	29.0 W/m ² K	Loss Fraction	0.1 % at STC		
		Uv (wind)	0.0 W/m ² K/m/s				
LID - Light Induced Degradation		Module Quality Loss		Module mismatch losses			
Loss Fraction	0.5 %	Loss Fraction	-0.3 %	Loss Fraction	0.5 % at MPP		
Strings Mismatch loss							
Loss Fraction	0.1 %						
IAM loss factor							
Incidence effect (IAM): User defined profile							
0°	60°	65°	70°	75°	80°	85°	90°
1.000	1.000	0.988	0.965	0.942	0.874	0.744	0.000

DC wiring losses

Global wiring resistance	0.37 mΩ		
Loss Fraction	1.0 % at STC		
Array #1 - PV Array 300kW inverters		Array #2 - PV Array 200kW inverters	
Global array res.	0.41 mΩ	Global array res.	4.5 mΩ
Loss Fraction	1.0 % at STC	Loss Fraction	1.0 % at STC



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AC wiring losses

Inv. output line up to MV transfo

Inverter voltage 800 Vac tri
Loss Fraction 1.00 % at STC

Inverter: SUN2000-330KTL-H1

Wire section (85 Inv.) Alu 85 x 3 x 240 mm²
Average wires length 141 m

Inverter: SUN2000-215KTL-H0

Wire section (12 Inv.) Alu 12 x 3 x 120 mm²
Average wires length 110 m

MV line up to Injection

MV Voltage 30 kV
Average each inverter
Wires Alu 3 x 95 mm²
Length 7150 m
Loss Fraction 0.50 % at STC

AC losses in transformers

MV transfo

Medium voltage 30 kV

One transfo parameters

Nominal power at STC 1.90 MVA
Iron Loss (24/24 Connexion) 1.42 kVA
Iron loss fraction 0.08 % at STC
Copper loss 15.23 kVA
Copper loss fraction 0.80 % at STC
Coils equivalent resistance 3 x 2.71 mΩ

Operating losses at STC (full system)

Nb. identical MV transfos 17
Nominal power at STC 32.24 MVA
Iron loss (24/24 Connexion) 24.18 kVA
Copper loss 258.86 kVA



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Horizon definition

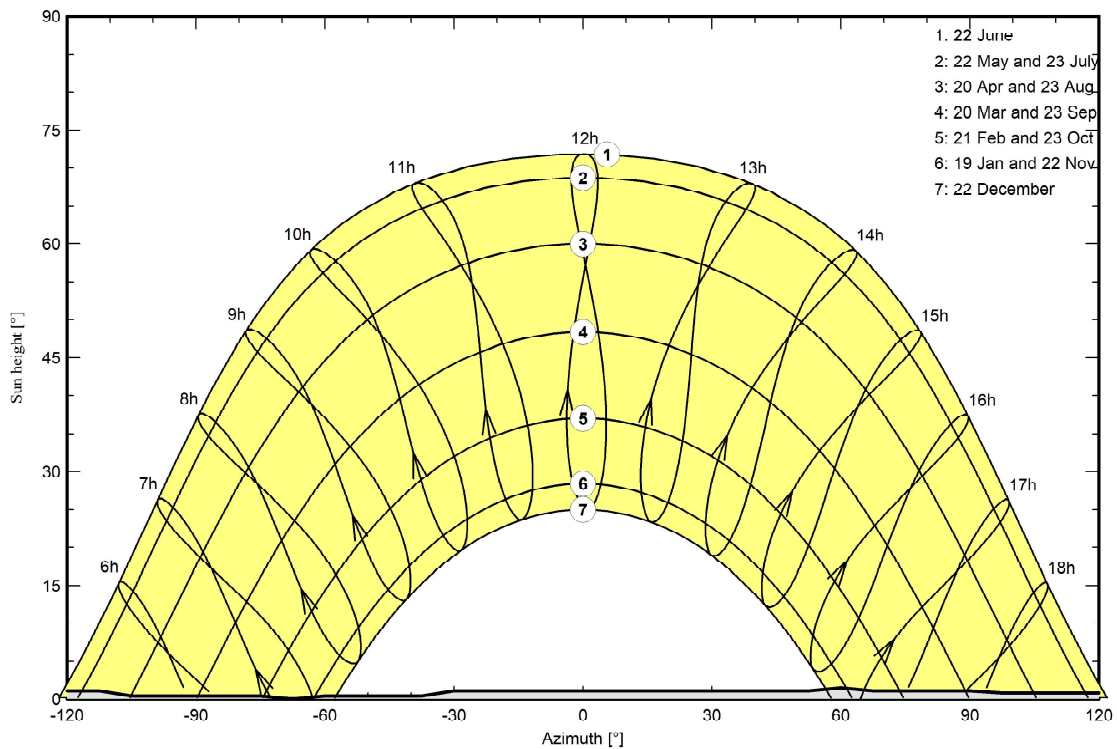
Horizon from PVGIS website API, Lat=41°34'30", Long=15°28'26", Alt=49m

Average Height	1.0 °	Albedo Factor	0.95
Diffuse Factor	1.00	Albedo Fraction	100 %

Horizon profile

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

Sun Paths (Height / Azimuth diagram)



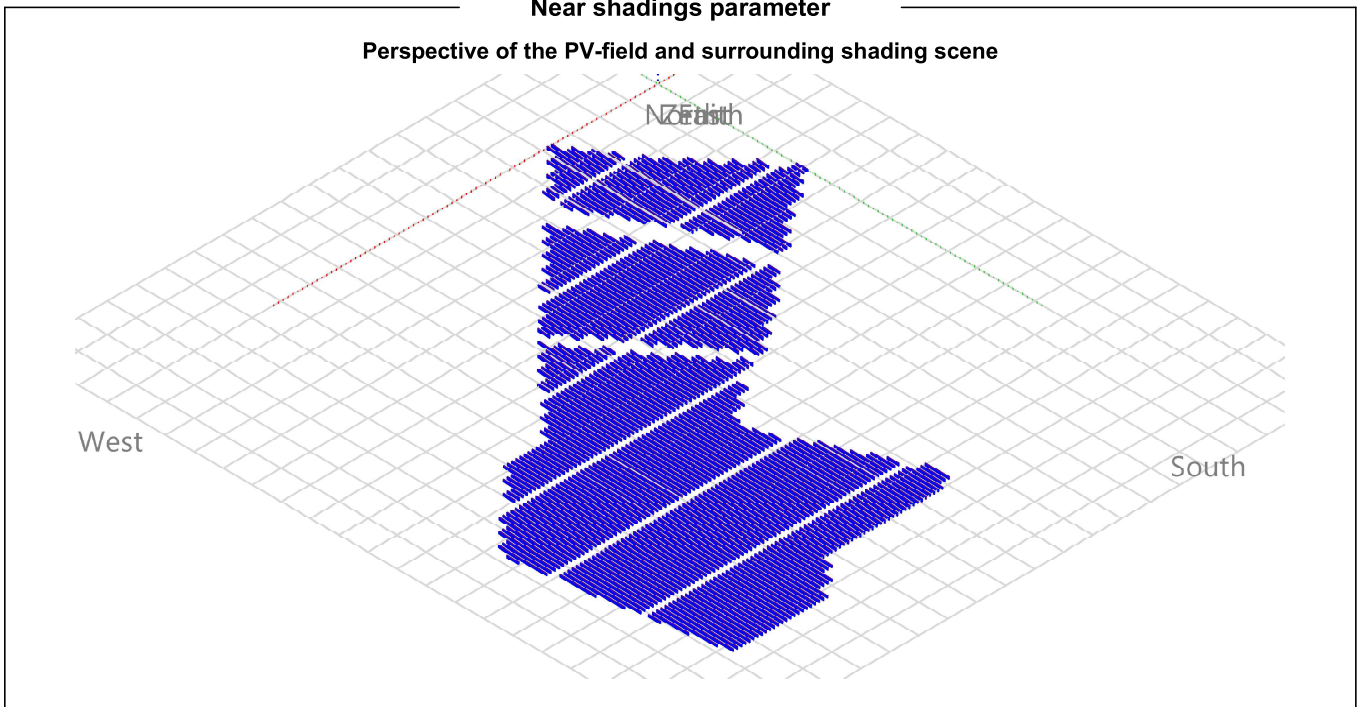


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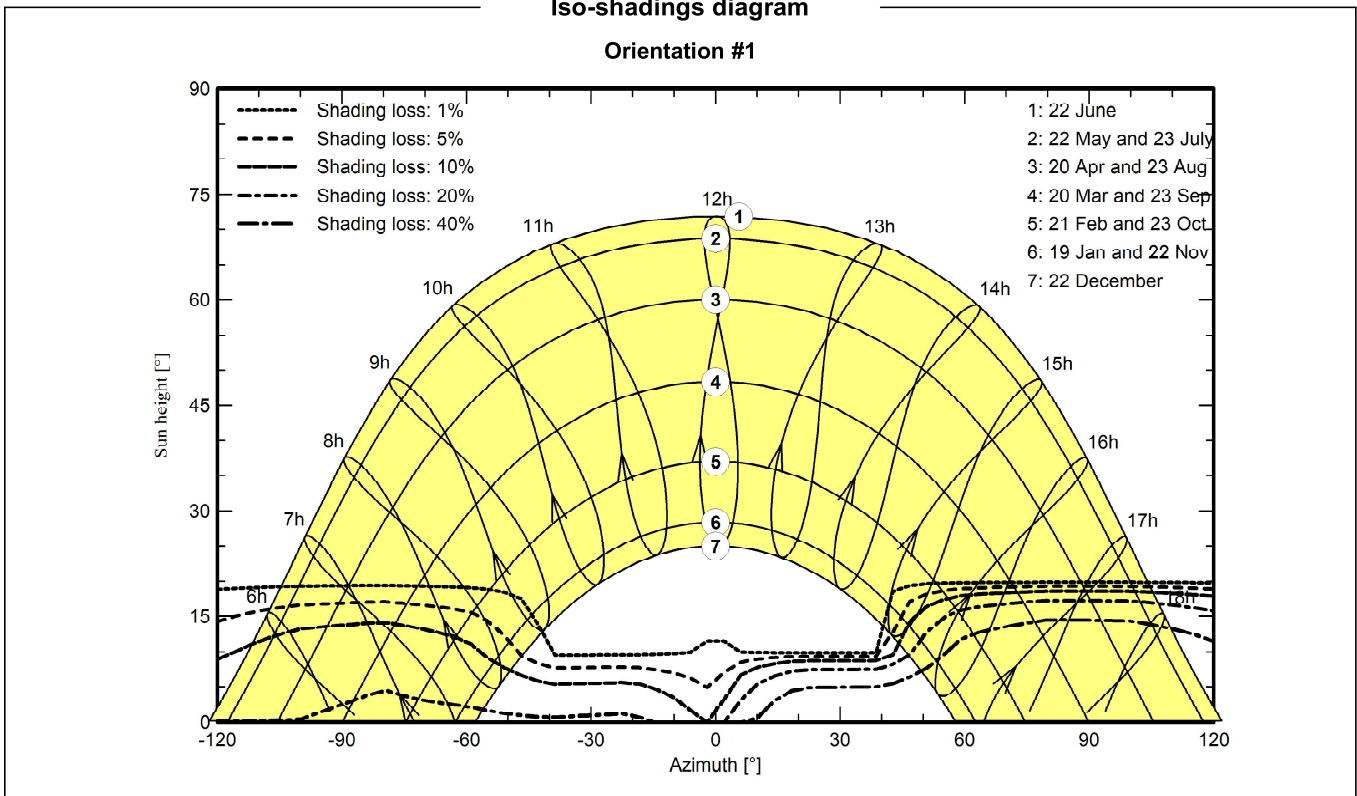
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1





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Main results

System Production

Produced Energy 59704238 kWh/year

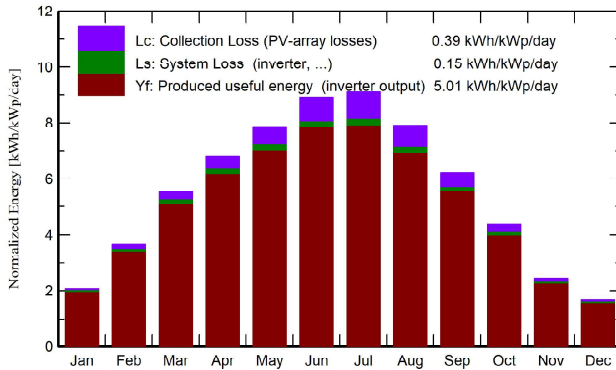
Specific production

1829 kWh/kWp/year

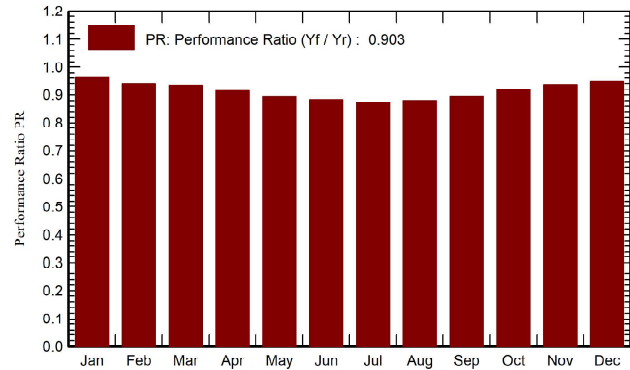
Perf. Ratio PR

90.26 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

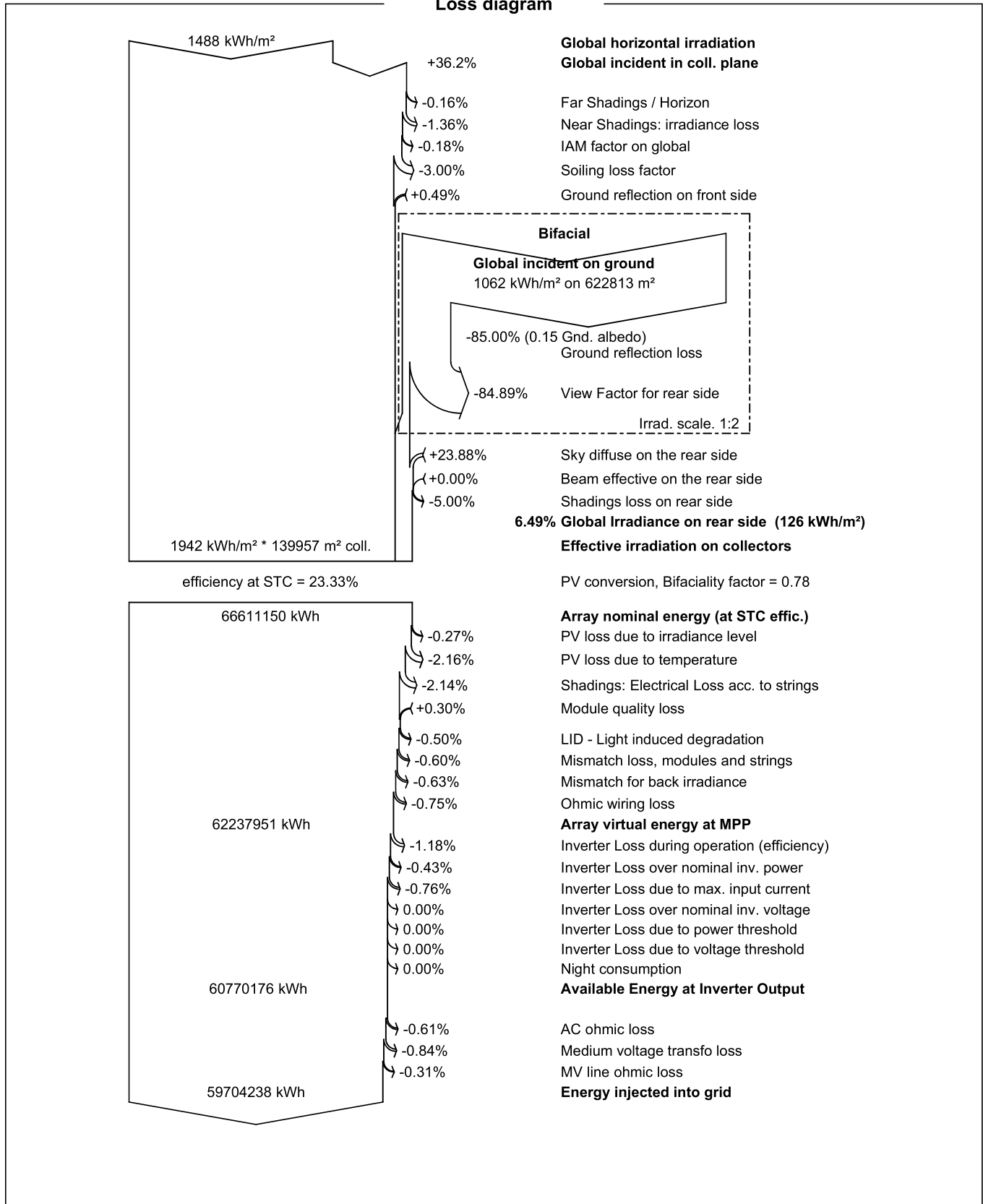
	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray kWh	E_Grid kWh	PR ratio
January	47.5	23.50	3.35	64.0	61.0	2072227	2008154	0.961
February	71.9	29.00	3.70	102.1	97.6	3219184	3129034	0.939
March	122.9	46.90	6.65	171.0	163.8	5369525	5215049	0.934
April	150.1	62.90	9.30	203.6	195.2	6266053	6080008	0.915
May	185.0	75.20	14.70	244.2	234.2	7349638	7132052	0.895
June	201.6	79.70	18.80	267.1	256.5	7937885	7702915	0.883
July	208.2	75.10	21.40	282.2	270.9	8284477	8039593	0.873
August	180.6	64.80	21.20	245.3	235.3	7261946	7046529	0.880
September	134.2	48.90	16.55	186.8	179.0	5624058	5459536	0.895
October	96.7	38.10	12.85	135.3	129.5	4176247	4060531	0.919
November	51.4	24.70	7.75	72.9	69.5	2292896	2226572	0.936
December	37.7	21.10	4.20	51.9	49.3	1657995	1604265	0.947
Year	1487.8	589.90	11.75	2026.4	1941.9	61512131	59704238	0.903

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



Loss diagram





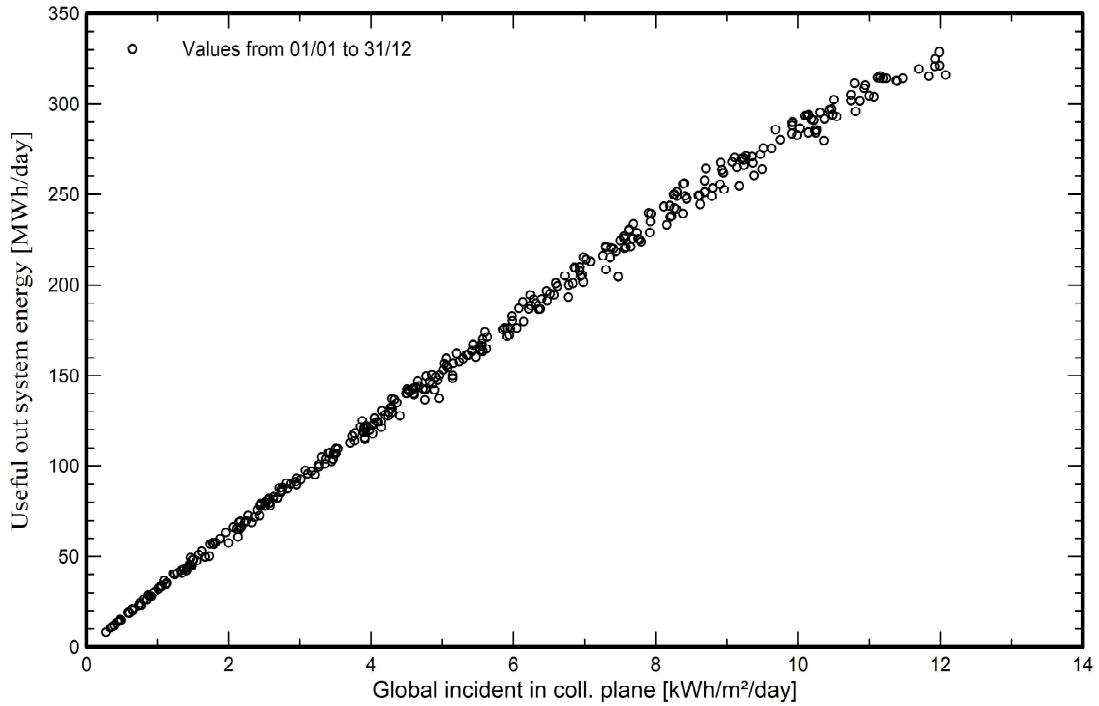
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Predef. graphs

Daily Input/Output diagram



System Output Power Distribution

