

PVsyst - Simulation report

Grid-Connected System

Project: UFV Maricá

Variant: 20MWp

Tracking system with backtracking

System power: 20.03 MWp

UFV Maricá - Brazil

**PVsyst V7.4.1**

VD2, Simulation date:
27/10/25 16:06
with v7.4.1

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Project summary**Geographical Site**

UFV Maricá
Brazil

Situation

Latitude -22.92 °S
Longitude -42.83 °W
Altitude 6 m
Time zone UTC-3

Project settings

Albedo 0.20

Meteo data

UFV Maricá
Meteonorm 8.1 (2010-2021), Sat=100% - Synthetic

System summary**Grid-Connected System**

Simulation for year no 1

Tracking system with backtracking**PV Field Orientation**

Orientation
Tracking plane, horizontal N-S axis
Axis azimuth 0 °

Tracking algorithm

Astronomic calculation
Backtracking activated
Wind Speed threshold 0 m/s
Wind stow position 0 °

Near Shadings

Linear shadings : Fast (table)
Diffuse shading Automatic

System information**PV Array**

Nb. of modules 29456 units
Pnom total 20.03 MWp

Inverters

Nb. of units 60 units
Pnom total 18.00 MWac
Pnom ratio 1.113

User's needs

Unlimited load (grid)

Results summary

Produced Energy	37.11 GWh/year	Specific production	1853 kWh/kWp/year	Perf. Ratio PR	84.02 %
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General parameters

Grid-Connected System

PV Field Orientation

Orientation

Tracking plane, horizontal N-S axis
Axis azimuth 0 °

Models used

Transposition Perez
Diffuse Perez, Meteorism
Circumsolar separate

Horizon

Free Horizon

Bifacial system

Model 2D Calculation
unlimited trackers

Bifacial model geometry

Tracker Spacing 5.50 m
Tracker width 2.38 m
GCR 43.3 %
Axis height above ground 1.48 m

Tracking system with backtracking

Tracking algorithm

Astronomic calculation
Backtracking activated
Wind Speed threshold 0 m/s
Wind stop position 0 °

Near Shadings

Linear shadings : Fast (table)
Diffuse shading Automatic

Backtracking array

Nb. of trackers 526 units

Sizes

Tracker Spacing 5.50 m
Collector width 2.38 m
Ground Cov. Ratio (GCR) 43.3 %
Phi min / max. -/+ 55.0 °

Backtracking strategy

Phi limits for BT -/+ 64.1 °
Backtracking pitch 5.50 m
Backtracking width 2.38 m

User's needs

Unlimited load (grid)

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 %

PV Array Characteristics

PV module

Manufacturer Trina Solar
Model TSM-680NEG21C.20
(Custom parameters definition)
Unit Nom. Power 680 Wp
Number of PV modules 29456 units
Nominal (STC) 20.03 MWp
Modules 1052 Strings x 28 In series
At operating cond. (50°C)
Pmpp 18.46 MWp
U mpp 1014 V
I mpp 18212 A

Total PV power

Nominal (STC) 20030 kWp
Total 29456 modules
Module area 91501 m²

Inverter

Manufacturer Huawei Technologies
Model SUN2000-330KTL-H1
(Custom parameters definition)
Unit Nom. Power 300 kWac
Number of inverters 60 units
Total power 18000 kWac
Operating voltage 500-1500 V
Max. power (=>30°C) 330 kWac
Pnom ratio (DC:AC) 1.11
Power sharing within this inverter

Total inverter power

Total power 18000 kWac
Max. power 19800 kWac
Number of inverters 60 units
Pnom ratio 1.11



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Array losses

Array Soiling Losses

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 25.0 W/m²K
Uv (wind) 1.2 W/m²K/m/s

DC wiring losses

Global array res. 0.48 mΩ
Loss Fraction 0.8 % at STC

LID - Light Induced Degradation

Loss Fraction 1.0 %

Module Quality Loss

Loss Fraction -0.4 %

Module mismatch losses

Loss Fraction 1.5 % at MPP

Strings Mismatch loss

Loss Fraction 0.2 %

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): 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

System losses

Unavailability of the system

Time fraction 2.0 %
7.3 days,
5 periods

System losses

Unavailability of the system

Time fraction 2.0 %
7.3 days,
5 periods

AC wiring losses

Inv. output line up to MV transfo

Inverter voltage 800 Vac tri
Loss Fraction 0.66 % at STC

Inverter: SUN2000-330KTL-H1

Wire section (60 Inv.) Copper 60 x 3 x 120 mm²
Average wires length 82 m

MV line up to Injection

MV Voltage 20 kV
Average each inverter
Wires Copper 3 x 700 mm²
Length 8810 m
Loss Fraction 0.23 % at STC

AC losses in transformers

MV transfo

Medium voltage 20 kV

One transfo parameters

Nominal power at STC 3.94 MVA
Iron Loss (24/24 Connexion) 4.02 kVA
Iron loss fraction 0.10 % at STC
Copper loss 38.19 kVA
Copper loss fraction 0.97 % at STC
Coils equivalent resistance 3 x 1.57 mΩ

Operating losses at STC (full system)

Nb. identical MV transfos 5
Nominal power at STC 19.71 MVA
Iron loss (24/24 Connexion) 20.10 kVA
Copper loss 190.97 kVA



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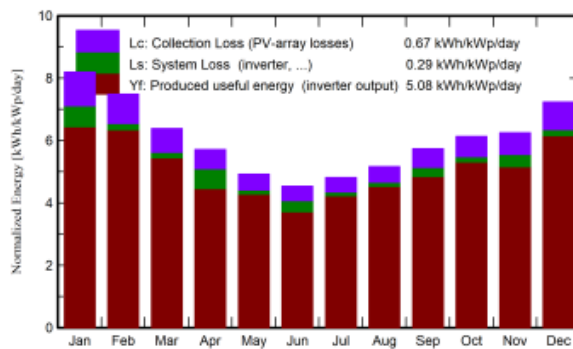
with v7.4.1

Main results

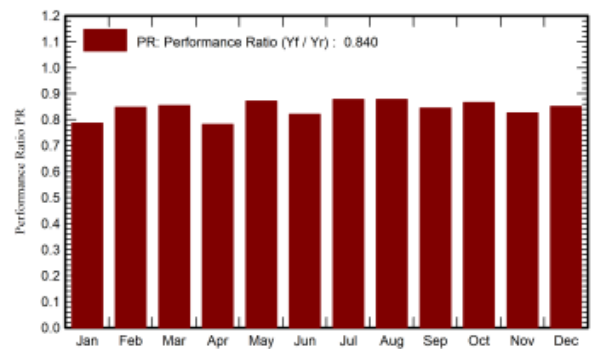
System Production

Produced Energy (P50)	37.11 GWh/year	Specific production (P50)	1853 kWh/kWp/year	Perf. Ratio PR	84.02 %
Produced Energy (P90)	35.64 GWh/year	Specific production (P90)	1779 kWh/kWp/year		
Produced Energy (P95)	35.23 GWh/year	Specific production (P95)	1759 kWh/kWp/year		

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 GWh	E_Grid GWh	PR ratio
January	203.4	79.23	27.70	254.1	239.6	4.421	4.004	0.787
February	170.2	78.11	27.62	209.7	197.0	3.677	3.560	0.848
March	160.9	80.80	26.20	197.9	185.3	3.495	3.385	0.854
April	139.0	59.74	24.43	171.3	160.9	3.065	2.682	0.782
May	121.0	51.90	22.40	152.6	141.9	2.743	2.662	0.871
June	106.4	42.19	20.81	136.0	126.0	2.448	2.237	0.821
July	117.2	47.47	20.21	149.2	138.5	2.702	2.624	0.878
August	129.4	58.89	21.32	160.2	149.9	2.901	2.815	0.877
September	140.4	69.10	22.46	172.1	160.9	3.094	2.912	0.845
October	160.1	81.83	24.51	190.2	178.8	3.408	3.301	0.866
November	157.5	86.34	25.05	187.5	175.7	3.338	3.101	0.826
December	186.7	90.80	26.99	224.2	211.2	3.949	3.823	0.851
Year	1792.0	826.40	24.12	2204.9	2065.7	39.240	37.106	0.840

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

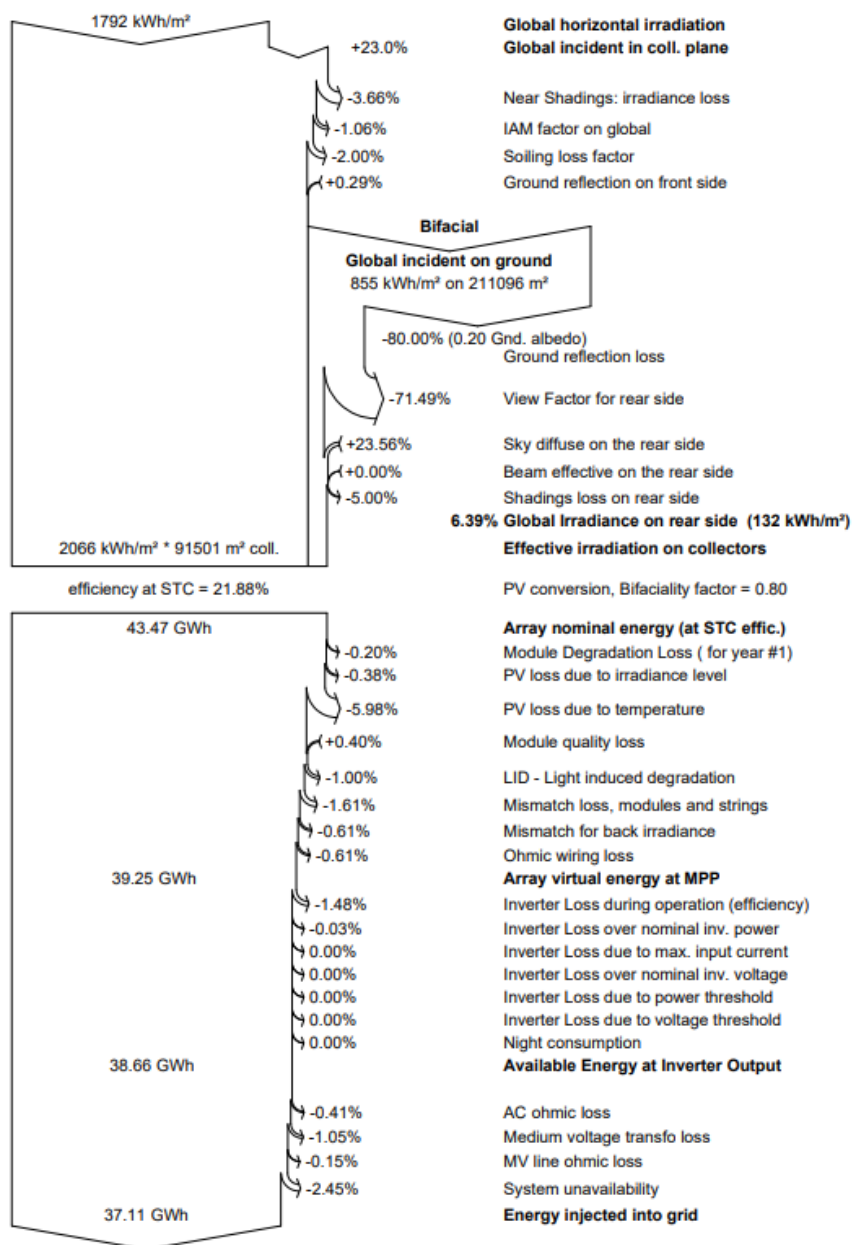
EArray Effective energy at the output of the array
E_Grid Energy injected into grid
PR Performance Ratio

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Loss diagram



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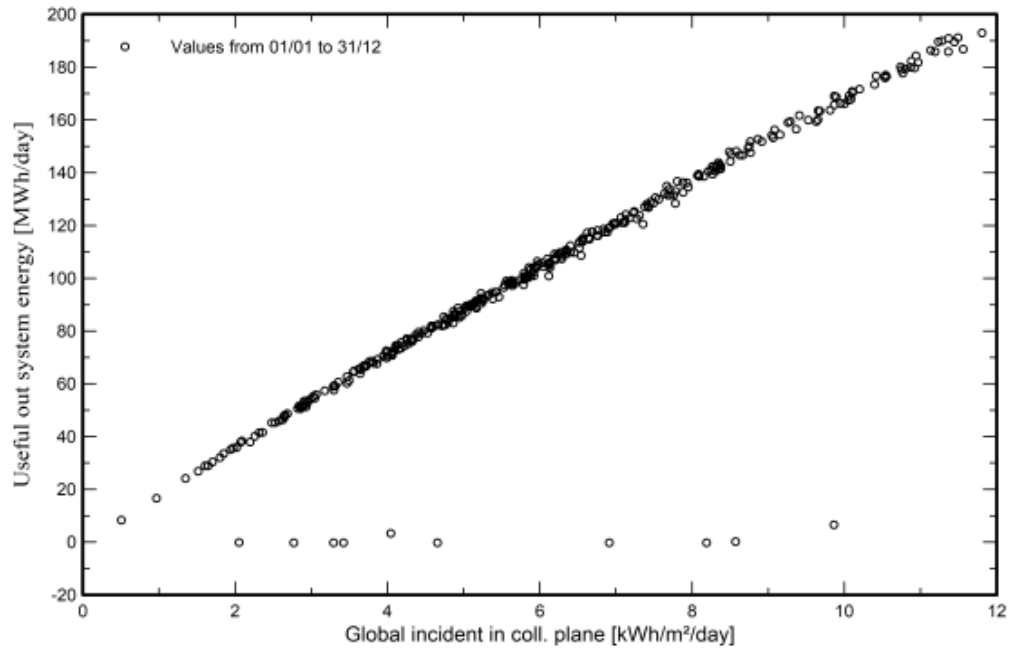
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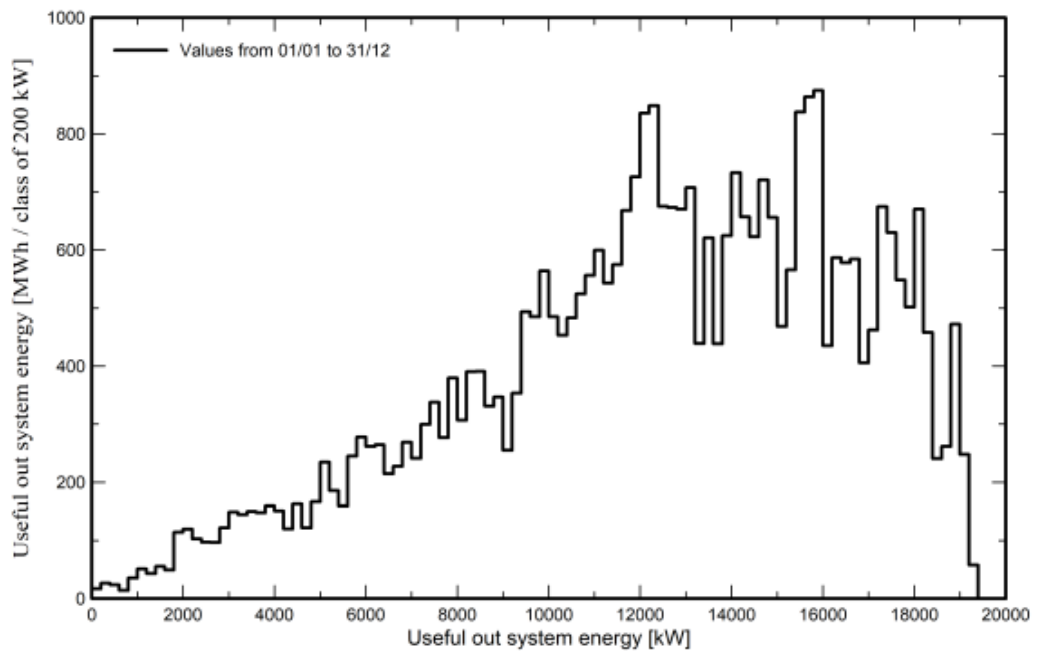
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Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





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Aging Tool

Aging Parameters

Time span of simulation 25 years

Module average degradation

Loss factor 0.4 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

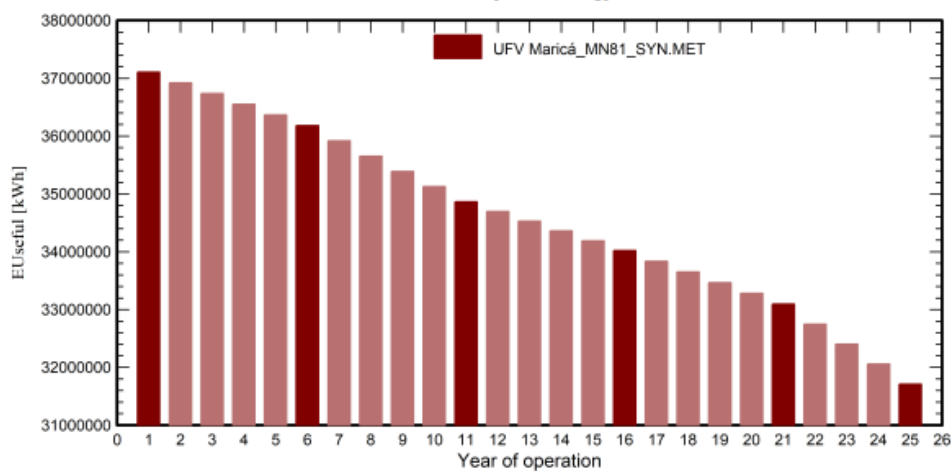
Vmp RMS dispersion 0.4 %/year

Meteo used in the simulation

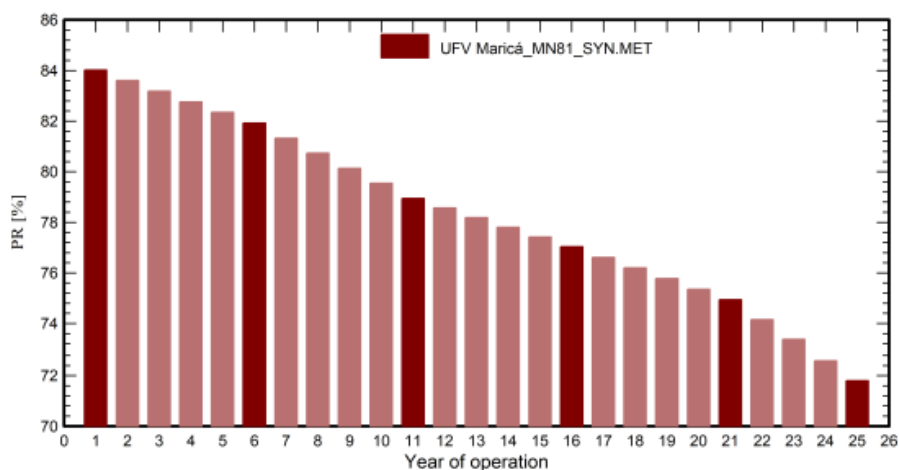
UFV Maricá MN81 SYN

Years reference year

Useful out system energy



Performance Ratio





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Aging Tool

Aging Parameters

Time span of simulation 25 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

UFV Maricá MN81 SYN

Years reference year

	EUseful	PR	PR loss
Year	kWh	%	%
1	37105849	84.02	-0.25
2	36920453	83.60	-0.75
3	36735057	83.18	-1.25
4	36549661	82.76	-1.74
5	36364265	82.34	-2.24
6	36178870	81.92	-2.74
7	35916099	81.32	-3.45
8	35653329	80.73	-4.15
9	35390558	80.13	-4.86
10	35127788	79.54	-5.57
11	34865017	78.94	-6.27
12	34696100	78.56	-6.73
13	34527183	78.18	-7.18
14	34358266	77.80	-7.64
15	34189349	77.41	-8.09
16	34020432	77.03	-8.54
17	33835145	76.61	-9.04
18	33649858	76.19	-9.54
19	33464571	75.77	-10.04
20	33279284	75.35	-10.54
21	33093997	74.93	-11.03
22	32748248	74.15	-11.96
23	32402499	73.37	-12.89
24	32056750	72.59	-13.82
25	31711000	71.80	-14.75



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P50 - P90 evaluation

Meteo data

Source Meteonorm 8.1 (2010-2021), Sat=100%
Kind Monthly averages
Synthetic - Multi-year average
Year-to-year variability(Variance) 2.5 %
Specified Deviation
Climate change 0.0 %

Global variability (meteo + system)

Variability (Quadratic sum) 3.1 %

Simulation and parameters uncertainties

PV module modelling/parameters 1.0 %
Inverter efficiency uncertainty 0.5 %
Soiling and mismatch uncertainties 1.0 %
Degradation uncertainty 1.0 %

Annual production probability

Variability 1.14 GWh
P50 37.11 GWh
P90 35.64 GWh
P95 35.23 GWh

Probability distribution

