

PVsyst - Simulation report

Grid-Connected System

Project: Sim00

Variant: MONOFACIAL

Unlimited Trackers with backtracking

System power: 51.8 kWp

NREL BEST Field - United States

Author

National renewable energy laboratory (United states)



PVsyst V7.3.4

VC1, Simulation date:
06/16/23 09:02
with v7.3.4

National renewable energy laboratory (United states)

Project summary

Geographical Site

NREL BEST Field

United States

Situation

Latitude 39.74 °N
Longitude -105.17 °W
Altitude 1765 m
Time zone UTC-7

Meteo data

DENVER/CENTENNIAL [GOLDEN - NREL]
NREL BEST Field - TMY

Monthly albedo values

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Albedo	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20

System summary

Grid-Connected System

Unlimited Trackers with backtracking

PV Field Orientation

Orientation

Tracking horizontal axis

Tracking algorithm

Astronomic calculation
Backtracking activated

Near Shadings

No Shadings

System information

PV Array

Nb. of modules

144 units

Pnom total

51.8 kWp

Inverters

Nb. of units

3 units

Pnom total

72.0 kWac

Pnom ratio

0.720

User's needs

Unlimited load (grid)

Results summary

Produced Energy	101840 kWh/year	Specific production	1965 kWh/kWp/year	Perf. Ratio PR	83.15 %
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General parameters**Grid-Connected System****Unlimited Trackers with backtracking****PV Field Orientation****Orientation**

Tracking horizontal axis

Tracking algorithm

Astronomic calculation

Backtracking activated

Backtracking array

Nb. of trackers 10 units

Unlimited trackers

Sizes

Tracker Spacing 5.70 m

Collector width 2.00 m

Ground Cov. Ratio (GCR) 35.1 %

Left inactive band 0.02 m

Right inactive band 0.02 m

Phi min / max. -/+ 50.0 °

Backtracking strategy

Phi limits for BT -/+ 68.9 °

Backtracking pitch 5.70 m

Backtracking width 2.00 m

Models used

Transposition Perez

Diffuse Imported

Circumsolar with diffuse

Horizon

Free Horizon

Near Shadings

No Shadings

User's needs

Unlimited load (grid)

PV Array Characteristics**PV module**

Manufacturer

CSI Solar

Model

CS3U-360MB-AG 1500V

(Original PVsyst database)

Unit Nom. Power

360 Wp

Number of PV modules

144 units

Nominal (STC)

51.8 kWp

Modules

9 Strings x 16 In series

At operating cond. (50°C)

Pmpp

47.1 kWp

U mpp

566 V

I mpp

83 A

Total PV power

Nominal (STC)

52 kWp

Total

144 modules

Module area

289 m²

Cell area

253 m²

Inverter

Manufacturer

Fronius USA

Model

Symo Advanced 24.0-3 480

(Original PVsyst database)

Unit Nom. Power

24.0 kWac

Number of inverters

3 * MPPT 0.57 3 units

Total power

72.0 kWac

Operating voltage

200-800 V

Pnom ratio (DC:AC)

0.72

Total inverter power

Total power

72 kWac

Number of inverters

3 units

Pnom ratio

0.72

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.

113 mΩ

Loss Fraction

1.5 % at STC

Module Quality Loss

Loss Fraction

-0.4 %

Module mismatch losses

Loss Fraction

2.0 % at MPP

Strings Mismatch loss

Loss Fraction

0.2 %



Array losses

IAM loss factor

Incidence effect (IAM): User defined profile

10°	20°	30°	40°	50°	60°	70°	80°	90°
1.000	1.000	1.000	0.990	0.990	0.970	0.920	0.760	0.000



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Main results

System Production

Produced Energy

101840 kWh/year

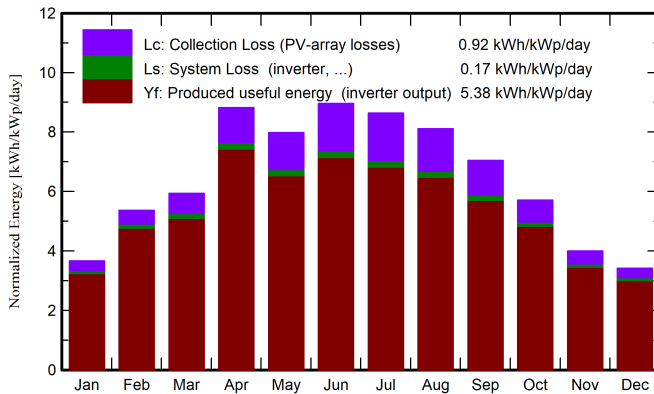
Specific production

1965 kWh/kWp/year

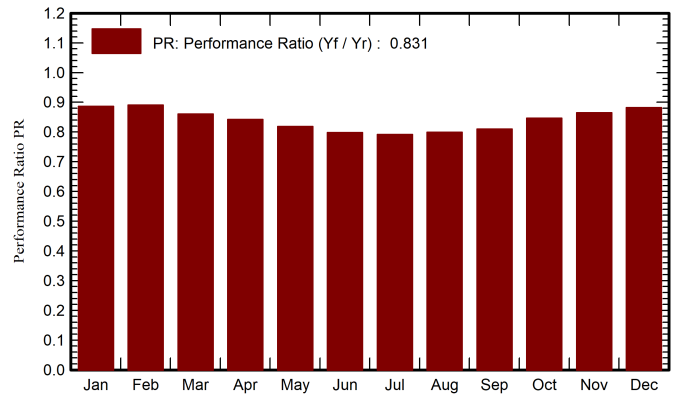
Perf. Ratio PR

83.15 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	kWh	kWh	ratio
January	81.2	28.03	1.69	113.6	108.4	5386	5222	0.886
February	108.6	32.46	-0.42	150.1	144.4	7132	6932	0.891
March	142.7	55.33	5.08	184.2	177.2	8465	8217	0.861
April	197.1	56.45	9.87	264.6	257.0	11903	11560	0.843
May	195.2	72.55	13.83	247.6	239.4	10837	10507	0.819
June	209.8	67.86	21.86	269.0	260.8	11479	11124	0.798
July	211.3	68.73	24.14	267.7	259.5	11336	10984	0.791
August	194.5	68.72	23.50	251.5	243.2	10753	10422	0.799
September	155.8	43.00	20.31	211.5	205.0	9159	8881	0.810
October	126.1	30.14	12.96	177.1	171.2	8009	7771	0.847
November	84.5	25.42	9.39	119.9	114.8	5548	5377	0.865
December	74.1	23.40	5.14	105.9	100.8	4999	4843	0.882
Year	1781.0	572.09	12.35	2362.6	2281.8	105006	101840	0.831

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

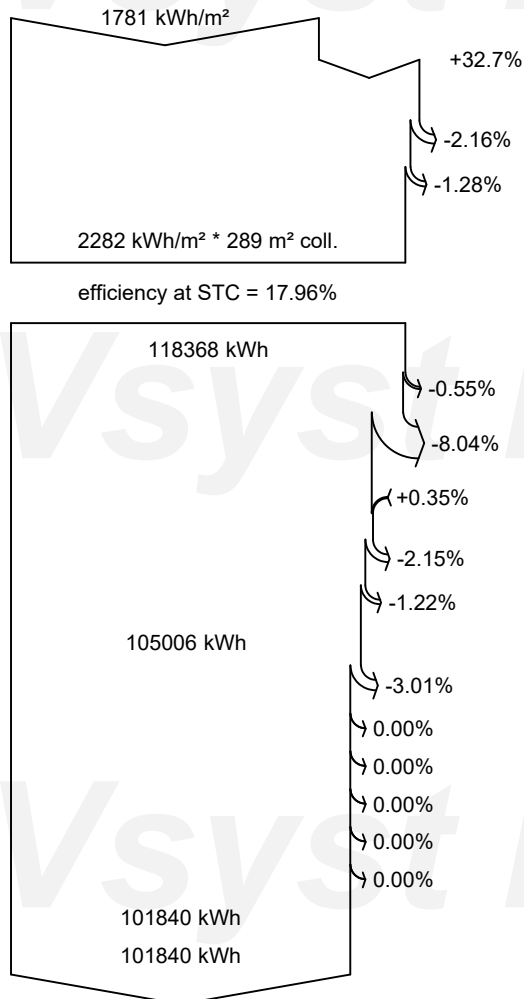
EArray Effective energy at the output of the array

E_Grid Energy injected into grid

PR Performance Ratio



Loss diagram



Global horizontal irradiation

Global incident in coll. plane

Near Shadings: irradiance loss

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

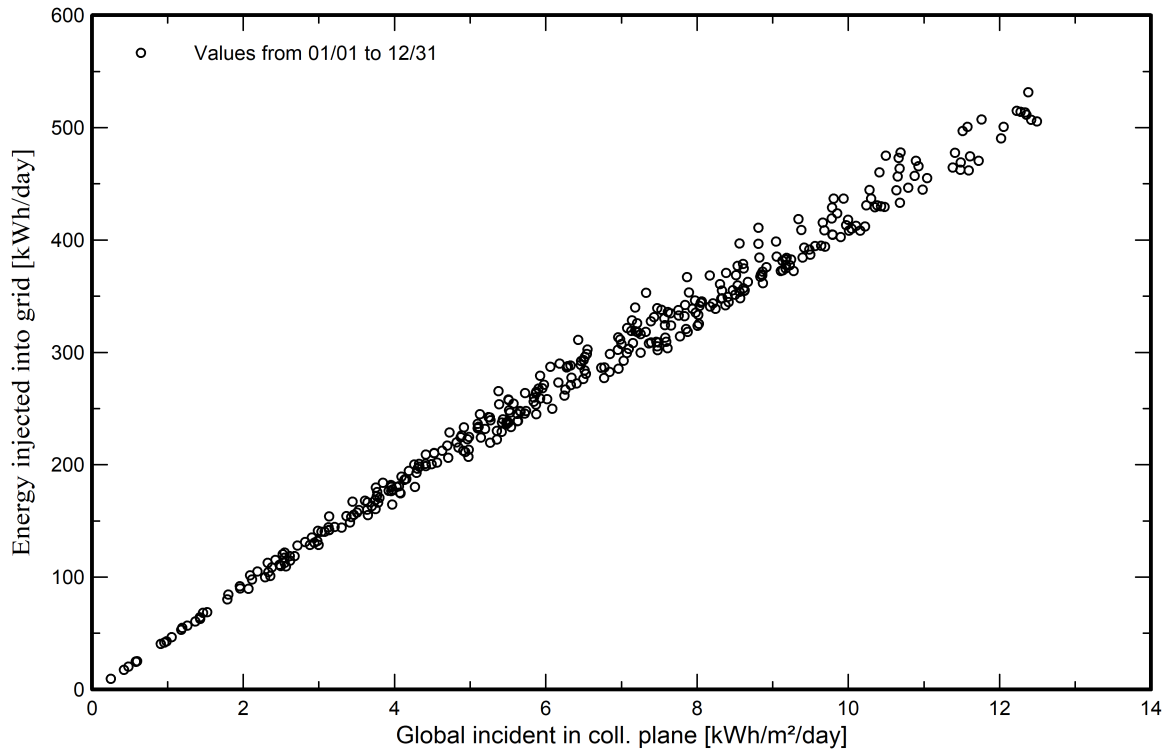
Available Energy at Inverter Output

Energy injected into grid



Predef. graphs

Daily Input/Output diagram



System Output Power Distribution

