

PVsyst - Simulation report

Grid-Connected System

Project: 20MWp_Bhbhar

Variant: New simulation variant

Sheds system, seasonal tilt

System power: 20.02 MWp

Bhābhar - India

**PVsyst V7.4.8**

VC0, Simulation date:
20/08/24 19:34
with V7.4.8

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

India

Situation

Latitude 23.99 °N

Longitude 71.57 °E

Altitude 26 m

Time zone UTC+5.5

Project settings

Albedo 0.20

Weather data

Bhābhar

Meteonorm 8.1 (1996-2015), Sat=100% - Synthetic

System summary**Grid-Connected System****PV Field Orientation**

Seasonal tilt adjustment

azimuth 0 °

Summer Tilt 5 °

winter 22 °

Oct.-Nov.-Dec.-Jan.-Feb.-Mar.-

Sheds system, seasonal tilt**Near Shadings**

No Shadings

User's needs

Unlimited load (grid)

System information**PV Array**

Nb. of modules

36400 units

Pnom total

20.02 MWp

Inverters

Nb. of units

50 units

Pnom total

17.50 MWac

Pnom ratio

1.144

Results summary

Produced Energy	33384056 kWh/year	Specific production	1668 kWh/kWp/year	Perf. Ratio PR	82.75 %
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General parameters

Grid-Connected System

Sheds system, seasonal tilt

PV Field Orientation

Orientation

Seasonal tilt adjustment

azimuth 0 °

Summer Tilt 5 °

winter 22 °

Oct.-Nov.-Dec.-Jan.-Feb.-Mar.-

Sheds configuration

Models used

Transposition Perez

Diffuse Perez, Meteonorm

Circumsolar separate

Horizon

Free Horizon

Near Shadings

No Shadings

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer

Waaree

Model

Bi-55-550

(Custom parameters definition)

Unit Nom. Power

550 Wp

Number of PV modules

36400 units

Nominal (STC)

20.02 MWp

Modules

1400 string x 26 In series

At operating cond. (50°C)

Pmpp

18.49 MWp

U mpp

992 V

I mpp

18630 A

Total PV power

Nominal (STC)

20020 kWp

Total

36400 modules

Module area

93700 m²

Cell area

86801 m²

Inverter

Manufacturer

Sungrow

Model

SG350-HX

(Original PVsyst database)

Unit Nom. Power

350 kWac

Number of inverters

50 units

Total power

17500 kWac

Operating voltage

500-1450 V

Pnom ratio (DC:AC)

1.14

Power sharing within this inverter

Total inverter power

Total power

17500 kWac

Number of inverters

50 units

Pnom ratio

1.14

Array losses

Array Soiling Losses

Average loss Fraction 2.0 %

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%

Thermal Loss factor

Module temperature according to irradiance

Uc (const) 29.0 W/m²KUv (wind) 0.0 W/m²K/m/s

DC wiring losses

Global array res.

0.29 mΩ

Loss Fraction

0.5 % at STC

LID - Light Induced Degradation

Loss Fraction

2.0 %

Module Quality Loss

Loss Fraction 0.0 %

Module mismatch losses

Loss Fraction

1.0 % at MPP

Strings Mismatch loss

Loss Fraction

0.1 %

IAM loss factor

Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.985	0.958	0.886	0.809	0.676	0.449	0.000



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System losses

Unavailability of the system

Time fraction 1.0 %
 3.7 days,
 3 periods

Auxiliaries loss

Proportional to Power 3.0 W/kW
0.0 kW from Power thresh.

AC wiring losses

Inv. output line up to injection point

Inverter voltage 800 Vac tri
Loss Fraction 1.50 % at STC

Inverter: SG350-HX

Wire section (50 Inv.) Copper 50 x 3 x 150 mm²
Average wires length 193 m



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Main results

System Production

Produced Energy

33384056 kWh/year

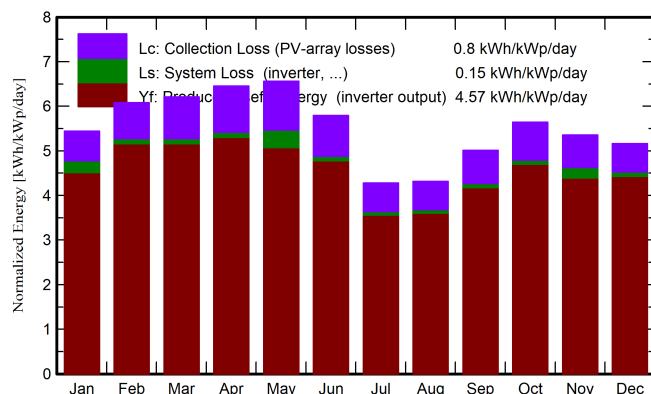
Specific production

1668 kWh/kWp/year

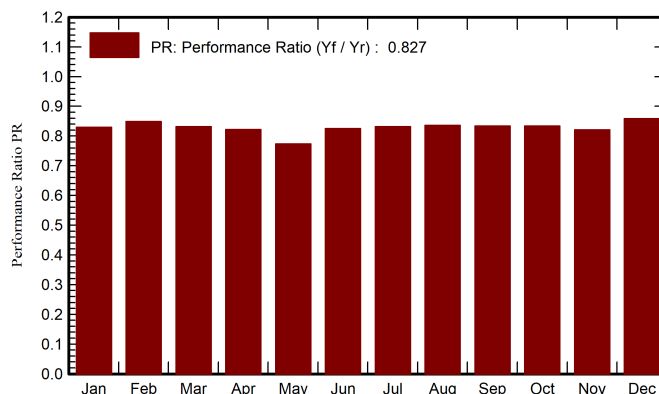
Perf. Ratio PR

82.75 %

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	129.4	45.5	19.37	168.7	162.3	2969755	2802182	0.830
February	140.3	47.8	22.69	170.3	164.2	2959649	2895841	0.849
March	174.6	69.8	28.12	192.5	185.3	3275830	3203798	0.831
April	191.2	84.9	31.52	193.6	185.7	3255570	3186797	0.822
May	203.7	96.7	33.95	203.4	195.1	3397018	3150529	0.774
June	175.1	104.7	32.36	173.9	166.4	2932903	2871663	0.825
July	133.4	98.4	30.00	132.8	126.4	2259103	2210590	0.832
August	133.5	90.8	28.63	133.9	127.6	2288379	2239622	0.836
September	147.5	78.1	28.87	150.4	143.7	2565886	2511989	0.834
October	152.2	72.3	29.15	174.9	167.9	2978963	2917734	0.833
November	127.9	51.8	24.77	160.6	154.8	2783218	2640684	0.821
December	120.9	42.9	20.70	160.2	154.5	2812541	2752627	0.858
Year	1829.8	883.7	27.53	2015.2	1933.8	34478815	33384056	0.827

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

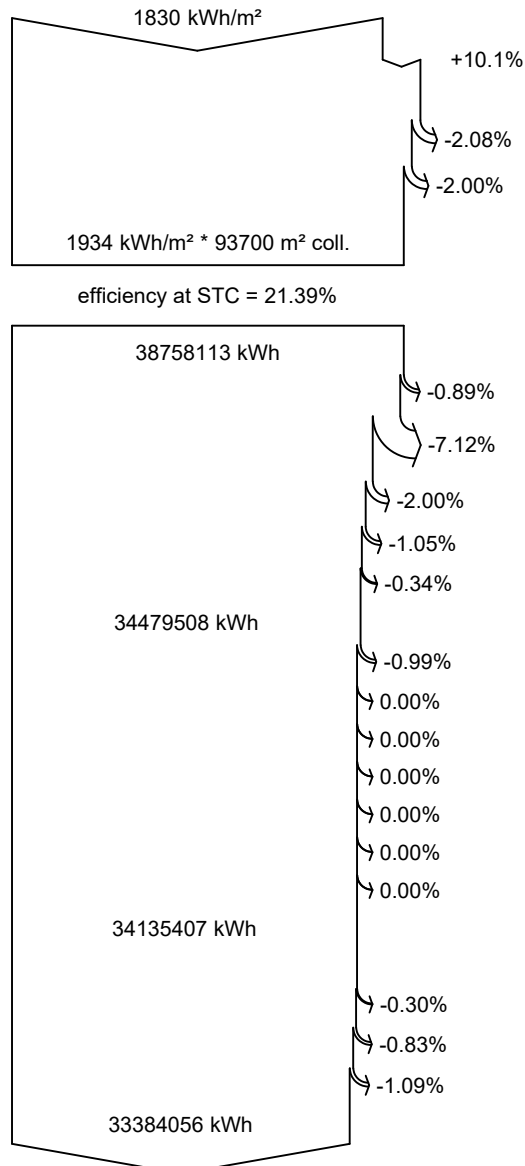
PR Performance Ratio



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Loss diagram



Global horizontal irradiation

Global incident in coll. plane

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

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

System unavailability

Energy injected into grid

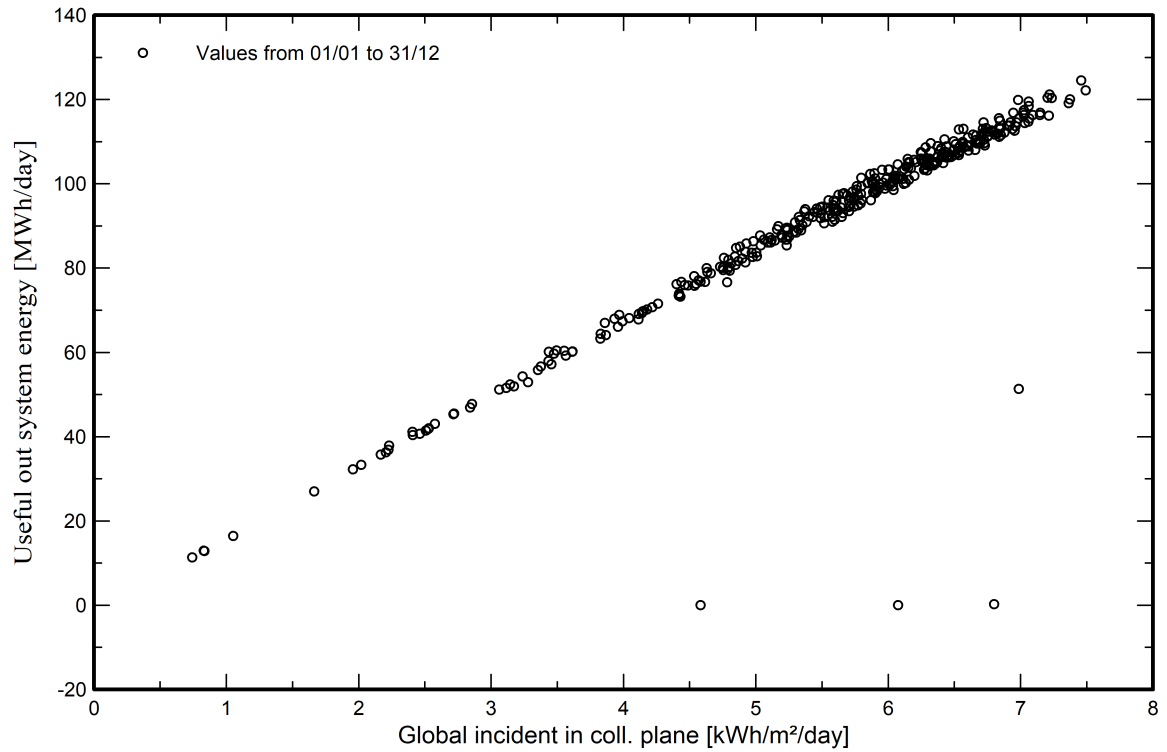


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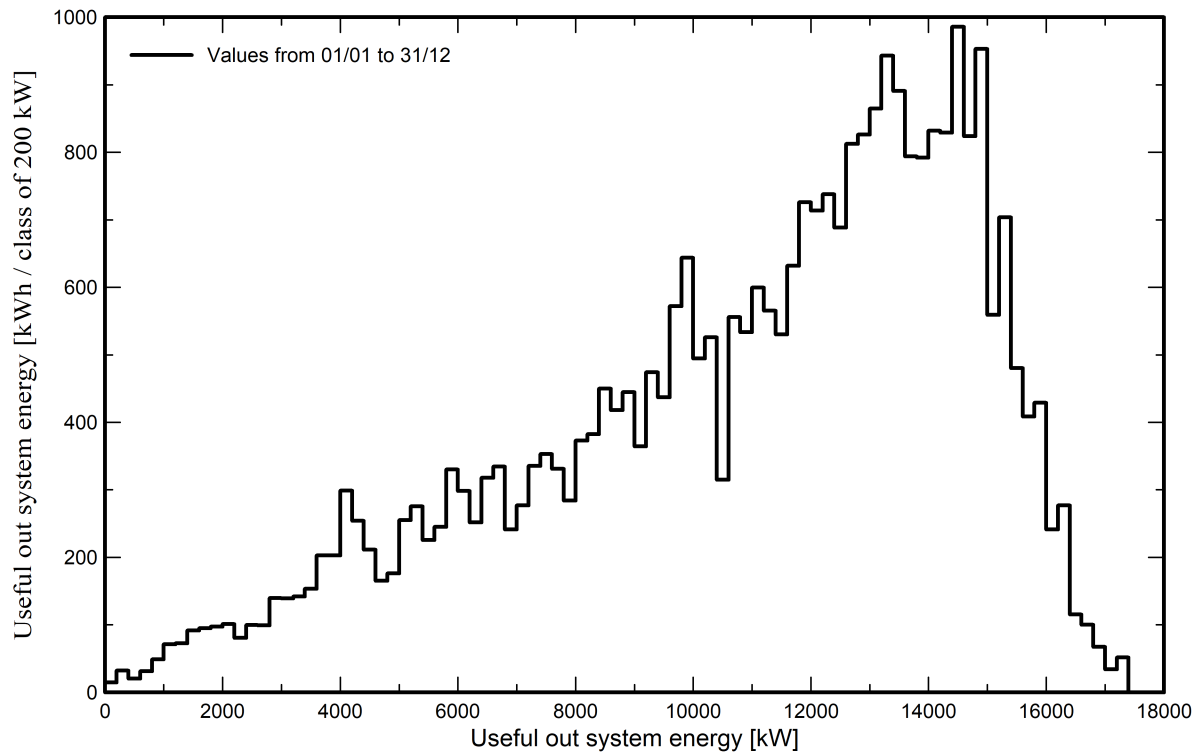
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Predef. graphs

Daily Input/Output diagram



System Output Power Distribution



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P50 - P90 evaluation**Weather data**

Source Meteonorm 8.1 (1996-2015), Sat=100%
Kind TMY, multi-year
Year-to-year variability(Variance) 0.0 %

Specified Deviation

Climate change 0.0 %

Global variability (weather data + system)

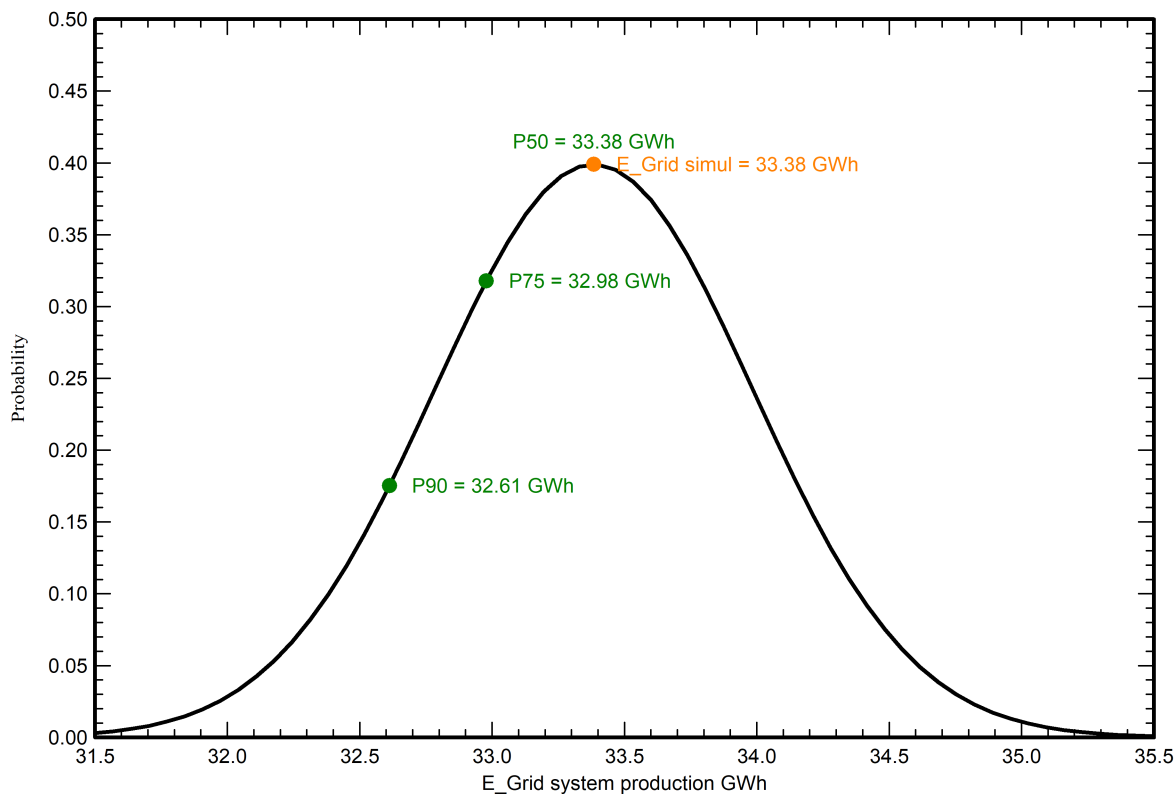
Variability (Quadratic sum) 1.8 %

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	0.60 GWh
P50	33.38 GWh
P90	32.61 GWh
P75	32.98 GWh

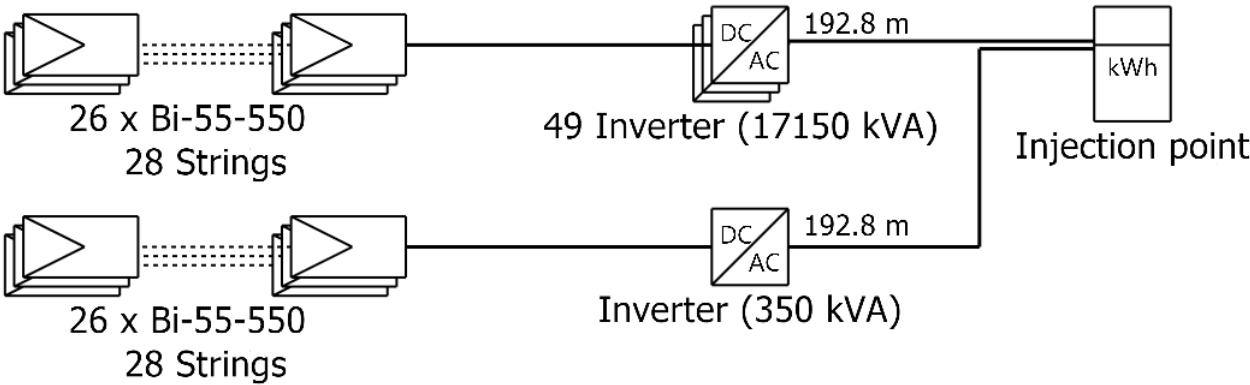
Probability distribution



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Single-line diagram



PV module	Bi-55-550
Inverter	SG350-HX
String	26 x Bi-55-550

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VC0 : New simulation variant

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