PVSYST
PHOTOVOLTAIC SOFTWARE

PVsyst - Simulation report

Grid-Connected System

Project: Floating_solar_plant

Variant: New simulation variant_facing south

No 3D scene defined, no shadings

System power: 20.24 MWp

Rohtas, Bihar - India

Ankit gupta- NITP

PVsyst V8.0.15
VC1, Simulation date:
05/09/25 01:07
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 25

No 3D scene defined, no shadings

Orientation #1
Fixed plane
Tilt/Azimuth 22 / 0 °

Near Shadings
no Shadings

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	36800 units
Pnom total	20.24 MWp

Inverters

Nb. of units	8 units
Total power	20000 kWac
Grid power limit	20.00 MWac
Grid lim. Pnom ratio	1.012

Results summary

Produced Energy	23183 MWh/year	Specific production	1145 kWh/kWp/year	Perf. Ratio PR	70.40 %

Table of contents

Project and results summary 2
General parameters, PV Array Characteristics, System losses 3
Main results 6
Loss diagram 7
Predef. graphs 8
P50 - P90 evaluation 9
Single-line diagram 10
Cost of the system 11
Financial analysis 13
CO_2 Emission Balance 16

PVsyst V8.0.15
VC1, Simulation date:
05/09/25 01:07
with V8.0.15

General parameters

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

Orientation #1
Fixed plane
Tilt/Azimuth 22 / 0 °

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	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 #2 - Sub-array #2

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 #3 - Sub-array #3

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 #4 - Sub-array #4

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		

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	36800 modules
Module area	94980 m²
Cell area	87765 m²

Total inverter power

Total power	20000 kWac
Max. power	22000 kWac
Number of inverters	8 units
Pnom ratio	1.01

Array losses

Array Soiling Losses

Loss Fraction 1.5 %

Thermal Loss factor

Module temperature according to irradiance

Uc (const)	29.0 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	25
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

Array losses

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 0.78 mΩ
Loss Fraction 1.4 % at STC

Array #1 - PV Array
Global array res. 4.6 mΩ
Loss Fraction 1.0 % at STC

Array #2 - Sub-array #2
Global array res. 6.6 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sub-array #3
Global array res. 6.6 mΩ
Loss Fraction 1.5 % at STC

Array #4 - Sub-array #4
Global array res. 6.6 mΩ
Loss Fraction 1.5 % at STC

Array #5 - Sub-array #5
Global array res. 6.6 mΩ
Loss Fraction 1.5 % at STC

Array #6 - Sub-array #6
Global array res. 6.6 mΩ
Loss Fraction 1.5 % at STC

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

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 0.19 % at STC
Inverter: SG2500-HV-20
Wire section (8 Inv.) Copper 8 x 3 x 2000 mm²
Average wires length 25 m

PVsyst V8.0.15
VC1, Simulation date:
05/09/25 01:07
with V8.0.15

Main results

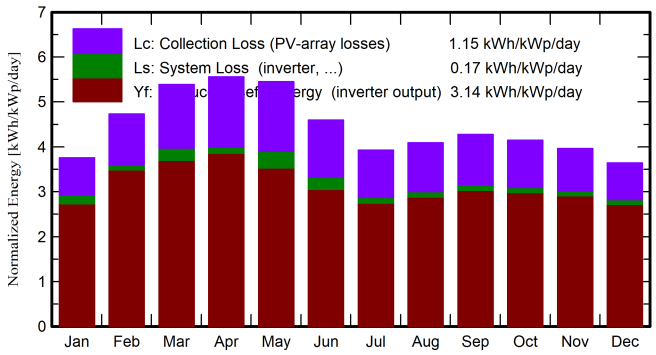
System Production

Produced Energy	23183 MWh/year	Specific production	1145 kWh/kWp/year
		Perf. Ratio PR	70.40 %

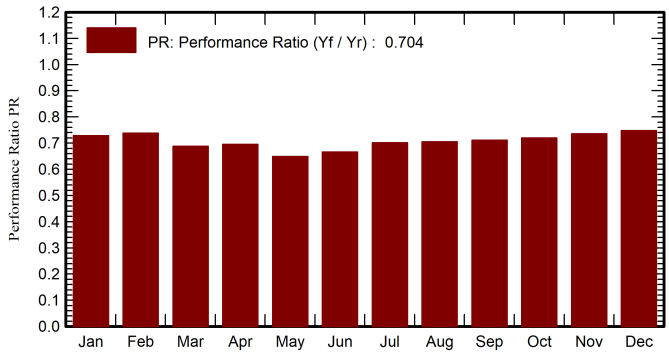
Economic evaluation

Investment		Yearly cost		LCOE	
Global	689,172,000.00 INR	Annuities	0.00 INR/yr	Energy cost	3.38 INR/kWh
Specific	34.1 INR/Wp	Run. costs	52,845,477.99 INR/yr		
		Payback period	22.0 years		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

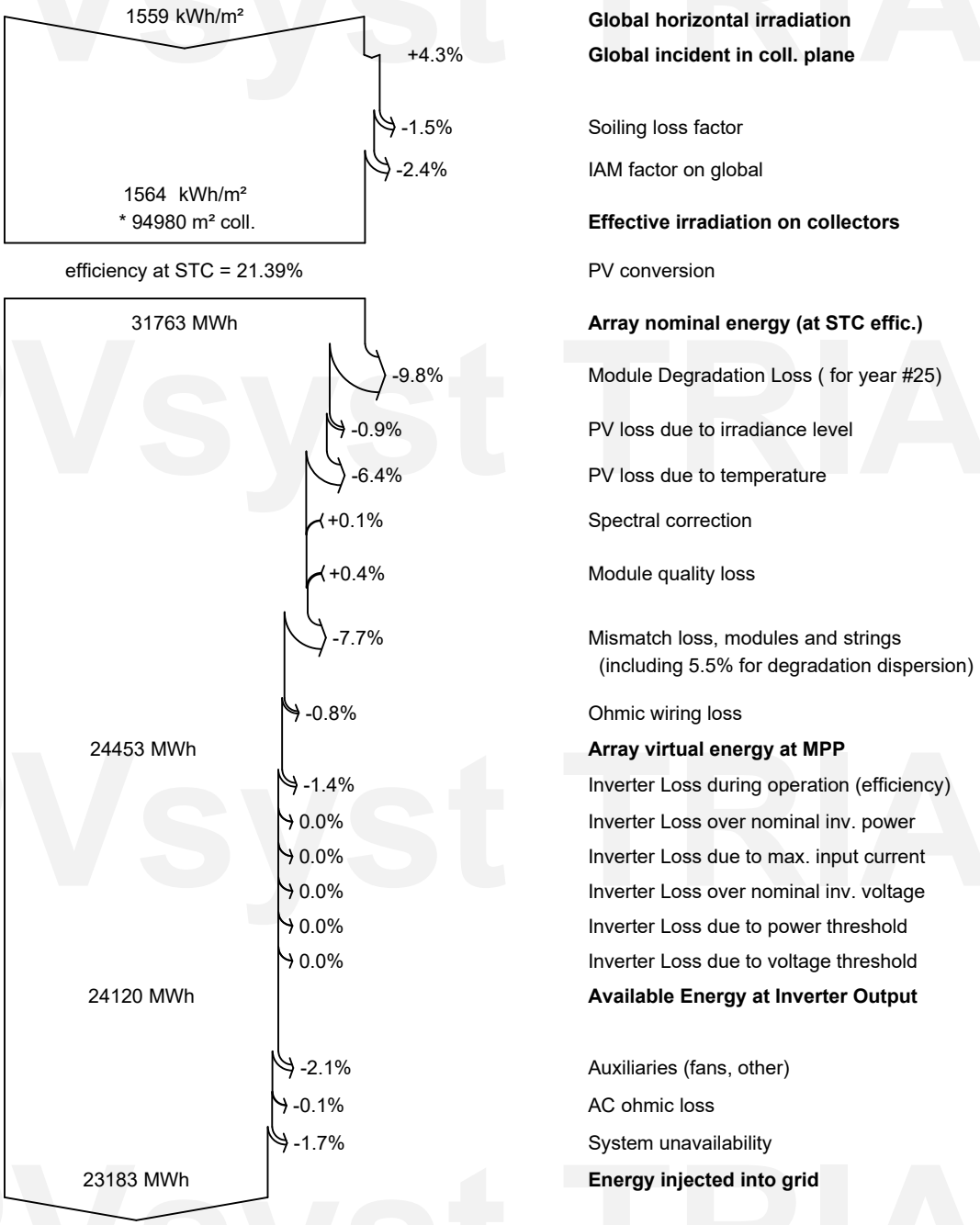
	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	98.3	56.9	15.21	116.5	112.2	1841	1716	0.728
February	116.1	59.3	19.91	132.6	128.0	2045	1980	0.738
March	156.2	73.8	25.57	167.0	161.3	2495	2325	0.688
April	167.0	81.6	30.80	166.7	160.3	2431	2347	0.696
May	178.3	102.9	33.50	169.0	162.1	2454	2219	0.649
June	146.8	98.9	32.26	137.8	131.8	2021	1859	0.666
July	129.5	84.8	29.93	121.8	116.5	1806	1729	0.701
August	130.8	83.9	29.31	126.8	121.3	1887	1810	0.705
September	125.9	76.1	28.56	128.2	123.0	1918	1845	0.711
October	118.2	70.1	26.36	128.5	123.6	1946	1874	0.720
November	100.6	54.3	21.12	118.9	114.7	1837	1770	0.736
December	91.8	49.1	16.77	112.9	108.9	1775	1709	0.748
Year	1559.4	891.8	25.80	1626.9	1563.7	24453	23183	0.704

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		

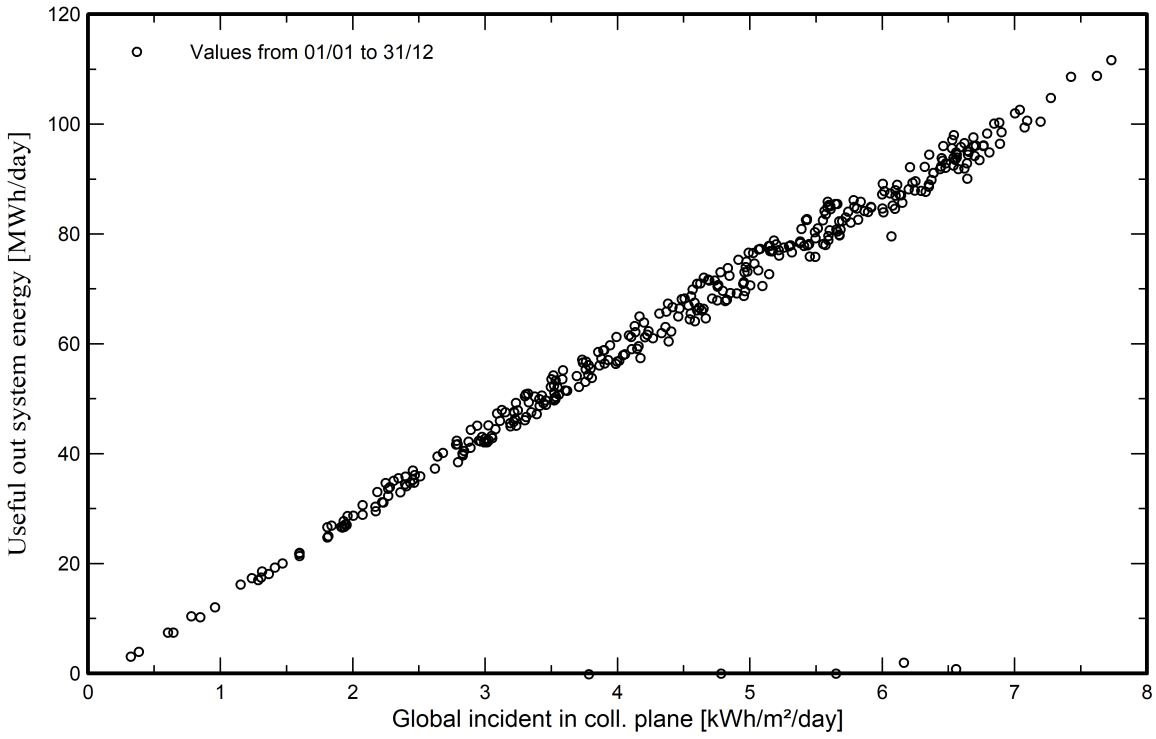
PVsyst V8.0.15
VC1, Simulation date:
05/09/25 01:07
with V8.0.15

Loss diagram

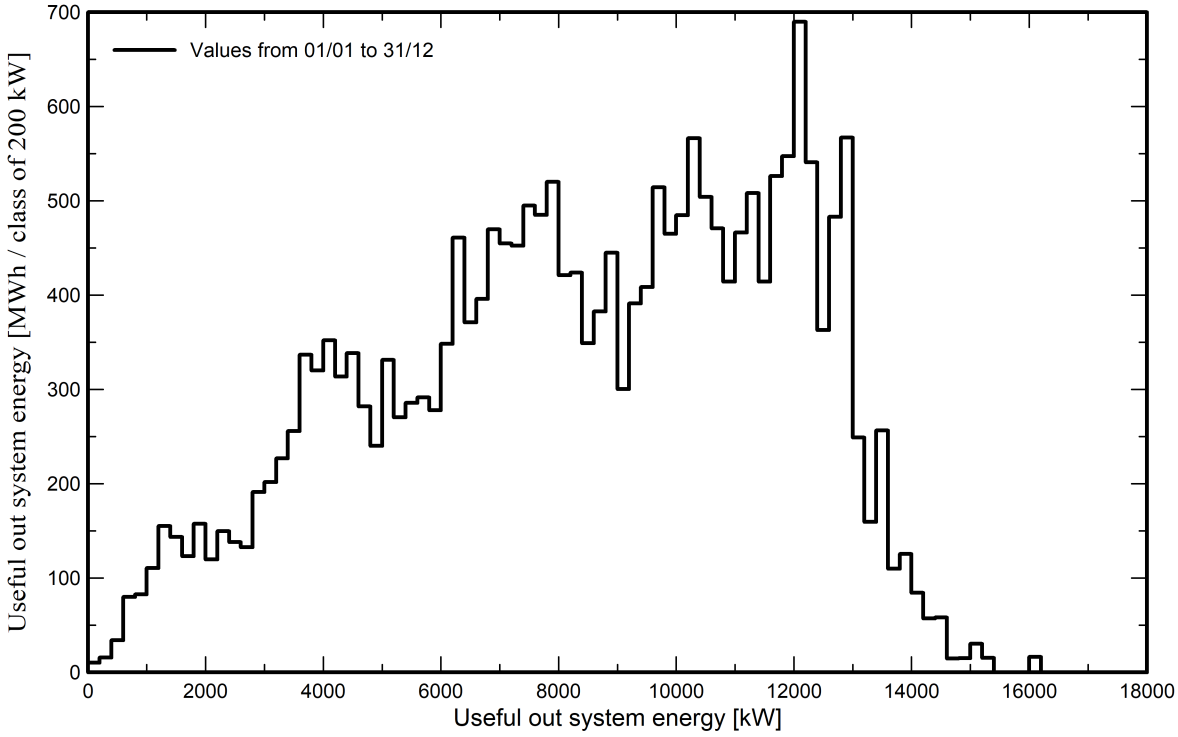


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution



PVsyst V8.0.15
VC1, Simulation date:
05/09/25 01:07
with V8.0.15

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)	4.7 %

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 %

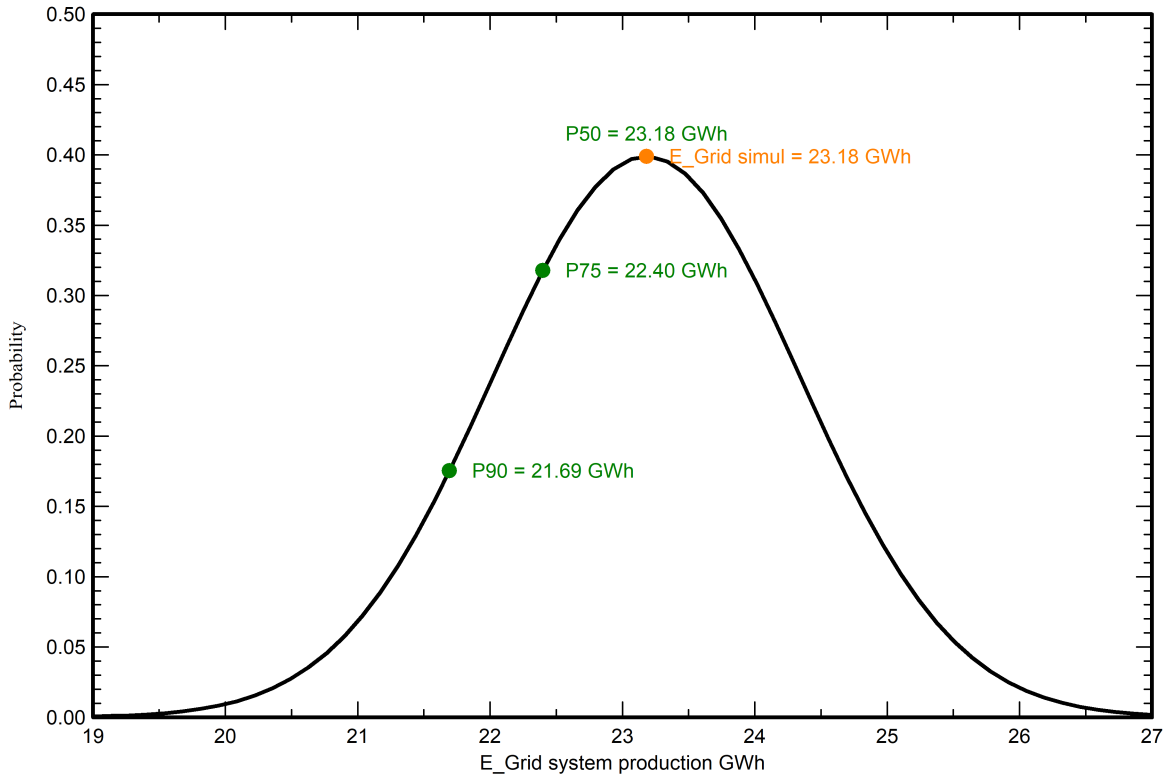
Global variability (weather data + system)

Variability (Quadratic sum)	5.0 %

Annual production probability

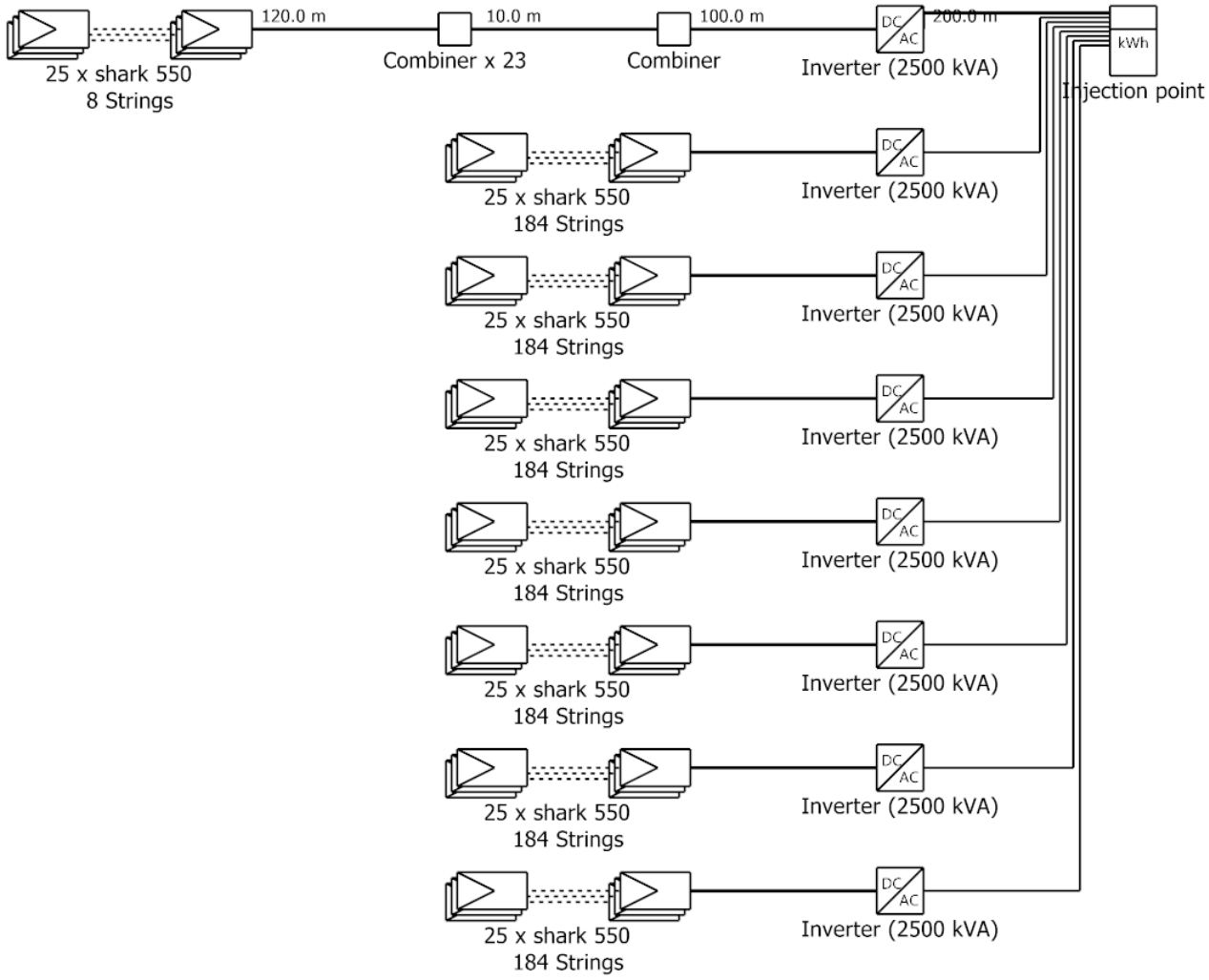
Variability	1.16 GWh
P50	23.18 GWh
P90	21.69 GWh
P75	22.40 GWh

Probability distribution



Single-line diagram

PVsyst V8.0.15
VC1, Simulation date:
05/09/25 01:07
with V8.0.15



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

	Floating_solar_plant	
	VC1 : New simulation variant_facing south	05/09/25

Cost of the system

Installation costs

Item	Quantity units	Cost INR	Total INR
PV modules			
shark 550	36800	11,000.00	404,800,000.00
Supports for modules	36800	2,750.00	101,200,000.00
Inverters			
SG2500-HV-20	8	5,060,000.00	40,480,000.00
Other components			
Accessories, fasteners	1	8,096,000.00	8,096,000.00
Wiring	1	8,096,000.00	8,096,000.00
Combiner box	1	1,012,000.00	1,012,000.00
Monitoring system, display screen	1	4,048,000.00	4,048,000.00
Measurement system, pyranometer	1	2,024,000.00	2,024,000.00
Surge arrester	1	2,024,000.00	2,024,000.00
Studies and analysis			
Engineering	1	2,024,000.00	2,024,000.00
Permitting and other admin. Fees	1	2,024,000.00	2,024,000.00
Environmental studies	1	1,012,000.00	1,012,000.00
Economic analysis	1	1,012,000.00	1,012,000.00
Installation			
Global installation cost per module	36800	275.00	10,120,000.00
Global installation cost per inverter	8	759,000.00	6,072,000.00
Transport	1	20,240,000.00	20,240,000.00
Settings	1	4,048,000.00	4,048,000.00
Grid connection	1	60,720,000.00	60,720,000.00
Insurance			
Building insurance	1	3,036,000.00	3,036,000.00
Transport insurance	1	2,024,000.00	2,024,000.00
Liability insurance	1	1,012,000.00	1,012,000.00
Delay in start-up insurance	1	1,012,000.00	1,012,000.00
Land costs			
Land preparation	1	2,024,000.00	2,024,000.00
Loan bank charges			1,012,000.00
		Total	689,172,000.00
		Depreciable asset	554,576,000.00

Operating costs

Item	Total INR/year
Maintenance	
Provision for inverter replacement	4,048,000.00
Salaries	40,480,000.00
Repairs	202,400.00
Cleaning	1,012,000.00
Taxes	
Other taxes	40,480,000.00
Subsidies	-40,480,000.00
Total (OPEX)	45,742,400.00
Including inflation (1.18%)	52,845,477.99

PVsyst V8.0.15
VC1, Simulation date:
05/09/25 01:07
with V8.0.15

Cost of the system

System summary

Total installation cost	689,172,000.00	INR
Operating costs (incl. inflation 1.18%/year)	52,845,477.99	INR/year
Produced Energy	23319	MWh/year
Cost of produced energy (LCOE)	3.3812	INR/kWh

Financial analysis

Simulation period

Project lifetime	25 years	Start year	2026

Income variation over time

Inflation	1.18	%/year
Module Degradation	Ageing tool results	
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	404,800,000.00
Supports for modules	Straight-line	20	0.00	101,200,000.00
Inverters				
SG2500-HV-20	Straight-line	20	0.00	40,480,000.00
Accessories, fasteners	Straight-line	20	0.00	8,096,000.00
		Total	0.00	554,576,000.00

Financing

Own funds	650,000,000.00	INR
Subsidies	39,172,000.00	INR

Electricity sale

Feed-in tariff	3.50000	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	22.0	years
Net present value (NPV)	63,500,805.89	INR
Internal rate of return (IRR)	0.81	%
Return on investment (ROI)	9.8	%

Financial analysis

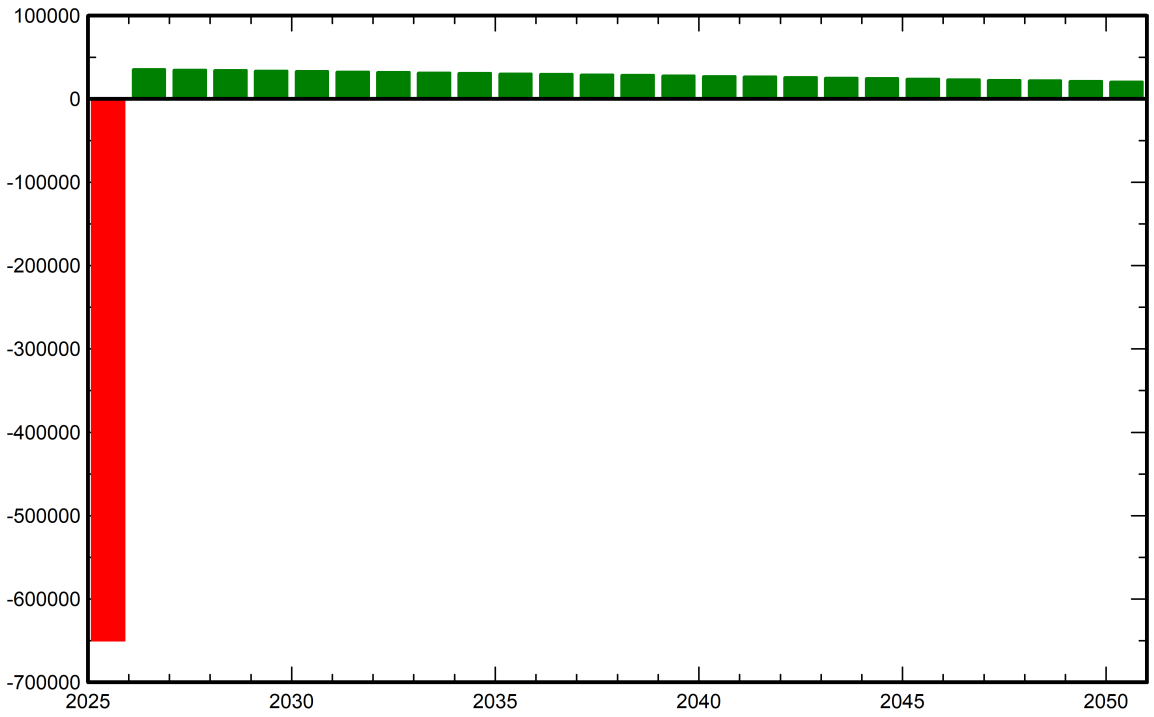
Detailed economic results (INR)

Year	Electricity sale	Own funds	Run. costs	Deprec. allow.	Taxable income	Taxes	After-tax profit	Cumul. profit	% amorti.
0	0	650,000,000	0	0	0	0	0	-650,000,000	0.0%
1	81,385,510	0	45,742,400	27,728,800	7,914,310	0	35,643,110	-614,356,890	5.5%
2	81,385,510	0	46,282,160	27,728,800	7,374,550	0	35,103,350	-579,253,540	10.9%
3	81,385,510	0	46,828,290	27,728,800	6,828,420	0	34,557,220	-544,696,319	16.2%
4	81,385,510	0	47,380,864	27,728,800	6,275,847	0	34,004,647	-510,691,673	21.4%
5	81,385,510	0	47,939,958	27,728,800	5,716,752	0	33,445,552	-477,246,120	26.6%
6	81,385,510	0	48,505,649	27,728,800	5,151,061	0	32,879,861	-444,366,260	31.6%
7	81,385,510	0	49,078,016	27,728,800	4,578,694	0	32,307,494	-412,058,765	36.6%
8	81,385,510	0	49,657,137	27,728,800	3,999,574	0	31,728,374	-380,330,392	41.5%
9	81,385,510	0	50,243,091	27,728,800	3,413,619	0	31,142,419	-349,187,972	46.3%
10	81,385,510	0	50,835,959	27,728,800	2,820,751	0	30,549,551	-318,638,421	51.0%
11	81,385,510	0	51,435,824	27,728,800	2,220,887	0	29,949,687	-288,688,735	55.6%
12	81,385,510	0	52,042,766	27,728,800	1,613,944	0	29,342,744	-259,345,991	60.1%
13	81,385,510	0	52,656,871	27,728,800	999,839	0	28,728,639	-230,617,351	64.5%
14	81,385,510	0	53,278,222	27,728,800	378,488	0	28,107,288	-202,510,063	68.8%
15	81,385,510	0	53,906,905	27,728,800	0	0	27,478,605	-175,031,458	73.1%
16	81,385,510	0	54,543,007	27,728,800	0	0	26,842,504	-148,188,954	77.2%
17	81,385,510	0	55,186,614	27,728,800	0	0	26,198,896	-121,990,058	81.2%
18	81,385,510	0	55,837,816	27,728,800	0	0	25,547,694	-96,442,364	85.2%
19	81,385,510	0	56,496,702	27,728,800	0	0	24,888,808	-71,553,556	89.0%
20	81,385,510	0	57,163,363	27,728,800	0	0	24,222,147	-47,331,409	92.7%
21	81,385,510	0	57,837,891	0	23,547,619	0	23,547,619	-23,783,790	96.3%
22	81,385,510	0	58,520,378	0	22,865,132	0	22,865,132	-918,658	99.9%
23	81,385,510	0	59,210,919	0	22,174,592	0	22,174,592	21,255,934	103.3%
24	81,385,510	0	59,909,607	0	21,475,903	0	21,475,903	42,731,836	106.6%
25	81,385,510	0	60,616,541	0	20,768,969	0	20,768,969	63,500,806	109.8%
Total	**2,034,637,756**	**650,000,000**	**1,321,136,950**	**554,576,000**	**170,118,952**	**0**	**713,500,806**	**63,500,806**	**109.8%**

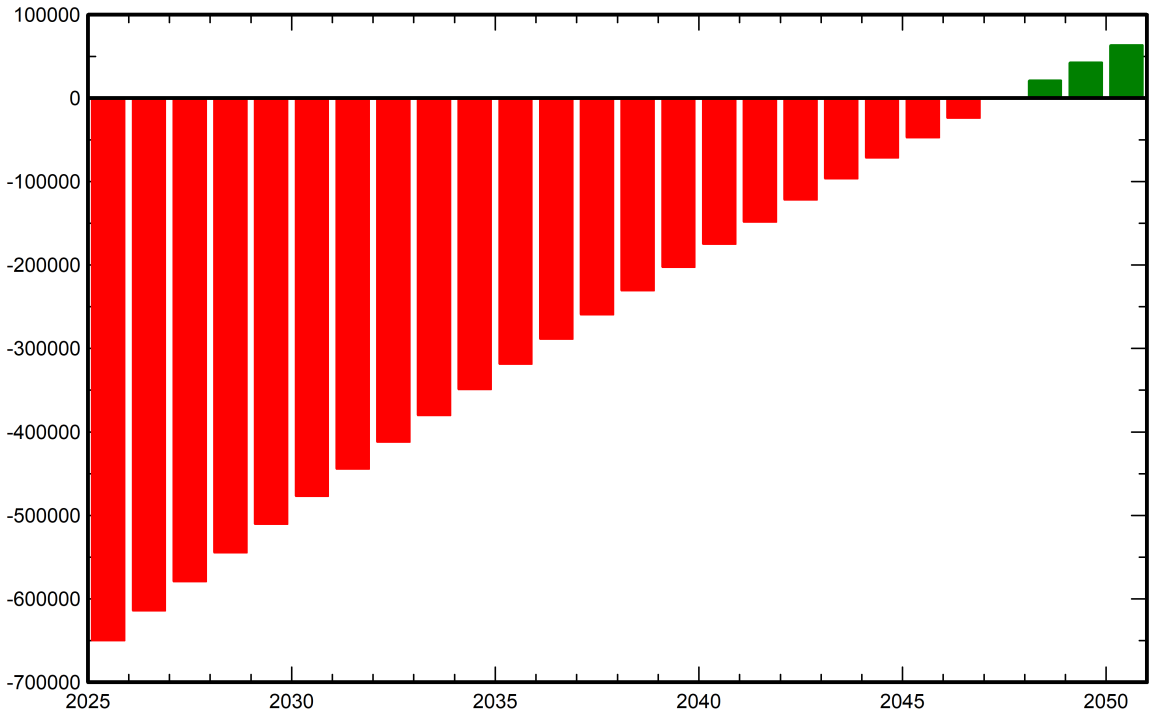
PVsyst V8.0.15
VC1, Simulation date:
05/09/25 01:07
with V8.0.15

Financial analysis

Yearly net profit (kINR)



Cumulative cashflow (kINR)



PVsyst V8.0.15
VC1, Simulation date:
05/09/25 01:07
with V8.0.15

CO_2 Emission Balance

Total: 527857.7 tCO_2

Generated emissions

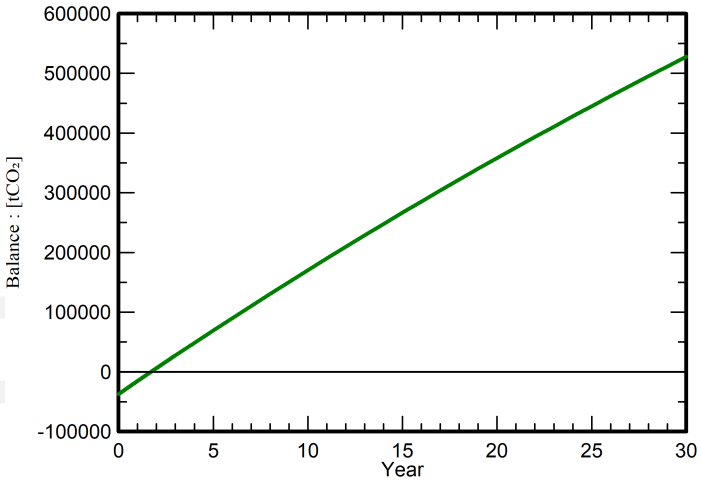
Total: 36967.87 tCO_2

Source: Detailed calculation from table below

Replaced Emissions

Total:	650971.7 tCO_2
System production:	23182.75 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	20240 kWp	34665453
Supports	6.24 kgCO2/kg	368000 kg	2297468
Inverters	619 kgCO2/units	8.00 units	4948