



Committente:

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Progetto definitivo:

PROVVEDIMENTO AUTORIZZATIVO UNICO REGIONALE ai sensi dell' art. 27 bis del D.Lgs. 152/06 e del D.M. 52/2015

Denominazione progetto:

IMPIANTO FOTOVOLTAICO "CARPI-Fossoli" di potenza 21,91 MWp con annesso SISTEMA DI ACCUMULO (BESS) di potenza 15 MWp

Sito in:

COMUNE DI CARPI (MO)

Titolo elaborato:

Stima di producibilità dell'impianto

Elaborato: T-6

Scala -



Responsabile Coordinamento progetto : dott. for. Edoardo Pio Iurato

TIMBRI E FIRME:

Progettisti : Ing. Roberto Graffi

Collaboratori : Paola Russo



Roberto Graffi

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PVsyst - Simulation report

Grid-Connected System

Project: Carpi

Variant: Nuova variante di simulazione

Tracking system

System power: 21.91 MWp

Goldoni - Italy

Author

flyRen Development srl (Italy)

**PVsyst V8.0.8**

VC0, Simulation date:
24/03/25 12:54
with V8.0.8

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Project summary**Geographical Site****Goldoni**

Italy

Situation

Latitude 44.85 °(N)

Longitude 10.91 °(E)

Altitude 24 m

Time zone UTC+1

Project settings

Albedo 0.20

Weather data

Goldoni

Meteonorm 8.2 (1991-2012), Sat=100% - Sintetico

System summary**Grid-Connected System****Orientation #1****Tracking plane, horizontal N-S axis**

Axis azimuth 7.5 °

Phi min / max. -/+ 60 °

Diffuse shading all trackers

Tracking algorithm

Astronomic calculation

Tracking system**Orientation #2****Tracking plane, horizontal N-S axis**

Axis azimuth 0 °

Phi min / max. -/+ 60 °

Diffuse shading all trackers

Tracking algorithm

Astronomic calculation

Near Shadings

Linear shadings : Slow (simul.)

System information**PV Array**

Nb. of modules 30016 units

Pnom total 21.91 MWp

Inverters

Nb. of units 58 units

Total power 19140 kWac

Pnom ratio 1.14

User's needs

Unlimited load (grid)

Results summary

Produced Energy	32238 MWh/year	Specific production	1471 kWh/kWp/year	Perf. Ratio PR	79.46 %
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General parameters

Grid-Connected System

Orientation #1

Tracking plane, horizontal N-S axis

Axis azimuth 7.5 °
Phi min / max. +/- 60 °
Diffuse shading all trackers

Tracking algorithm

Astronomic calculation

Orientation #2

Tracking plane, horizontal N-S axis

Axis azimuth 0 °
Phi min / max. +/- 60 °
Diffuse shading all trackers

Tracking algorithm

Astronomic calculation

Models used

Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

User's needs

Unlimited load (grid)

Tracking system

Trackers configuration

Nb. of trackers 940 units
Tracking plane, horizontal N-S axis
Shading limit angles
Phi limits +/- 61.5 °

Sizes

Tracker Spacing 5.00 m
Collector width 2.38 m
Average GCR 47.7 %

Trackers configuration

Nb. of trackers 204 units
Tracking plane, horizontal N-S axis
Shading limit angles
Phi limits +/- 61.5 °

Sizes

Tracker Spacing 5.00 m
Collector width 2.38 m
Average GCR 47.7 %

Horizon

Free Horizon

Near Shadings

Linear shadings : Slow (simul.)

PV Array Characteristics

PV module

Manufacturer Sungi Solar
Model SNG-730-M-132
(Original PVsyst database)
Unit Nom. Power 730 Wp
Number of PV modules 30016 units
Nominal (STC) 21.91 MWp

Array #1 - Campo FV

Orientation #1
Tilt/Azimuth 0/-83 °
Number of PV modules 24864 units
Nominal (STC) 18.15 MWp
Modules 888 string x 28 In series

At operating cond. (50°C)

Pmpp 17.00 MWp
U mpp 1132 V
I mpp 15025 A

Array #2 - Sottocampo #2

Orientation #2
Tilt/Azimuth 0/-90 °
Number of PV modules 5152 units
Nominal (STC) 3761 kWp
Modules 184 string x 28 In series

At operating cond. (50°C)

Pmpp 3523 kWp
U mpp 1132 V
I mpp 3113 A

Inverter

Manufacturer Huawei Technologies
Model SUN2000-300KTL-H0
(Custom parameters definition)
Unit Nom. Power 330 kWac
Number of inverters 58 units
Total power 19140 kWac

Number of inverters 48 units
Total power 15840 kWac

Operating voltage 550-1500 V
Max. power (=>30°C) 330 kWac
Pnom ratio (DC:AC) 1.15
Power sharing within this inverter

Number of inverters 10 units
Total power 3300 kWac

Operating voltage 550-1500 V
Max. power (=>30°C) 330 kWac
Pnom ratio (DC:AC) 1.14
Power sharing within this inverter

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PV Array Characteristics**Total PV power**

Nominal (STC) 21912 kWp
Total 30016 modules
Module area 93240 m²

Total inverter power

Total power 19140 kWac
Number of inverters 58 units
Pnom ratio 1.14

Array losses**Array Soiling Losses**

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

Module Quality Loss

Loss Fraction -0.2 %

Module mismatch losses

Loss Fraction 1.5 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

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	0.963	0.892	0.814	0.679	0.438	0.000

DC wiring losses

Global wiring resistance 0.38 mΩ
Loss Fraction 0.6 % at STC

Array #1 - Campo FV

Global array res. 0.41 mΩ
Loss Fraction 0.5 % at STC

Array #2 - Sottocampo #2

Global array res. 5.9 mΩ
Loss Fraction 1.5 % at STC

System losses**Unavailability of the system**

Time fraction 1.5 %
5.5 days,
3 periods



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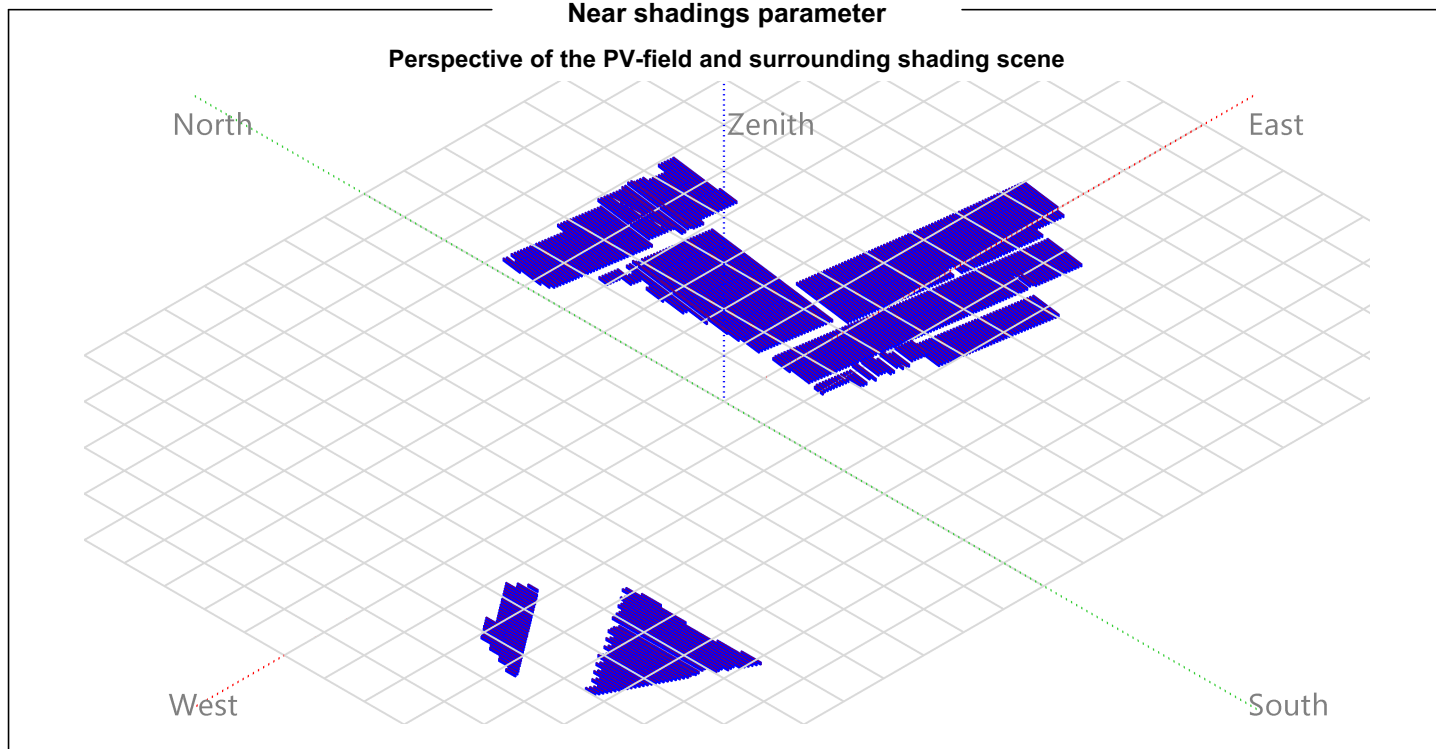
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Near shadings parameter

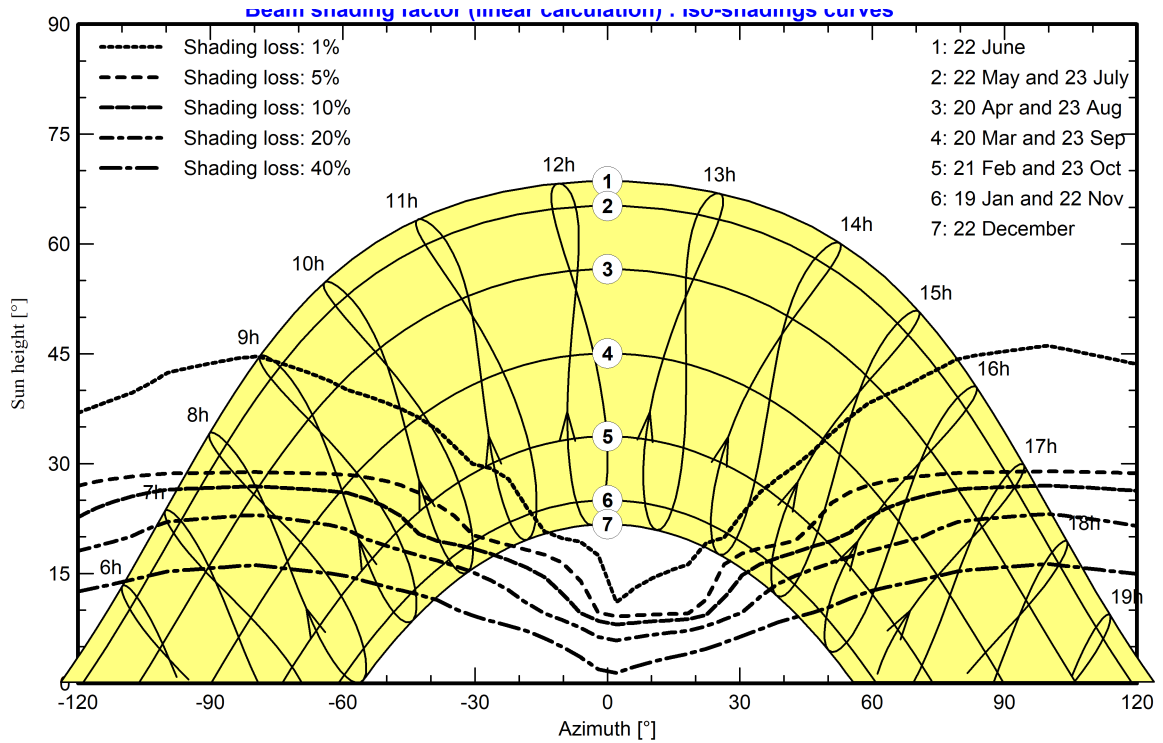
Perspective of the PV-field and surrounding shading scene



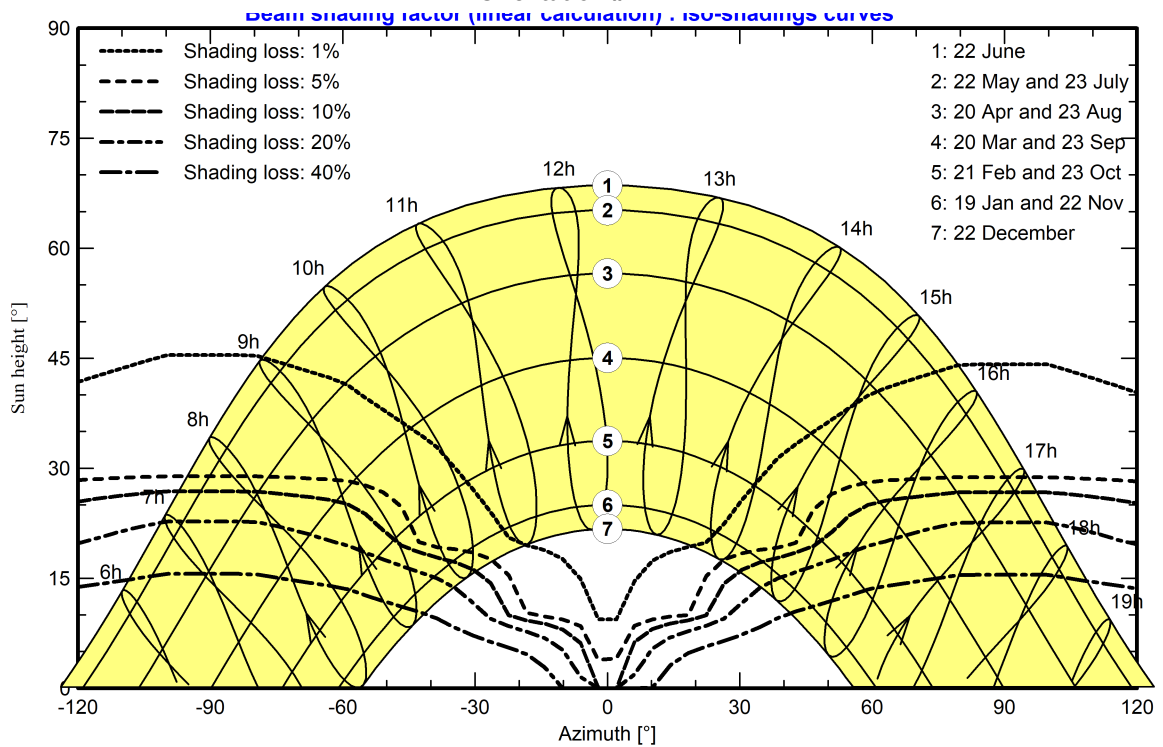


Iso-shadings diagram

Orientation #1 -



Orientation #2 -





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Main results

System Production

Produced Energy

32238 MWh/year

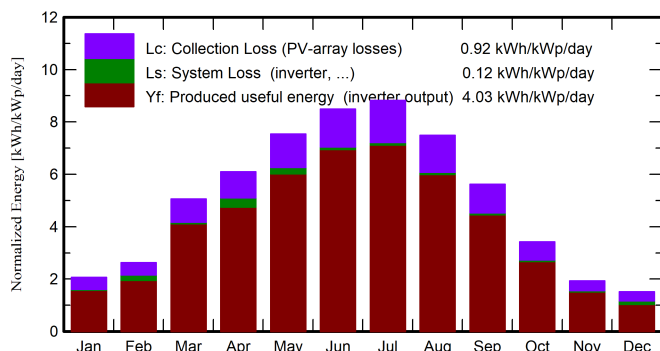
Specific production

1471 kWh/kWp/year

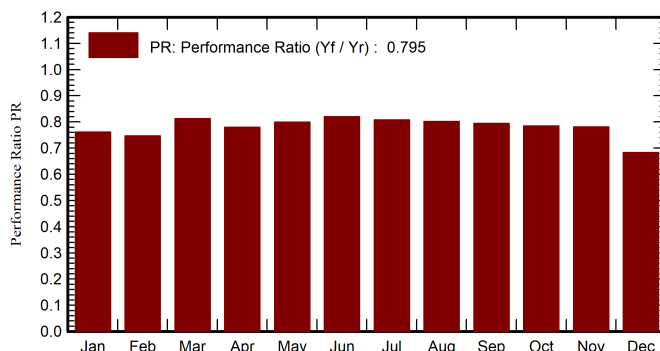
Perf. Ratio PR

79.46 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

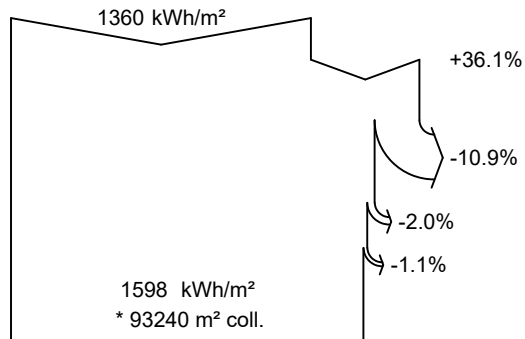
	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray MWh	E_Grid MWh	PR ratio
January	43.4	20.83	2.83	64.1	50.4	1101	1069	0.761
February	55.1	32.55	4.83	73.5	61.4	1331	1202	0.746
March	111.6	48.34	9.76	157.0	132.9	2840	2796	0.813
April	137.2	66.11	13.80	182.8	159.3	3360	3124	0.780
May	174.7	77.11	18.72	233.7	205.7	4255	4093	0.799
June	193.8	86.55	23.21	254.6	226.5	4634	4572	0.819
July	199.9	74.65	25.70	273.5	241.9	4907	4842	0.808
August	170.9	72.21	25.19	232.3	203.1	4135	4079	0.802
September	120.1	49.61	19.73	168.6	143.7	2981	2936	0.795
October	77.7	42.70	14.90	106.1	88.0	1860	1822	0.784
November	42.6	22.30	8.99	58.1	47.9	1027	996	0.781
December	33.3	18.43	3.93	47.2	37.0	801	706	0.683
Year	1360.4	611.38	14.35	1851.6	1597.9	33231	32238	0.795

Legends

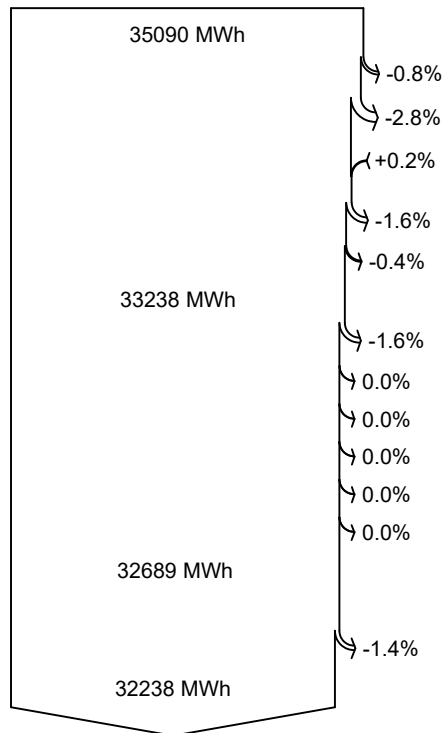
GlobHor	Global horizontal irradiation	EArray	Effective energy at the output of the array
DiffHor	Horizontal diffuse irradiation	E_Grid	Energy injected into grid
T_Amb	Ambient Temperature	PR	Performance Ratio
GlobInc	Global incident in coll. plane		
GlobEff	Effective Global, corr. for IAM and shadings		



Loss diagram



efficiency at STC = 23.55%



Global horizontal irradiation

Global incident in coll. plane

Near Shadings: irradiance loss

Soiling loss factor

IAM factor on global

Effective irradiation on collectors

PV conversion

Array nominal energy (at STC effic.)

PV loss due to irradiance level

PV loss due to temperature

Module quality loss

Mismatch loss, modules and strings

Ohmic wiring loss

Array virtual energy at MPP

Inverter Loss during operation (efficiency)

Inverter Loss over nominal inv. power

Inverter Loss due to max. input current

Inverter Loss over nominal inv. voltage

Inverter Loss due to power threshold

Inverter Loss due to voltage threshold

Available Energy at Inverter Output

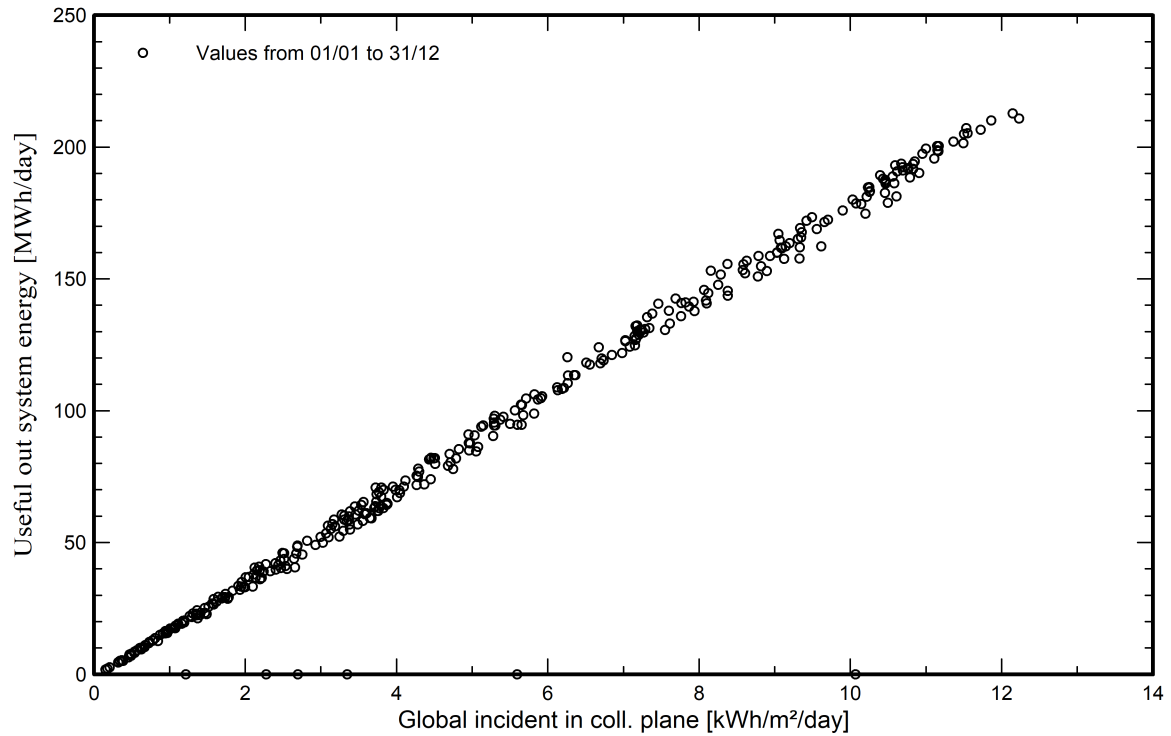
System unavailability

Energy injected into grid

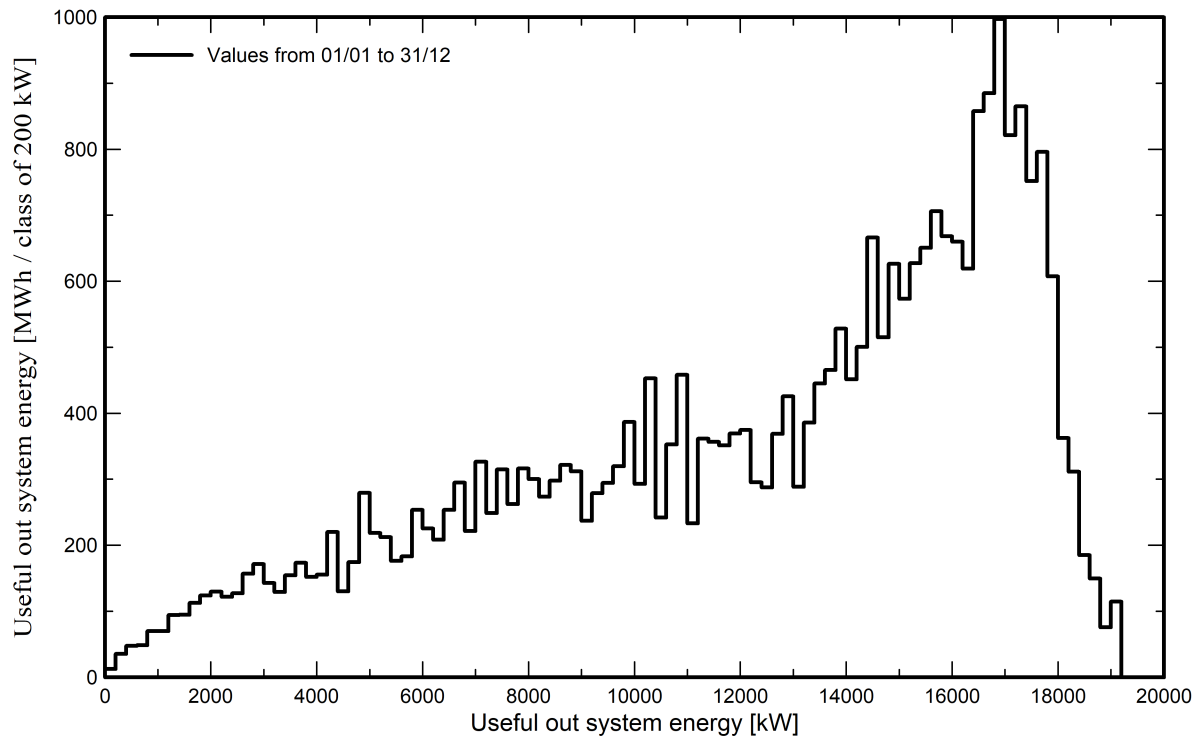


Predef. graphs

Diagramma giornaliero entrata/uscita



Distribuzione potenza in uscita sistema





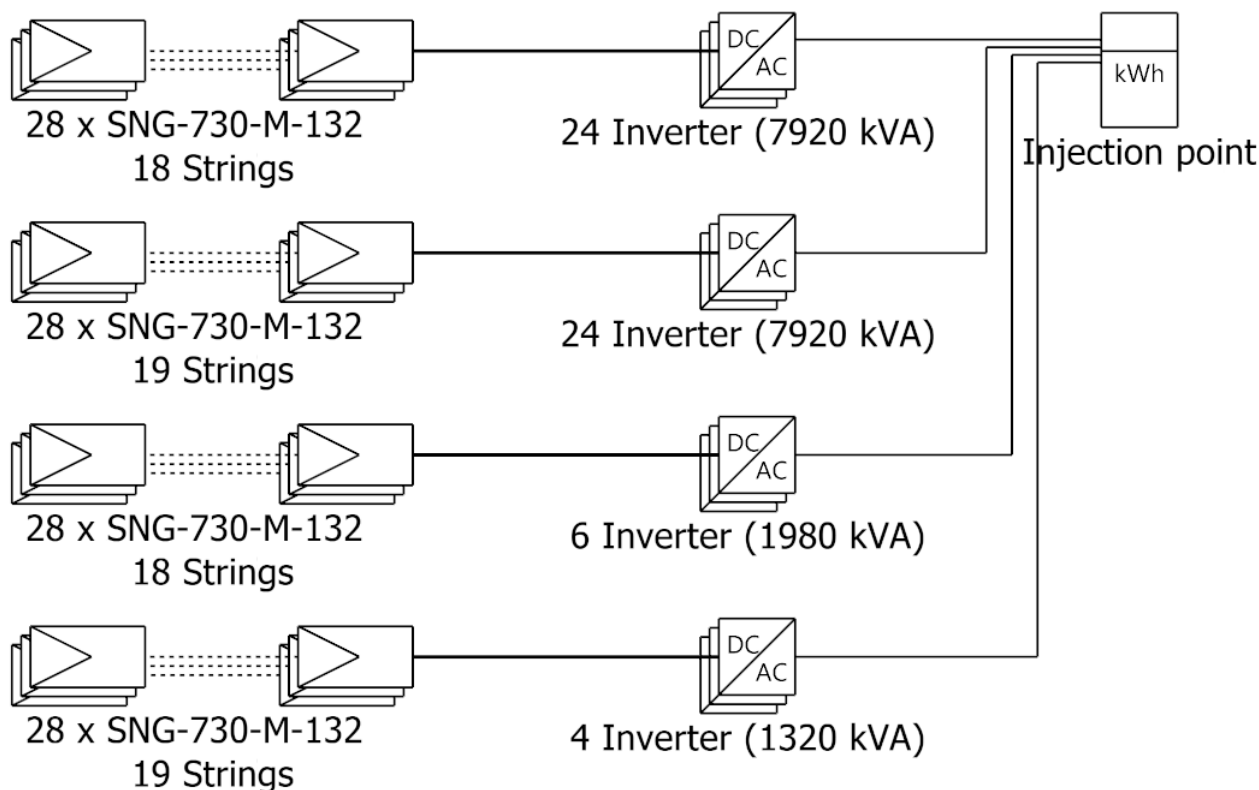
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Single-line diagram



PV module	SNG-730-M-132
Inverter	SUN2000-300KTL-H0
String	28 x SNG-730-M-132

Carpi

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srl (Italy)

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24/03/25