PVsyst
PHOTOVOLTAIC SOFTWARE

PVsyst - Simulation report

Grid-Connected System

Project: Pvsyst_simulation

Variant: New simulation variant_facing_South_east

No 3D scene defined, no shadings

System power: 20.24 MWp

Rohtas, Bihar - India

Ankit gupta- NITP

PVsyst V8.0.15
VC0, Simulation date:
22/08/25 23:55
with V8.0.15

Project summary

Geographical Site
Rohtas, Bihar

India

Situation	
Latitude	24.83 °(N)
Longitude	84.13 °(E)
Altitude	101 m
Time zone	UTC+5.5

Project settings
Albedo	0.18

Weather data
Rohtas, Bihar

Meteonorm 8.2 (2001-2020), Sat=100% - Synthetic

System summary

Grid-Connected System
Simulation for year no 10

No 3D scene defined, no shadings

Orientation #1
Fixed plane

Tilt/Azimuth   5 / 132.5 °

Near Shadings
no Shadings

User's needs
Unlimited load (grid)

System information

PV Array		Inverters	
Nb. of modules	36800 units	Nb. of units	8 units
Pnom total	20.24 MWp	Total power	20000 kWac
		Grid power limit	20.00 MWac
		Grid lim. Pnom ratio	1.012

Results summary

Produced Energy	23387 MWh/year	Specific production	1156 kWh/kWp/year	Perf. Ratio PR	75.42 %

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General parameters

Grid-Connected System	**No 3D scene defined, no shadings**	

Orientation #1

Fixed plane

Tilt/Azimuth   5 / 132.5 °

Models used

Transposition	Hay
Diffuse	Perez, Meteonorm
Circumsolar	separate

Horizon

Free Horizon

Near Shadings

no Shadings

User's needs

Unlimited load (grid)

Grid power limitation

Active power	20.00 MWac
Pnom ratio	1.012

Limit applied at the inverter level

PV Array Characteristics

PV module

Manufacturer	Generic
Model	shark 550

  (Custom parameters definition)

    Loom_Mono_550W_Half_PERC.PAN

Unit Nom. Power	550 Wp

Inverter

Manufacturer	Generic
Model	SG2500-HV-20

  (Original PVsyst database)

Unit Nom. Power	2500 kWac

Array #1 - PV Array

Number of PV modules	4600 units
Nominal (STC)	2530 kWp
Modules	184 string x 25 In series

At operating cond. (50°C)	
Pmpp	2329 kWp
U mpp	961 V
I mpp	2422 A

Number of inverters	1 unit
Total power	2500 kWac

Operating voltage	800-1300 V
Max. power (=>25°C)	2750 kWac
Pnom ratio (DC:AC)	1.01

Array #2 - Sub-array #2

Number of PV modules	4600 units
Nominal (STC)	2530 kWp
Modules	184 string x 25 In series

At operating cond. (50°C)	
Pmpp	2329 kWp
U mpp	961 V
I mpp	2422 A

Number of inverters	1 unit
Total power	2500 kWac

Operating voltage	800-1300 V
Max. power (=>25°C)	2750 kWac
Pnom ratio (DC:AC)	1.01

Array #3 - Sub-array #3

Number of PV modules	4600 units
Nominal (STC)	2530 kWp
Modules	184 string x 25 In series

At operating cond. (50°C)	
Pmpp	2329 kWp
U mpp	961 V
I mpp	2422 A

Number of inverters	1 unit
Total power	2500 kWac

Operating voltage	800-1300 V
Max. power (=>25°C)	2750 kWac
Pnom ratio (DC:AC)	1.01

Array #4 - Sub-array #4

Number of PV modules	4600 units
Nominal (STC)	2530 kWp
Modules	184 string x 25 In series

At operating cond. (50°C)	
Pmpp	2329 kWp
U mpp	961 V
I mpp	2422 A

Number of inverters	1 unit
Total power	2500 kWac

Operating voltage	800-1300 V
Max. power (=>25°C)	2750 kWac
Pnom ratio (DC:AC)	1.01

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PV Array Characteristics

Array #5 - Sub-array #5

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kWac
Modules	184 string x 25 In series		
At operating cond. (50°C)		Operating voltage	800-1300 V
Pmpp	2329 kWp	Max. power (=>25°C)	2750 kWac
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A		

Array #6 - Sub-array #6

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kWac
Modules	184 string x 25 In series		
At operating cond. (50°C)		Operating voltage	800-1300 V
Pmpp	2329 kWp	Max. power (=>25°C)	2750 kWac
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A		

Array #7 - Sub-array #7

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kWac
Modules	184 string x 25 In series		
At operating cond. (50°C)		Operating voltage	800-1300 V
Pmpp	2329 kWp	Max. power (=>25°C)	2750 kWac
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A		

Array #8 - Sub-array #8

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kWac
Modules	184 string x 25 In series		
At operating cond. (50°C)		Operating voltage	800-1300 V
Pmpp	2329 kWp	Max. power (=>25°C)	2750 kWac
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A		

Total PV power

Nominal (STC)	20240 kWp	Total power	20000 kWac
Total	36800 modules	Max. power	22000 kWac
Module area	94980 m²	Number of inverters	8 units
Cell area	87765 m²	Pnom ratio	1.01

Array losses

Array Soiling Losses		**Thermal Loss factor**		**DC wiring losses**	
Loss Fraction	1.5 %	Module temperature according to irradiance		Global array res.	4.6 mΩ
		Uc (const)	29.0 W/m²K	Global wiring resistance	0.57 mΩ
		Uv (wind)	0.0 W/m²K/m/s	Loss Fraction	1.04 % at STC
Serie Diode Loss		**LID - Light Induced Degradation**		**Module Quality Loss**	
Voltage drop	0.7 V	Loss Fraction	2.0 %	Loss Fraction	-0.38 %
Loss Fraction	0.1 % at STC				

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Array losses

Module mismatch losses
Loss Fraction	2.00 % at MPP

Strings Mismatch loss
Loss Fraction	0.15 %

Module average degradation
Year no	10
Loss factor	0.4 %/year
Imp / Vmp contributions	80% / 20%

Mismatch due to degradation
Imp RMS dispersion	0.4 %/year
Vmp RMS dispersion	0.4 %/year

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	0.963	0.892	0.814	0.679	0.438	0.000

Spectral correction
FirstSolar model

Precipitable water estimated from relative humidity

Coefficient Set	C0	C1	C2	C3	C4	C5
Monocrystalline Si	0.85914	-0.02088	-0.0058853	0.12029	0.026814	-0.001781

System losses

Unavailability of the system
Time fraction	1.4 %
	5.0 days,
	5 periods

Auxiliary losses
constant (fans)	110.0 kW
0.0 kW from Power thresh.	

AC wiring losses

Inv. output line up to injection point
Inverter voltage	550 Vac tri
Loss Fraction	1.56 % at STC

Inverter: SG2500-HV-20
Wire section (8 Inv.)	Copper 8 x 3 x 2000 mm²
Average wires length	200 m

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Main results

System Production

Produced Energy	23387 MWh/year	Specific production	1156 kWh/kWp/year
		Perf. Ratio PR	75.42 %

Economic evaluation

Investment		Yearly cost		LCOE	
Global	860,200,000.00 INR	Annuities	18,162,701.36 INR/yr	Energy cost	1.99 INR/kWh
Specific	42.5 INR/Wp	Run. costs	12,576,131.87 INR/yr		
		Payback period	9.9 years		

Normalized productions (per installed kWp)

Lc: Collection Loss (PV-array losses) 0.84 kWh/kWp/day
Ls: System Loss (inverter, ...) 0.2 kWh/kWp/day
Yf: Produced useful energy (inverter output) 3.17 kWh/kWp/day

Performance Ratio PR

PR: Performance Ratio (Yf / Yr) : 0.754
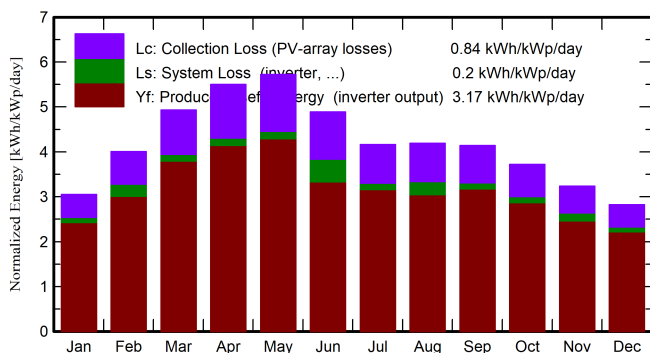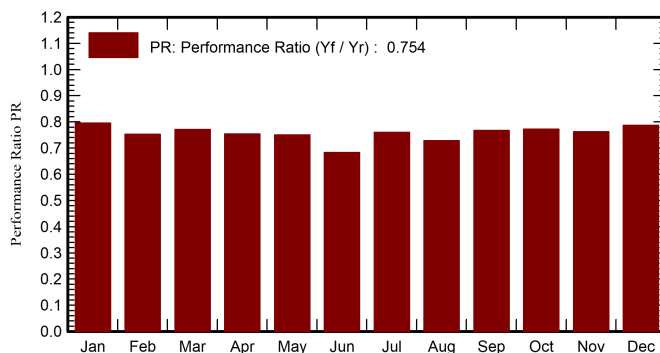
Balances and main results

|	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m²	kWh/m²	°C	kWh/m²	kWh/m²	MWh	MWh	ratio
January	98.3	56.9	15.21	94.6	89.1	1596	1524	0.796
February	116.1	59.3	19.91	112.2	106.5	1862	1708	0.752
March	156.2	73.8	25.57	152.9	146.4	2477	2384	0.770
April	167.0	81.6	30.80	165.1	158.2	2617	2519	0.754
May	178.3	102.9	33.50	177.4	170.1	2800	2696	0.751
June	146.8	98.9	32.26	146.6	140.1	2334	2028	0.683
July	129.5	84.8	29.93	129.0	123.2	2076	1985	0.760
August	130.8	83.9	29.31	129.9	123.9	2097	1916	0.729
September	125.9	76.1	28.56	124.2	118.4	2013	1928	0.767
October	118.2	70.1	26.36	115.5	109.7	1885	1805	0.772
November	100.6	54.3	21.12	97.1	91.7	1607	1499	0.763
December	91.8	49.1	16.77	87.6	82.2	1465	1395	0.787
Year	1559.4	891.8	25.80	1532.0	1459.6	24830	23387	0.754

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		

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Loss diagram
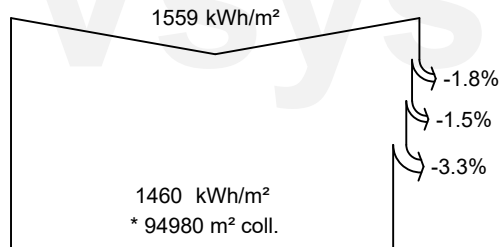
|	
1559 kWh/m²	**Global horizontal irradiation**
-1.8%	**Global incident in coll. plane**
-1.5%	Soiling loss factor
-3.3%	IAM factor on global
1460 kWh/m²	**Effective irradiation on collectors**
* 94980 m² coll.	
efficiency at STC = 21.39%	PV conversion
29649 MWh	**Array nominal energy (at STC effic.)**
-3.8%	Module Degradation Loss (for year #10)
-1.0%	PV loss due to irradiance level
-6.3%	PV loss due to temperature
+0.0%	Spectral correction
+0.4%	Module quality loss
-2.0%	LID - Light induced degradation
-4.1%	Mismatch loss, modules and strings
	(including 1.9% for degradation dispersion)
-0.6%	Ohmic wiring loss
24830 MWh	**Array virtual energy at MPP**
-1.3%	Inverter Loss during operation (efficiency)
0.0%	Inverter Loss over nominal inv. power
0.0%	Inverter Loss due to max. input current
0.0%	Inverter Loss over nominal inv. voltage
0.0%	Inverter Loss due to power threshold
0.0%	Inverter Loss due to voltage threshold
24494 MWh	**Available Energy at Inverter Output**
-2.1%	Auxiliaries (fans, other)
-0.7%	AC ohmic loss
-1.8%	System unavailability
23387 MWh	**Energy injected into grid**

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Predef. graphs

Daily Input/Output diagram
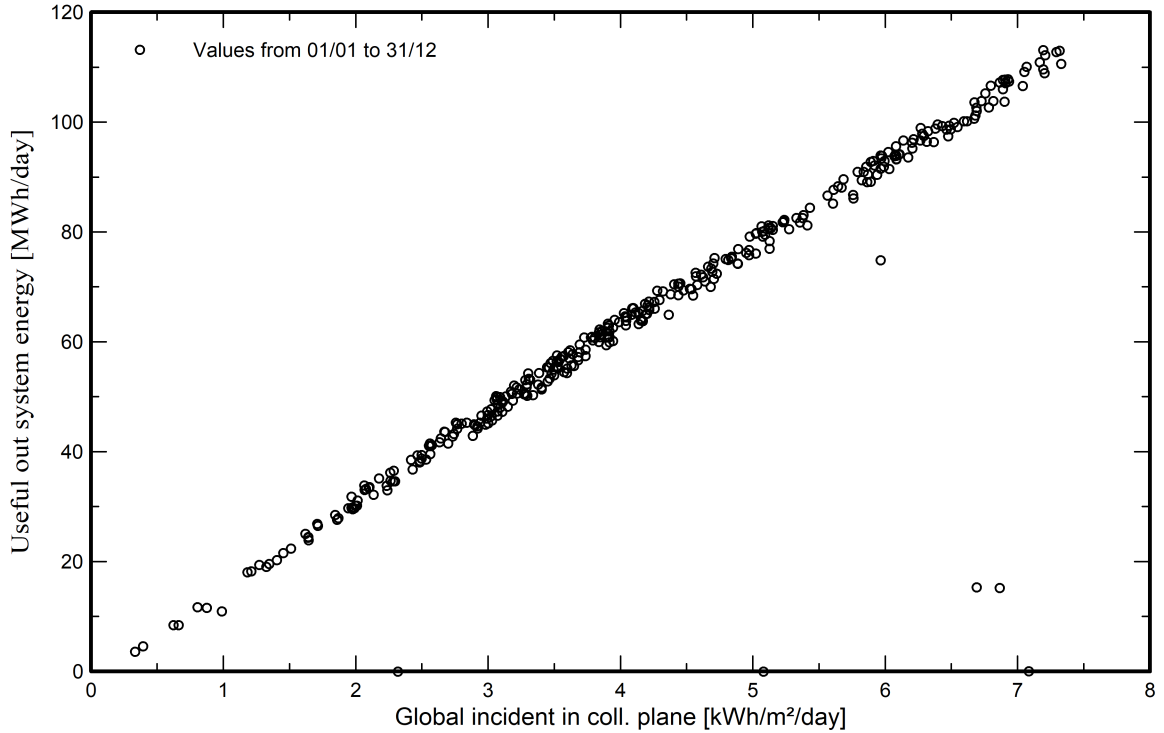
System Output Power Distribution
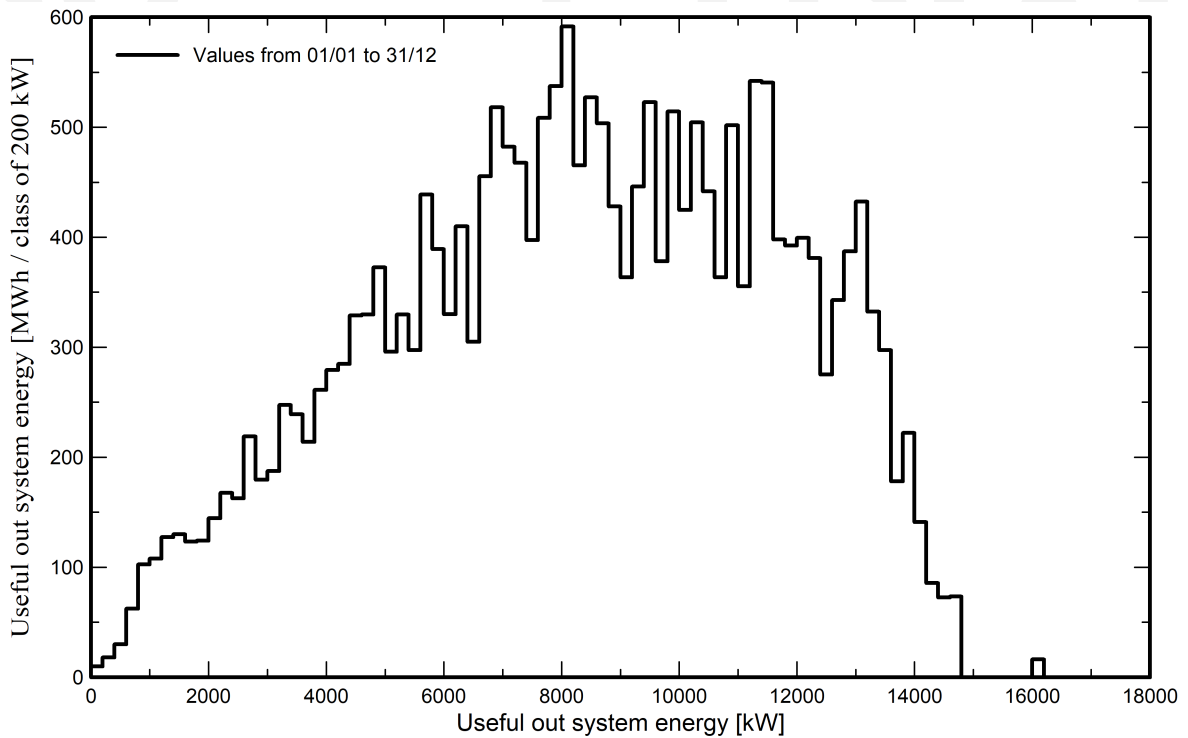
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P50 - P90 evaluation

Weather data

Source	Meteonorm 8.2 (2001-2020), Sat=100%	
Kind	Monthly averages	
Synthetic - Multi-year average		
Year-to-year variability(Variance)	2.0 %	

Specified Deviation

Climate change	0.8 %

Global variability (weather data + system)

Variability (Quadratic sum)	2.7 %

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	0.63 GWh
P50	23.57 GWh
P90	22.76 GWh
P75	23.15 GWh

Probability distribution

Single-line diagram

25 x shark 550
8 Strings

120.0 m   Combiner x 23   10.0 m   Combiner   100.0 m   Inverter (2500 kVA)   200.0 m

kWh

Injection point

25 x shark 550
8 Strings

120.0 m   Combiner x 23   10.0 m   Combiner   100.0 m   Inverter (2500 kVA)   200.0 m

25 x shark 550
8 Strings

120.0 m   Combiner x 23   10.0 m   Combiner   100.0 m   Inverter (2500 kVA)   200.0 m

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25 x shark 550
8 Strings

120.0 m   Combiner x 23   10.0 m   Combiner   100.0 m   Inverter (2500 kVA)   200.0 m

PV module	shark 550
Inverter	SG2500-HV-20
String	25 x shark 550

Pvsyst_simulation

VC0 : New simulation variant_facing_South_east

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Cost of the system

Installation costs

Item	Quantity units	Cost INR	Total INR
PV modules			
shark 550	36800	11,550.00	425,040,000.00
Supports for modules	36800	3,575.00	131,560,000.00
Inverters			
SG2500-HV-20	8	8,855,000.00	70,840,000.00
Other components			
Accessories, fasteners	1	20,240,000.00	20,240,000.00
Wiring	1	20,240,000.00	20,240,000.00
Combiner box	1	10,120,000.00	10,120,000.00
Monitoring system, display screen	1	10,120,000.00	10,120,000.00
Measurement system, pyranometer	1	10,120,000.00	10,120,000.00
Surge arrester	1	10,120,000.00	10,120,000.00
Studies and analysis			
Engineering	1	5,060,000.00	5,060,000.00
Permitting and other admin. Fees	1	5,060,000.00	5,060,000.00
Environmental studies	1	5,060,000.00	5,060,000.00
Economic analysis	1	5,060,000.00	5,060,000.00
Installation			
Global installation cost per module	36800	550.00	20,240,000.00
Global installation cost per inverter	8	2,530,000.00	20,240,000.00
Transport	1	20,240,000.00	20,240,000.00
Settings	1	20,240,000.00	20,240,000.00
Grid connection	1	20,240,000.00	20,240,000.00
Insurance			
Building insurance	1	2,530,000.00	2,530,000.00
Transport insurance	1	2,530,000.00	2,530,000.00
Liability insurance	1	2,530,000.00	2,530,000.00
Delay in start-up insurance	1	2,530,000.00	2,530,000.00
Loan bank charges			20,240,000.00
		Total	860,200,000.00
		Depreciable asset	647,680,000.00

Operating costs

Item	Total INR/year
Maintenance	
Provision for inverter replacement	4,048,000.00
Salaries	4,048,000.00
Repairs	4,048,000.00
Cleaning	2,024,000.00
Security fund	2,024,000.00
Bank charges	2,024,000.00
Administrative, accounting	3,036,000.00
Subsidies	-10,120,000.00
Total (OPEX)	11,132,000.00
Including inflation (1.00%)	12,576,131.87

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Cost of the system

System summary	
Total installation cost	860,200,000.00 INR
Operating costs (incl. inflation 1.00%/year)	12,576,131.87 INR/year
Produced Energy	23456 MWh/year
Cost of produced energy (LCOE)	1.9926 INR/kWh

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Financial analysis

Simulation period

Project lifetime	25 years	Start year	2026

Income variation over time

Inflation	1.00 %/year
Module Degradation	0.00 %/year
Discount rate	0.00 %/year

Income dependent expenses

Income tax rate	0.00 %/year
Other income tax	0.00 %/year
Dividends	0.00 %/year

Depreciable assets

Asset	Depreciation method	Depreciation period (years)	Salvage value (INR)	Depreciable (INR)
PV modules				
shark 550	Straight-line	20	0.00	425,040,000.00
Supports for modules	Straight-line	20	0.00	131,560,000.00
Inverters				
SG2500-HV-20	Straight-line	20	0.00	70,840,000.00
Accessories, fasteners	Straight-line	20	0.00	20,240,000.00
		Total	0.00	647,680,000.00

Financing

Own funds	400,000,000.00 INR	
Subsidies	60,200,000.00 INR	
Loan - Redeemable with fixed annuity - 25 years	400,000,000.00 INR	Interest rate: 1.00%/year

Electricity sale

Feed-in tariff	4.10000 INR/kWh
Duration of tariff warranty	20 years
Annual connection tax	0.00 INR/year
Annual tariff variation	0.0 %/year
Feed-in tariff decrease after warranty	0.00 %

Return on investment

Payback period	9.9 years
Net present value (NPV)	1,235,745,239.94 INR
Internal rate of return (IRR)	16.17 %
Return on investment (ROI)	154.5 %

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Variant: New simulation variant_facing_South_east

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Financial analysis

Detailed economic results (INR)

Year	Electricity sale	Own funds	Loan principal	Loan interest	Run. costs	Deprec. allow.	Taxable income	Taxes	After-tax profit	Cumul. profit	% amorti.
0	0	400,000,000	0	0	0	0	0	0	0	-400,000,000	0.0%
1	96,168,643	0	14,162,701	4,000,000	11,132,000	32,384,000	48,652,643	0	66,873,941	-333,126,059	10.1%
2	96,168,643	0	14,304,328	3,858,373	11,243,320	32,384,000	48,682,950	0	66,762,621	-266,363,437	20.3%
3	96,168,643	0	14,447,372	3,715,330	11,355,753	32,384,000	48,713,560	0	66,650,188	-199,713,249	30.4%
4	96,168,643	0	14,591,845	3,570,856	11,469,311	32,384,000	48,744,476	0	66,536,631	-133,176,618	40.5%
5	96,168,643	0	14,737,764	3,424,938	11,584,004	32,384,000	48,775,701	0	66,421,938	-66,754,680	50.7%
6	96,168,643	0	14,885,141	3,277,560	11,699,844	32,384,000	48,807,239	0	66,306,098	-448,583	60.8%
7	96,168,643	0	15,033,993	3,128,708	11,816,842	32,384,000	48,839,092	0	66,189,099	65,740,516	71.0%
8	96,168,643	0	15,184,333	2,978,369	11,935,011	32,384,000	48,871,264	0	66,070,931	131,811,447	81.1%
9	96,168,643	0	15,336,176	2,826,525	12,054,361	32,384,000	48,903,757	0	65,951,581	197,763,028	91.3%
10	96,168,643	0	15,489,538	2,673,163	12,174,904	32,384,000	48,936,575	0	65,831,037	263,594,065	101.5%
11	96,168,643	0	15,644,433	2,518,268	12,296,654	32,384,000	48,969,721	0	65,709,288	329,303,353	111.6%
12	96,168,643	0	15,800,878	2,361,824	12,419,620	32,384,000	49,003,199	0	65,586,321	394,889,674	121.8%
13	96,168,643	0	15,958,886	2,203,815	12,543,816	32,384,000	49,037,012	0	65,462,125	460,351,799	132.0%
14	96,168,643	0	16,118,475	2,044,226	12,669,254	32,384,000	49,071,162	0	65,336,687	525,688,486	142.2%
15	96,168,643	0	16,279,660	1,883,041	12,795,947	32,384,000	49,105,655	0	65,209,995	590,898,481	152.4%
16	96,168,643	0	16,442,457	1,720,245	12,923,906	32,384,000	49,140,492	0	65,082,035	655,980,516	162.5%
17	96,168,643	0	16,606,881	1,555,820	13,053,145	32,384,000	49,175,677	0	64,952,796	720,933,312	172.7%
18	96,168,643	0	16,772,950	1,389,751	13,183,677	32,384,000	49,211,215	0	64,822,265	785,755,577	182.9%
19	96,168,643	0	16,940,679	1,222,022	13,315,514	32,384,000	49,247,107	0	64,690,428	850,446,004	193.1%
20	96,168,643	0	17,110,086	1,052,615	13,448,669	32,384,000	49,283,359	0	64,557,273	915,003,277	203.4%
21	96,168,643	0	17,281,187	881,514	13,583,156	0	81,703,973	0	64,422,786	979,426,063	213.6%
22	96,168,643	0	17,453,999	708,702	13,718,987	0	81,740,953	0	64,286,954	1,043,713,017	223.8%
23	96,168,643	0	17,628,539	534,162	13,856,177	0	81,778,304	0	64,149,765	1,107,862,782	234.0%
24	96,168,643	0	17,804,824	357,877	13,994,739	0	81,816,027	0	64,011,203	1,171,873,985	244.2%
25	96,168,643	0	17,982,873	179,829	14,134,686	0	81,854,128	0	63,871,255	1,235,745,240	254.5%
Total	**2,404,216,071**	**400,000,000**	**400,000,000**	**54,067,534**	**314,403,297**	**647,680,000**	**1,388,065,240**	**0**	**1,635,745,240**	**1,235,745,240**	**254.5%**

Project: Pvsyst_simulation

Variant: New simulation variant_facing_South_east

Financial analysis

Yearly net profit (kINR)
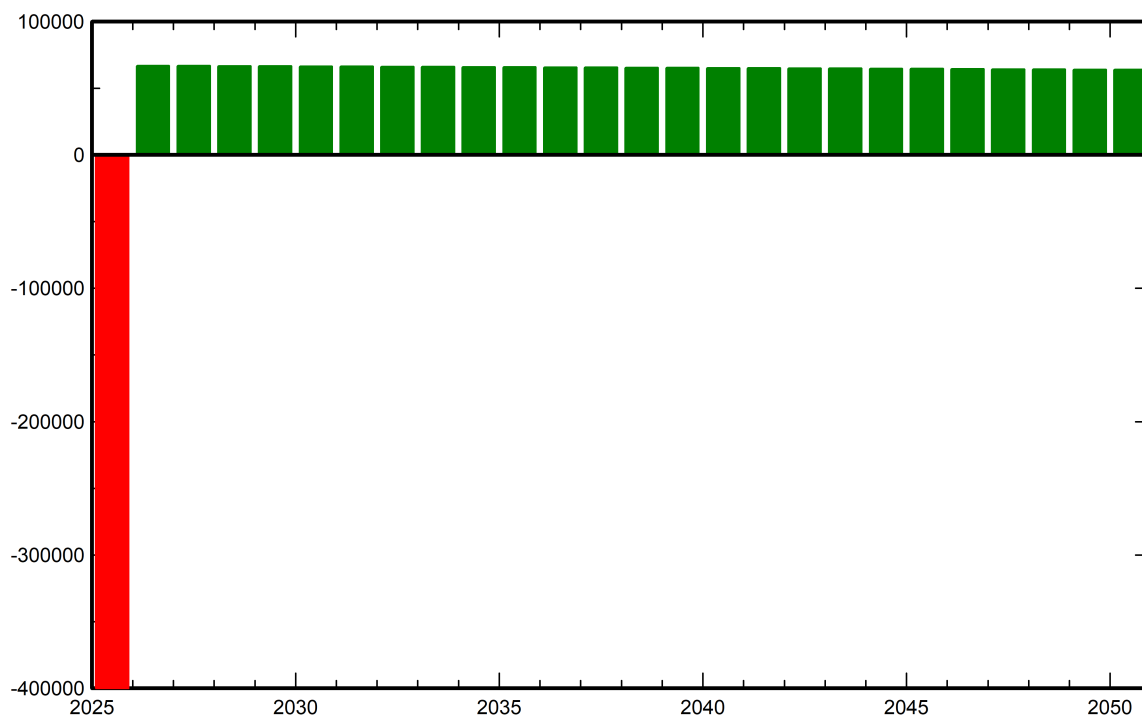
Cumulative cashflow (kINR)
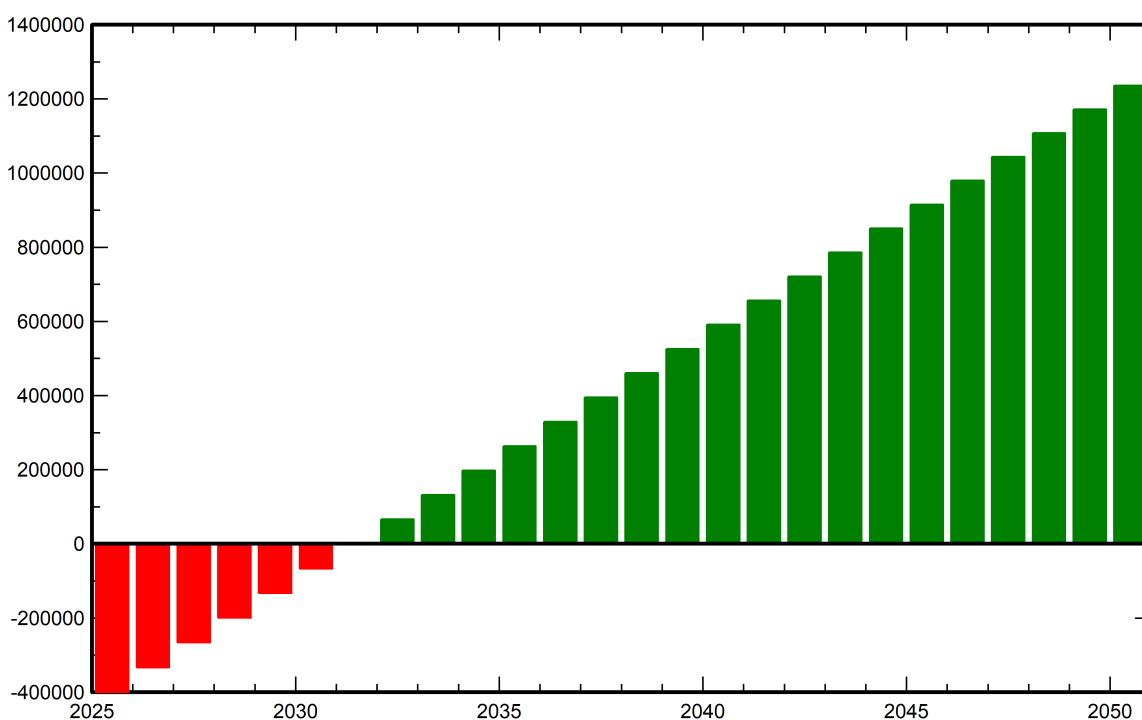
PVsyst V8.0.15
VC0, Simulation date:
22/08/25 23:55
with V8.0.15

CO₂ Emission Balance

		Saved CO₂ Emission vs. Time
Total:	449394.0 tCO₂	

Generated emissions

Total:	36967.87 tCO₂

Source: Detailed calculation from table below

Replaced Emissions

Total:	547264.5 tCO₂
System production:	23387.37 MWh/yr
Grid Lifecycle Emissions:	936 gCO₂/kWh
Source:	IEA List
Country:	India
Lifetime:	25 years
Annual degradation:	1.0 %

Saved CO₂ Emission vs. Time
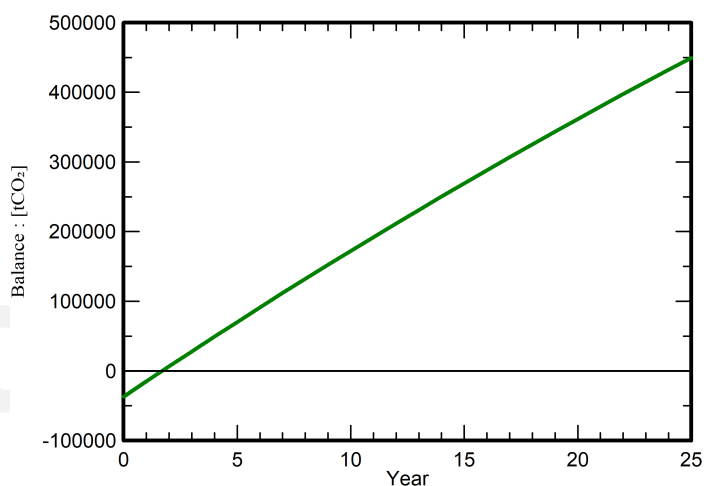
System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[kgCO₂]
Modules	1713 kgCO2/kWp	20240 kWp	34665453
Supports	6.24 kgCO2/kg	368000 kg	2297468
Inverters	619 kgCO2/units	8.00 units	4948