PVSYST
PHOTOVOLTAIC SOFTWARE

PVsyst - Simulation report

Grid-Connected System

Project: Floating_solar_plant

Variant: New simulation varian_22.5MW_2.5MW_block

No 3D scene defined, no shadings

System power: 22.77 MWp

Rohtas, Bihar - India

Ankit gupta- NITP

PVsyst V8.0.15
VC4, Simulation date:
09/09/25 00:28
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 5

No 3D scene defined, no shadings

Orientation #1
Fixed plane
Tilt/Azimuth 11 / 0 °

Near Shadings
no Shadings

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	41400 units
Pnom total	22.77 MWp

Inverters

Nb. of units	9 units
Total power	22500 kVA
Grid power limit	22.00 MWac
Grid lim. Pnom ratio	1.035

Results summary

Produced Energy	30170 MWh/year	Specific production	1325 kWh/kWp/year	Perf. Ratio PR	82.13 %
Apparent energy	30170 MVAh/year				

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General parameters

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

Orientation #1
Fixed plane
Tilt/Azimuth 11 / 0 °

Models used
Transposition Hay
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon
Free Horizon

Near Shadings
no Shadings

User's needs
Unlimited load (grid)

Grid injection point
Grid power limitation
Active power 22.00 MWac
Pnom ratio 1.035
Limit applied at the inverter level

Power factor
Cos(phi) (lagging) 1.000

PV Array Characteristics

PV module
Manufacturer Loom
Model shark 550
(Custom parameters definition)
Loom_Mono_550W_Half_PERC.PAN
Unit Nom. Power 550 Wp

Inverter
Manufacturer Sungrow
Model SG2500-HV-20
(Original PVsyst database)
Unit Nom. Power 2500 kVA

Array #1 - PV Array

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kVA
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 kVA
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A	Leading limit Cos(phi) min	0.800
		Lagging limit Cos(phi) min	0.800

Array #2 - Sub-array #2

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kVA
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 kVA
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A	Leading limit Cos(phi) min	0.800
		Lagging limit Cos(phi) min	0.800

Array #3 - Sub-array #3

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kVA
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 kVA
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A	Leading limit Cos(phi) min	0.800
		Lagging limit Cos(phi) min	0.800

PV Array Characteristics

Array #4 - Sub-array #4

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kVA
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 kVA
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A	Leading limit Cos(phi) min	0.800
		Lagging limit Cos(phi) min	0.800

Array #5 - Sub-array #5

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kVA
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 kVA
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A	Leading limit Cos(phi) min	0.800
		Lagging limit Cos(phi) min	0.800

Array #6 - Sub-array #6

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kVA
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 kVA
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A	Leading limit Cos(phi) min	0.800
		Lagging limit Cos(phi) min	0.800

Array #7 - Sub-array #7

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kVA
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 kVA
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A	Leading limit Cos(phi) min	0.800
		Lagging limit Cos(phi) min	0.800

Array #8 - Sub-array #8

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kVA
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 kVA
U mpp	961 V	Pnom ratio (DC:AC)	1.01
I mpp	2422 A	Leading limit Cos(phi) min	0.800
		Lagging limit Cos(phi) min	0.800

Array #9 - Sub-array #9

Number of PV modules	4600 units	Number of inverters	1 unit
Nominal (STC)	2530 kWp	Total power	2500 kVA
Modules	184 string x 25 In series		

PV Array Characteristics

Array #9 - Sub-array #9

At operating cond. (50°C)

Pmpp	2329 kWp	Operating voltage	800-1300 V
U mpp	961 V	Max. power (=>25°C)	2750 kVA
I mpp	2422 A	Pnom ratio (DC:AC)	1.01
		Leading limit Cos(phi) min	0.800
		Lagging limit Cos(phi) min	0.800

Total PV power

		Total inverter power	
Nominal (STC)	22770 kWp	Total power	22500 kVA
Total	41400 modules	Max. power	24750 kWac
Module area	106852 m²	Number of inverters	9 units
Cell area	98736 m²	Pnom ratio	1.01

Array losses

Array Soiling Losses
Loss Fraction 1.2 %

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 20.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

Module Quality Loss
Loss Fraction -0.38 %

Module mismatch losses
Loss Fraction 2.00 % at MPP

Strings Mismatch loss
Loss Fraction 0.15 %

Module average degradation
Year no 5
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

DC wiring losses

Global wiring resistance 0.72 mΩ
Loss Fraction 1.5 % at STC

Array #1 - PV Array		**Array #2 - Sub-array #2**	
Global array res.	6.2 mΩ	Global array res.	6.6 mΩ
Loss Fraction	1.4 % at STC	Loss Fraction	1.5 % at STC
Array #3 - Sub-array #3		**Array #4 - Sub-array #4**	
Global array res.	6.6 mΩ	Global array res.	6.6 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC
Array #5 - Sub-array #5		**Array #6 - Sub-array #6**	
Global array res.	6.6 mΩ	Global array res.	6.6 mΩ
Loss Fraction	1.5 % at STC	Loss Fraction	1.5 % at STC

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DC wiring losses

Array #7 - Sub-array #7

Global array res.	6.6 mΩ
Loss Fraction	1.5 % at STC

Array #8 - Sub-array #8

Global array res.	6.6 mΩ
Loss Fraction	1.5 % at STC

Array #9 - Sub-array #9

Global array res.	6.6 mΩ
Loss Fraction	1.5 % at STC

AC wiring losses

Inv. output line up to injection point

Inverter voltage	550 Vac tri
Loss Fraction	0.58 % at STC

Inverter: SG2500-HV-20

Wire section (1 Inv.)	Copper 1 x 3 x 3000 mm²
Wires length	1000 m

Inverter: SG2500-HV-20

Wire section (8 Inv.)	Copper 8 x 3 x 2000 mm²
Average wires length	0 m

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Main results

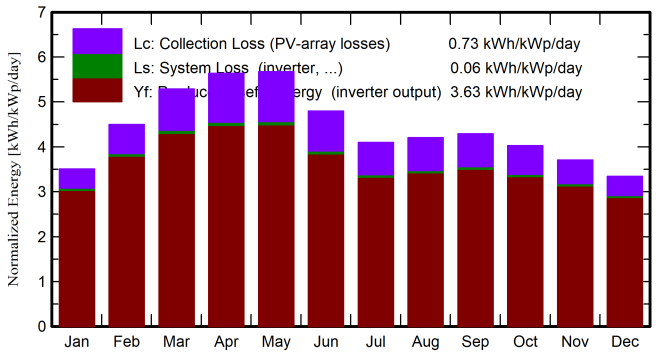
System Production

Produced Energy	30170 MWh/year	Specific production	1325 kWh/kWp/year
Apparent energy	30170 MVAh/year	Perf. Ratio PR	82.13 %

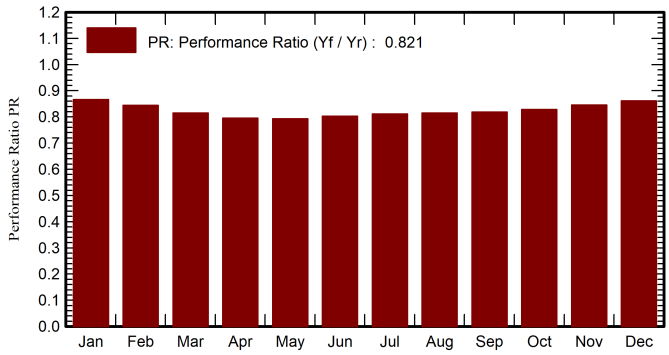
Economic evaluation

Investment		Yearly cost		LCOE	
Global	751,410,000.00 INR	Annuities	0.00 INR/yr	Energy cost	3.87 INR/kWh
Specific	33.0 INR/Wp	Run. costs	35,293,500.00 INR/yr		
		Payback period	Unprofitable		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	98.3	56.9	15.21	108.8	104.3	2179	2146	0.866
February	116.1	59.3	19.91	126.0	121.4	2459	2421	0.844
March	156.2	73.8	25.57	163.8	158.2	3088	3041	0.815
April	167.0	81.6	30.80	169.1	162.9	3109	3063	0.795
May	178.3	102.9	33.50	175.8	169.1	3223	3173	0.793
June	146.8	98.9	32.26	143.9	137.9	2674	2630	0.803
July	129.5	84.8	29.93	127.0	121.7	2388	2349	0.812
August	130.8	83.9	29.31	130.3	124.8	2457	2418	0.815
September	125.9	76.1	28.56	128.6	123.4	2435	2396	0.818
October	118.2	70.1	26.36	124.9	119.9	2395	2357	0.829
November	100.6	54.3	21.12	111.2	106.9	2176	2141	0.846
December	91.8	49.1	16.77	103.7	99.4	2065	2033	0.861
Year	1559.4	891.8	25.80	1613.2	1549.9	30649	30170	0.821

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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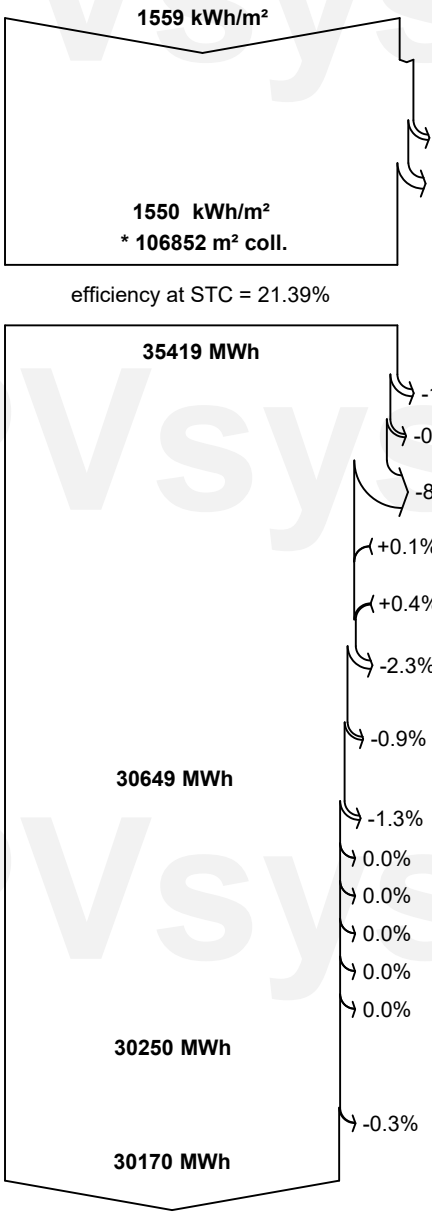
Loss diagram



Global horizontal irradiation
Global incident in coll. plane
Soiling loss factor
IAM factor on global
Effective irradiation on collectors
PV conversion
Array nominal energy (at STC effic.)
Module Degradation Loss (for year #5)
PV loss due to irradiance level
PV loss due to temperature
Spectral correction
Module quality loss
Mismatch loss, modules and strings
(including 0.2% for degradation dispersion)
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
AC ohmic loss
Active Energy injected into grid

0 MVARh
Reactive energy to the grid, Yearly effective cos(Phi) = 1.000
30170 MVAh
Apparent energy to the grid

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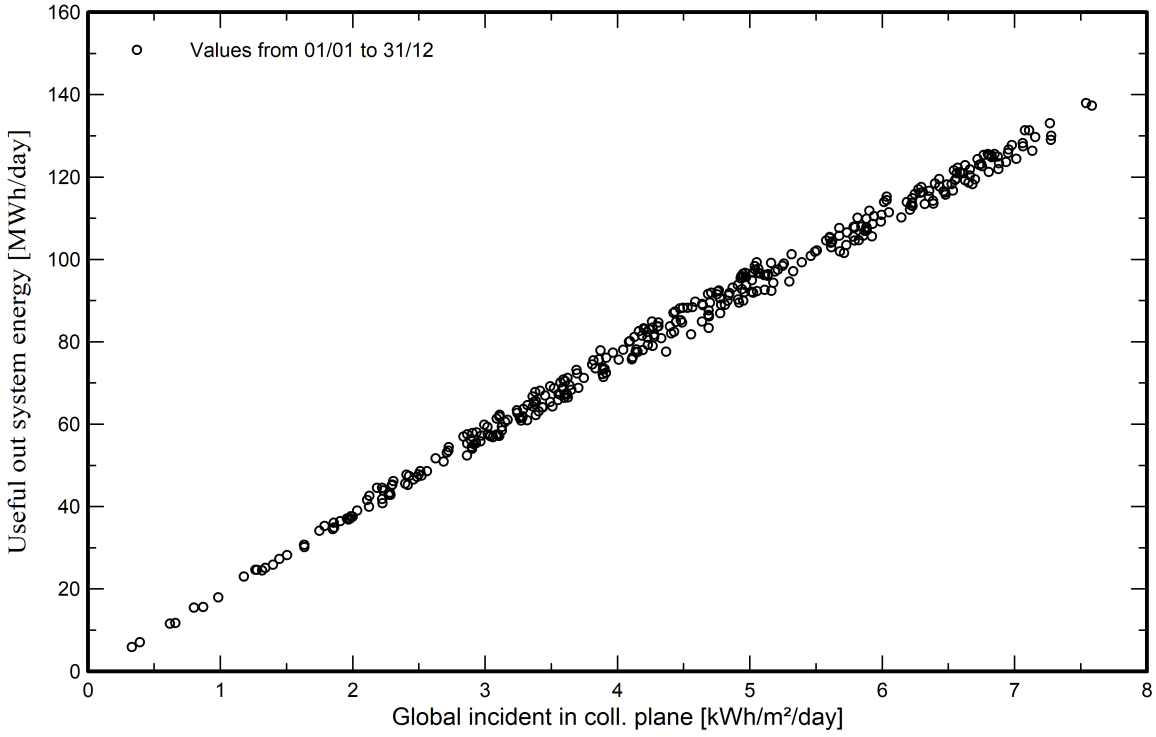
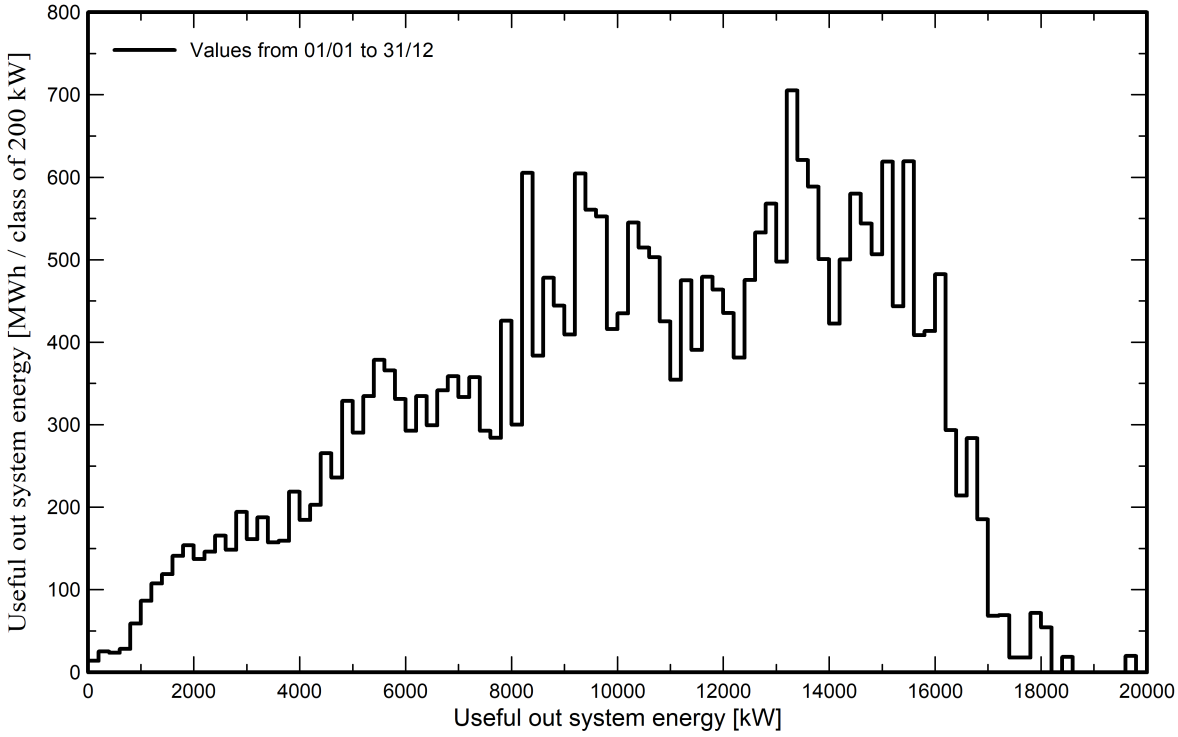
Predef. graphs

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	TMY, multi-year
Year-to-year variability(Variance)	-1.0 %
Specified Deviation	
Climate change	0.0 %

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 %

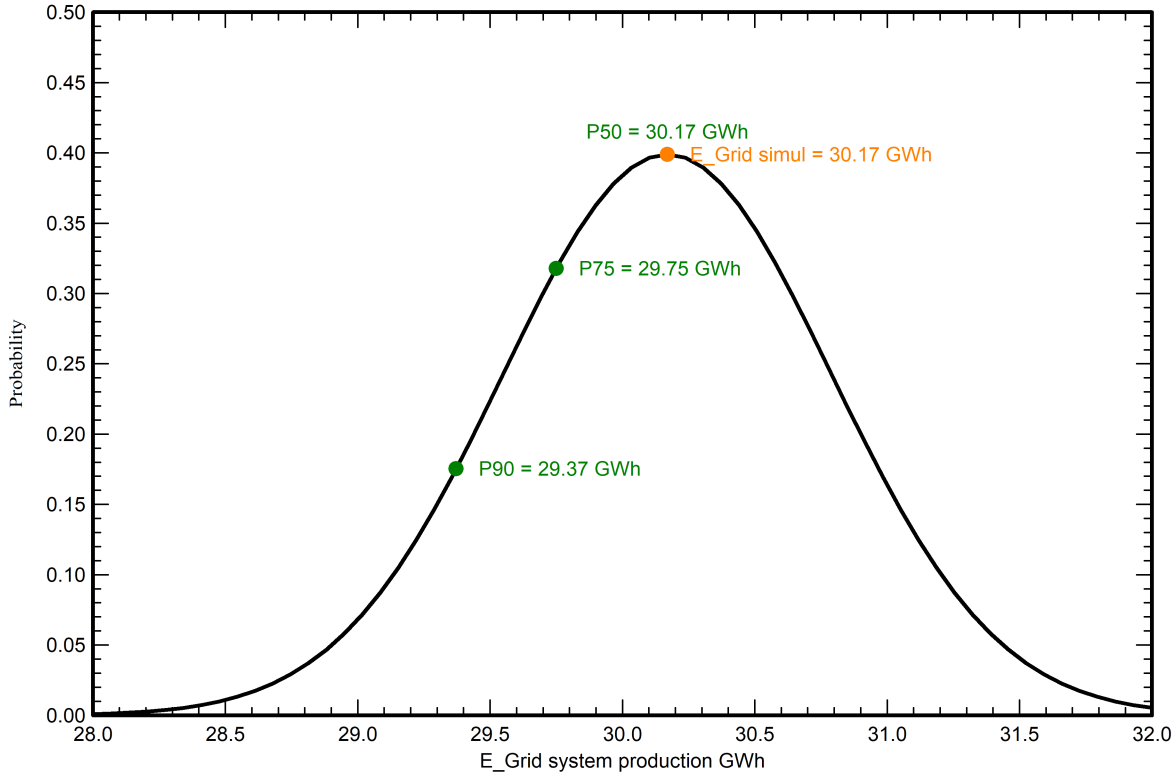
Global variability (weather data + system)

Variability (Quadratic sum)	2.1 %

Annual production probability

Variability	0.62 GWh
P50	30.17 GWh
P90	29.37 GWh
P75	29.75 GWh

Probability distribution



Single-line diagram

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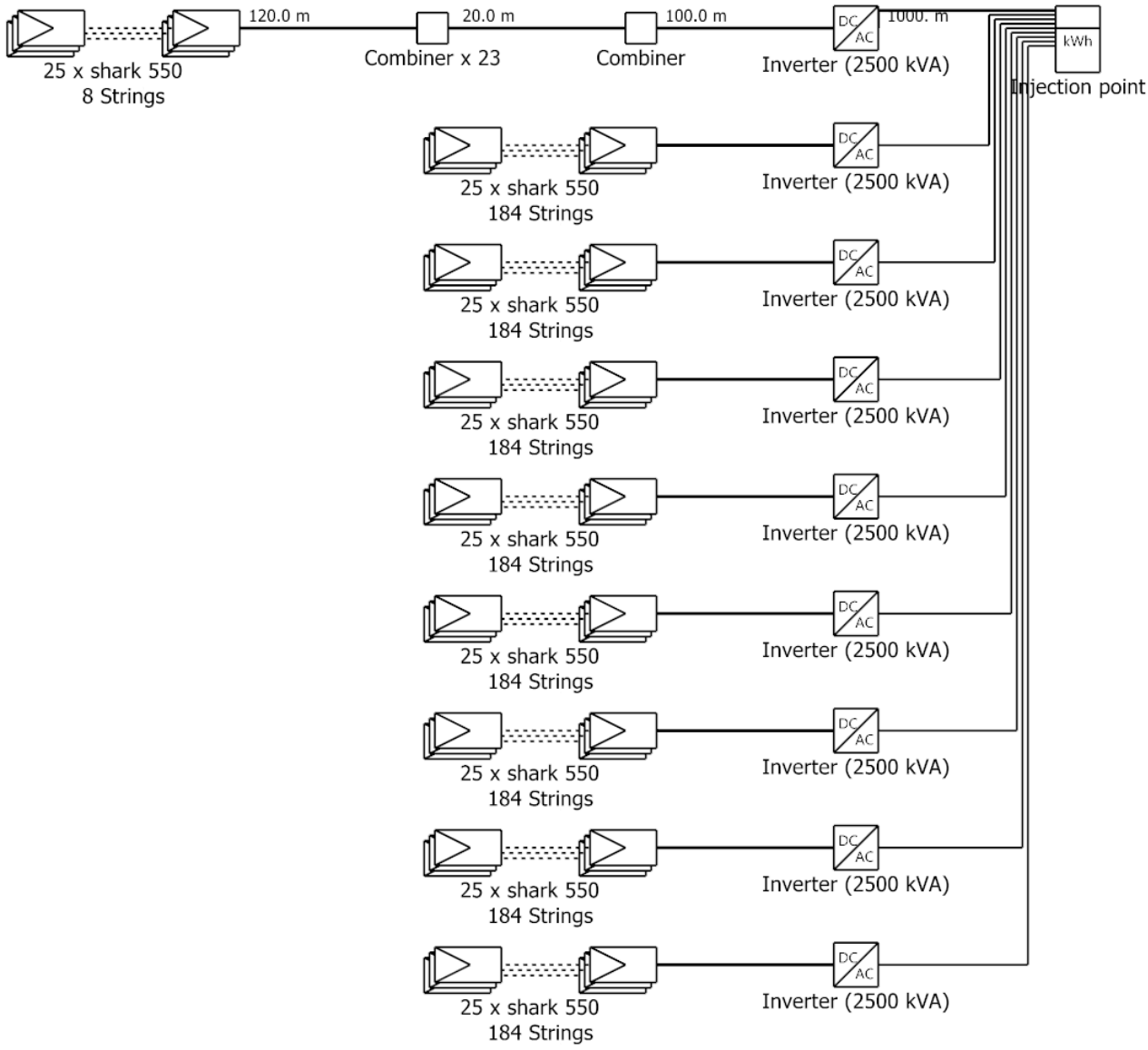

PV module	shark 550
Inverter	SG2500-HV-20
String	25 x shark 550

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Cost of the system

Installation costs

Item	Quantity units	Cost INR	Total INR
PV modules			
shark 550	41400	11,550.00	478,170,000.00
Supports for modules	41400	2,750.00	113,850,000.00
Inverters			
SG2500-HV-20	9	7,590,000.00	68,310,000.00
Other components			
Accessories, fasteners	1	2,277,000.00	2,277,000.00
Wiring	1	13,662,000.00	13,662,000.00
Combiner box	1	13,662,000.00	13,662,000.00
Monitoring system, display screen	1	6,831,000.00	6,831,000.00
Measurement system, pyranometer	1	6,831,000.00	6,831,000.00
Surge arrester	1	2,277,000.00	2,277,000.00
Studies and analysis			
Engineering	1	4,554,000.00	4,554,000.00
Permitting and other admin. Fees	1	4,554,000.00	4,554,000.00
Environmental studies	1	2,277,000.00	2,277,000.00
Economic analysis	1	2,277,000.00	2,277,000.00
Installation			
Global installation cost per module	41400	165.00	6,831,000.00
Global installation cost per inverter	9	759,000.00	6,831,000.00
Transport	1	2,277,000.00	2,277,000.00
Settings	1	4,554,000.00	4,554,000.00
Grid connection	1	11,385,000.00	11,385,000.00
		Total	751,410,000.00
		Depreciable asset	662,607,000.00

Operating costs

Item	Total INR/year
Maintenance	
Provision for inverter replacement	5,692,500.00
Salaries	22,770,000.00
Repairs	4,554,000.00
Cleaning	2,277,000.00
Total (OPEX)	35,293,500.00
Including inflation (-1.87%)	35,293,500.00

System summary

Total installation cost	751,410,000.00 INR
Operating costs	35,293,500.00 INR/year
Produced Energy	30170 MWh/year
Cost of produced energy (LCOE)	3.8660 INR/kWh

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Financial analysis

Simulation period

Project lifetime	25 years	Start year	2026

Income variation over time

Inflation	-1.87 %/year
Module Degradation	0.50 %/year
Discount rate	10.00 %/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	478,170,000.00
Supports for modules	Straight-line	20	0.00	113,850,000.00
Inverters				
SG2500-HV-20	Straight-line	20	0.00	68,310,000.00
Accessories, fasteners	Straight-line	20	0.00	2,277,000.00
		Total	0.00	662,607,000.00

Financing

Own funds	700,000,000.00 INR
Subsidies	51,410,000.00 INR

Electricity sale

Feed-in tariff	2.50000 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	Unprofitable
Net present value (NPV)	-360,525,379.24 INR
Internal rate of return (IRR)	0.00 %
Return on investment (ROI)	-51.5 %

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Financial analysis

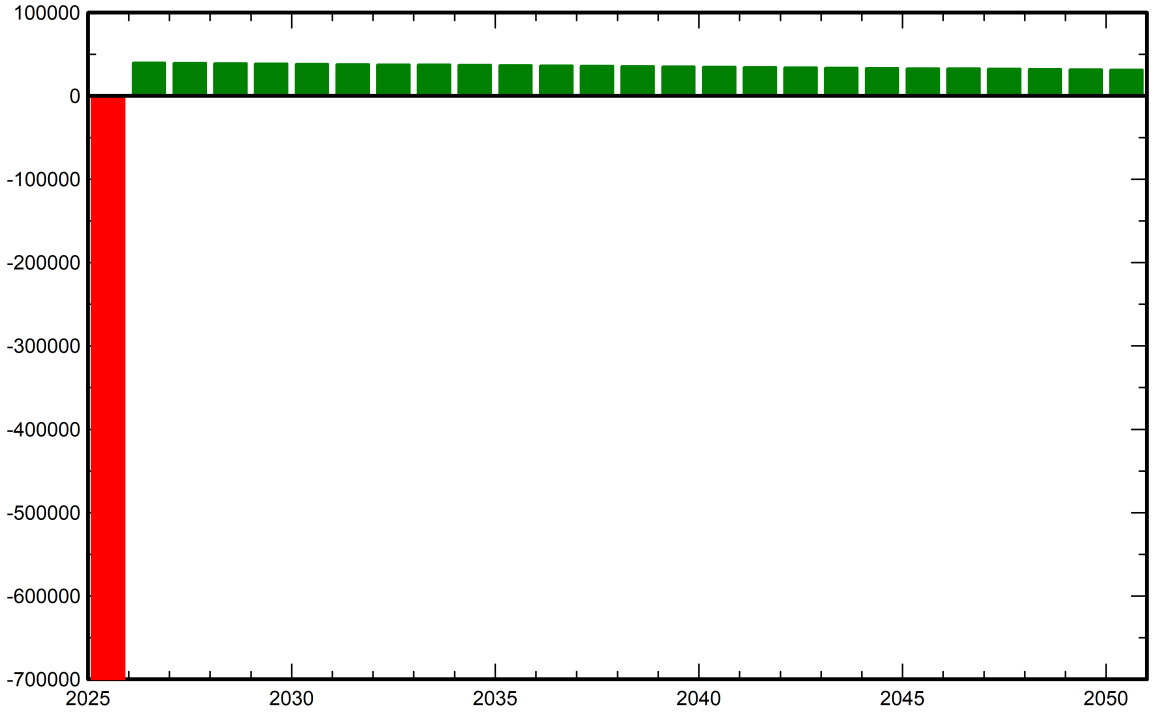
Detailed economic results (INR)

Year	Electricity sale	Own funds	Run. costs	Deprec. allow.	Taxable income	Taxes	After-tax profit	Cumul. profit	% amorti.
0	0	700,000,000	0	0	0	0	0	-700,000,000	0.0%
1	75,424,129	0	35,293,500	33,130,350	7,000,279	0	40,130,629	-663,517,610	5.2%
2	75,047,008	0	35,293,500	33,130,350	6,623,158	0	39,753,508	-630,663,472	9.9%
3	74,671,773	0	35,293,500	33,130,350	6,247,923	0	39,378,273	-601,077,992	14.1%
4	74,298,414	0	35,293,500	33,130,350	5,874,564	0	39,004,914	-574,437,111	17.9%
5	73,926,922	0	35,293,500	33,130,350	5,503,072	0	38,633,422	-550,448,796	21.4%
6	73,557,287	0	35,293,500	33,130,350	5,133,437	0	38,263,787	-528,849,885	24.5%
7	73,189,501	0	35,293,500	33,130,350	4,765,651	0	37,896,001	-509,403,245	27.2%
8	72,823,553	0	35,293,500	33,130,350	4,399,703	0	37,530,053	-491,895,198	29.7%
9	72,459,436	0	35,293,500	33,130,350	4,035,586	0	37,165,936	-476,133,213	32.0%
10	72,097,138	0	35,293,500	33,130,350	3,673,288	0	36,803,638	-461,943,817	34.0%
11	71,736,653	0	35,293,500	33,130,350	3,312,803	0	36,443,153	-449,170,714	35.8%
12	71,377,970	0	35,293,500	33,130,350	2,954,120	0	36,084,470	-437,673,090	37.5%
13	71,021,080	0	35,293,500	33,130,350	2,597,230	0	35,727,580	-427,324,083	39.0%
14	70,665,974	0	35,293,500	33,130,350	2,242,124	0	35,372,474	-418,009,405	40.3%
15	70,312,644	0	35,293,500	33,130,350	1,888,794	0	35,019,144	-409,626,100	41.5%
16	69,961,081	0	35,293,500	33,130,350	1,537,231	0	34,667,581	-402,081,425	42.6%
17	69,611,276	0	35,293,500	33,130,350	1,187,426	0	34,317,776	-395,291,836	43.5%
18	69,263,219	0	35,293,500	33,130,350	839,369	0	33,969,719	-389,182,083	44.4%
19	68,916,903	0	35,293,500	33,130,350	493,053	0	33,623,403	-383,684,388	45.2%
20	68,572,319	0	35,293,500	33,130,350	148,469	0	33,278,819	-378,737,703	45.9%
21	68,229,457	0	35,293,500	0	32,935,957	0	32,935,957	-374,287,049	46.5%
22	67,888,310	0	35,293,500	0	32,594,810	0	32,594,810	-370,282,908	47.1%
23	67,548,868	0	35,293,500	0	32,255,368	0	32,255,368	-366,680,687	47.6%
24	67,211,124	0	35,293,500	0	31,917,624	0	31,917,624	-363,440,232	48.1%
25	66,875,068	0	35,293,500	0	31,581,568	0	31,581,568	-360,525,379	48.5%
Total	**1,776,687,109**	**700,000,000**	**882,337,500**	**662,607,000**	**231,742,609**	**0**	**894,349,609**	**-360,525,379**	**48.5%**

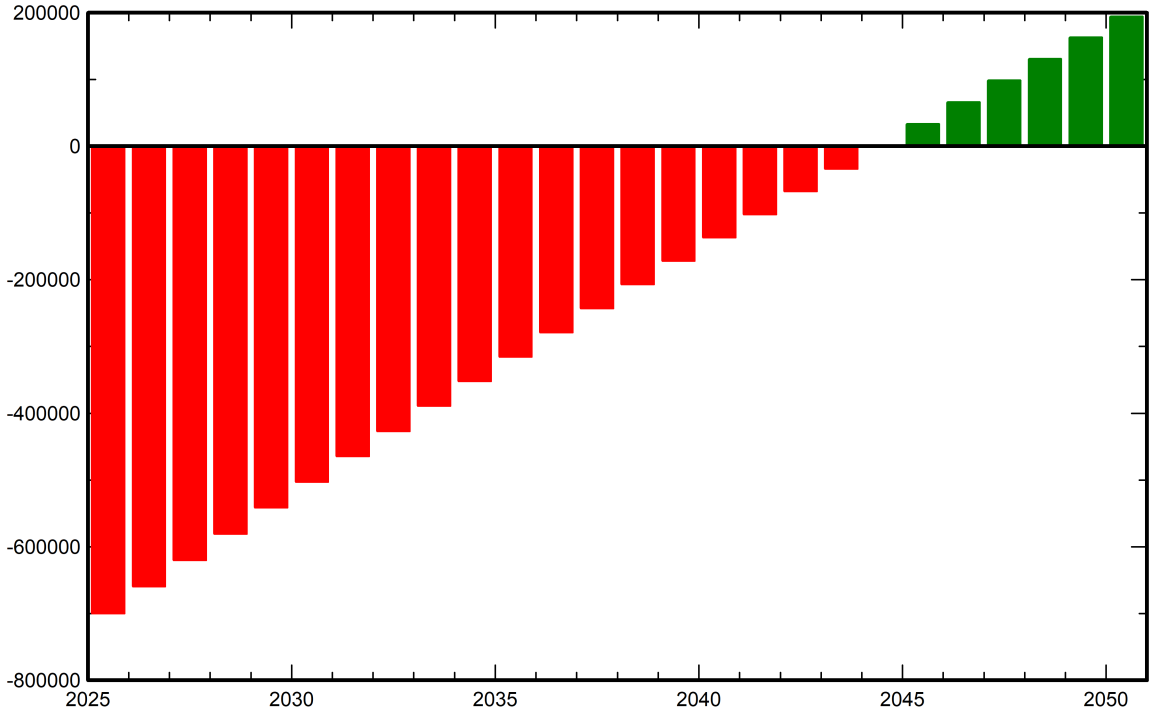
PVsyst V8.0.15
VC4, Simulation date:
09/09/25 00:28
with V8.0.15

Financial analysis

Yearly net profit (kINR)



Cumulative cashflow (kINR)

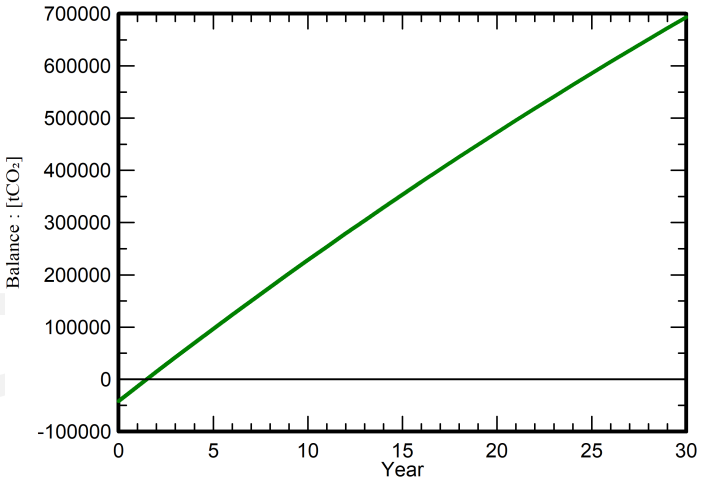


PVsyst V8.0.15
VC4, Simulation date:
09/09/25 00:28
with V8.0.15

CO_2 Emission Balance

Total:	693467.3	tCO_2
Generated emissions		
Total:	41588.85	tCO_2
Source: Detailed calculation from table below		
Replaced Emissions		
Total:	847165.4	tCO_2
System production:	30169.71	MWh/yr
Grid Lifecycle Emissions:	936	gCO_2/kWh
Source:	IEA List	
Country:	India	
Lifetime:	30	years
Annual degradation:	1.0	%

Saved CO_2 Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[$kgCO_2$]
Modules	1713 kgCO2/kWp	22770 kWp	38998634
Supports	6.24 kgCO2/kg	414000 kg	2584652
Inverters	619 kgCO2/units	9.00 units	5567