

**IMPIANTO AGRIVOLTAICO
PER LA PRODUZIONE ENERGETICA ED AGRICOLA
DENOMINATO "Risicone"
DELLA POTENZA DI 37,54 MWp
SITUATO NEL COMUNE DI VIZZINI (CT)**

PROGETTO DEFINITIVO

Relazione di producibilità impianto

IDENTIFICAZIONE ELABORATO

| Livello Prog. | Codice | Tipo doc. | N° elaborato | Nome file | TIPO ELAB. | SCALA |
|---------------|--------|-----------|--------------|-----------|------------|-------|
| PD | REL_14 | PDF | | REL_14 | R | |

| REV. | DATA | DESCRIZIONE | ESEGUITO | VERIFICATO | APPROVATO |
|------|------------|---------------------|---------------|------------|----------------------|
| 00 | 21/12/2023 | Prima emissione VIA | Ing. Longo G. | EGP S.R.L. | Re nera Energy Italy |
| | | | | | |
| | | | | | |
| | | | | | |

PROGETTAZIONE



The image shows a handwritten signature in black ink over a blue circular official stamp. The stamp contains the text: "UFFICIO PROV. DI CATANIA", "DOTT. ING. FRANCESCO MUZZICANO", and "3925".

RICHIEDENTE

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Soggetta all'attività di direzione e al coordinamento da parte di Energie Zukunft Schweiz AG (CH)



The logo for Re nera, consisting of three vertical blue bars of varying heights followed by the word "Re nera" in a blue sans-serif font.

PVsyst - Simulation report

Grid-Connected System

Project: Progetto Risicone

Variant: Nuova variante di simulazione

System power: 37.54 MWp

Vizzini - Italy



PVsyst V7.4.4

VCO, Simulation date:
 05/12/23 15:27
 with v7.4.4

Project summary

| | | |
|---|--------------------|-------------------------|
| Geographical Site | Situation | Project settings |
| Vizzini | Latitude 37.19 °N | Albedo 0.20 |
| Italy | Longitude 14.83 °E | |
| | Altitude 554 m | |
| | Time zone UTC+1 | |
| Meteo data | | |
| Vizzini | | |
| Meteonorm 8.1 (1989-2003), Sat=100% - Sintetico | | |

System summary

| | | | |
|-------------------------------|---|-----------------------|--|
| Grid-Connected System | No 3D scene defined, no shadings | | |
| PV Field Orientation | Tracking algorithm | Near Shadings | |
| Orientation | Astronomic calculation | No Shadings | |
| Tracking plane, vertical axis | | | |
| Plane tilt 60 ° | | | |
| System information | | | |
| PV Array | | Inverters | |
| Nb. of modules 60060 units | | Nb. of units 11 units | |
| Pnom total 37.54 MWp | | Pnom total 32.26 MWac | |
| | | Pnom ratio 1.163 | |
| User's needs | | | |
| Unlimited load (grid) | | | |

Results summary

| | | | | | |
|-----------------|-------------------|---------------------|-------------------|----------------|---------|
| Produced Energy | 78603630 kWh/year | Specific production | 2094 kWh/kWp/year | Perf. Ratio PR | 84.69 % |
|-----------------|-------------------|---------------------|-------------------|----------------|---------|

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General parameters

| | | | |
|-------------------------------|------------------|---|--|
| Grid-Connected System | | No 3D scene defined, no shadings | |
| PV Field Orientation | | Tracking algorithm | |
| Orientation | | Astronomic calculation | |
| Tracking plane, vertical axis | | | |
| Plane tilt | 60 ° | | |
| Models used | | | |
| Transposition | Perez | | |
| Diffuse | Perez, Meteonorm | | |
| Circumsolar | separate | | |
| Horizon | | Near Shadings | |
| Free Horizon | | No Shadings | |
| | | User's needs | |
| | | Unlimited load (grid) | |

PV Array Characteristics

| | | | |
|----------------------------------|----------------------------|--------------------------------|-----------------------|
| PV module | | Inverter | |
| Manufacturer | Generic | Manufacturer | Generic |
| Model | AE 625TME-120BDS | Model | Sunny Central 2930 UP |
| (Original PVsyst database) | | (Custom parameters definition) | |
| Unit Nom. Power | 625 Wp | Unit Nom. Power | 2933 kWac |
| Number of PV modules | 60060 units | Number of inverters | 11 units |
| Nominal (STC) | 37.54 MWp | Total power | 32263 kWac |
| Modules | 2310 string x 26 In series | Operating voltage | 962-1500 V |
| At operating cond. (50°C) | | Pnom ratio (DC:AC) | 1.16 |
| Pmpp | 35.10 MWp | | |
| U mpp | 917 V | | |
| I mpp | 38256 A | | |
| Total PV power | | Total inverter power | |
| Nominal (STC) | 37538 kWp | Total power | 32263 kWac |
| Total | 60060 modules | Number of inverters | 11 units |
| | | Pnom ratio | 1.16 |

Array losses

| | | | | | | | | |
|--|--------|--|---------------|------------------------------|--------------|-------|-------|-------|
| Array Soiling Losses | | Thermal Loss factor | | DC wiring losses | | | | |
| Loss Fraction | 5.0 % | Module temperature according to irradiance | | Global array res. | 0.39 mΩ | | | |
| | | Uc (const) | 29.0 W/m²K | Loss Fraction | 1.5 % at STC | | | |
| | | Uv (wind) | 0.0 W/m²K/m/s | | | | | |
| Module Quality Loss | | Module mismatch losses | | Strings Mismatch loss | | | | |
| Loss Fraction | -0.8 % | Loss Fraction | 2.0 % at MPP | 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 |



Horizon

Linea dell'orizzonte a Vizzini

Geographical Site
Vizzini
Italy

Situation
Latitude 37.19 °N
Longitude 14.83 °E
Altitude 554 m
Time zone UTC+1

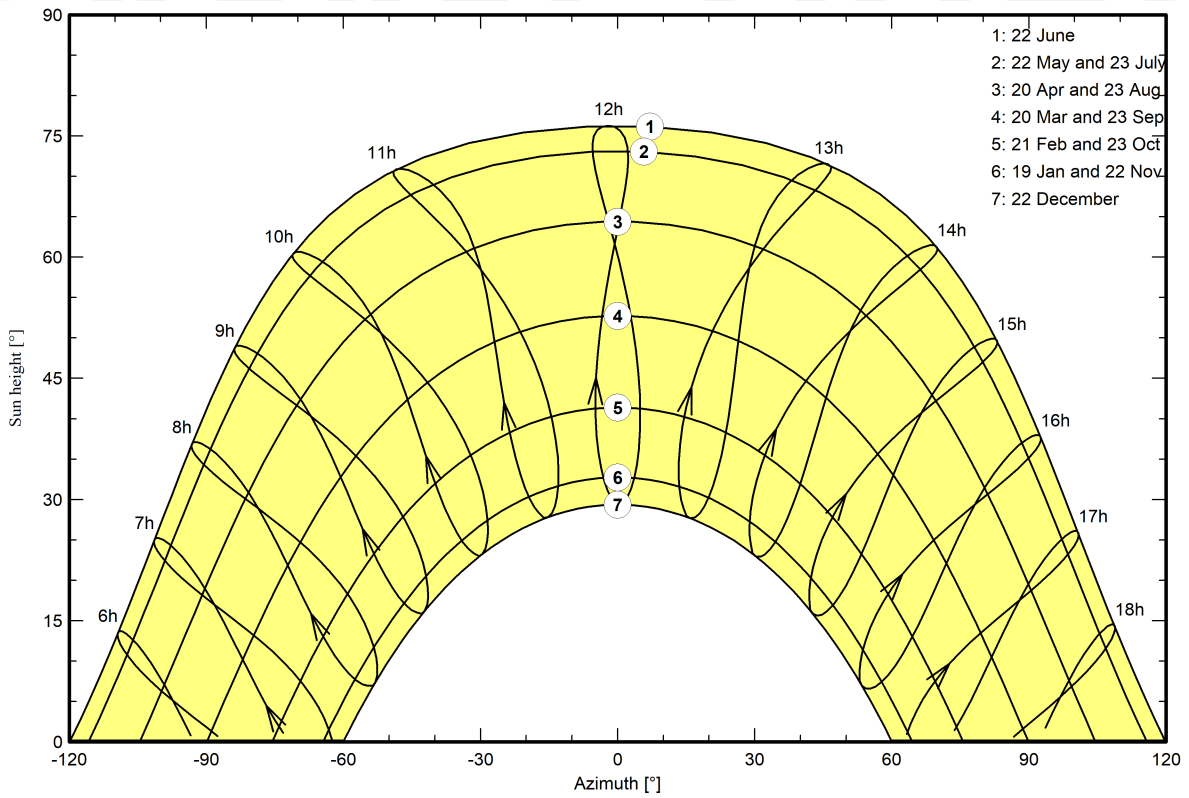
Average Height 0.0 °
Diffuse Factor 1.00

Albedo Factor 1.00
Albedo Fraction 100 %

Horizon profile

| | | | | |
|-------------|------|-----|-----|-----|
| Azimuth [°] | -120 | -40 | 40 | 120 |
| Height [°] | 0.0 | 0.0 | 0.0 | 0.0 |

Sun Paths (Height / Azimuth diagram)





PVsyst V7.4.4

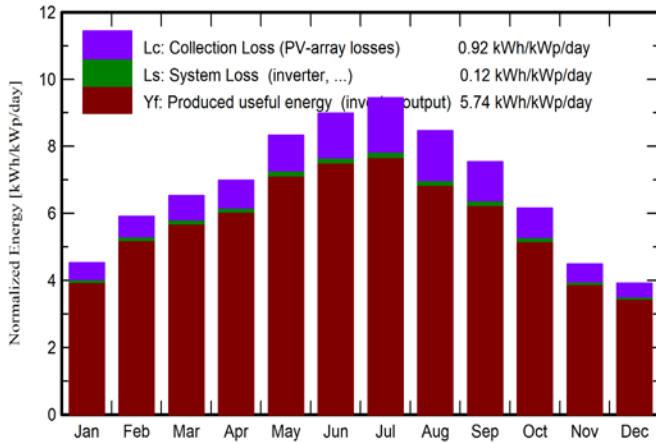
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Main results

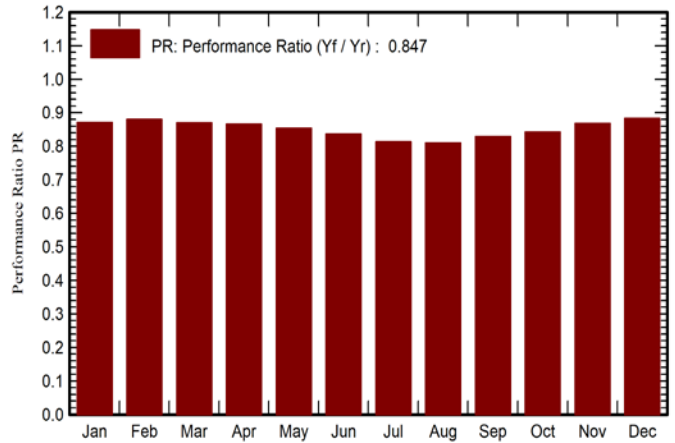
System Production

Produced Energy 78603630 kWh/year Specific production 2094 kWh/kWp/year
 Perf. Ratio PR 84.69 %

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 kWh | E_Grid kWh | PR ratio |
|-------------|-------------------------------|-------------------------------|--------------|-------------------------------|-------------------------------|-----------------|-----------------|--------------|
| January | 69.9 | 27.60 | 8.49 | 140.3 | 132.6 | 4690852 | 4588748 | 0.872 |
| Februar | 92.7 | 35.70 | 8.48 | 165.4 | 156.4 | 5581244 | 5462038 | 0.880 |
| March | 133.8 | 53.30 | 10.74 | 202.5 | 191.3 | 6765059 | 6619693 | 0.871 |
| April | 157.8 | 69.40 | 13.13 | 209.3 | 197.4 | 6952831 | 6808076 | 0.866 |
| May | 200.3 | 76.70 | 17.08 | 258.2 | 243.5 | 8457427 | 8281226 | 0.855 |
| June | 210.4 | 75.40 | 21.16 | 269.4 | 254.1 | 8642317 | 8467239 | 0.837 |
| July | 222.4 | 73.60 | 24.50 | 292.7 | 276.3 | 9120872 | 8936336 | 0.813 |
| August | 195.7 | 71.00 | 24.87 | 262.4 | 247.8 | 8141268 | 7976217 | 0.810 |
| September | 149.8 | 55.30 | 21.43 | 226.1 | 213.6 | 7189782 | 7040049 | 0.829 |
| October | 112.3 | 42.80 | 18.18 | 190.6 | 180.1 | 6154848 | 6025091 | 0.842 |
| November | 73.3 | 36.10 | 13.67 | 134.4 | 126.9 | 4470896 | 4379221 | 0.868 |
| December | 61.7 | 31.30 | 10.14 | 121.2 | 114.4 | 4103527 | 4019696 | 0.884 |
| Year | 1680.1 | 648.20 | 16.04 | 2472.5 | 2334.3 | 80270923 | 78603630 | 0.847 |

Legends

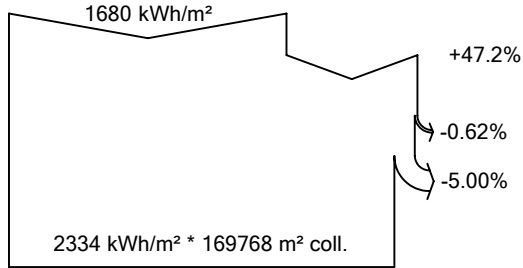
| | | | |
|---------|--|--------|---|
| GlobHor | Global horizontal irradiation | EArray | Effective energy at the output of the array |
| DiffHor | Horizontal diffuse irradiation | E_Grid | Energy injected into grid |
| T_Amb | Ambient Temperature | PR | Performance Ratio |
| GlobInc | Global incident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



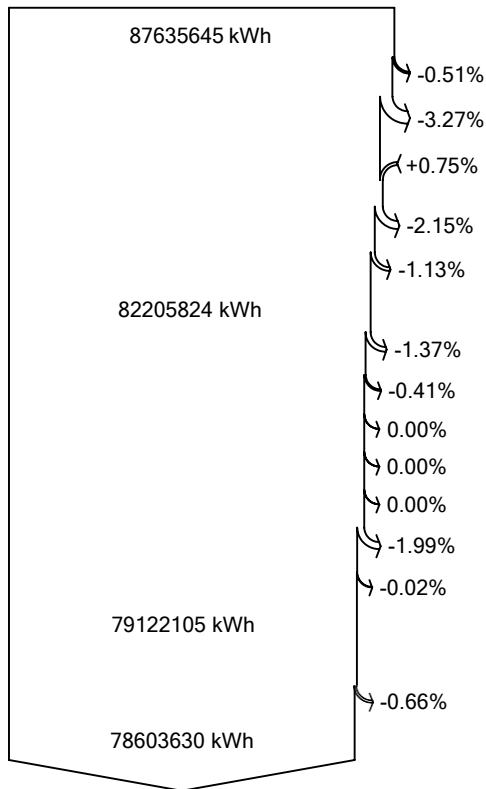
PVsyst V7.4.4

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Loss diagram



efficiency at STC = 22.11%



Global horizontal irradiation

Global incident in coll. plane

IAM factor on global

Soiling loss factor

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

Night consumption

Available Energy at Inverter Output

AC ohmic loss

Energy injected into grid

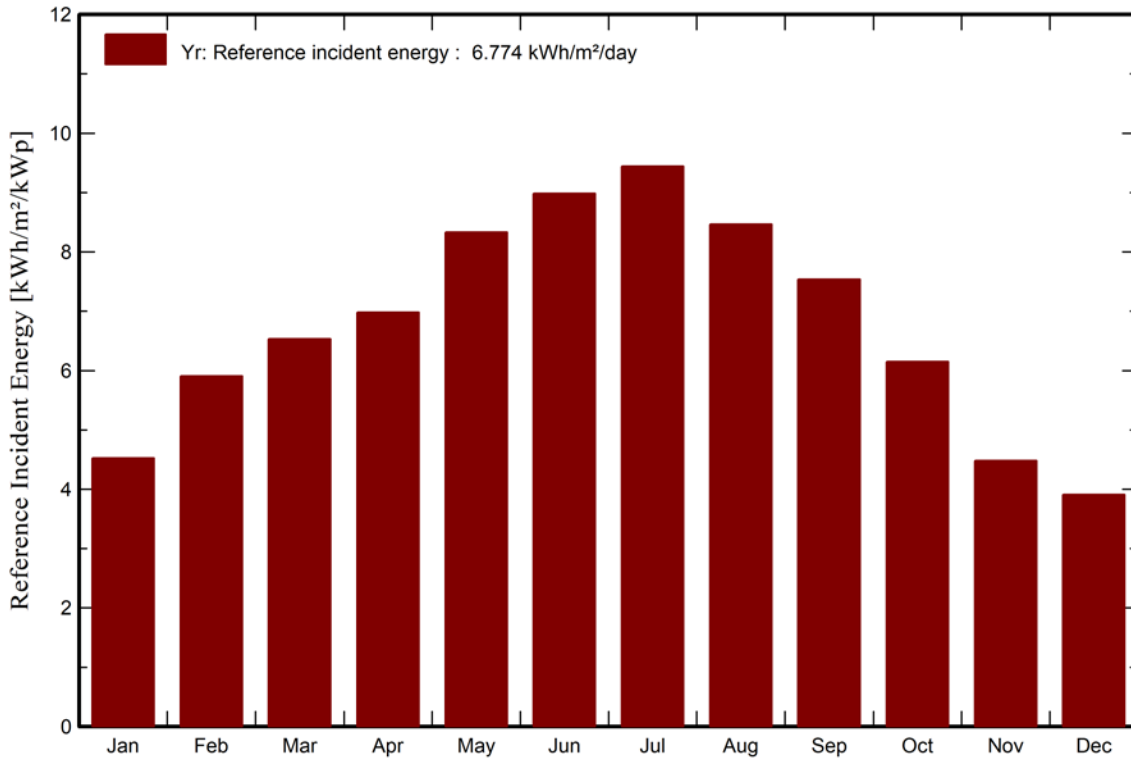


PVsyst V7.4.4

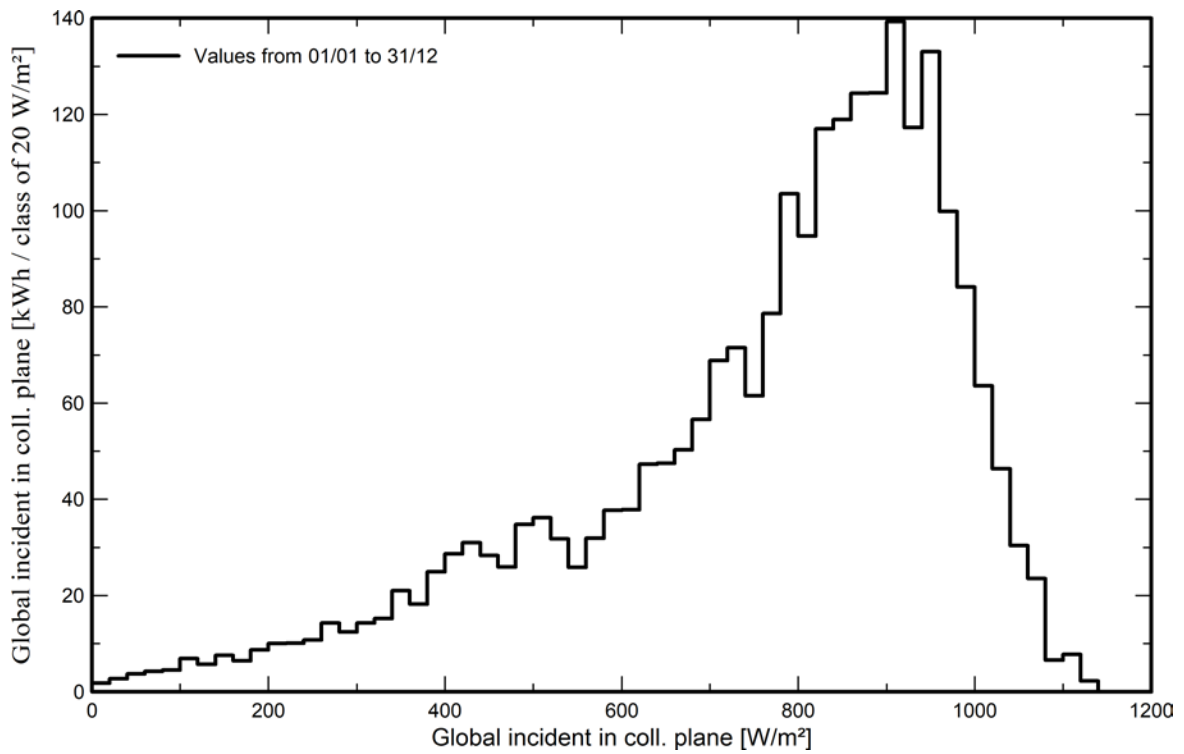
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Predef. graphs

Energia incidente di riferimento su piano collettori



Distribuzione irraggiamento incidente



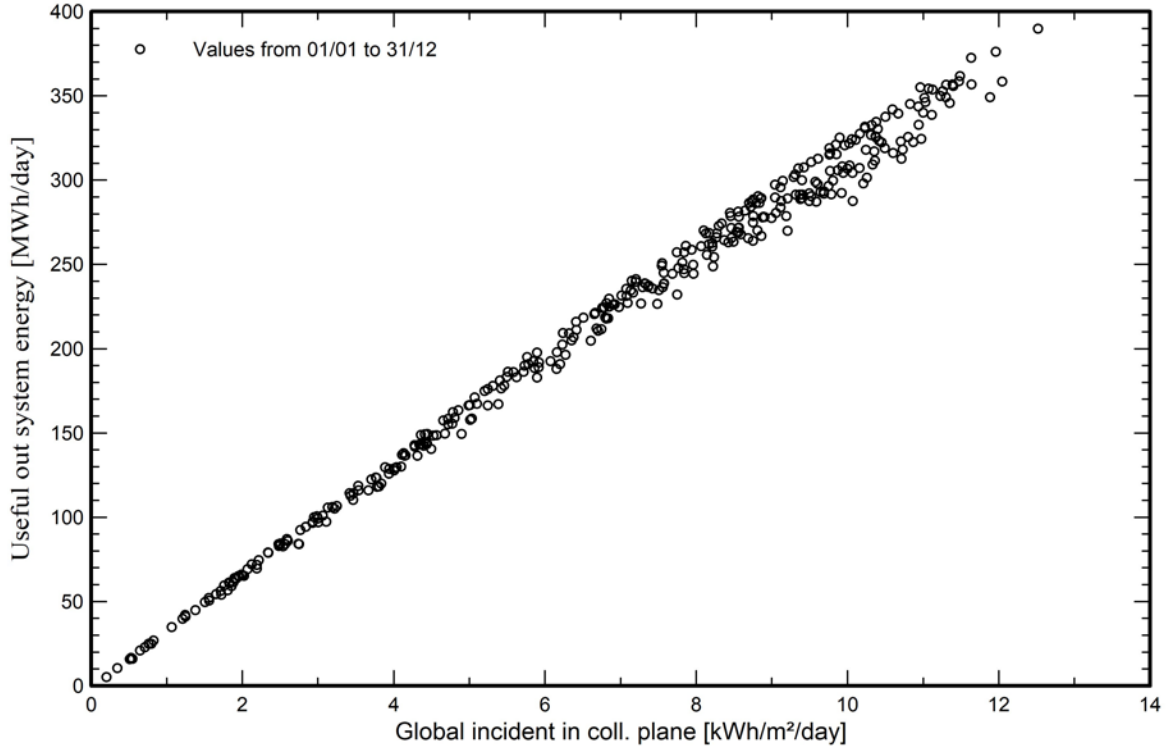


PVsyst V7.4.4

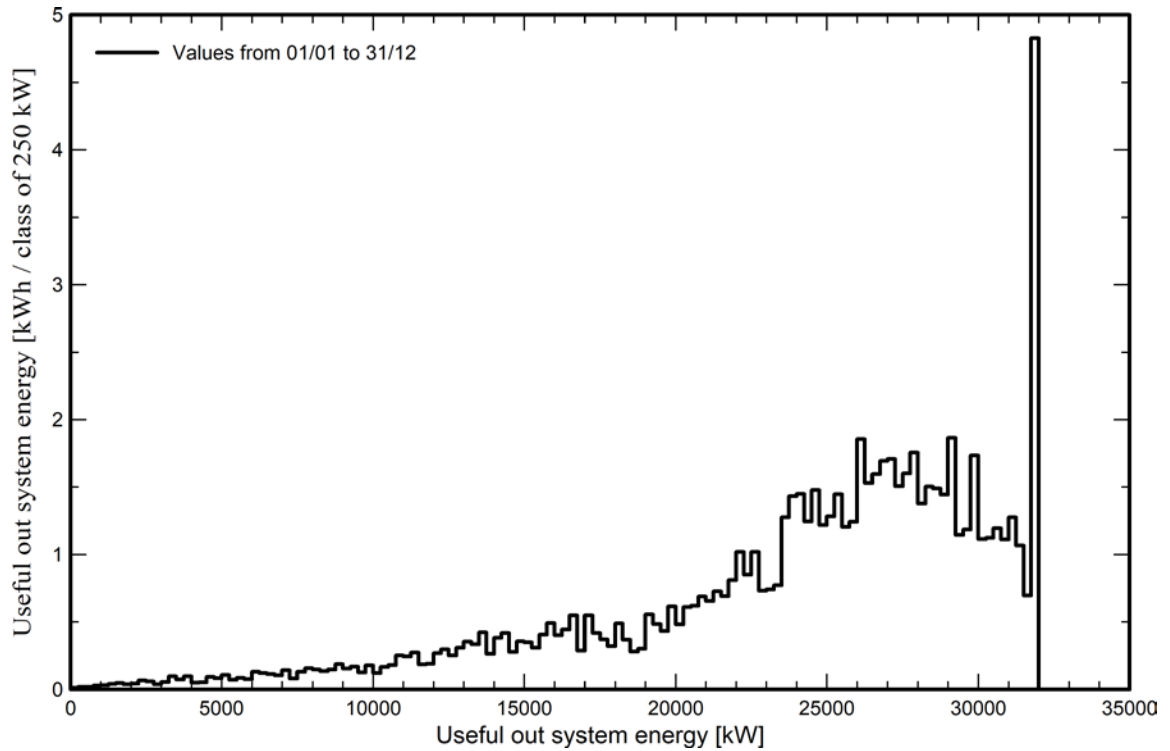
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Predef. graphs

Diagramma giornaliero entrata/uscita



Distribuzione potenza in uscita sistema





Producibilità elettrica minima

In accordo con le "Linee Guida in materia di Impianti Agrivoltaici" la produzione elettrica specifica di un impianto agrivoltaico (FV_{agri} in GWh/ha/anno) correttamente progettato, paragonata alla producibilità elettrica specifica di riferimento di un impianto fotovoltaico standard (FV_{standard} in GWh/ha/anno), non dovrebbe essere inferiore al 60 % di quest'ultima.

Nel caso in esame l'impianto agrivoltaico produce il 63.19% di un impianto PV tradizionale, nella tabella riportata di seguito si riporta il risultato ottenuto.

| FV _{agri} (GWh/ha/anno) | FV _{Standard} (GWh/ha/anno) | % |
|-------------------------------------|---|--------|
| 1.134242857 | 1.795 | 63.19% |