

**ISTANZA VIA**  
**Presentata al**  
**Ministero della Transizione Ecologica**  
**e al Ministero della Cultura**  
**(Art. 23 del D. Lgs 152/2006 e ss. mm. ii**  
**Art. 12 del D. Lgs. 387/03 e ss. mm. ii.)**

**PROGETTO**

**IMPIANTO AGRIVOLTAICO**

**POTENZA NOMINALE (DC) 15,48 MWp**  
**POTENZA IN IMMISSIONE (AC) 13,01 MW**  
**Comune di Barbona (PD)**

**CALCOLO PRODUCIBILITÀ**

**22-00062-IT-BARBONA\_PI-R02**

**PROPONENTE:**

**TEP RENEWABLES (BARBONA PV) S.r.l.**  
**Piazzale Giulio Douhet, 25 – CAP 00143 Roma (RM)**  
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**PROGETTISTI:**

**ING. MATTEO BERTONERI**  
**Ordine degli Ing. della Provincia di Massa Carrara al n. 669 sez. A**

<b>Data</b>	<b>Rev.</b>	<b>Tipo revisione</b>	<b>Redatto</b>	<b>Verificato</b>	<b>Approvato</b>
12/2022	0	Prima emissione	MB	GG	G.Calzolari

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	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b>	2 di 12

## INDICE

<b>1</b>	<b>PREMESSA .....</b>	<b>3</b>
<b>2</b>	<b>RISULTATI .....</b>	<b>3</b>

	<b>IMPIANTO AGRIVOLTAICO</b> <b>POTENZA NOMINALE (DC) 15,48 MWp -</b> <b>POTENZA IN IMMISSIONE (AC) 13,01 MW</b> <b>Comune di Barbona (PD)</b>	<b>Rev.</b>	0
	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b>	3 di 12

## 1 PREMESSA

Il presente documento rappresenta costituisce la Relazione di calcolo della producibilità di un impianto fotovoltaico a terra con una potenza installata pari a 15,48 MWp, sito nel comune di Barbona (PD) in territorio agricolo.

L'impianto fotovoltaico sarà tecnicamente connesso alla Nuova SE mediante cavo interrato che si estenderà per un percorso di circa 21,79 km, massimamente lungo la viabilità pubblica. L'allaccio alla Stazione Elettrica avverrà in antenna a 36 kV su una nuova Stazione Elettrica (SE) della RTN a 132/36 kV da inserire in entra – esce alle linee RTN a 132 kV “San Bellino – Rovigo ZI” e “Canaro – Rovigo RT”.

La simulazione prende in esame un anno tipo ed è stata è effettuata tramite il programma per sistemi fotovoltaici PVsyst.

## 2 RISULTATI

In sintesi, l'energia prodotta risulta essere di circa 23982 MWh/anno e la produzione specifica è pari a circa 1550 (kWh/kWp)/anno. In base ai parametri impostati per le relative perdite d'impianto, i componenti scelti (moduli e inverter) e alle condizioni meteorologiche del sito in esame risulta un indice di rendimento (performance ratio PR) del 84,57% circa;

Di seguito si riportano i report delle simulazioni effettuate con il software.

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	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b>	4 di 12



Version 7.2.11

# PVsyst - Simulation report

## Grid-Connected System

Project: Barbona

Variant: Fotovoltaico

Tracking system with backtracking

System power: 15.48 MWp

Barbona - Italia

| Author

	<b>IMPIANTO AGRIVOLTAICO</b> <b>POTENZA NOMINALE (DC) 15,48 MWp -</b> <b>POTENZA IN IMMISSIONE (AC) 13,01 MW</b> <b>Comune di Barbona (PD)</b>	<b>Rev.</b> 0
	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b> 5 di 12



**PVsyst V7.2.11**

VC0, Simulation date:  
20/12/22 17:16  
with v7.2.11

Project: Barbona

Variant: Fotovoltaico

**Project summary**

<b>Geographical Site</b> <b>Barbona</b> Italia	<b>Situation</b> Latitude 45.11 °N Longitude 11.70 °E Altitude 7 m Time zone UTC+1	<b>Project settings</b> Albedo 0.20
<b>Meteo data</b> Barbona PVGIS api TMY		

**System summary**

<b>Grid-Connected System</b>  <b>PV Field Orientation</b> Tracking plane, horizontal N-S axis Axis azimuth 0 °	<b>Tracking system with backtracking</b>  <b>Near Shadings</b> Linear shadings	<b>User's needs</b> Unlimited load (grid)
<b>System information</b> <b>PV Array</b>		
Nb. of modules 25792 units Pnom total 15.48 MWp	<b>Inverters</b> Nb. of units 6 units Pnom total 18.00 MWac Grid power limit 13.01 MWac Grid lim. Pnom ratio 1.189	

**Results summary**

Produced Energy	23982 MWh/year	Specific production	1550 kWh/kWp/year	Perf. Ratio PR	84.57 %
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**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
Special graphs	9

	<b>IMPIANTO AGRIVOLTAICO</b> <b>POTENZA NOMINALE (DC) 15,48 MWp -</b> <b>POTENZA IN IMMISSIONE (AC) 13,01 MW</b> <b>Comune di Barbona (PD)</b>	<b>Rev.</b> 0
	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b> 6 di 12


**PVsyst V7.2.11**

VC0, Simulation date:  
20/12/22 17:16  
with v7.2.11

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**General parameters**

<b>Grid-Connected System</b>		<b>Tracking system with backtracking</b>	
<b>PV Field Orientation</b>		<b>Backtracking strategy</b>	
<b>Orientation</b>		<b>Nb. of trackers</b>	806 units
Tracking plane, horizontal N-S axis		<b>Sizes</b>	
Axis azimuth	0 °	Tracker Spacing	10.0 m
		Collector width	4.36 m
		Ground Cov. Ratio (GCR)	43.6 %
		Phi min / max.	-/+ 55.0 °
		<b>Backtracking limit angle</b>	
		Phi limits	+/- 64.0 °
<b>Horizon</b>		<b>Near Shadings</b>	
Free Horizon		Linear shadings	
<b>Bifacial system</b>		<b>User's needs</b>	
Model	2D Calculation unlimited trackers	Unlimited load (grid)	
<b>Bifacial model geometry</b>		<b>Bifacial model definitions</b>	
Tracker Spacing	10.00 m	Ground albedo	0.20
Tracker width	4.40 m	Bifaciality factor	80 %
GCR	44.0 %	Rear shading factor	4.0 %
Axis height above ground	2.30 m	Rear mismatch loss	1.0 %
		Shed transparent fraction	1.3 %
<b>Grid power limitation</b>			
Active Power	13.01 MWac		
Pnom ratio	1.189		

**PV Array Characteristics**

<b>PV module</b>		<b>Inverter</b>	
Manufacturer	Trina Solar	Manufacturer	SMA
Model	TSM-DEG20C.20	Model	SG3000HV-MV
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	600 Wp	Unit Nom. Power	3000 kWac
Number of PV modules	25792 units	Number of inverters	6 units
Nominal (STC)	15.48 MWp	Total power	18000 kWac
<b>Array #1 - Settore A</b>		Number of inverters	1 unit
Number of PV modules	4416 units	Total power	3000 kWac
Nominal (STC)	2650 kWp	Operating voltage	900-1500 V
Modules	138 Strings x 32 In series	Pnom ratio (DC:AC)	0.88
<b>At operating cond. (50°C)</b>			
Pmpp	2424 kWp		
U mpp	1009 V		
I mpp	2403 A		
<b>Array #2 - Settore B</b>		Number of inverters	1 unit
Number of PV modules	4416 units	Total power	3000 kWac
Nominal (STC)	2650 kWp	Operating voltage	900-1500 V
Modules	138 Strings x 32 In series	Pnom ratio (DC:AC)	0.88
<b>At operating cond. (50°C)</b>			
Pmpp	2424 kWp		
U mpp	1009 V		
I mpp	2403 A		

	<b>IMPIANTO AGRIVOLTAICO</b> <b>POTENZA NOMINALE (DC) 15,48 MWp -</b> <b>POTENZA IN IMMISSIONE (AC) 13,01 MW</b> <b>Comune di Barbona (PD)</b>	<b>Rev.</b> 0
	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b> 7 di 12


**PVsyst V7.2.11**

 VCO, Simulation date:  
 20/12/22 17:16  
 with v7.2.11

Project: Barbona

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**PV Array Characteristics**

<b>Array #3 - Settore C</b>			
Number of PV modules	4416 units	Number of inverters	1 unit
Nominal (STC)	2650 kWp	Total power	3000 kWac
Modules	138 Strings x 32 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	900-1500 V
Pmpp	2424 kWp	Pnom ratio (DC:AC)	0.88
U mpp	1009 V		
I mpp	2403 A		
<b>Array #4 - Settore D</b>			
Number of PV modules	4416 units	Number of inverters	1 unit
Nominal (STC)	2650 kWp	Total power	3000 kWac
Modules	138 Strings x 32 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	900-1500 V
Pmpp	2424 kWp	Pnom ratio (DC:AC)	0.88
U mpp	1009 V		
I mpp	2403 A		
<b>Array #5 - Settore E</b>			
Number of PV modules	4064 units	Number of inverters	1 unit
Nominal (STC)	2438 kWp	Total power	3000 kWac
Modules	127 Strings x 32 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	900-1500 V
Pmpp	2231 kWp	Pnom ratio (DC:AC)	0.81
U mpp	1009 V		
I mpp	2211 A		
<b>Array #6 - Settore F</b>			
Number of PV modules	4064 units	Number of inverters	1 unit
Nominal (STC)	2438 kWp	Total power	3000 kWac
Modules	127 Strings x 32 In series		
<b>At operating cond. (50°C)</b>		Operating voltage	900-1500 V
Pmpp	2231 kWp	Pnom ratio (DC:AC)	0.81
U mpp	1009 V		
I mpp	2211 A		
<b>Total PV power</b>		<b>Total inverter power</b>	
Nominal (STC)	15475 kWp	Total power	18000 kWac
Total	25792 modules	Number of inverters	6 units
Module area	72994 m <sup>2</sup>	Pnom ratio	0.86

**Array losses**

<b>Array Soiling Losses</b>		<b>Thermal Loss factor</b>		<b>LID - Light Induced Degradation</b>				
Loss Fraction	4.0 %	Module temperature according to irradiance		Loss Fraction	0.5 %			
		Uc (const)	31.3 W/m <sup>2</sup> K					
		Uv (wind)	2.3 W/m <sup>2</sup> K/m/s					
<b>Module Quality Loss</b>		<b>Module mismatch losses</b>		<b>Strings Mismatch loss</b>				
Loss Fraction	-0.8 %	Loss Fraction	2.0 % at MPP	Loss Fraction	0.1 %			
<b>IAM loss factor</b>								
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

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	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b> 8 di 12


**PVsyst V7.2.11**

 VCO, Simulation date:  
 20/12/22 17:16  
 with v7.2.11

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Variant: Fotovoltaico

**DC wiring losses**

Global wiring resistance	1.2 mΩ		
Loss Fraction	1.5 % at STC		
<b>Array #1 - Settore A</b>			
Global array res.	6.8 mΩ	<b>Array #2 - Settore B</b>	6.8 mΩ
Loss Fraction	1.5 % at STC	Global array res.	6.8 mΩ
		Loss Fraction	1.5 % at STC
<b>Array #3 - Settore C</b>			
Global array res.	6.8 mΩ	<b>Array #4 - Settore D</b>	6.8 mΩ
Loss Fraction	1.5 % at STC	Global array res.	6.8 mΩ
		Loss Fraction	1.5 % at STC
<b>Array #5 - Settore E</b>			
Global array res.	7.4 mΩ	<b>Array #6 - Settore F</b>	7.4 mΩ
Loss Fraction	1.5 % at STC	Global array res.	7.4 mΩ
		Loss Fraction	1.5 % at STC

**System losses**

<b>Unavailability of the system</b>		<b>Auxiliaries loss</b>	
Time fraction	2.0 %	constant (fans)	2.00 kW
	7.3 days,	0.0 kW from Power thresh.	
	3 periods		

**AC wiring losses**

<b>Inv. output line up to MV transfo</b>	
Inverter voltage	600 Vac tri
Loss Fraction	0.03 % at STC
<b>Inverter: SG3000HV-MV</b>	
Wire section (6 Inv.)	Copper 6 x 3 x 2000 mm <sup>2</sup>
Average wires length	5 m
<b>HV line up to Injection</b>	
HV line voltage	36 kV
Wires	Copper 3 x 240 mm <sup>2</sup>
Length	21790 m
Loss Fraction	2.00 % at STC

**AC losses in transformers**

<b>MV transfo</b>		Medium voltage		36 kV
<b>Operating losses at STC</b>				
Nominal power at STC	15214 kVA	Nominal power at STC	15214 kVA	
Iron loss (24/24 Connexion)	15.21 kW	Iron loss (24/24 Connexion)	33.00 kW	
Loss Fraction	0.10 % at STC	Loss Fraction	0.22 % at STC	
Coils equivalent resistance	3 x 0.24 mΩ	Coils equivalent resistance	3 x 357.0 mΩ	
Loss Fraction	1.00 % at STC	Loss Fraction	0.42 % at STC	
<b>HV transfo</b>				
Grid voltage		36 kV		
<b>Transformer from Datasheets</b>				
Nominal power	33000 kVA	Nominal power at STC	15214 kVA	
Iron loss	33.00 kVA	Iron loss (24/24 Connexion)	33.00 kW	
Loss Fraction	0.10 % of PNom	Loss Fraction	0.22 % at STC	
Copper loss	300.00 kVA	Coils equivalent resistance	3 x 357.0 mΩ	
Loss Fraction	0.91 % of PNom	Loss Fraction	0.42 % at STC	

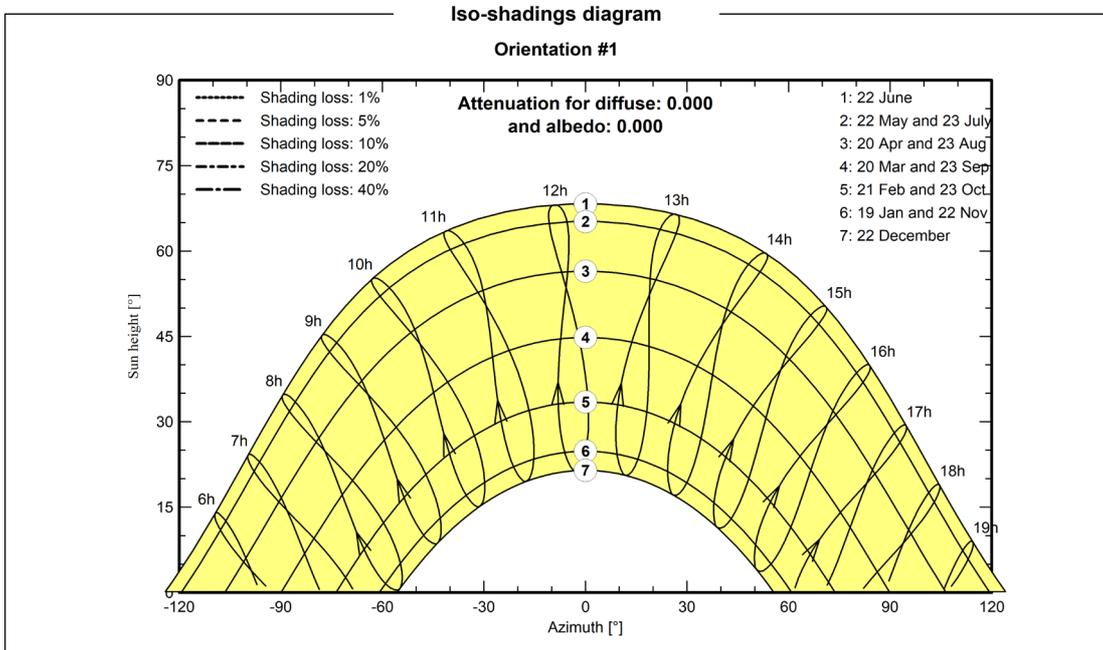
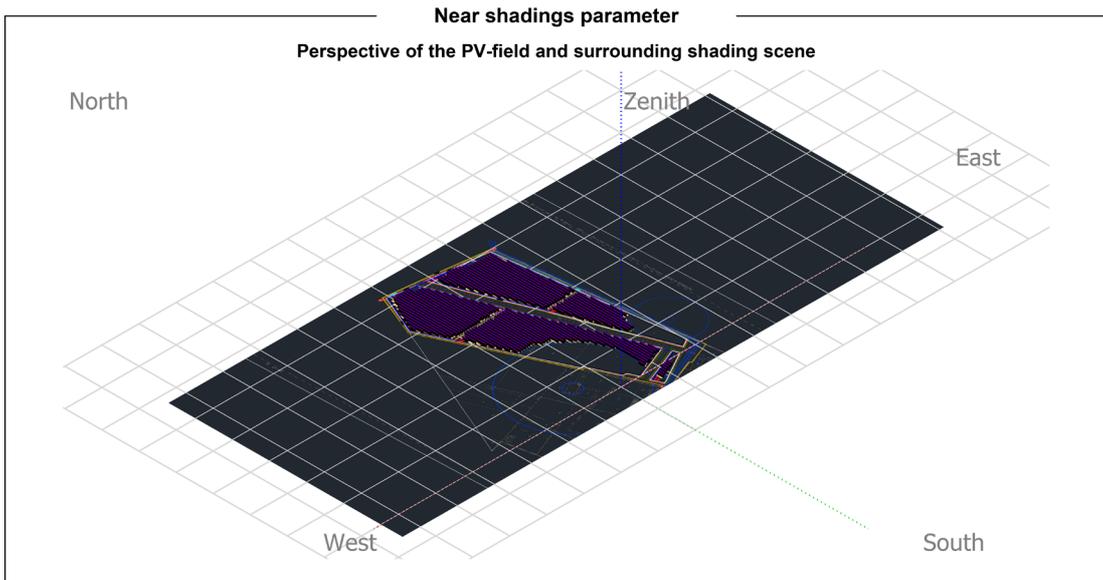
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	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b> 9 di 12



Project: Barbona

Variant: Fotovoltaico

**PVsyst V7.2.11**  
 VCO, Simulation date:  
 20/12/22 17:16  
 with v7.2.11





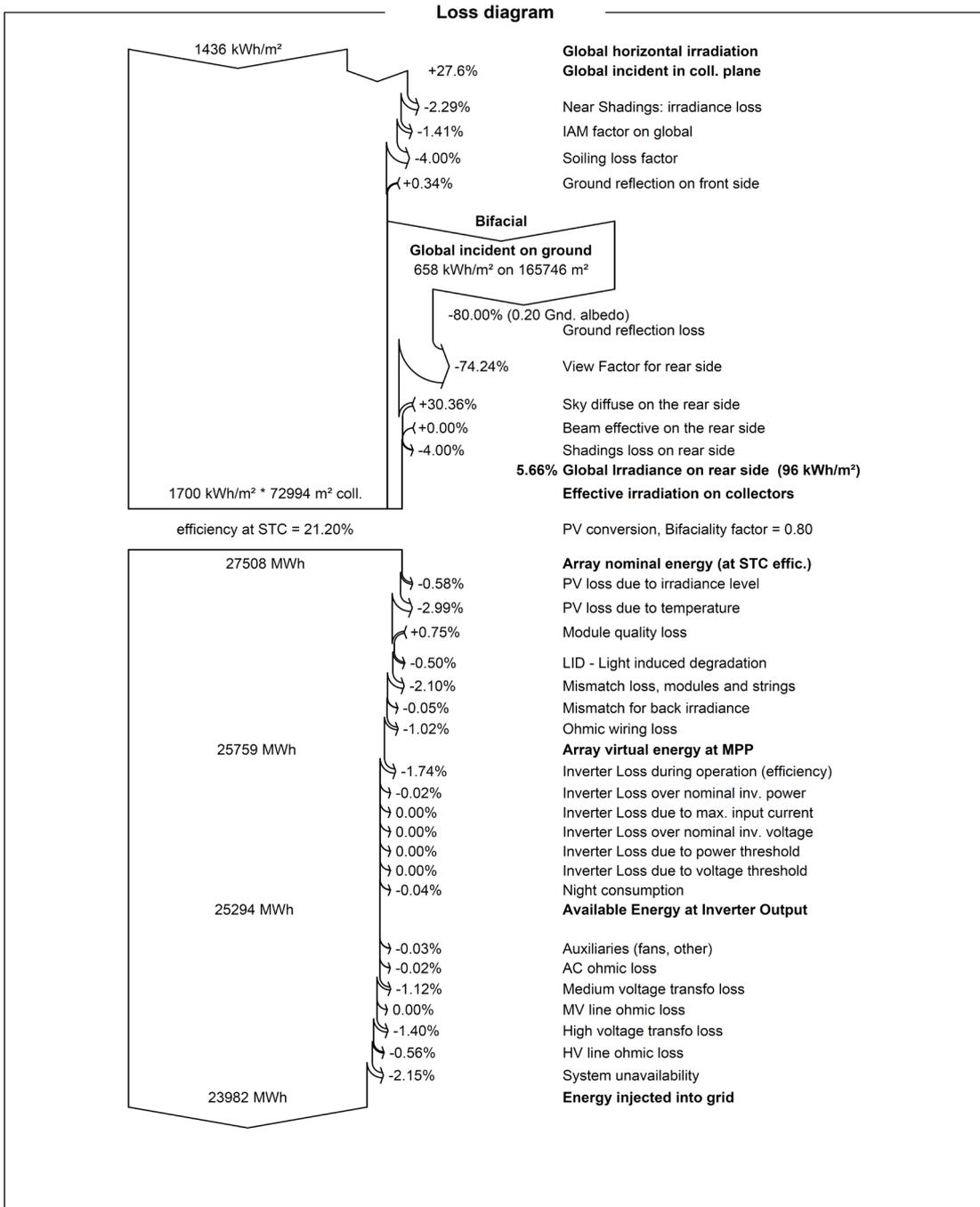
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	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b> 11 di 12



Project: Barbona

Variant: Fotovoltaico

**PVsyst V7.2.11**  
 VCO, Simulation date:  
 20/12/22 17:16  
 with v7.2.11



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	<b>22-00062-IT-BARBONA_PI-R02</b> <b>CALCOLO PRODUCIBILITÀ</b>	<b>Pag.</b> 12 di 12



Project: Barbona

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**PVsyst V7.2.11**  
 VC0, Simulation date:  
 20/12/22 17:16  
 with v7.2.11

Special graphs

