Comune di Melfi
Provincia di Potenza, Regione Basilicata

MELFI CAMARDA SOLAR PARK S.R.L.

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Impianto Agrivoltaico "MELFI CAMARDA 15.9"

PD01_21 – SIMULAZIONE ENERGETICA (PVSYST)

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Version 7.4.0

PVsyst - Simulation report

Grid-Connected System

Project: ITS2CA - Melfi Camarda A

Variante: RA - Melfi Camarda A_Tracker_2P(15-30)_660Wp.Bif_Pitch=9.15m_3D

Tracking system with backtracking

System power: 19.98 MWp

Leonessa - Italia

NRG PLUS ITALIA S.r.l.

Project: ITS2CA - Melfi Camarda A

Variant: P12 - Melfi Camarda A_Tracker_2P(15-30)_660Wp.Bif_Pitch=9.15m_3D

Project summary

Geographical Site
Leonessa
Italia

Situation

Latitude	41.07 °N
Longitude	15.60 °E
Altitude	274 m
Time zone	UTC+1

Project settings

Albedo	0.20

Meteo data
Leonessa
Solcast TMY

System summary

Grid-Connected System
Simulation for year no 1

Tracking system with backtracking

PV Field Orientation

Orientation	
Tracking plane, tilted axis	
Avg axis tilt	-1.6 °
Avg axis azim.	0 °

Tracking algorithm
Irradiance optimization
Backtracking activated

Near Shadings

According to strings	
Electrical effect	100 %
Diffuse shading	Automatic

System information

PV Array

Nb. of modules	30270 units
Pnom total	19.98 MWp

Inverters

Nb. of units	63 units
Pnom total	20.79 MWac
Grid power limit	15.90 MWac
Grid lim. Pnom ratio	1.256

User's needs
Unlimited load (grid)

Results summary

Produced Energy	32486.24 MWh/year	Specific production	1626 kWh/kWp/year	Perf. Ratio PR	85.36 %

Table of contents

General parameters

Grid-Connected System

Tracking system with backtracking

PV Field Orientation

Orientation

Tracking plane, tilted axis	
Avg axis tilt	-1.6 °
Avg axis azim.	0 °

Tracking algorithm

Irradiance optimization	
Backtracking activated	

Backtracking array

Nb. of trackers	542 units

Sizes

Tracker Spacing	9.15 m
Collector width	4.91 m
Ground Cov. Ratio (GCR)	53.6 %
Phi min / max.	-/+ 38.7 °

Backtracking strategy

Phi limits for BT	-/+ 57.4 °
Backtracking pitch	9.15 m
Backtracking width	4.91 m

Models used

Transposition	Perez
Diffuse	Imported
Circumsolar	separate

Horizon

Average Height	3.2 °

Near Shadings

According to strings	
Electrical effect	100 %
Diffuse shading	Automatic

User's needs

Unlimited load (grid)

Bifacial system

Model: 2D Calculation unlimited trackers

Bifacial model geometry

Tracker Spacing	9.15 m
Tracker width	4.91 m
GCR	53.6 %
Axis height above ground	5.19 m

Bifacial model definitions

Ground albedo	0.20
Bifaciality factor	80 %
Rear shading factor	5.0 %
Rear mismatch loss	10.0 %
Shed transparent fraction	0.0 %

Grid power limitation

Active power	15.90 MWac
Pnom ratio	1.256

PV Array Characteristics

PV module

Manufacturer	Trina Solar
Model	TSM-660NEG21C.20
(Custom parameters definition)	
Unit Nom. Power	660 Wp
Number of PV modules	30270 units
Nominal (STC)	19.98 MWp
Modules	1009 Strings x 30 In series
At operating cond. (49°C)	
Pmpp	18.51 MWp
U mpp	1067 V
I mpp	17348 A

Inverter

Manufacturer	Huawei Technologies
Model	SUN2000-330KTL-H1-Preliminary V0.1
(Custom parameters definition)	
Unit Nom. Power	330 kWac
Number of inverters	63 units
Total power	20790 kWac
Operating voltage	500-1500 V
Pnom ratio (DC:AC)	0.96
Power sharing within this inverter	

PV Array Characteristics

Total PV power

Nominal (STC)	19978 kWp
Total	30270 modules
Module area	94029 m²
Cell area	88104 m²

Total inverter power

Total power	20790 kWac
Number of inverters	63 units
Pnom ratio	0.96

Array losses

Array Soiling Losses
Loss Fraction 2.5 %

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. 1.00 mΩ
Loss Fraction 1.5 % at STC

Serie Diode Loss
Voltage drop 0.7 V
Loss Fraction 0.1 % at STC

LID - Light Induced Degradation
Loss Fraction 0.5 %

Module Quality Loss
Loss Fraction -0.8 %

Module mismatch losses
Loss Fraction 1.0 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

Module average degradation
Year no 1
Loss factor 0.4 %/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	0.963	0.891	0.672	0.000

System losses

Auxiliaries loss
constant (fans) 17.00 kW
0.0 kW from Power thresh.
Night aux. cons. 10.00 kW

AC wiring losses

Inv. output line up to MV transfo
Inverter voltage 800 Vac tri
Loss Fraction 1.28 % at STC
Inverter: SUN2000-330KTL-H1-Preliminary V0.1
Wire section (63 Inv.) Alu 63 x 3 x 240 mm²
Average wires length 200 m

MV line up to Injection
MV Voltage 36 kV
Wires Alu 3 x 300 mm²
Length 2750 m
Loss Fraction 0.44 % at STC

AC losses in transformers

MV transfo

Medium voltage	36 kV
Transformer parameters	
Nominal power at STC	19.63 MVA
Iron Loss (24/24 Connexion)	20.81 kVA
Iron loss fraction	0.11 % at STC
Copper loss	185.31 kVA
Copper loss fraction	0.94 % at STC
Coils equivalent resistance	3 x 0.31 mΩ

Horizon definition

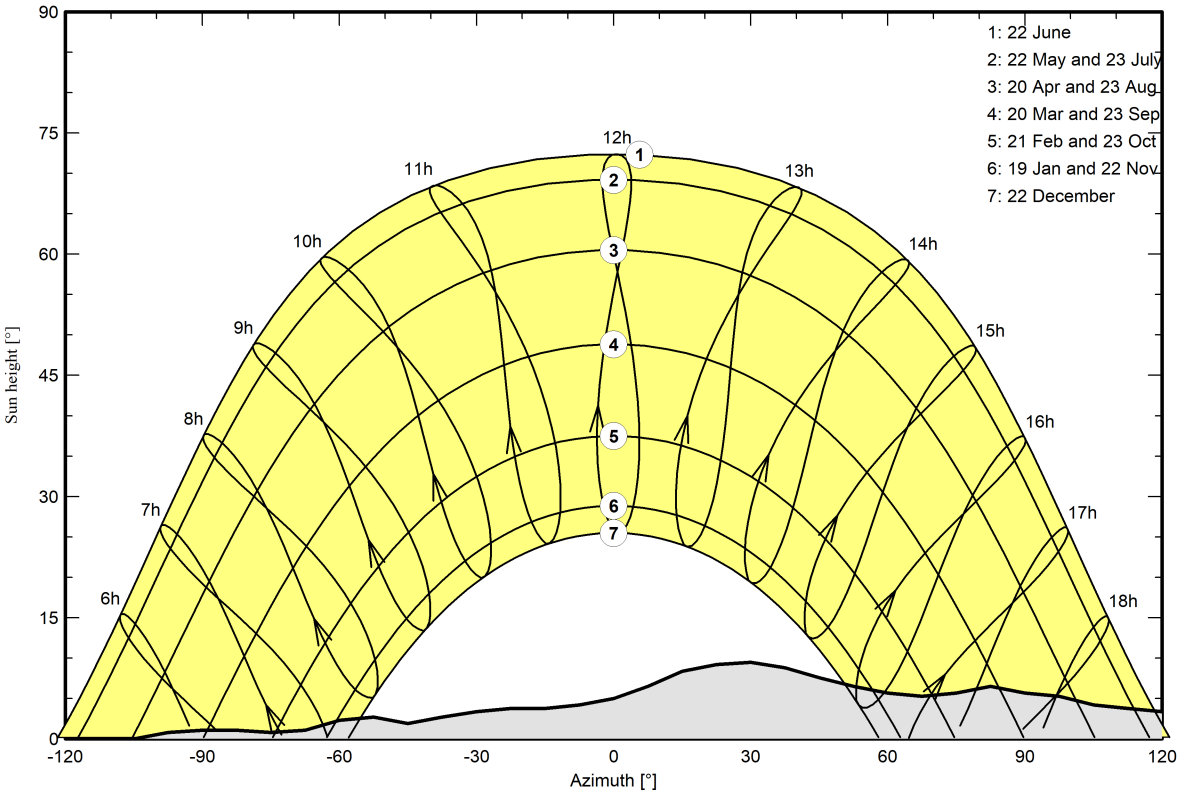
Horizon from PVGIS website API, Lat=41°4'12", Long=15°36'0", Alt=274m

Average Height	3.2 °	Albedo Factor	0.75
Diffuse Factor	0.96	Albedo Fraction	100 %

Horizon profile

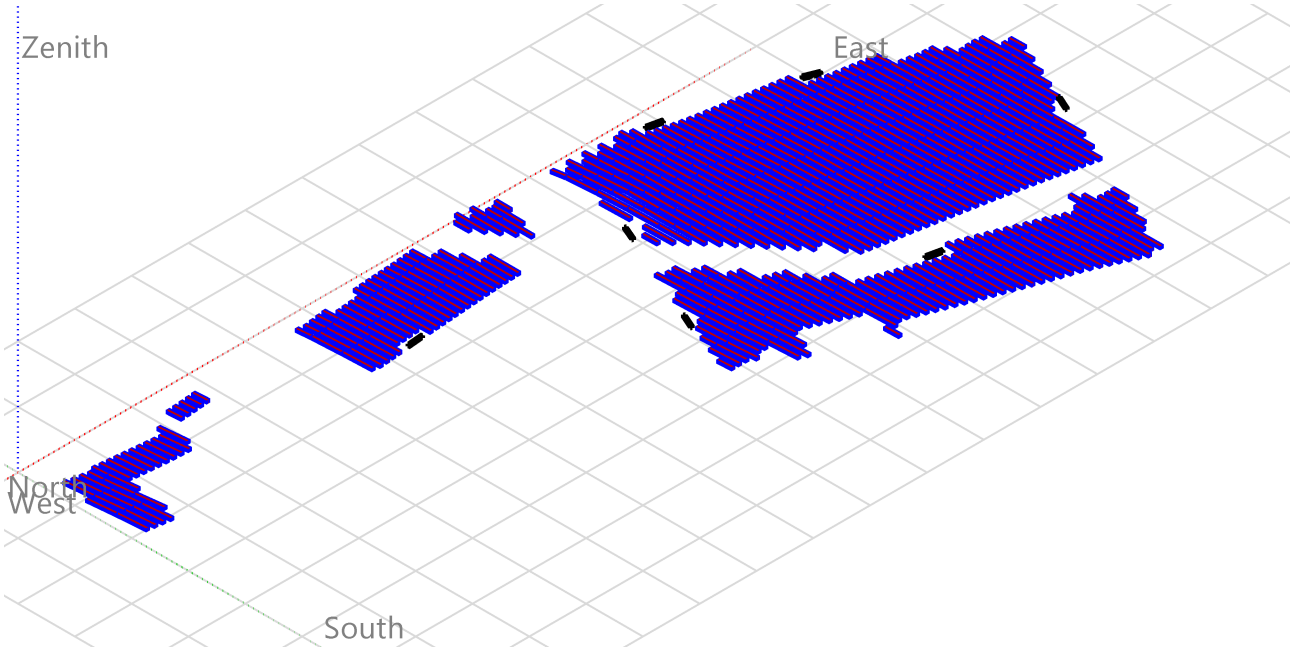
Azimuth [°]	-180	-173	-165	-158	-150	-135	-128	-105	-98	-90	-83
Height [°]	0.4	0.4	0.8	0.8	0.4	0.4	0.0	0.0	0.8	1.1	1.1
Azimuth [°]	-75	-68	-60	-53	-45	-38	-30	-23	-15	-8	0
Height [°]	0.8	1.1	2.3	2.7	1.9	2.7	3.4	3.8	3.8	4.2	5.0
Azimuth [°]	8	15	23	30	38	45	53	60	68	75	83
Height [°]	6.5	8.4	9.2	9.5	8.8	7.6	6.5	5.7	5.3	5.7	6.5
Azimuth [°]	90	98	105	113	120	135	143	158	165	173	180
Height [°]	5.7	5.3	4.2	3.8	3.4	3.4	1.9	1.9	0.8	0.8	0.4

Sun Paths (Height / Azimuth diagram)



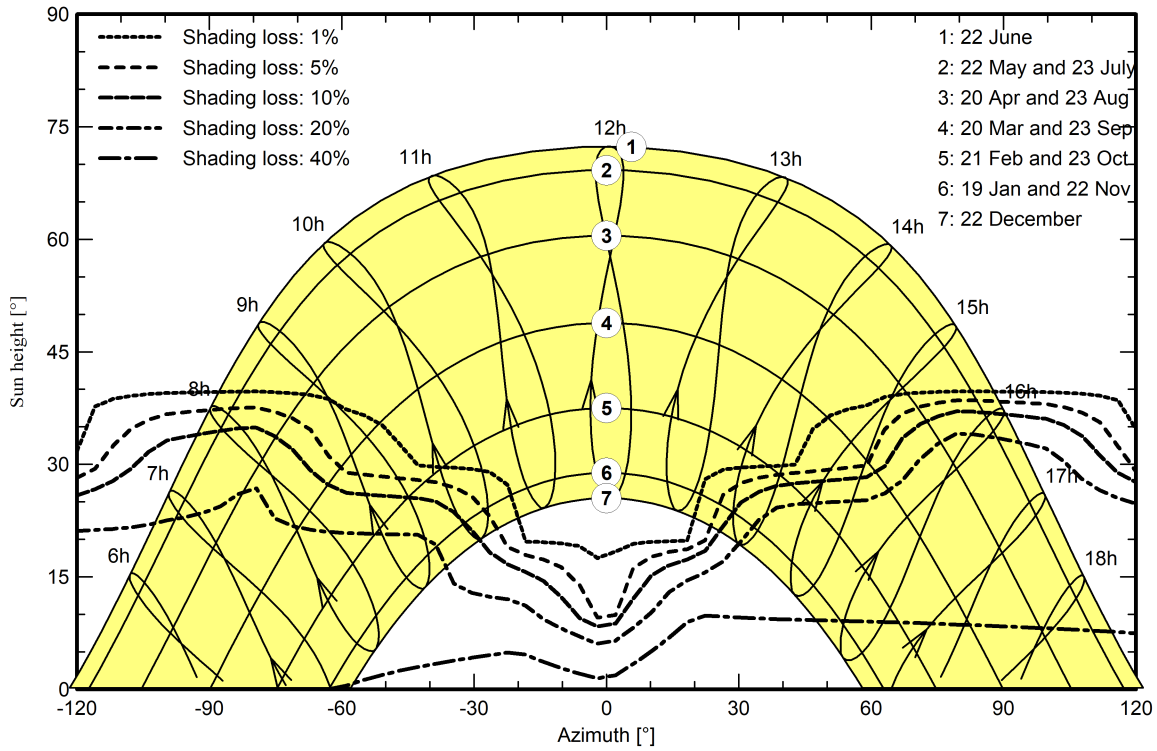
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

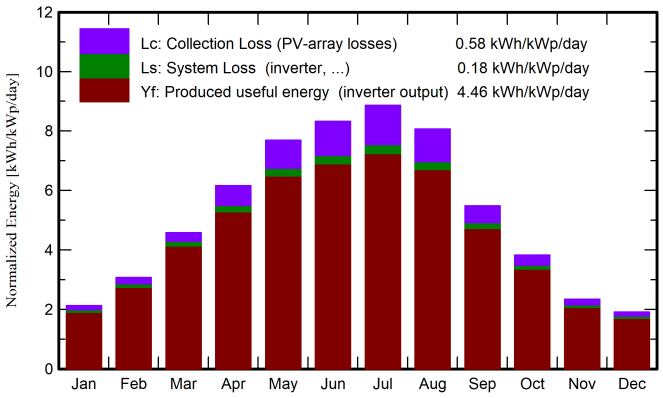


Main results

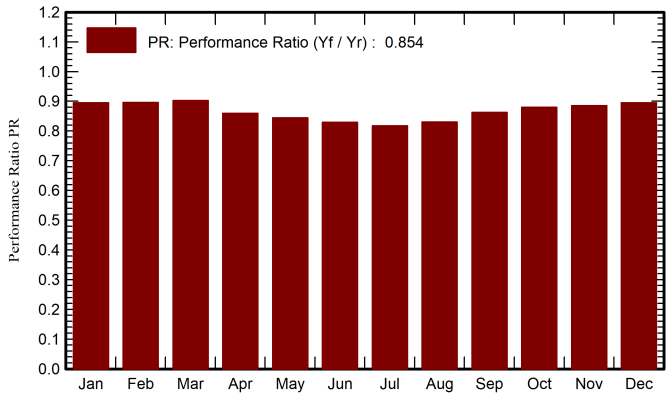
System Production

Produced Energy	32486.24 MWh/year	Specific production	1626 kWh/kWp/year
		Perf. Ratio PR	85.36 %

Normalized productions (per installed kWp)



Performance Ratio PR



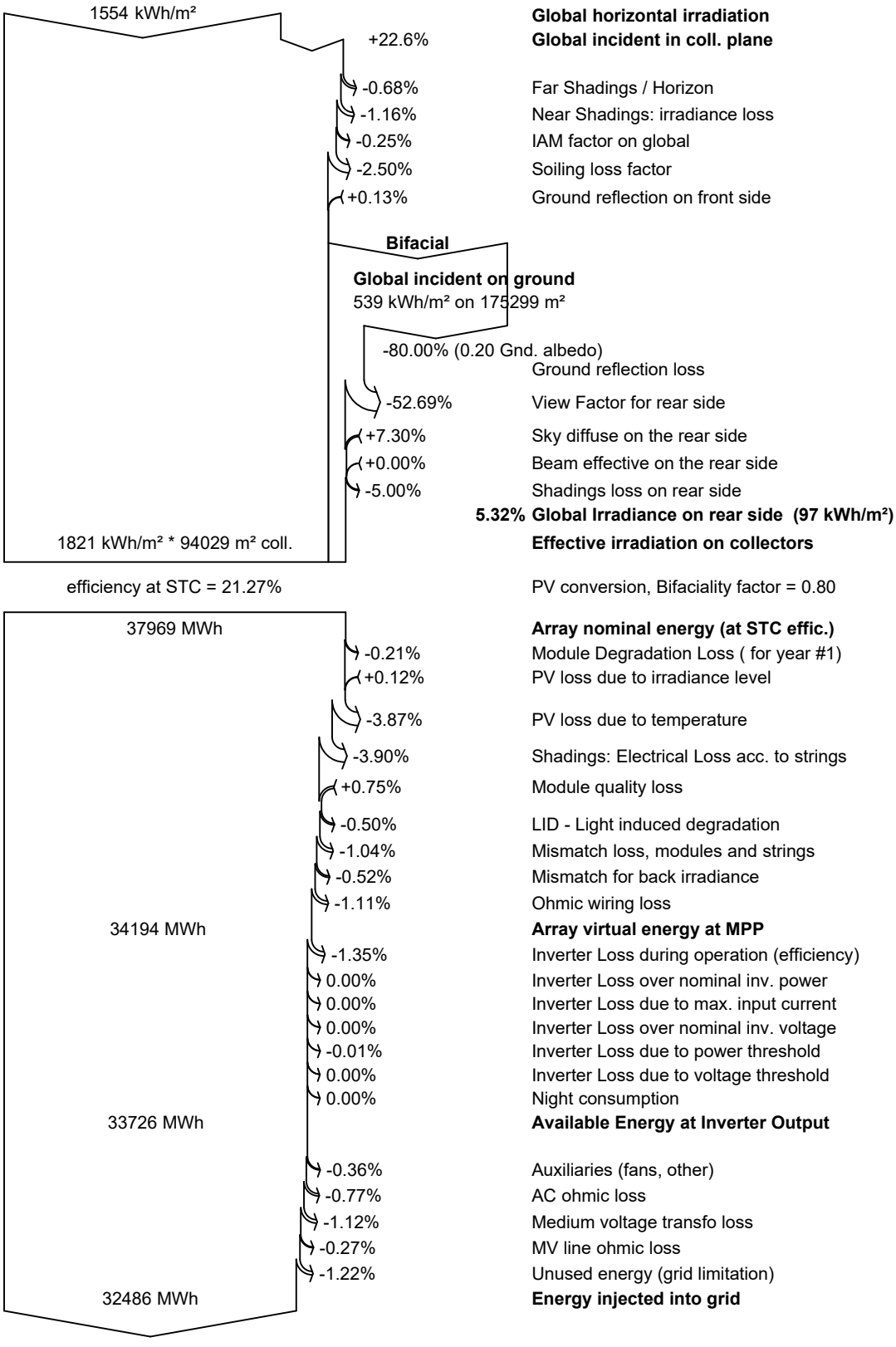
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh
January	56.0	27.94	7.77	66.1	62.4	1234
February	72.1	33.88	10.56	86.1	81.8	1603
March	117.2	52.55	7.95	142.1	135.5	2662
April	150.9	54.94	13.24	184.8	177.2	3303
May	194.1	75.58	17.20	238.5	228.6	4183
June	203.0	72.67	22.88	249.8	239.9	4310
July	220.0	59.88	25.12	274.9	264.1	4680
August	200.5	65.86	25.33	250.3	239.8	4323
September	133.6	50.60	19.42	164.6	157.2	2950
October	96.6	41.76	15.00	118.5	112.8	2166
November	58.9	28.78	10.82	70.2	66.4	1297
December	51.2	28.08	8.69	59.1	55.4	1106
Year	1554.1	592.53	15.36	1904.9	1821.0	33815

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

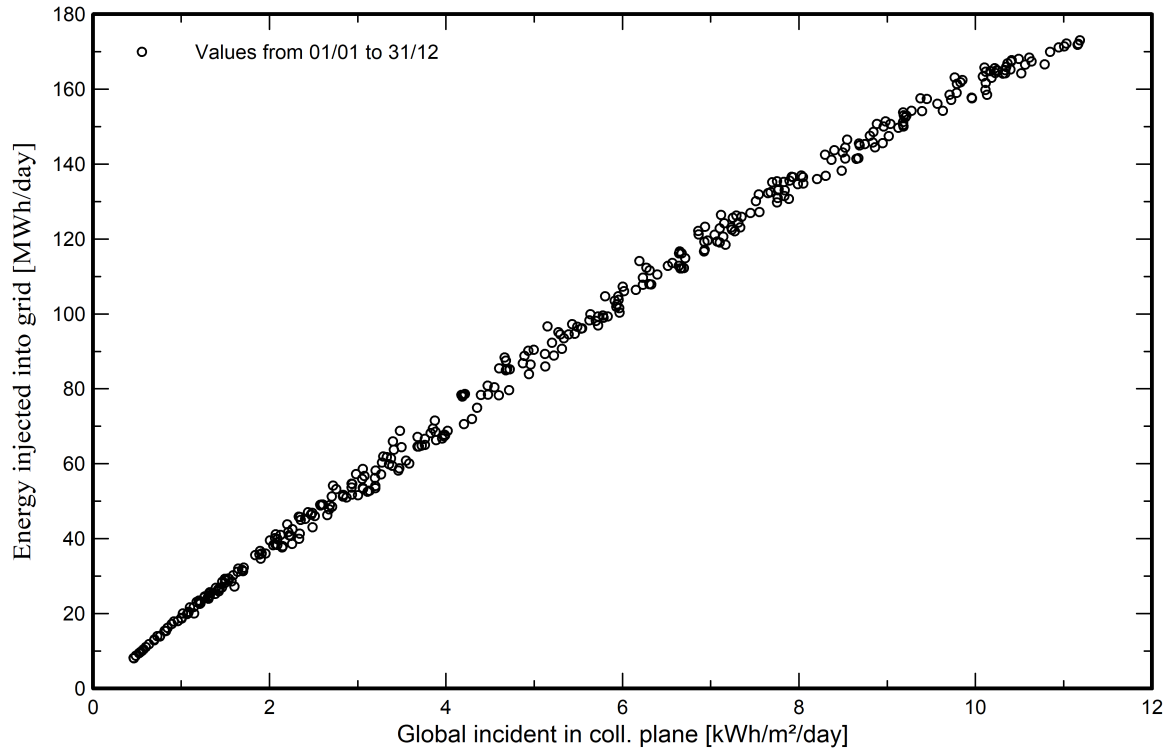
Loss diagram



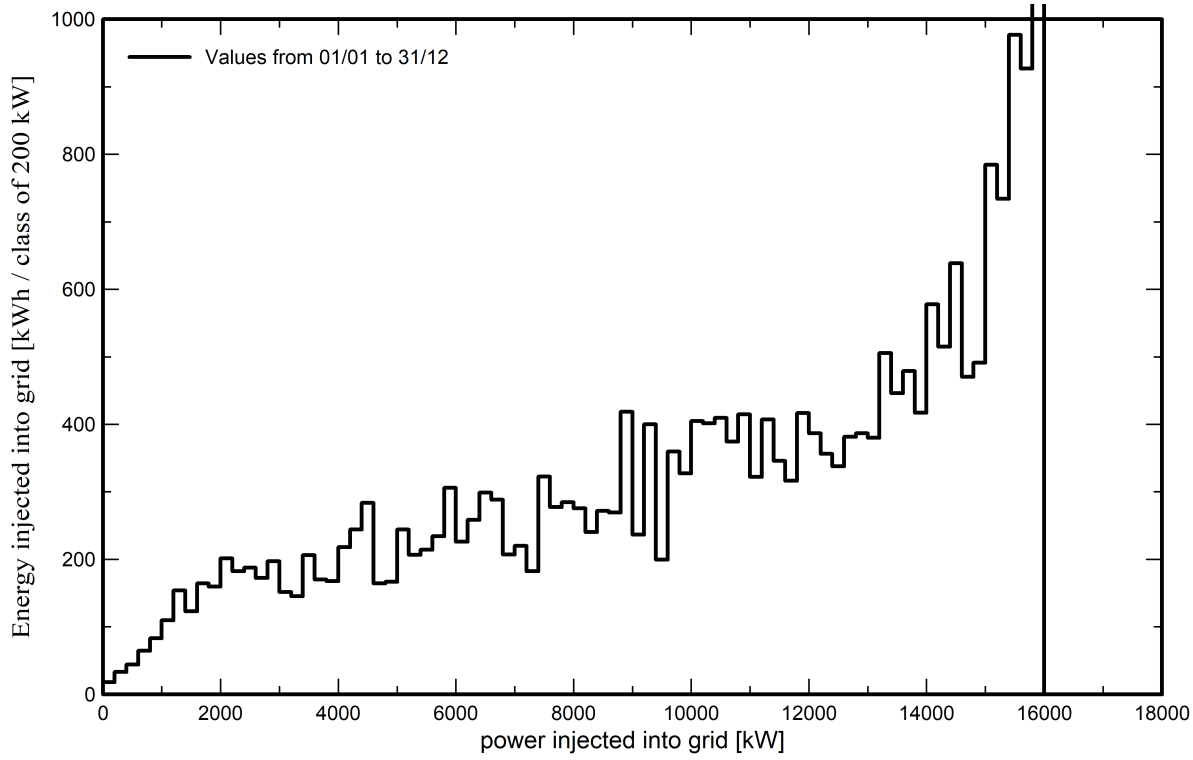
PVsyst V7.4.0
VC7, Simulation date:
03/12/23 18:39
with v7.4.0

Predef. graphs

Diagramma giornaliero entrata/uscita



Distribuzione potenza in uscita sistema



PVsyst V7.4.0
VC7, Simulation date:
03/12/23 18:39
with v7.4.0

Aging Tool

Aging Parameters

Time span of simulation 30 years

Module average degradation

Loss factor 0.4 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

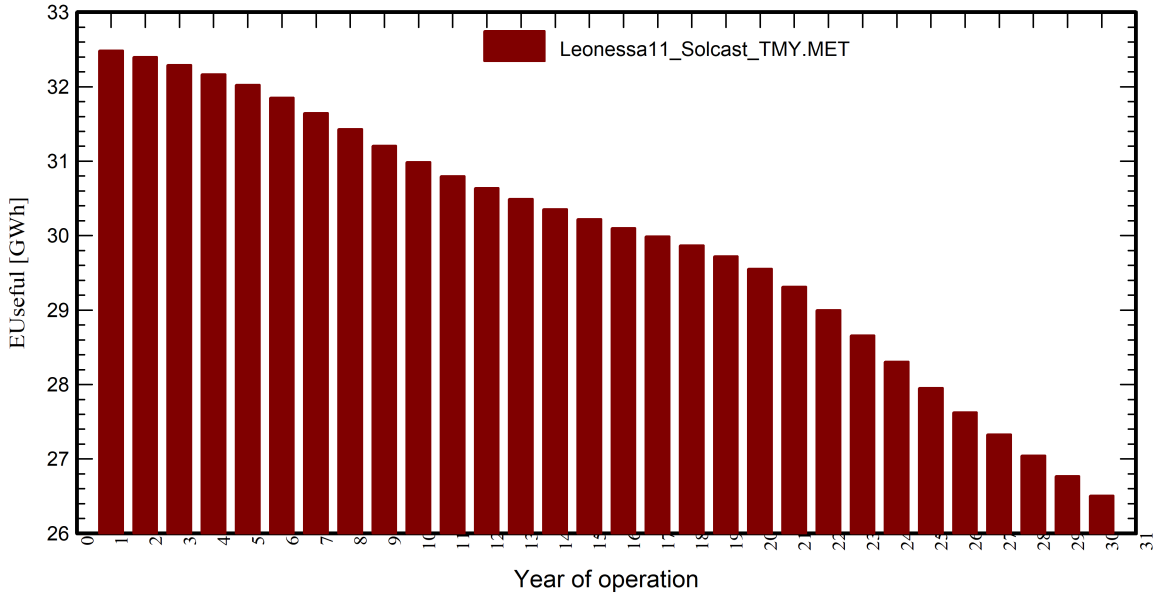
Vmp RMS dispersion 0.4 %/year

Meteo used in the simulation

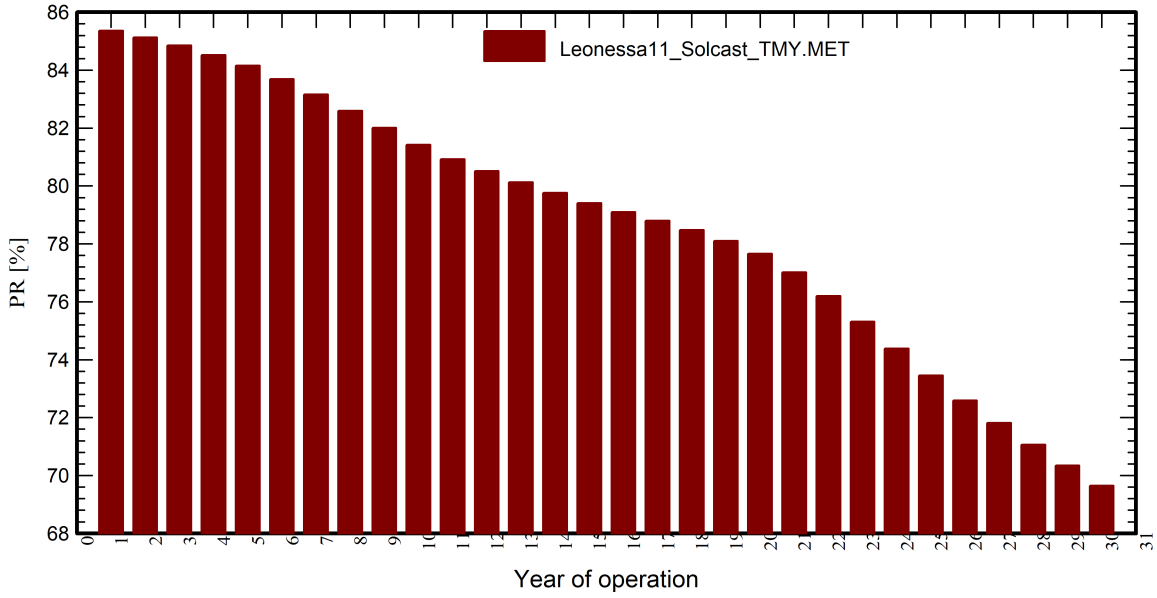
Leonessa11 Solcast TMY

Years reference year

Useful out system energy



Performance Ratio



Aging Tool

Aging Parameters

Time span of simulation 30 years

Module average degradation

Loss factor 0.4 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

Vmp RMS dispersion 0.4 %/year

Meteo used in the simulation

Leonessa11 Solcast TMY

Years reference year

	EUseful	PR	PR loss
Year	GWh	%	%
1	32.49	85.36	-0.14
2	32.40	85.13	-0.41
3	32.29	84.85	-0.74
4	32.17	84.52	-1.12
5	32.02	84.15	-1.56
6	31.85	83.69	-2.09
7	31.65	83.16	-2.72
8	31.43	82.59	-3.38
9	31.21	82.00	-4.07
10	30.99	81.42	-4.75
11	30.80	80.92	-5.34
12	30.64	80.51	-5.82
13	30.49	80.12	-6.27
14	30.35	79.76	-6.69
15	30.22	79.41	-7.10
16	30.10	79.10	-7.47
17	29.99	78.80	-7.81
18	29.87	78.48	-8.19
19	29.72	78.11	-8.63
20	29.55	77.66	-9.15
21	29.31	77.02	-9.90
22	29.00	76.20	-10.86
23	28.66	75.31	-11.90
24	28.31	74.38	-12.98
25	27.95	73.45	-14.07
26	27.63	72.59	-15.08
27	27.33	71.81	-15.99
28	27.04	71.06	-16.87
29	26.77	70.34	-17.71
30	26.51	69.65	-18.52