ENE 002a – Grosseto
Comune: Grosseto
Provincia: Grosseto
Regione: Toscana

Nome Progetto:

ENE 002a - Grosseto
Progetto di un impianto agrivoltaico sito nel comune di Grosseto in Località "Brancacci" di potenza nominale pari a 38.47 MWp in DC

Proponente:	Consulenza ambientale e progettazione:
GROSSETO GREEN POWER S.R.L	ARCADIS Italia S.r.l. Via Monte Rosa, 93 20149 | Milano (MI) P.Iva: 01521770212 E-mail: info@arcadis.it

PROGETTO DEFINITIVO

Nome documento:

Stima Producibilità Impianto

Commessa	Codice elaborato	Nome file
30190245	PRO_REL_12	PRO-REL-12- Stima producibilità Impianto

00	Dic. 23	Prima Emissione	MA	MA	SDA
Rev.	Data	Oggetto revisione	Redatto	Verificato	Approvato

Version 7.4.5

PVsyst - Simulation report

Grid-Connected System

Project: Grosseto

Variant: New simulation variant

Tracking system

System power: 38.47 MWp

Pollino - Italy

Author
ARCADIS (italy)

Project summary

Geographical Site
Pollino
Italy

Situation

Latitude	42.76 °N
Longitude	11.07 °E
Altitude	11 m
Time zone	UTC+1

Project settings

Albedo	0.20

Meteo data
Pollino
PVGIS api TMY

System summary

Grid-Connected System

Tracking system

PV Field Orientation

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

Tracking algorithm	
Astronomic calculation	

Near Shadings

Linear shadings : Fast (table)	
Diffuse shading	Automatic

System information

PV Array		**Inverters**	
Nb. of modules	55748 units	Nb. of units	8 units
Pnom total	38.47 MWp	Pnom total	33.60 MWac
		Pnom ratio	1.145

User's needs
Unlimited load (grid)

Results summary

Produced Energy	67440103 kWh/year	Specific production	1753 kWh/kWp/year	Perf. Ratio PR	80.65 %

Table of contents

General parameters

Grid-Connected System

Tracking system

PV Field Orientation

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

Tracking algorithm
Astronomic calculation

Trackers configuration
Nb. of trackers 2103 units

Sizes
Tracker Spacing 6.60 m
Collector width 2.38 m
Ground Cov. Ratio (GCR) 36.1 %
Phi min / max. -/+ 55.0 °

Shading limit angles
Phi limits for BT -/+ 68.7 °

Models used

Transposition	Perez
Diffuse	Imported
Circumsolar	separate

Horizon
Free Horizon

Near Shadings
Linear shadings : Fast (table)
Diffuse shading Automatic

User's needs
Unlimited load (grid)

Bifacial system
Model 2D Calculation
unlimited trackers

Bifacial model geometry

Tracker Spacing	6.60 m
Tracker width	2.38 m
GCR	36.1 %
Axis height above ground	3.00 m

Bifacial model definitions

Ground albedo	0.20
Bifaciality factor	72 %
Rear shading factor	17.0 %
Rear mismatch loss	10.0 %
Shed transparent fraction	0.0 %

PV Array Characteristics

PV module

Manufacturer	Trina Solar
Model	TSM-DEG21C-20-690Wp Vertex
(Custom parameters definition)	
Unit Nom. Power	690 Wp
Number of PV modules	55748 units
Nominal (STC)	38.47 MWp
Modules	1991 string x 28 In series

At operating cond. (50°C)

Pmpp	35.24 MWp
U mpp	1017 V
I mpp	34634 A

Inverter

Manufacturer	SMA
Model	Sunny Central 4200 UP
(Original PVsyst database)	
Unit Nom. Power	4200 kWac
Number of inverters	8 units
Total power	33600 kWac
Operating voltage	921-1325 V
Pnom ratio (DC:AC)	1.14

Total PV power

Nominal (STC)	38466 kWp
Total	55748 modules
Module area	173173 m²

Total inverter power

Total power	33600 kWac
Number of inverters	8 units
Pnom ratio	1.14

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Array losses

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 20.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 0.97 mΩ
Loss Fraction 3.0 % at STC

LID - Light Induced Degradation
Loss Fraction 1.5 %

Module Quality Loss
Loss Fraction -0.4 %

Module mismatch losses
Loss Fraction 2.0 % at MPP

Strings Mismatch loss
Loss Fraction 0.2 %

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,
3 periods

Auxiliaries loss
constant (fans) 65.0 kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to MV transfo
Inverter voltage 630 Vac tri
Loss Fraction 0.03 % at STC

Global System
Wire section Copper 3 x 30000 mm²
Wires length 5 m

MV line up to HV Transfo
MV Voltage 30 kV
Average each inverter
Wires Alu 3 x 240 mm²
Length 11125 m
Loss Fraction 0.77 % at STC

HV line up to Injection
HV line voltage 132 kV
Wires Alu 3 x 500 mm²
Length 20 m
Loss Fraction 0.00 % at STC

AC losses in transformers

MV transfo
Medium voltage 30 kV

One transfo parameters
Nominal power at STC 4.72 MVA
Iron Loss (24/24 Connexion) 4.72 kVA
Iron loss fraction 0.10 % at STC
Copper loss 47.18 kVA
Copper loss fraction 1.00 % at STC
Coils equivalent resistance 3 x 0.84 mΩ

Operating losses at STC (full system)
Nb. identical MV transfos 8
Nominal power at STC 37.75 MVA
Iron loss (24/24 Connexion) 37.75 kVA
Copper loss 377.46 kVA

AC losses in transformers

HV transfo

Grid voltage	132 kV
Transformer from Datasheets	
Nominal power	40000 kVA
Iron Loss (24/24 Connexion)	12.90 kVA
Iron loss fraction	0.03 % of PNom
Copper loss	236.00 kVA
Copper loss fraction	0.59 % at PNom
Coils equivalent resistance	3 x 132.75 mΩ

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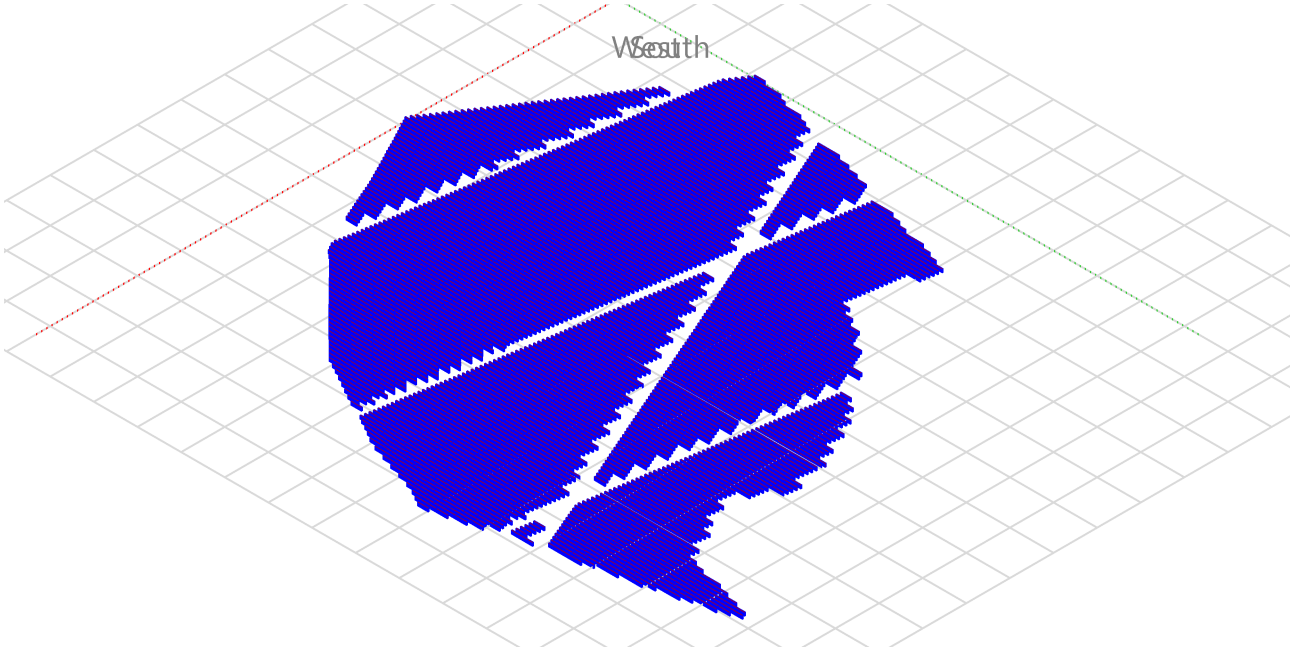
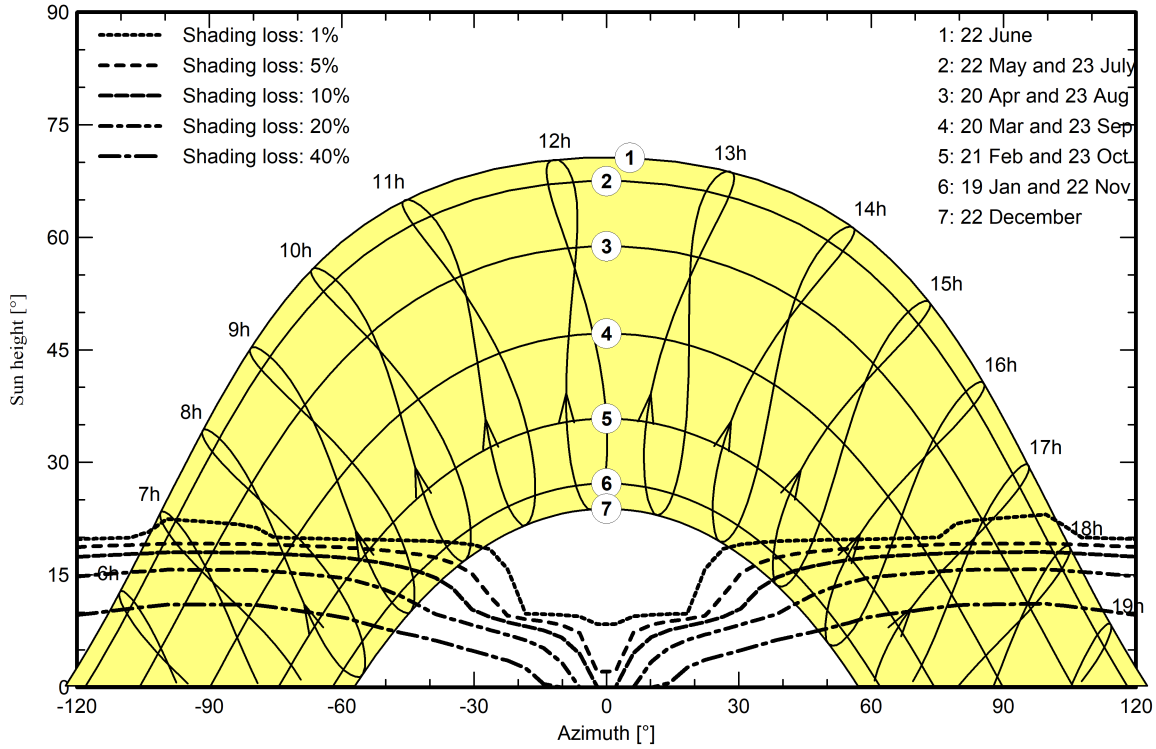
Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

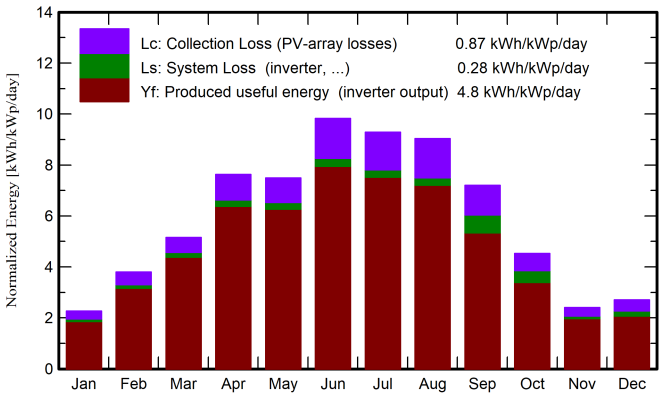


Main results

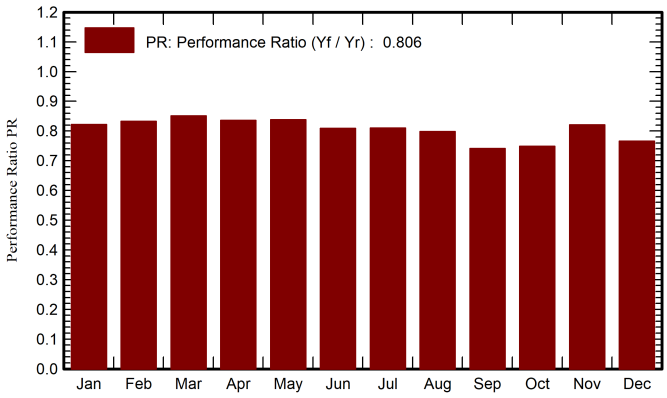
System Production

Produced Energy	67440103 kWh/year	Specific production	1753 kWh/kWp/year
		Perf. Ratio PR	80.65 %

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 kWh	E_Grid kWh	PR ratio
January	48.6	24.70	9.14	70.3	61.2	2337298	2223240	0.822
February	72.9	30.35	8.43	106.5	95.0	3563656	3413889	0.833
March	116.4	49.17	10.19	159.9	148.6	5458183	5235196	0.851
April	168.6	62.55	13.48	229.0	215.4	7666794	7362953	0.836
May	178.3	77.39	16.36	232.4	220.9	7794400	7486938	0.838
June	219.1	75.97	21.73	295.0	279.6	9545205	9179323	0.809
July	213.7	74.81	22.58	288.0	273.3	9328867	8971885	0.810
August	202.2	61.30	25.86	280.2	266.4	8945190	8604997	0.798
September	150.7	50.39	21.80	216.0	201.6	6985236	6160416	0.742
October	98.0	40.87	18.57	140.5	128.2	4610989	4048630	0.749
November	52.2	28.58	14.12	72.2	63.5	2394109	2280101	0.821
December	54.5	24.76	10.13	83.9	71.6	2722761	2472534	0.766
Year	1575.4	600.84	16.08	2174.0	2025.2	71352687	67440103	0.806

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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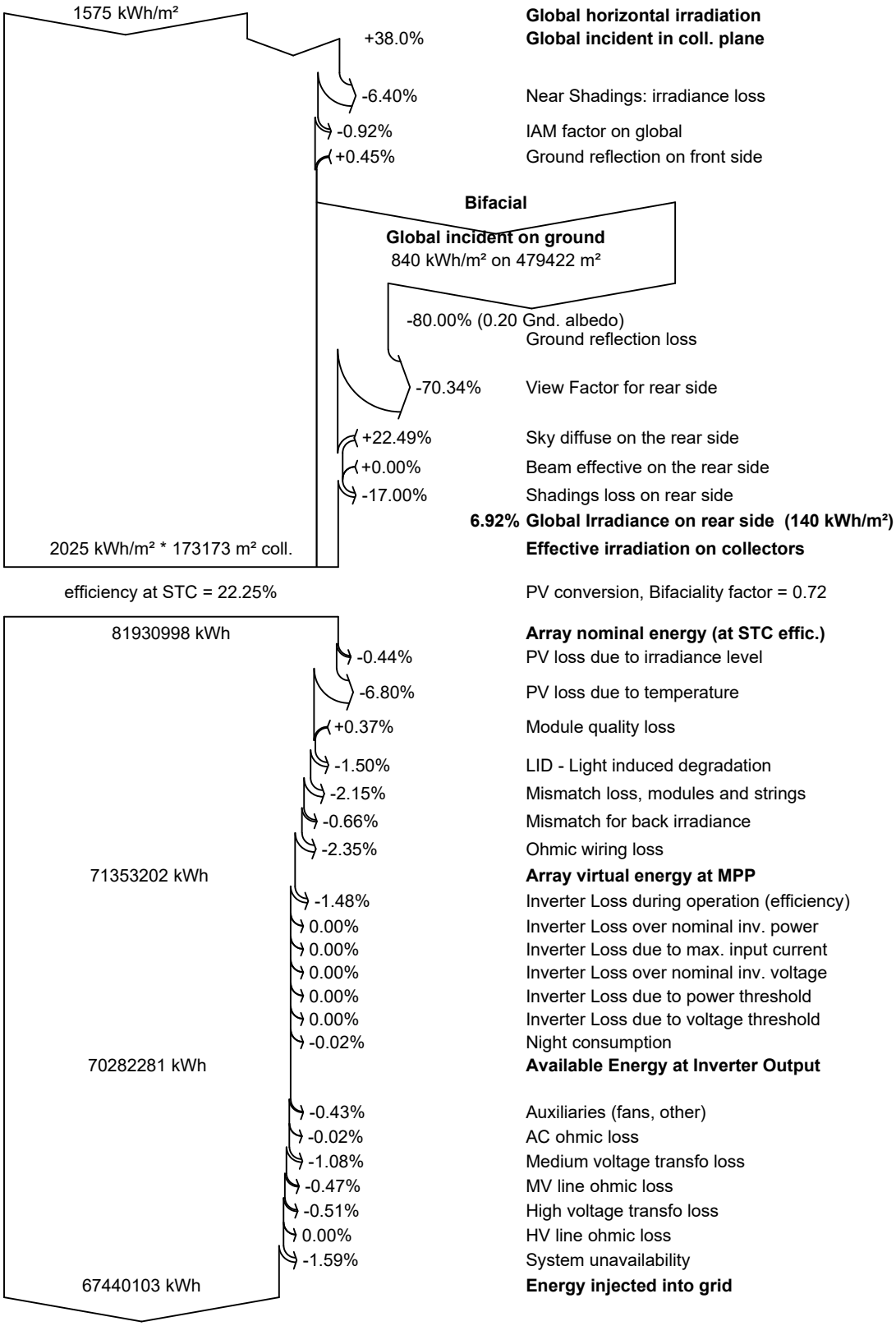
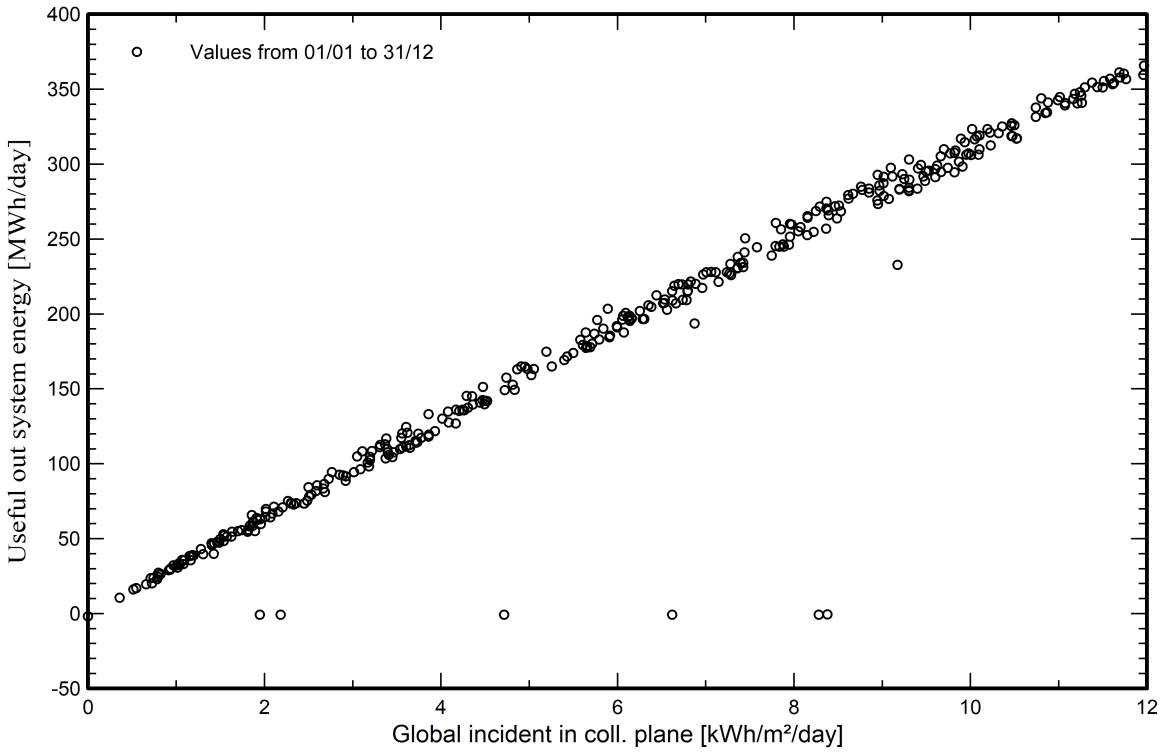
Loss diagram

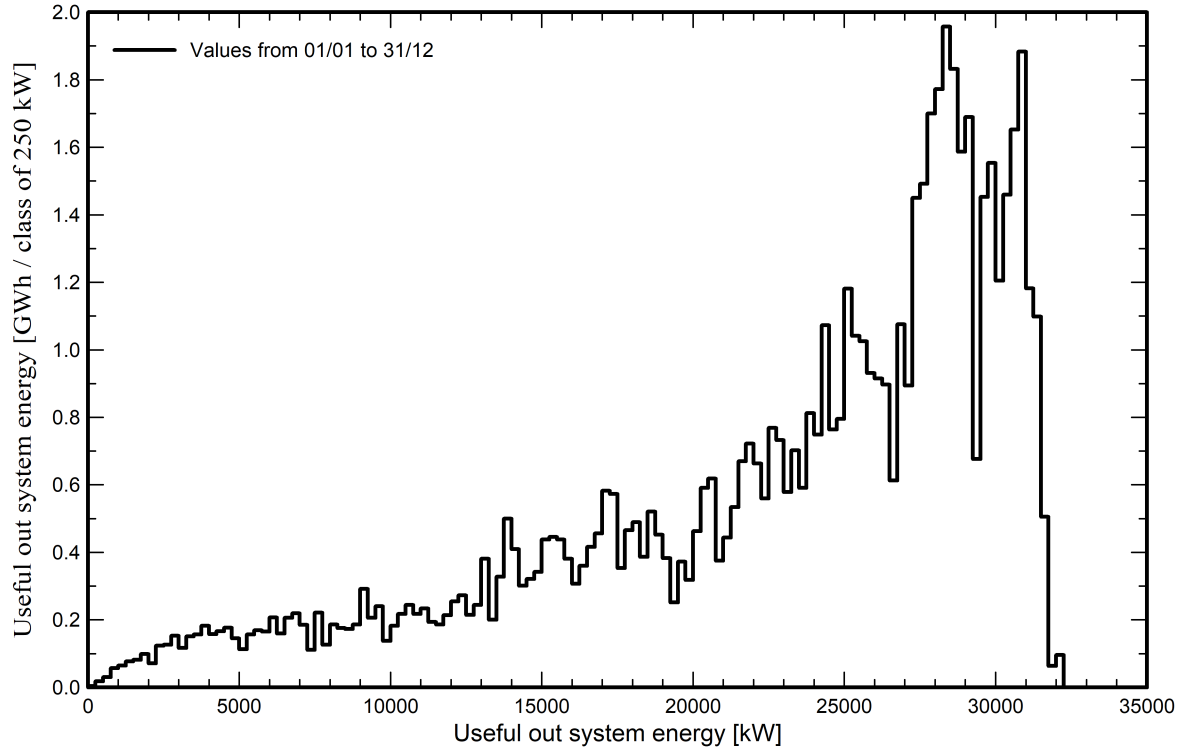


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution



Single-line diagram

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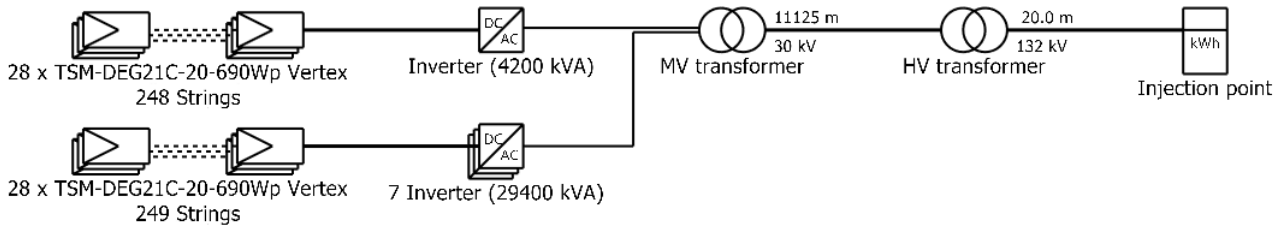

PV module	TSM-DEG21C-20-690Wp Vertex
Inverter	Sunny Central 4200 UP
String	28 x TSM-DEG21C-20-690Wp Vertex

	Grosseto	ARCADIS (italy)
	VC0 : New simulation variant	05/02/24