

REGIONE SARDEGNA  
**COMUNE DI CODRONGIANOS**  
PROVINCIA DI SASSARI

**PROGETTO DEFINITIVO**

**PER LA REALIZZAZIONE E L'ESERCIZIO DI UN IMPIANTO SOLARE AGRIVOLTAICO A TERRA DELLA POTENZA DI PICCO (DC) PARI A 39,99 MWp CON SISTEMA DI ACCUMULO, CON CONNESSIONE ALLA RETE TERNA PER UNA POTENZA (AC) PARI A 30,8 MW**



Proponente: **SOLAR TORRES SRL**

VIA BORBOGNA, 8 - 20122 MILANO (MI)

**TAVOLA:**

**D1.R10**

**ELABORATO:**

**CALCOLO DI PRODUCIBILITA' DELL'IMPIANTO AGRIVOLTAICO**

DATA STESURA  
**OTTOBRE 2023**

AGGIORNAMENTO

SCALA  
-

PROPONENTE



**SOLAR TORRES s.r.l.**

Via Borgogna, 8  
20122 Milano (MI)  
PEC: solartorres@legalmail.it  
P.IVA 10670410967



PROGETTAZIONE



**MARE s.r.l.s.**

Ing. Enrico Gadaleta  
Via Galluzzi 5  
70044 Polignano a Mare (BA)  
Tel. 3382263891  
P.IVA 08324050726



# PVsyst - Simulation report

## Grid-Connected System

---

Project: Codrongianus\_def

Variant: JAM 625W

Tracking system with backtracking

System power: 39.99 MWp

Codrongianus - Italia

**Autore**

Mare srls (Italy)



**PVsyst V7.4.2**

VCO, Simulation date:  
21/10/23 14:46  
with v7.4.2

Mare srls (Italy)

**Project summary**

<b>Geographical Site</b> Codrongianus Italia	<b>Situation</b> Latitude 40.65 °N Longitude 8.71 °E Altitude 317 m Time zone UTC+1	<b>Project settings</b> Albedo 0.20
<b>Meteo data</b> Codrongianus MeteoNorm file - Synthetic		

**System summary**

<b>Grid-Connected System</b> Simulation for year no 1	<b>Tracking system with backtracking</b>		
<b>PV Field Orientation</b> <b>Orientation</b> Tracking plane, horizontal N-S axis Avg axis azim. 0 °	<b>Tracking algorithm</b> Astronomic calculation Backtracking activated Wind Speed threshold 0 m/s Wind stow position 0 °	<b>Near Shadings</b> According to strings : Fast (table) Electrical effect 90 % Diffuse shading Automatic	
<b>System information</b> <b>PV Array</b> Nb. of modules 63984 units Pnom total 39.99 MWp	<b>Inverters</b> Nb. of units 8 units Pnom total 35.20 MWac Pnom ratio 1.136		
<b>User's needs</b> Unlimited load (grid)			

**Results summary**

Produced Energy 73218812 kWh/year	Specific production 1831 kWh/kWp/year	Perf. Ratio PR 85.46 %
-----------------------------------	---------------------------------------	------------------------

**Table of contents**

Project and results summary	2
General parameters, PV Array Characteristics, System losses	3
Near shading definition - Iso-shadings diagram	6
Main results	7
Loss diagram	8
Predef. graphs	9
Single-line diagram	10



## PVsyst V7.4.2

VC0, Simulation date:  
21/10/23 14:46  
with v7.4.2

Mare srls (Italy)

## General parameters

## Grid-Connected System

## PV Field Orientation

## Orientation

Tracking plane, horizontal N-S axis  
Avg axis azim. 0 °

## Models used

Transposition Perez  
Diffuse Perez, Meteonorm  
Circumsolar separate

## Horizon

Free Horizon

## Bifacial system

Model 2D Calculation  
unlimited trackers

## Bifacial model geometry

Tracker Spacing 6.00 m  
Tracker width 2.38 m  
GCR 39.7 %  
Axis height above ground 2.10 m

## Tracking system with backtracking

## Tracking algorithm

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

## Near Shadings

According to strings : Fast (table)  
Electrical effect 90 %  
Diffuse shading Automatic

## Backtracking array

Nb. of trackers 688 units

## Sizes

Tracker Spacing 6.00 m  
Collector width 2.38 m  
Ground Cov. Ratio (GCR) 39.7 %  
Phi min / max. -/+ 60.0 °

## Backtracking strategy

Phi limits for BT -/+ 66.4 °  
Backtracking pitch 6.00 m  
Backtracking width 2.38 m

## User's needs

Unlimited load (grid)

## Bifacial model definitions

Ground albedo 0.30  
Bifaciality factor 77 %  
Rear shading factor 5.0 %  
Rear mismatch loss 10.0 %  
Shed transparent fraction 0.0 %

## PV Array Characteristics

## PV module

Manufacturer JA Solar  
Model JAM78D40-625/GB  
(Custom parameters definition)

Unit Nom. Power 625 Wp  
Number of PV modules 63984 units  
Nominal (STC) 39.99 MWp  
Modules 2666 Strings x 24 In series

## At operating cond. (50°C)

Pmpp 36.97 MWp  
U mpp 1015 V  
I mpp 36407 A

## Total PV power

Nominal (STC) 39990 kWp  
Total 63984 modules  
Module area 178855 m<sup>2</sup>  
Cell area 168288 m<sup>2</sup>

## Inverter

Manufacturer SMA  
Model Sunny Central 4400 UP  
(Original PVsyst database)

Unit Nom. Power 4400 kWac  
Number of inverters 8 units  
Total power 35200 kWac  
Operating voltage 962-1325 V  
Pnom ratio (DC:AC) 1.14

## Total inverter power

Total power 35200 kWac  
Number of inverters 8 units  
Pnom ratio 1.14



## PVsyst V7.4.2

VC0, Simulation date:  
21/10/23 14:46  
with v7.4.2

Mare srls (Italy)

## Array losses

## Array Soiling Losses

Loss Fraction 1.5 %

## Thermal Loss factor

Module temperature according to irradiance

Uc (const) 29.0 W/m<sup>2</sup>KUv (wind) 0.0 W/m<sup>2</sup>K/m/s

## DC wiring losses

Global array res. 0.46 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 2.0 %

## Module Quality Loss

Loss Fraction -0.4 %

## Module mismatch losses

Loss Fraction 2.0 % 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°	60°	65°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.993	0.972	0.939	0.863	0.736	0.000

## System losses

## Unavailability of the system

Time fraction 1.0 %

3.7 days,  
3 periods

## Auxiliaries loss

constant (fans) 14.00 kW

14.0 kW from Power thresh.

Proportionnal to Power 5.0 W/kW

0.0 kW from Power thresh.

## AC wiring losses

## Inv. output line up to MV transfo

Inverter voltage 660 Vac tri

Loss Fraction 0.50 % at STC

## Inverter: Sunny Central 4400 UP

Wire section (8 Inv.) Copper 8 x 3 x 3000 mm<sup>2</sup>

Average wires length 71 m

## MV line up to HV Transfo

MV Voltage 30 kV

Average each inverter

Wires Copper 3 x 70 mm<sup>2</sup>

Length 1000 m

Loss Fraction 0.17 % at STC

## HV line up to Injection

HV line voltage 150 kV

Wires Copper 3 x 50 mm<sup>2</sup>

Length 1700 m

Loss Fraction 0.11 % at STC

## AC losses in transformers

## MV transfo

Medium voltage 30 kV

## One transfo parameters

Nominal power at STC 5.61 MVA

Iron Loss (24/24 Connexion) 5.61 kVA

Iron loss fraction 0.10 % at STC

Copper loss 56.12 kVA

Copper loss fraction 1.00 % at STC

Coils equivalent resistance 3 x 0.78 mΩ

## Operating losses at STC (full system)

Nb. identical MV transfos 7

Nominal power at STC 39.27 MVA

Iron loss (24/24 Connexion) 39.25 kVA

Copper loss 392.87 kVA



**PVsyst V7.4.2**

VC0, Simulation date:  
21/10/23 14:46  
with v7.4.2

Mare srls (Italy)

**AC losses in transformers**

**HV transfo**

Grid voltage 150 kV

**Transformer from Datasheets**

Nominal power 35000 kVA

Iron Loss (24/24 Connexion) 350.00 kVA

Iron loss fraction 1.00 % of PNom

Copper loss 350.00 kVA

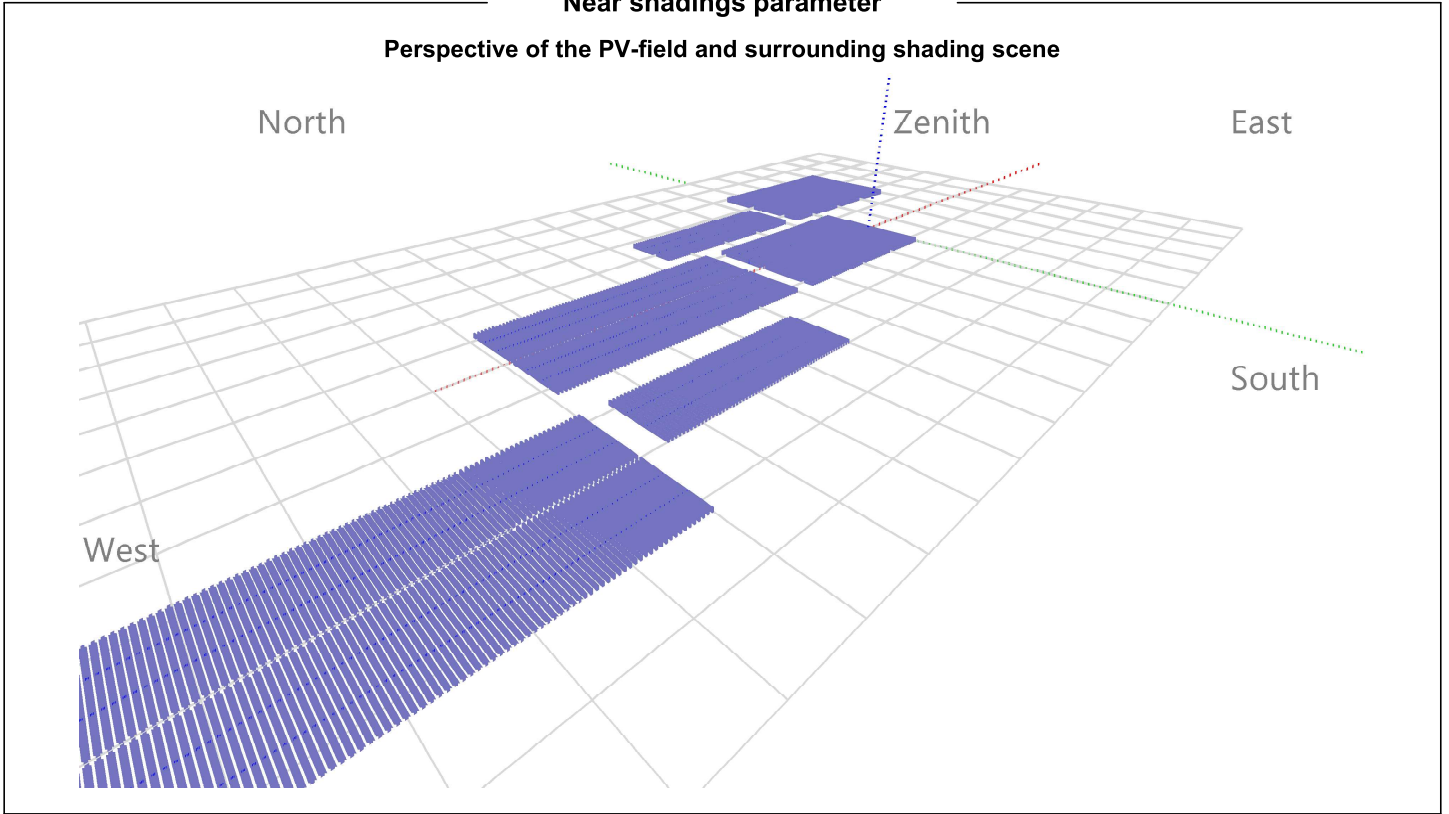
Copper loss fraction 1.00 % at PNom

Coils equivalent resistance 3 x 257.14 mΩ



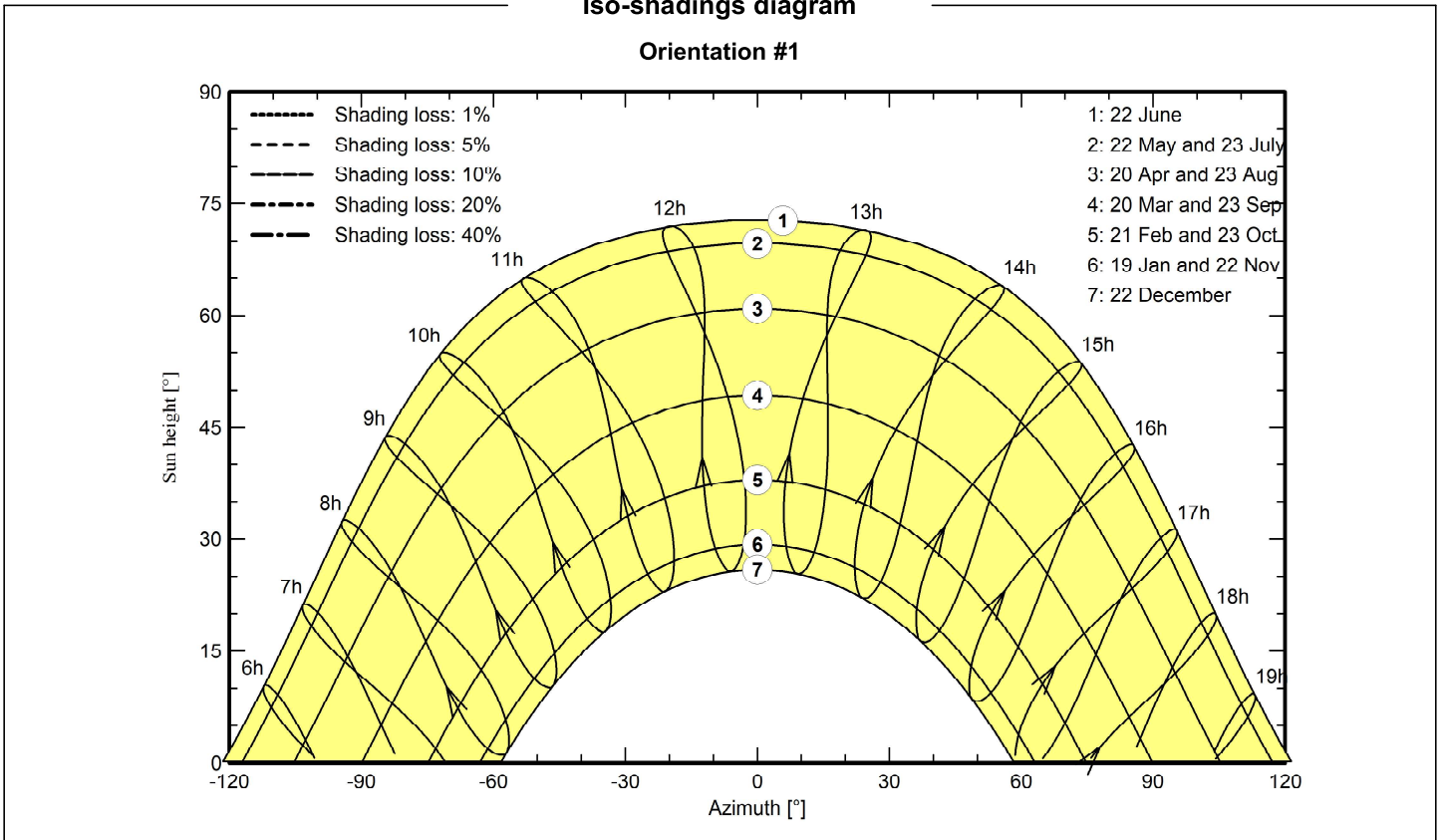
### Near shadings parameter

Perspective of the PV-field and surrounding shading scene



### Iso-shadings diagram

Orientation #1





**Main results**

**System Production**

Produced Energy 73218812 kWh/year

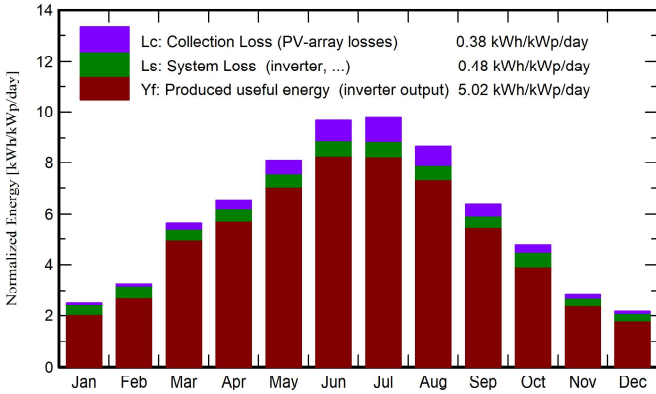
Specific production

1831 kWh/kWp/year

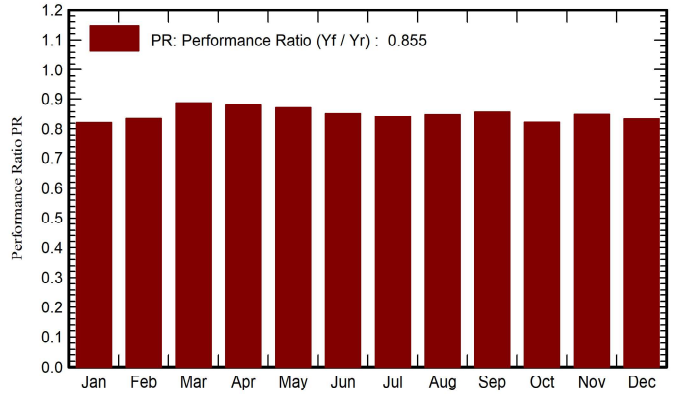
Perf. Ratio PR

85.46 %

**Normalized productions (per installed kWp)**



**Performance Ratio PR**



**Balances and main results**

	<b>GlobHor</b> kWh/m <sup>2</sup>	<b>DiffHor</b> kWh/m <sup>2</sup>	<b>T_Amb</b> °C	<b>GlobInc</b> kWh/m <sup>2</sup>	<b>GlobEff</b> kWh/m <sup>2</sup>	<b>EArray</b> kWh	<b>E_Grid</b> kWh	<b>PR</b> ratio
<b>January</b>	58.0	27.32	10.35	78.0	75.0	3037929	2563904	0.822
<b>February</b>	70.5	33.31	10.02	91.0	87.7	3567310	3040553	0.835
<b>March</b>	131.7	53.59	11.89	174.0	168.2	6717528	6175378	0.888
<b>April</b>	153.2	69.50	13.88	195.9	189.3	7481192	6905641	0.881
<b>May</b>	193.9	81.83	17.54	250.7	242.8	9416366	8746880	0.872
<b>June</b>	219.6	68.22	21.62	290.4	282.0	10634758	9906786	0.853
<b>July</b>	227.6	65.89	24.52	303.2	294.6	10955470	10204796	0.842
<b>August</b>	200.1	65.96	24.91	268.2	260.3	9798537	9114374	0.850
<b>September</b>	144.7	54.31	21.42	191.5	185.4	7127675	6576078	0.859
<b>October</b>	107.9	37.37	19.19	148.3	143.5	5577968	4876323	0.822
<b>November</b>	63.4	31.30	14.77	84.3	81.1	3252928	2868236	0.851
<b>December</b>	49.8	24.18	11.85	67.2	64.6	2610934	2239862	0.833
<b>Year</b>	1620.4	612.76	16.87	2142.5	2074.5	80178596	73218812	0.855

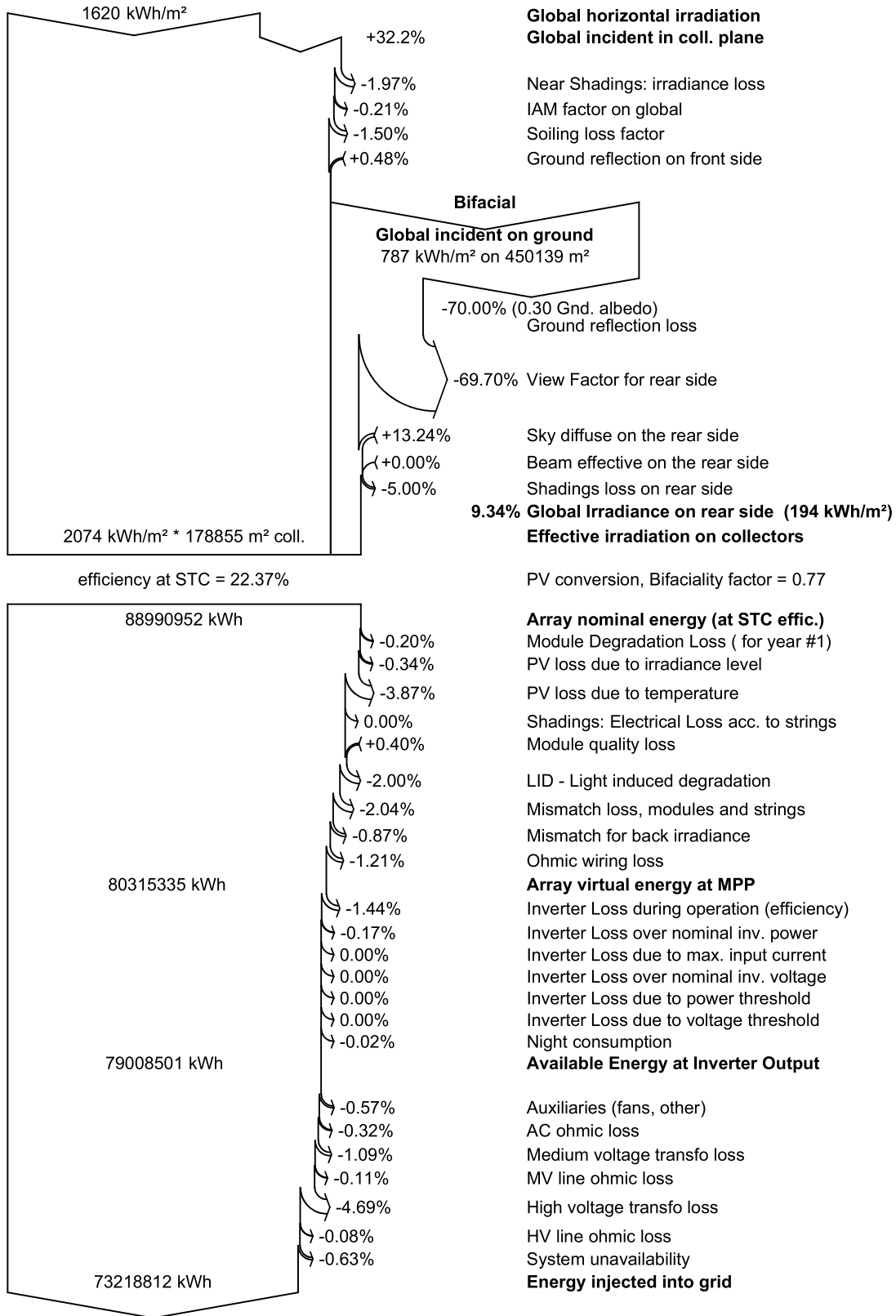
**Legends**

- 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





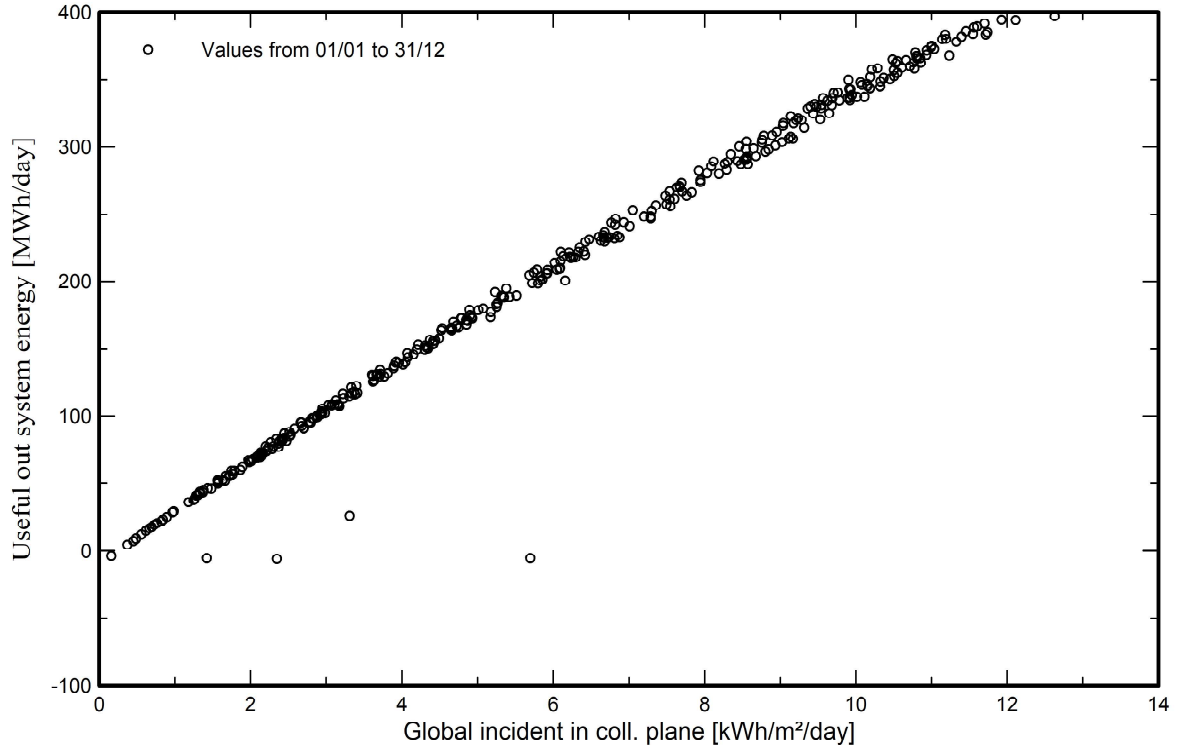
Loss diagram



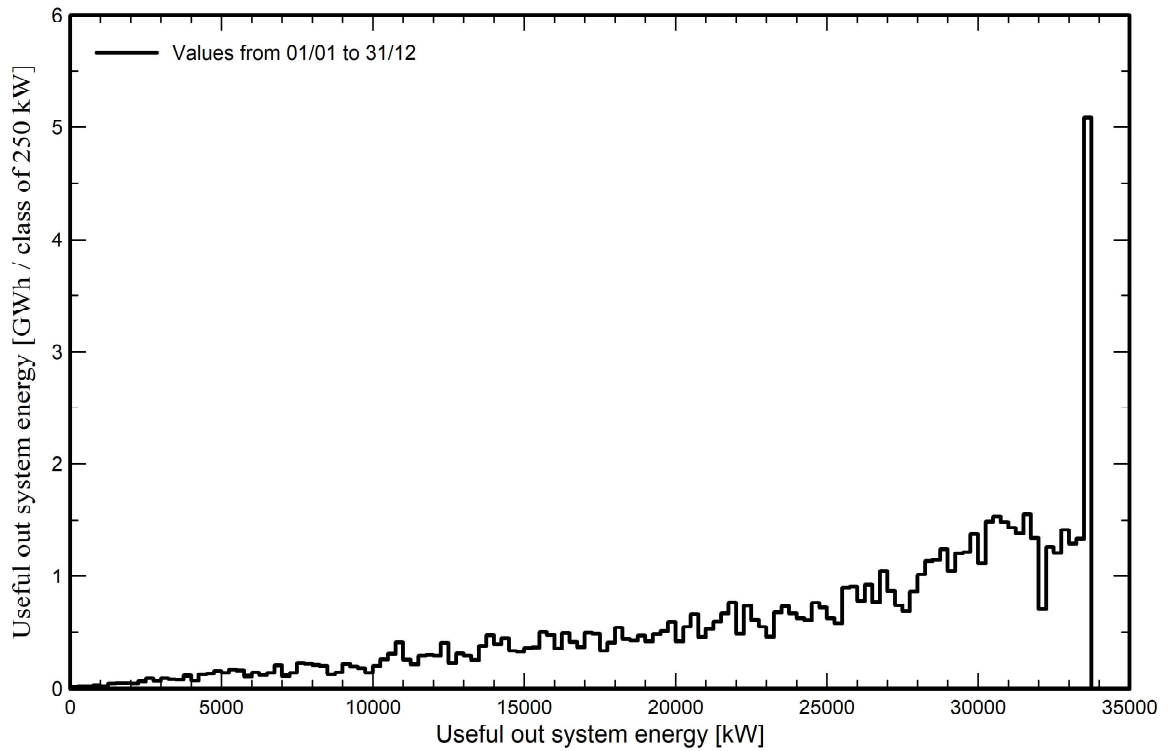


Predef. graphs

Diagramma giornaliero entrata/uscita



Distribuzione potenza in uscita sistema

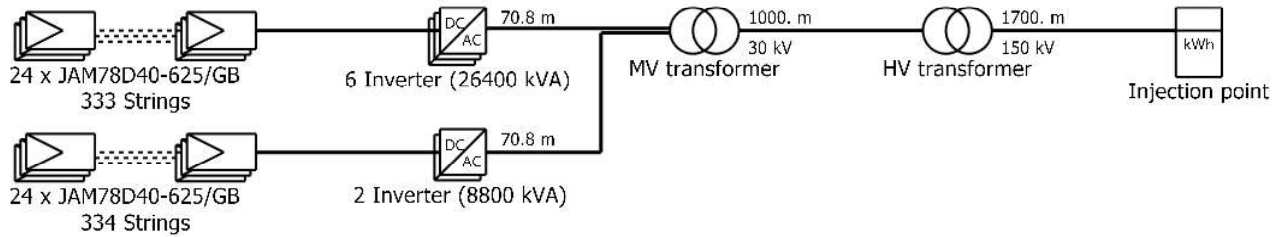




# Single-line diagram

**PVsyst V7.4.2**

VC0, Simulation date:  
21/10/23 14:46  
with v7.4.2



PV module	JAM78D40-625/GB
Inverter	Sunny Central 4400 UP
String	24 x JAM78D40-625/GB

Codrongianus\_def

Mare srls (Italy)

VC0 : JAM 625W

21/10/23