

**PROGETTO PER LA REALIZZAZIONE DI UN IMPIANTO AGRIVOLTAICO  
DENOMINATO "COLORSUN" INTEGRATO CON UN SISTEMA DI  
ACCUMULO E DELLE RELATIVE OPERE DI CONNESSIONE DA  
UBICARSI IN AGRO DI COLORNO E TORRILE (PR)**

Impianto AGV ibrido: Potenza nominale: 19,79 MWp - Potenza sistema di accumulo: 10,00 MW  
Potenza in prelievo: 10,00 MW - Potenza in immissione: 26,80 MW



ELABORATO

**SIMULAZIONE ENERGETICA (PVSYST)**

CODIFICA

**PD01\_23**

SCALA

-

GRUPPO DI PROGETTAZIONE

**NRG**

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COMMITTENTE



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| REV. | DATA          | DESCRIZIONE           | REDATTO         | VERIFICATO      | APPROVATO        |
|------|---------------|-----------------------|-----------------|-----------------|------------------|
| 1    | Febbraio 2026 | PRESENTAZIONE ISTANZA | Ing. A. Milella | Ing. A. Milella | Ing. M. De Donno |
|      |               |                       |                 |                 |                  |
|      |               |                       |                 |                 |                  |
|      |               |                       |                 |                 |                  |
|      |               |                       |                 |                 |                  |

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# PVsyst - Simulation report

## Grid-Connected System

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Project: ITS5CS - Colorsun

Variant: PD01\_23

Tracking system with backtracking

System power: 19.79 MWp

San Polo di Torrile - Italy

Author

**NRG**

**PVsyst V8.0.6**

VC0, Simulation date:  
17/02/26 15:04  
with V8.0.6

**Project summary****Geographical Site****San Polo di Torile**

Italia

**Situation**

Latitude 44.91 °N

Longitude 10.39 °E

Altitude 21 m

Time zone UTC+1

**Project settings**

Albedo 0.20

**Weather data**

San Polo di Torile

PVGIS-SARAH2 - 2020

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

Avg axis azim. 0 °

Phi min / max. +/- 60 °

Diffuse shading all trackers

**Tracking algorithm**

Irradiance optimization

Backtracking activated

**System information****PV Array**

Nb. of modules 26390 units

Pnom total 19.79 MWp

**Tracking system with backtracking****Near Shadings**

According to strings : Fast (table)

Electrical effect 100 %

**User's needs**

Unlimited load (grid)

**Inverters**

Nb. of units 62 units

Pnom total 19.84 MWac

Grid power limit 26.80 MWac

Grid lim. Pnom ratio 0.739

**Results summary**

|                 |                 |                     |                   |                |         |
|-----------------|-----------------|---------------------|-------------------|----------------|---------|
| Produced Energy | 32987 MWh/year  | Specific production | 1667 kWh/kWp/year | Perf. Ratio PR | 79.94 % |
| Apparent energy | 35549 MVAh/year |                     |                   |                |         |

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**PVsyst V8.0.6**

VC0, Simulation date:  
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**General parameters****Grid-Connected System****Orientation #1****Tracking plane, horizontal N-S axis**

Avg axis azim. 0 °  
Phi min / max. +/- 60 °  
Diffuse shading all trackers

**Tracking algorithm**

Irradiance optimization  
Backtracking activated

**Tracking system with backtracking****Field properties**

Nb. of trackers 1052 units  
Tracking plane, horizontal N-S axis

**Sizes**

Tracker Spacing 7.30 m  
Collector width 2.38 m  
Average GCR 32.7 %

**Backtracking limit angle**

Phi limits +/- 71 °

**Backtracking parameters**

Backtracking pitch 7.30 m  
Backtracking width 2.38 m  
Left inactive band 0.00 m  
Right inactive band 0.00 m  
Backtracking GCR 32.7 %  
Parameters choice:Automatic

**Models used**

Transposition Perez  
Diffuse Imported DHI  
Circumsolar separate

**Horizon**

Free Horizon

**Near Shadings**

According to strings : Fast (table)  
Electrical effect 100 %

**User's needs**

Unlimited load (grid)

**Bifacial system definition****Orientation #1****Bifacial system**

Model Unlimited Trackers 2D model

**Bifacial model geometry**

Tracker Spacing 7.30 m  
Tracker width 2.38 m  
GCR 32.7 %  
Axis height above ground 3.13 m  
Nb. of sheds 1052 units

**Bifacial model definitions**

Ground albedo 0.20  
Bifaciality factor 90 %  
Rear shading factor 5.0 %  
Rear mismatch loss 10.0 %  
Shed transparent fraction 0.0 %

**Grid injection point****Grid power limitation**

Active power 26.80 MWac  
Pnom ratio 0.739

**Power factor**

Cos(phi) (lagging) 0.944

**PV Array Characteristics****PV module**

Manufacturer Huasun

Model HSN-210-B132-DS750

(Custom parameters definition)

Unit Nom. Power 750 Wp  
Number of PV modules 26390 units  
Nominal (STC) 19.79 MWp  
Modules 1015 string x 26 In series



## PVsyst V8.0.6

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## PV Array Characteristics

## PV module

## At operating cond. (45°C)

|       |           |
|-------|-----------|
| Pmpp  | 18.68 MWp |
| U mpp | 1031 V    |
| I mpp | 18112 A   |

## Inverter

|                                    |                |
|------------------------------------|----------------|
| Manufacturer                       | Sungrow        |
| Model                              | SG350HX-12MPPT |
| (Custom parameters definition)     |                |
| Unit Nom. Power                    | 320 kWac       |
| Number of inverters                | 62 units       |
| Total power                        | 19840 kWac     |
| Operating voltage                  | 500-1500 V     |
| Max. power (=>30°C)                | 352 kWac       |
| Pnom ratio (DC:AC)                 | 1.00           |
| Power sharing within this inverter |                |

## Total PV power

|               |               |
|---------------|---------------|
| Nominal (STC) | 19793 kWp     |
| Total         | 26390 modules |
| Module area   | 81977 m²      |

## Total inverter power

|                                   |            |
|-----------------------------------|------------|
| Total power                       | 19840 kWac |
| Max. power                        | 21824 kWac |
| Number of inverters               | 62 units   |
| Pnom ratio                        | 1.00       |
| PNom limit forced to active power |            |

## Array losses

## Array Soiling Losses

|               |       |
|---------------|-------|
| Loss Fraction | 3.0 % |
|---------------|-------|

## Thermal Loss factor

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

## DC wiring losses

|                   |              |
|-------------------|--------------|
| Global array res. | 0.91 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 | -0.8 % |
|---------------|--------|

## Module mismatch losses

|               |              |
|---------------|--------------|
| Loss Fraction | 2.0 % at MPP |
|---------------|--------------|

## IAM loss factor

Incidence effect (IAM): User defined profile

| 0°    | 30°   | 50°   | 60°   | 70°   | 75°   | 80°   | 85°   | 90°   |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.000 | 1.000 | 0.999 | 0.994 | 0.969 | 0.928 | 0.829 | 0.588 | 0.000 |

## System losses

## Auxiliaries loss

|                           |        |
|---------------------------|--------|
| constant (fans)           | 700 kW |
| 0.0 kW from Power thresh. |        |
| Night aux. cons.          | 150 kW |

## AC wiring losses

## Inv. output line up to MV transfo

|                  |               |
|------------------|---------------|
| Inverter voltage | 800 Vac tri   |
| Loss Fraction    | 1.74 % at STC |

## Inverter: SG350HX-12MPPT

|                        |                      |
|------------------------|----------------------|
| Wire section (62 Inv.) | Alu 62 x 3 x 150 mm² |
| Average wires length   | 150 m                |

**PVsyst V8.0.6**

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**AC wiring losses****MV line up to Injection**

|               |                             |
|---------------|-----------------------------|
| MV Voltage    | 30 kV                       |
| Wires         | Alu 3 x 400 mm <sup>2</sup> |
| Length        | 900 m                       |
| Loss Fraction | 0.17 % at STC               |

**AC losses in transformers****MV transfo**

|                |       |
|----------------|-------|
| Medium voltage | 30 kV |
|----------------|-------|

**Transformer parameters**

|                             |               |
|-----------------------------|---------------|
| Nominal power at STC        | 19.49 MVA     |
| Iron Loss (24/24 Connexion) | 19.84 kVA     |
| Iron loss fraction          | 0.10 % at STC |
| Copper loss                 | 191.47 kVA    |
| Copper loss fraction        | 0.98 % at STC |
| Coils equivalent resistance | 3 x 0.32 mΩ   |

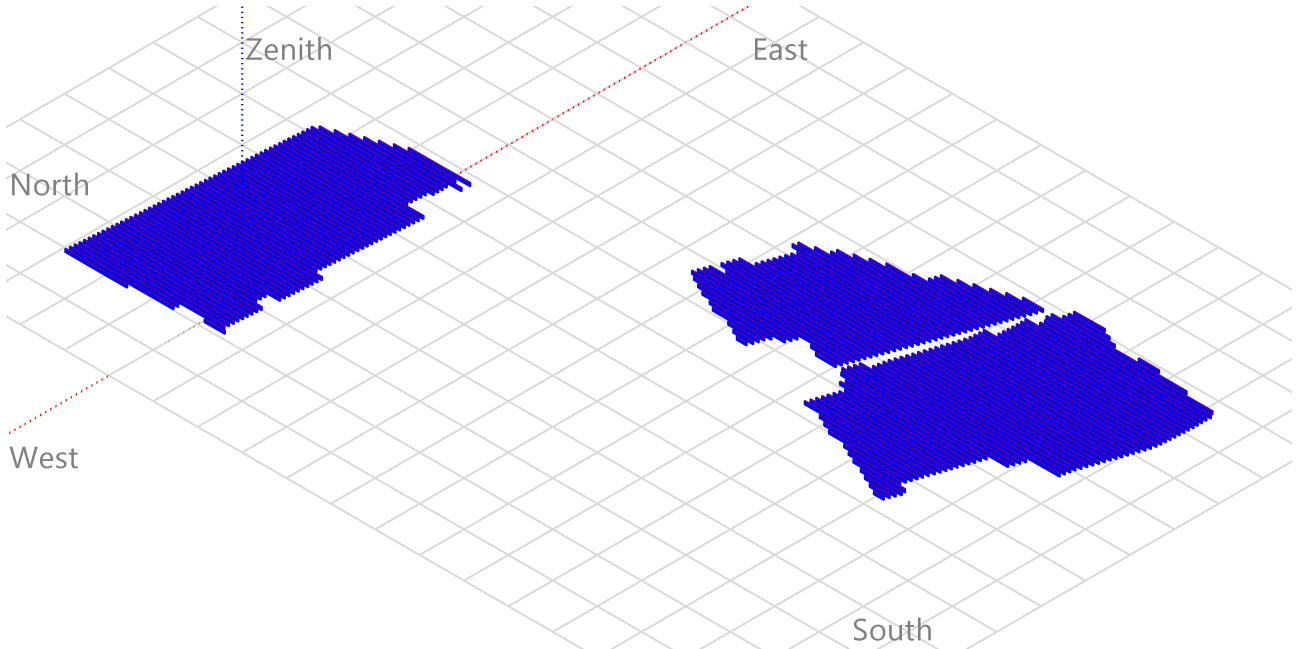


**PVsyst V8.0.6**

VC0, Simulation date:  
17/02/26 15:04  
with V8.0.6

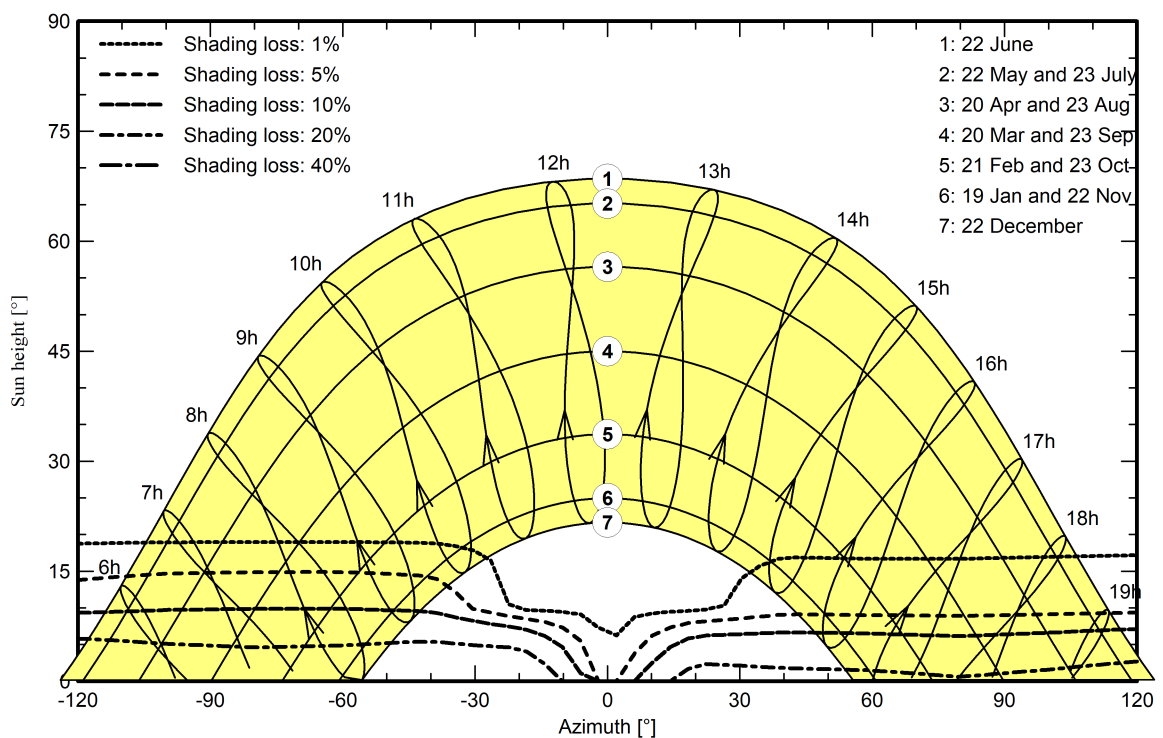
**Near shadings parameter**

**Perspective of the PV-field and surrounding shading scene**



**Iso-shadings diagram**

**Orientation #1**





## PVsyst V8.0.6

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17/02/26 15:04  
with V8.0.6

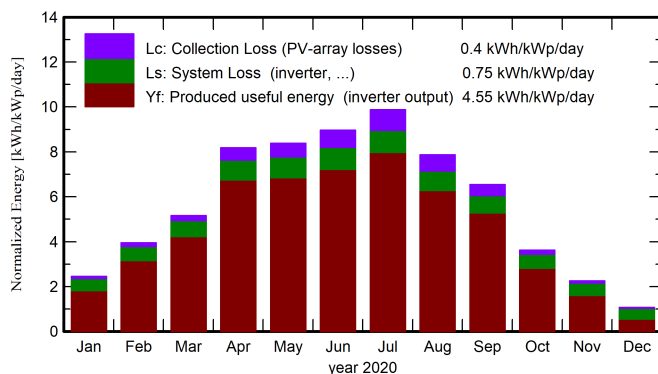
## Main results

## System Production

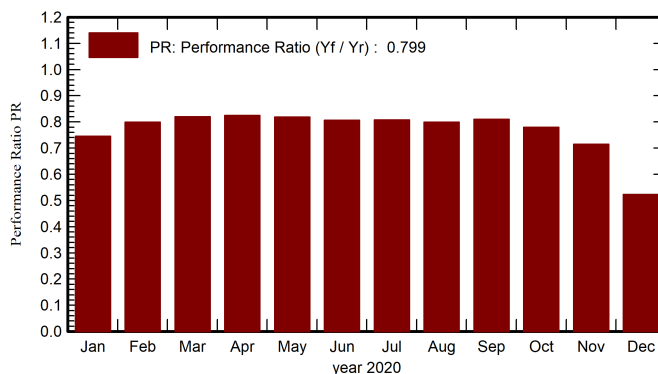
Produced Energy 32987 MWh/year  
Apparent energy 35549 MVAh/year

Specific production 1667 kWh/kWp/year  
Perf. Ratio PR 79.94 %

Normalized productions (per installed kWp)



Performance Ratio PR



## Balances and main results

|         | GlobHor<br>kWh/m <sup>2</sup> | DiffHor<br>kWh/m <sup>2</sup> | T_Amb<br>°C | GlobInc<br>kWh/m <sup>2</sup> | GlobEff<br>kWh/m <sup>2</sup> | EArray<br>MWh | E_Grid<br>MWh | PR<br>ratio |
|---------|-------------------------------|-------------------------------|-------------|-------------------------------|-------------------------------|---------------|---------------|-------------|
| Jan. 20 | 53.2                          | 23.09                         | 4.10        | 76.1                          | 71.7                          | 1456          | 1123          | 0.745       |
| Feb. 20 | 81.0                          | 28.89                         | 8.05        | 114.6                         | 108.7                         | 2177          | 1814          | 0.800       |
| Mar. 20 | 118.1                         | 46.37                         | 8.98        | 159.9                         | 151.8                         | 3036          | 2596          | 0.820       |
| Apr. 20 | 178.7                         | 51.88                         | 13.99       | 245.5                         | 234.1                         | 4537          | 4009          | 0.825       |
| May 20  | 199.3                         | 71.25                         | 18.77       | 260.0                         | 247.6                         | 4774          | 4211          | 0.818       |
| June 20 | 205.6                         | 70.61                         | 21.92       | 268.9                         | 256.3                         | 4874          | 4295          | 0.807       |
| July 20 | 229.1                         | 67.24                         | 25.07       | 306.4                         | 292.5                         | 5502          | 4901          | 0.808       |
| Aug. 20 | 181.8                         | 61.72                         | 25.04       | 244.1                         | 232.5                         | 4395          | 3861          | 0.799       |
| Sep. 20 | 144.1                         | 54.65                         | 21.03       | 196.1                         | 186.5                         | 3598          | 3143          | 0.810       |
| Oct. 20 | 83.5                          | 39.22                         | 13.60       | 112.4                         | 106.3                         | 2122          | 1734          | 0.779       |
| Nov. 20 | 49.7                          | 26.23                         | 9.15        | 67.6                          | 63.4                          | 1285          | 956           | 0.715       |
| Dec. 20 | 27.1                          | 18.94                         | 4.98        | 33.2                          | 30.8                          | 643           | 344           | 0.523       |
| Year    | 1551.1                        | 560.09                        | 14.57       | 2084.9                        | 1982.0                        | 38400         | 32987         | 0.799       |

## 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

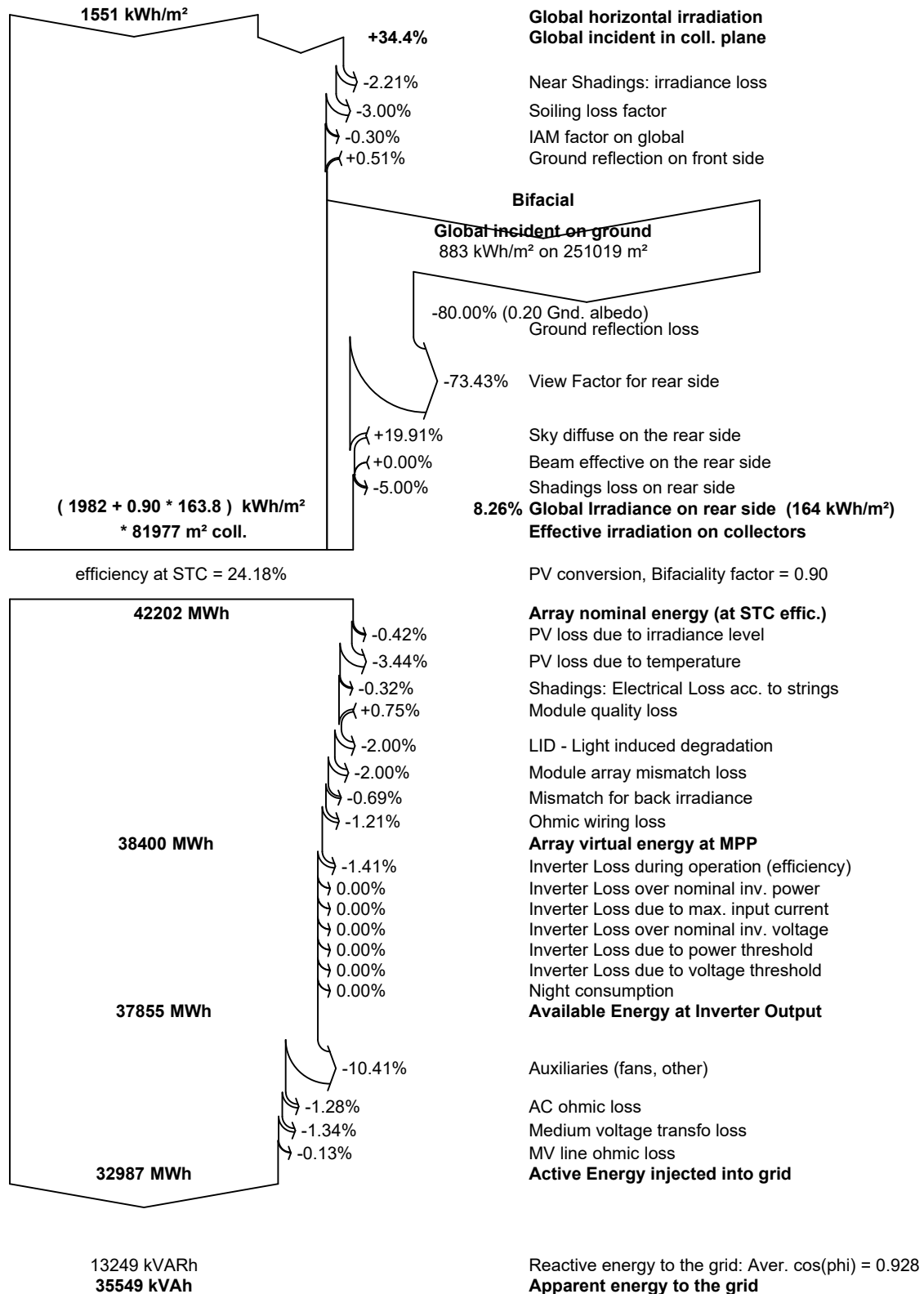




## PVsyst V8.0.6

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17/02/26 15:04  
with V8.0.6

## Loss diagram



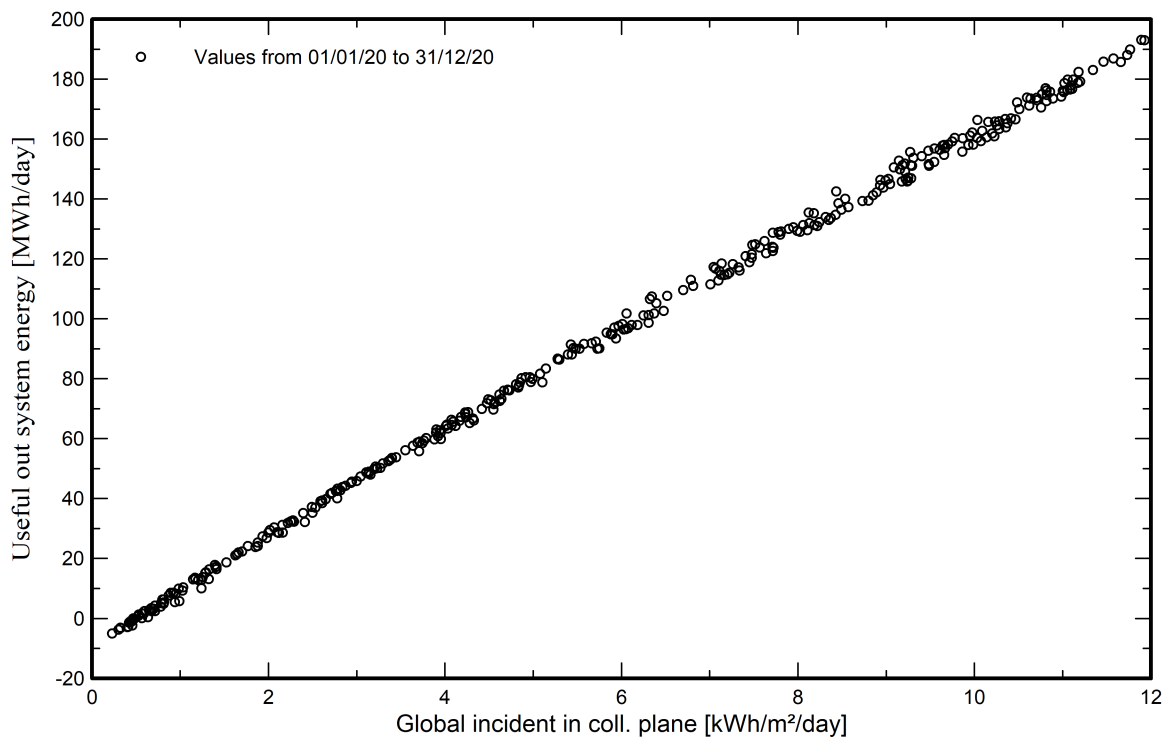


**PVsyst V8.0.6**

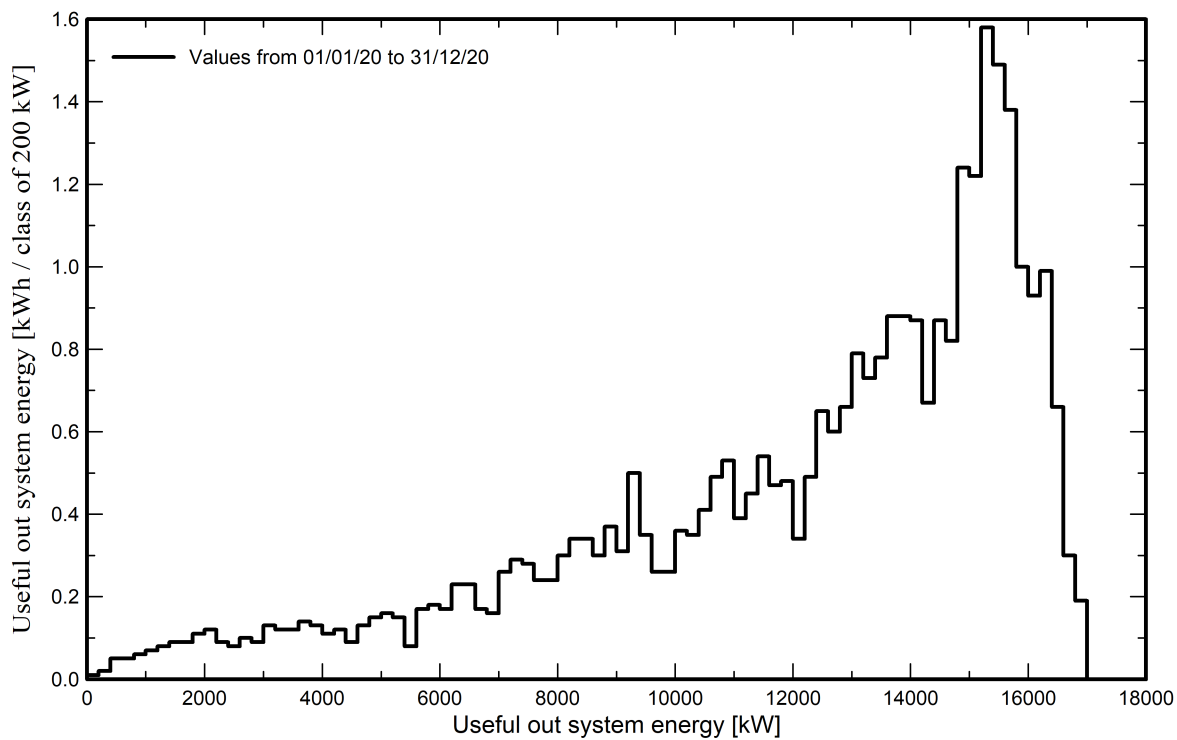
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**Predef. graphs**

**Diagramma giornaliero entrata/uscita**



**Distribuzione potenza in uscita sistema**





## PVsyst V8.0.6

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## Aging Tool

## Aging Parameters

Time span of simulation 30 years

## Module average degradation

Loss factor 0.4 %/year

## Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

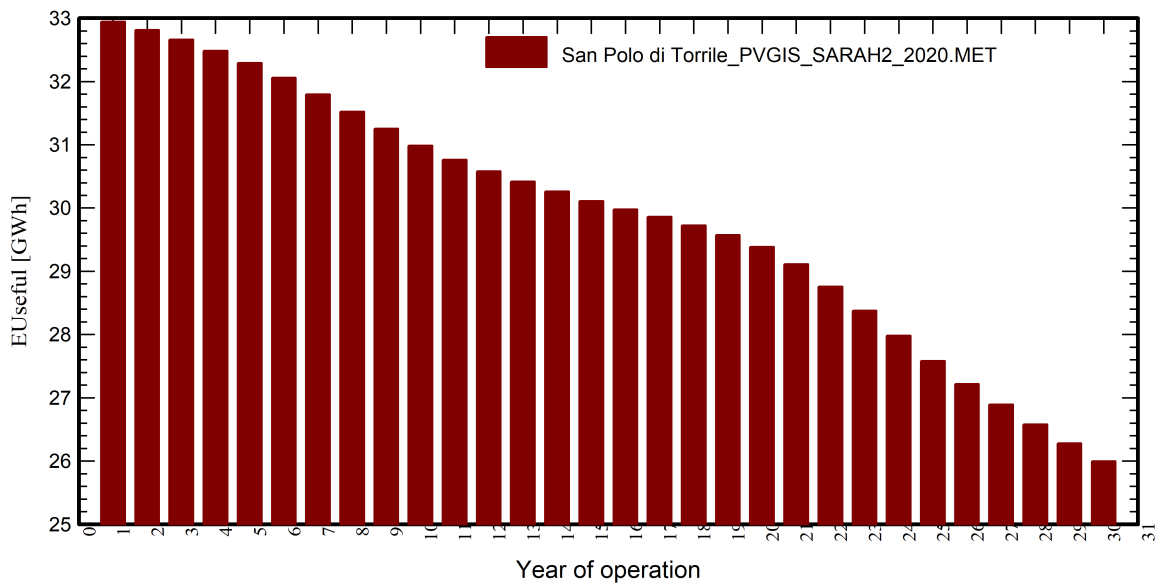
Vmp RMS dispersion 0.4 %/year

## Weather data used in the simulation

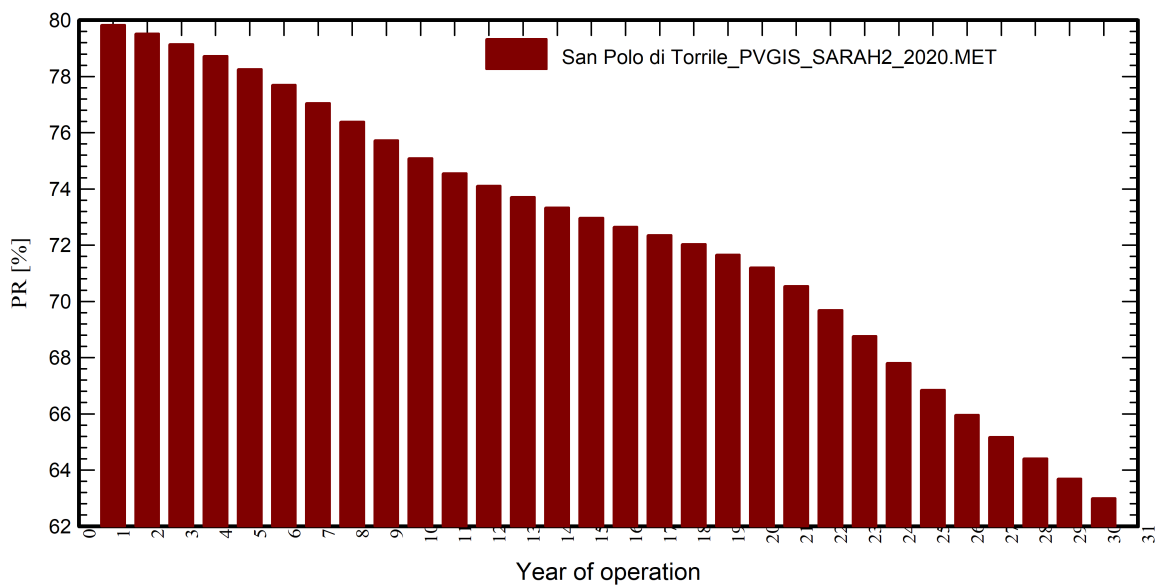
San Polo di Torriale PVGIS SARAH2

Years 2020

## Useful out system energy



## Performance Ratio



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17/02/26 15:04  
with V8.0.6

**Aging Tool****Aging Parameters**

Time span of simulation 30 years

**Module average degradation**

Loss factor 0.4 %/year

**Mismatch due to degradation**

Imp RMS dispersion 0.4 %/year

Vmp RMS dispersion 0.4 %/year

**Weather data used in the simulation**

San Polo di Torriale PVGIS SARAH2

Years 2020

|      | EUseful | PR    | PR loss |
|------|---------|-------|---------|
| Year | GWh     | %     | %       |
| 1    | 32.94   | 79.84 | -0.20   |
| 2    | 32.81   | 79.52 | -0.60   |
| 3    | 32.66   | 79.15 | -1.06   |
| 4    | 32.49   | 78.73 | -1.58   |
| 5    | 32.29   | 78.26 | -2.17   |
| 6    | 32.06   | 77.70 | -2.87   |
| 7    | 31.80   | 77.05 | -3.68   |
| 8    | 31.52   | 76.39 | -4.50   |
| 9    | 31.25   | 75.73 | -5.33   |
| 10   | 30.99   | 75.10 | -6.13   |
| 11   | 30.76   | 74.55 | -6.80   |
| 12   | 30.58   | 74.11 | -7.35   |
| 13   | 30.42   | 73.71 | -7.86   |
| 14   | 30.26   | 73.33 | -8.33   |
| 15   | 30.11   | 72.97 | -8.78   |
| 16   | 29.98   | 72.65 | -9.18   |
| 17   | 29.86   | 72.36 | -9.55   |
| 18   | 29.73   | 72.04 | -9.95   |
| 19   | 29.57   | 71.66 | -10.42  |
| 20   | 29.38   | 71.21 | -10.99  |
| 21   | 29.11   | 70.55 | -11.81  |
| 22   | 28.76   | 69.69 | -12.88  |
| 23   | 28.38   | 68.77 | -14.04  |
| 24   | 27.98   | 67.81 | -15.23  |
| 25   | 27.58   | 66.84 | -16.44  |
| 26   | 27.22   | 65.96 | -17.54  |
| 27   | 26.89   | 65.17 | -18.53  |
| 28   | 26.58   | 64.41 | -19.48  |
| 29   | 26.28   | 63.69 | -20.38  |
| 30   | 26.00   | 63.00 | -21.24  |

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**P50 - P90 evaluation****Weather data**

|                                    |               |
|------------------------------------|---------------|
| Source                             | PVGIS-SARAH2  |
| Kind                               | Specific year |
| Year                               | 2020          |
| Year-to-year variability(Variance) | 3.5 %         |

**Specified Deviation**

|                             |       |
|-----------------------------|-------|
| Year deviation from average | 0.0 % |
|-----------------------------|-------|

**Global variability (weather data + system)**

|                             |       |
|-----------------------------|-------|
| Variability (Quadratic sum) | 4.0 % |
|-----------------------------|-------|

**Simulation and parameters uncertainties**

|                                    |       |
|------------------------------------|-------|
| PV module modelling/parameters     | 1.0 % |
| Inverter efficiency uncertainty    | 0.5 % |
| Soiling and mismatch uncertainties | 1.0 % |
| Degradation uncertainty            | 1.0 % |

**Annual production probability**

|             |           |
|-------------|-----------|
| Variability | 1.31 GWh  |
| P50         | 32.99 GWh |
| P90         | 31.31 GWh |
| P95         | 30.84 GWh |

**Probability distribution**