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**NOME COMMESSA:**

Costruzione ed esercizio impianto Agrovoltaiico avente potenza in immissione pari a 66.000 kW e potenza moduli pari a 72.080,19 kWp con relativo collegamento alla rete elettrica, sito in Veglie (LE) al:

Fig. 1 p.lla n. 14-113-134; Fig. 2 p.lla n. 2-3-53-38-39-87-96-97-98-99-100-101-102-103-104-105-106; Fig. 3 p.lla n. 25-453-454-46-462-464-465-47- 478-479-480-481-482- 49; Fig. 4 p.lla n. 18 - 569 -570 - SU in Erchie (BR) al fg. 33 p.lla n. 121-123 - IMPIANTO SPOT40

**STATO DI AVANZAMENTO COMMESSA:**

**PROGETTO DEFINITIVO PER AUTORIZZAZIONE UNICA**

**PROGETTAZIONE INGEGNERISTICA:**

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**OGGETTO:**

**ANALISI DELLA RISORSA SOLARE E STIMA DI PRODUZIONE ENERGIA**

**PROGETTISTA:**

ORDINE DEGLI INGEGNERI  
DELLA PROV. DI TRENTO  
dott. ing. ALBERTO ALBUZZI  
ISCRIZIONE ALBO N° 2435

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**SCALA:**

-

**NOME FILE:**

YAY65S7\_AnalisiRisorsaSolare.pdf

**DATA:**

MARZO 2021

**TAVOLA:**

**DPE.RE01**

N. REV.	DATA	REVISIONE
0	03.2021	Emissione

**ELABORATO**

A. Albuzzi

**VERIFICATO**

responsabile commessa  
A. Albuzzi

**VALIDATO**

direttore tecnico  
N. Zuech

# PVsyst - Simulation report

## Grid-Connected System

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Project: HE.19.0024 HEPV SV SPOT40

Variant: SV SPOT40 PVGYS SARAH 2005-2016

Tracking system with backtracking

System power: 72.08 MWp

Veglie SPOT40 PVGIS SARAH 2005-2016 - Italy

**Author**

Heliopolis spa (Italy)

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

**Veglie SPOT40 PVGIS SARAH 2005-2016**  
Italy

**Situation**

Latitude 40.37 °N  
Longitude 17.86 °E  
Altitude 58 m  
Time zone UTC+1

**Project settings**

Albedo 0.20

**Meteo data**

Veglie SPOT40 PVGIS SARAH 2005-2016  
PVGIS TMY: SARAH, COSMO or NSRDB 2005-2016 - Synthetic

**System summary****Grid-Connected System**

Simulation for year no 1

**Tracking system with backtracking****PV Field Orientation**

Tracking plane, horizontal N-S axis  
Axis azimuth 0 °

**Near Shadings**

According to strings  
Electrical effect 50 %

**User's needs**

Unlimited load (grid)

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

Nb. of modules 158418 units  
Pnom total 72.08 MWp

**Inverters**

Nb. of units 22 units  
Pnom total 66.40 MWac  
Pnom ratio 1.086

**Results summary**

Produced Energy 135898 MWh/year Specific production 1885 kWh/kWp/year Perf. Ratio PR 83.90 %

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**General parameters****Grid-Connected System****PV Field Orientation****Orientation**

Tracking plane, horizontal N-S axis  
Axis azimuth 0 °

**Horizon**

Free Horizon

**Tracking system with backtracking****Backtracking strategy**

Nb. of trackers 168 units

**Sizes**

Tracker Spacing 5.50 m  
Collector width 2.11 m  
Ground Cov. Ratio (GCR) 38.4 %  
Phi min / max -/+ 60.0 °

**Backtracking limit angle**

Phi limits +/- 67.2 °

**Near Shadings**

According to strings  
Electrical effect 50 %

**Models used**

Transposition Perez  
Diffuse Perez, Meteonorm  
Circumsolar separate

**User's needs**

Unlimited load (grid)

**PV Array Characteristics****Array #1 - INV 2.800 x 4.658 Stringhe****PV module**

Manufacturer JA Solar  
Model JAM72S20-455/MR\_1stMarch2021  
(Custom parameters definition)

Unit Nom. Power 455 Wp  
Number of PV modules 121108 units  
Nominal (STC) 55.10 MWp  
Modules 4658 Strings x 26 In series

**At operating cond. (50°C)**

Pmpp 50.50 MWp  
U mpp 990 V  
I mpp 50990 A

**Array #2 - INV 4.000 x 1.435 x Stringhe****PV module**

Manufacturer JA Solar  
Model JAM72S20-455/MR\_1stMarch2021  
(Custom parameters definition)

Unit Nom. Power 455 Wp  
Number of PV modules 37310 units  
Nominal (STC) 16.98 MWp  
Modules 1435 Strings x 26 In series

**At operating cond. (50°C)**

Pmpp 15.56 MWp  
U mpp 990 V  
I mpp 15709 A

**Total PV power**

Nominal (STC) 72080 kWp  
Total 158418 modules  
Module area 351977 m<sup>2</sup>  
Cell area 316177 m<sup>2</sup>

**Inverter**

Manufacturer SMA  
Model Sunny Central 2800 UP (Preliminary)  
(Custom parameters definition)

Unit Nom. Power 2800 kWac  
Number of inverters 18 units  
Total power 50400 kWac  
Operating voltage 921-1325 V  
Pnom ratio (DC:AC) 1.09

**Inverter**

Manufacturer SMA  
Model Sunny Central 4000 UP  
(Custom parameters definition)

Unit Nom. Power 4000 kWac  
Number of inverters 4 units  
Total power 16000 kWac  
Operating voltage 880-1325 V  
Pnom ratio (DC:AC) 1.06

**Total inverter power**

Total power 66400 kWac  
Nb. of inverters 22 units  
Pnom ratio 1.09

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**Array losses****Array Soiling Losses**

Loss Fraction 1.0 %

**Thermal Loss factor**

Module temperature according to irradiance

Uc (const) 29.0 W/m<sup>2</sup>KUv (wind) 0.0 W/m<sup>2</sup>K/m/s**LID - Light Induced Degradation**

Loss Fraction 1.0 %

**Module Quality Loss**

Loss Fraction -0.3 %

**Module mismatch losses**

Loss Fraction 0.7 % at MPP

**Strings Mismatch loss**

Loss Fraction 0.1 %

**Module average degradation**

Year no 1

Loss factor 1 %/year

**Mismatch due to degradation**

Imp RMS dispersion 0.4 %/year

Vmp RMS dispersion 0.4 %/year

**IAM loss factor**

Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	1.000	1.000	0.985	0.943	0.840	0.000

**DC wiring losses**

Global wiring resistance 0.23 mΩ

Loss Fraction 1.4 % at STC

**Array #1 - INV 2.800 x 4.658 Stringhe**

Global array res. 0.30 mΩ

Loss Fraction 1.4 % at STC

**Array #2 - INV 4.000 x 1.435 x Stringhe**

Global array res. 0.97 mΩ

Loss Fraction 1.4 % at STC

**System losses****Auxiliaries loss**

Proportionnal to Power 4.0 W/kW

0.0 kW from Power thresh.

**AC wiring losses****Inv. output line up to MV transfo**

Inverter voltage 630 Vac tri

Loss Fraction 0.6 % at STC

**Inverters: Sunny Central 2800 UP (Preliminary), Sunny Central 4000 UP**Wire section (22 Inv.) Copper 22 x 3 x 5000 mm<sup>2</sup>

Average wires length 198 m

**MV line up to Injection**

MV Voltage 30 kV

Average each inverter

Wires Alu 3 x 300 mm<sup>2</sup>

Length 11650 m

Loss Fraction 2.4 % at STC



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**AC losses in transformers**

**MV transfo**

Grid Voltage 30 kV

**Operating losses at STC**

Nominal power at STC (PNomac) 70580 kVA

Iron loss (24/24 Connexion) 35.29 kW/Inv.

Loss Fraction 0.2 % at STC

Coils equivalent resistance 3 x 0.45 mΩ/inv.

Loss Fraction 2.0 % at STC



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**Main results**

**System Production**

Produced Energy 135898 MWh/year

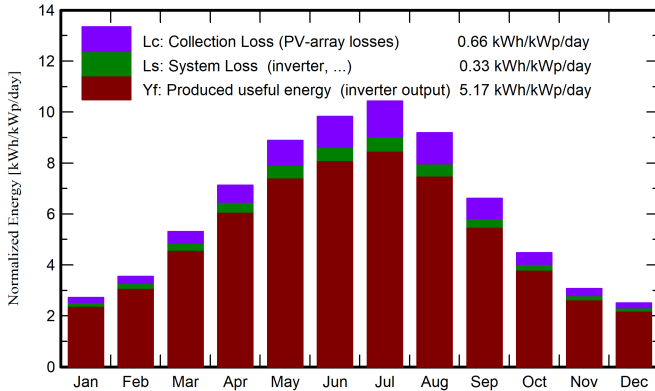
Specific production

1885 kWh/kWp/year

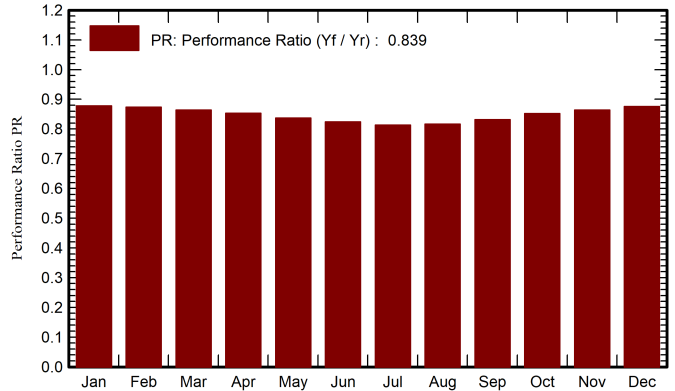
Performance Ratio PR

83.90 %

**Normalized productions (per installed kWp)**



**Performance Ratio PR**



**Balances and main results**

	<b>GlobHor</b> kWh/m <sup>2</sup>	<b>DiffHor</b> kWh/m <sup>2</sup>	<b>T_Amb</b> °C	<b>GlobInc</b> kWh/m <sup>2</sup>	<b>GlobEff</b> kWh/m <sup>2</sup>	<b>EArray</b> MWh	<b>E_Grid</b> MWh	<b>PR</b> ratio
<b>January</b>	62.9	28.90	11.27	84.5	81.5	5673	5347	0.878
<b>February</b>	76.0	36.00	11.07	99.3	95.7	6633	6252	0.874
<b>March</b>	125.4	53.00	12.61	164.6	159.3	10894	10257	0.864
<b>April</b>	163.6	64.70	14.95	213.7	207.2	13987	13149	0.853
<b>May</b>	208.5	71.10	18.53	275.3	267.6	17699	16610	0.837
<b>June</b>	223.5	70.40	22.62	294.9	286.8	18666	17522	0.824
<b>July</b>	239.7	63.00	25.72	323.4	315.0	20208	18957	0.813
<b>August</b>	209.4	58.60	26.02	284.8	277.2	17845	16766	0.817
<b>September</b>	148.2	54.20	23.09	198.2	192.2	12609	11876	0.831
<b>October</b>	105.1	44.10	19.38	138.7	134.2	9020	8516	0.852
<b>November</b>	68.3	31.50	15.88	92.0	88.6	6074	5729	0.864
<b>December</b>	57.1	25.70	12.38	77.8	75.1	5218	4916	0.876
<b>Year</b>	1687.7	601.20	17.83	2247.2	2180.4	144525	135898	0.839

**Legends**

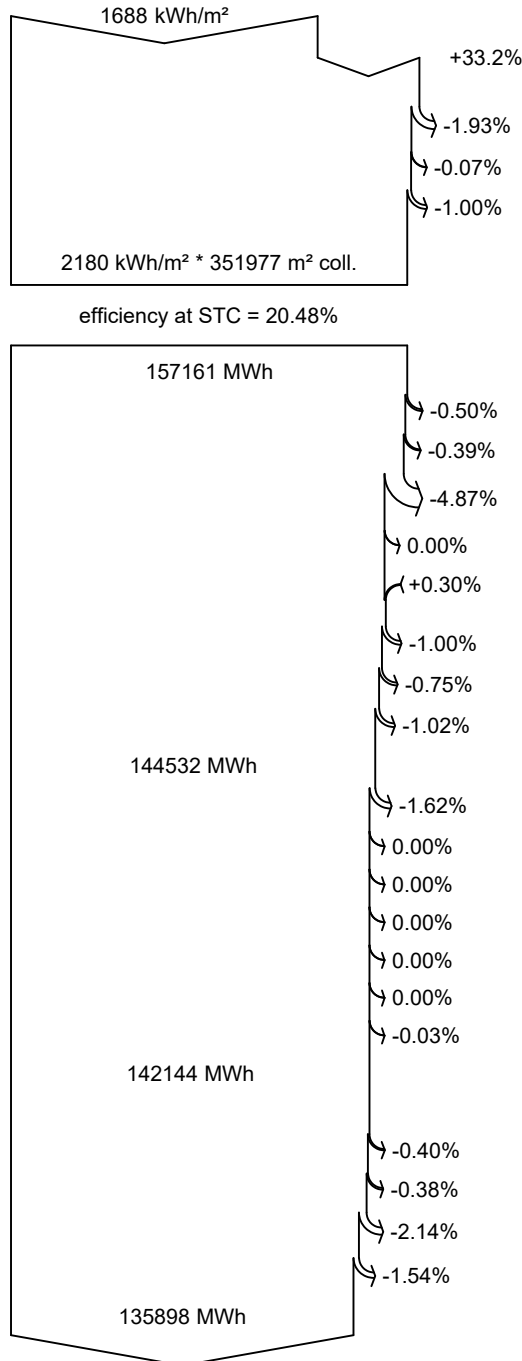
- GlobHor Global horizontal irradiation
- DiffHor Horizontal diffuse irradiation
- T\_Amb Ambient Temperature
- GlobInc Global incident in coll. plane
- GlobEff Effective Global, corr. for IAM and shadings
- EArray Effective energy at the output of the array
- E\_Grid Energy injected into grid
- PR Performance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



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**Loss diagram**



**Global horizontal irradiation**

**Global incident in coll. plane**

Near Shadings: irradiance loss

IAM factor on global

Soiling loss factor

**Effective irradiation on collectors**

PV conversion

**Array nominal energy (at STC effic.)**

Module Degradation Loss ( for year #1)

PV loss due to irradiance level

PV loss due to temperature

Shadings: Electrical Loss acc. to strings

Module quality loss

LID - Light induced degradation

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**

Auxiliaries (fans, other)

AC ohmic loss

Medium voltage transfo loss

MV line ohmic loss

**Energy injected into grid**





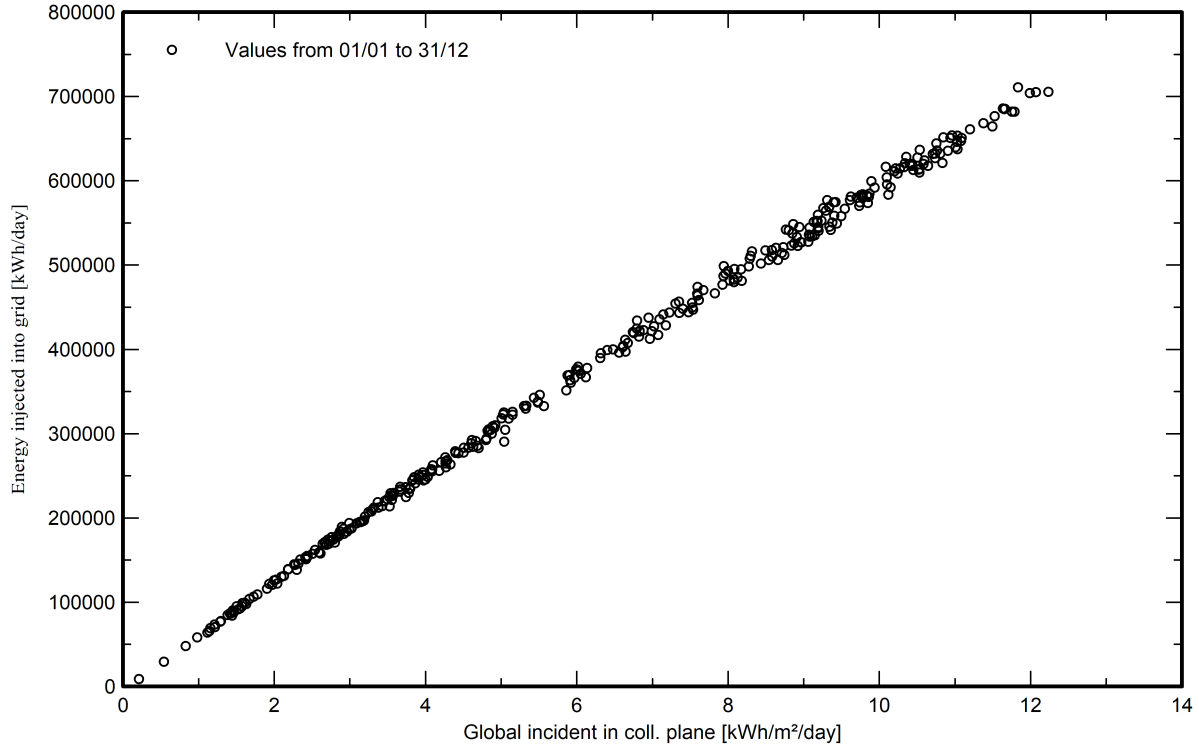
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**Special graphs**

**Daily Input/Output diagram**



**System Output Power Distribution**

