

PVsyst - Simulation report

Grid-Connected System

Project: 3.5MW Solar Power Plant_SFS

Variant: New simulation variant

Trackers single array, with backtracking

System power: 3499 kWp

Karkamb - India

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Project summary

Geographical Site Karkamb India	Situation Latitude 17.85 °N Longitude 75.32 °E Altitude 507 m Time zone UTC+5.5	Project settings Albedo 0.20
Weather data Karkamb Meteonorm 8.1 (1996-2015), Sat=100% - Synthetic		

System summary

Grid-Connected System Simulation for year no 1	Trackers single array, with backtracking		
PV Field Orientation Orientation Tracking plane, horizontal N-S axis Axis azimuth 0 °	Tracking algorithm Astronomic calculation Backtracking activated	Near Shadings Linear shadings : Fast (table) Diffuse shading Automatic	
System information PV Array Nb. of modules 6032 units Pnom total 3499 kWp	Inverters Nb. of units 11 units Pnom total 2475 kWac Pnom ratio 1.414		
User's needs Unlimited load (grid)			

Results summary

Produced Energy 6847265 kWh/year	Specific production 1957 kWh/kWp/year	Perf. Ratio PR 85.45 %
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General parameters

Grid-Connected System		Trackers single array, with backtracking	
PV Field Orientation			
Orientation		Tracking algorithm	Backtracking array
Tracking plane, horizontal N-S axis		Astronomic calculation	Nb. of trackers 72 units
Axis azimuth 0 °		Backtracking activated	Single array
			Sizes
			Tracker Spacing 5.00 m
			Collector width 2.28 m
			Ground Cov. Ratio (GCR) 45.6 %
			Phi min / max. +/- 50.0 °
			Backtracking strategy
			Phi limits for BT +/- 62.7 °
			Backtracking pitch 5.00 m
			Backtracking width 2.28 m
Models used			
Transposition Perez			
Diffuse Perez, Meteonorm			
Circumsolar separate			
Horizon		Near Shadings	
Free Horizon		Linear shadings : Fast (table)	User's needs
		Diffuse shading Automatic	Unlimited load (grid)
Bifacial system			
Model	2D Calculation unlimited trackers		
Bifacial model geometry		Bifacial model definitions	
Tracker Spacing	5.00 m	Ground albedo	0.30
Tracker width	2.28 m	Bifaciality factor	74 %
GCR	45.6 %	Rear shading factor	5.0 %
Axis height above ground	1.80 m	Rear mismatch loss	10.0 %
		Shed transparent fraction	0.0 %

PV Array Characteristics

PV module		Inverter	
Manufacturer	GOLDI SUN PRIVATE LIMITED	Manufacturer	SINENG ELECTRIC CO.LTD.
Model	GS10-T144-GF-580	Model	SP-275K-INH
(Custom parameters definition)		(Custom parameters definition)	
Unit Nom. Power	580 Wp	Unit Nom. Power	225 kWac
Number of PV modules	6032 units	Number of inverters	11 units
Nominal (STC)	3499 kWp	Total power	2475 kWac
Modules	232 string x 26 In series	Operating voltage	880-1360 V
At operating cond. (50°C)		Max. power (=>30°C)	275 kWac
Pmpp	3326 kWp	Pnom ratio (DC:AC)	1.41
U mpp	1055 V	Power sharing within this inverter	
I mpp	3154 A		
Total PV power		Total inverter power	
Nominal (STC)	3499 kWp	Total power	2475 kWac
Total	6032 modules	Max. power	3025 kWac
Module area	15582 m²	Number of inverters	11 units
		Pnom ratio	1.41



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Array losses

Array Soiling Losses		Thermal Loss factor		DC wiring losses				
Loss Fraction	3.0 %	Module temperature according to irradiance		Global array res.	5.3 mΩ			
		Uc (const)	29.0 W/m ² K	Loss Fraction	1.5 % at STC			
		Uv (wind)	0.0 W/m ² K/m/s					
Serie Diode Loss		LID - Light Induced Degradation		Module Quality Loss				
Voltage drop	0.7 V	Loss Fraction	2.0 %	Loss Fraction	-0.5 %			
Loss Fraction	0.1 % at STC							
Module mismatch losses		Strings Mismatch loss		Module average degradation				
Loss Fraction	2.0 % at MPP	Loss Fraction	0.1 %	Year no	1			
				Loss factor	0.4 %/year			
				Mismatch due to degradation				
				Imp RMS dispersion	0.4 %/year			
				Vmp RMS dispersion	0.4 %/year			
IAM loss factor								
Incidence effect (IAM): User defined profile								
0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	0.998	0.992	0.964	0.919	0.815	0.572	0.000

System losses

Unavailability of the system		Auxiliaries loss	
Time fraction	1.0 %	constant (fans)	2.20 kW
	3.7 days, 3 periods	0.0 kW from Power thresh.	

AC wiring losses

Inv. output line up to MV transfo	
Inverter voltage	800 Vac tri
Loss Fraction	1.00 % at STC
Inverter: SP-275K-INH	
Wire section (11 Inv.)	Alu 11 x 3 x 185 mm ²
Average wires length	120 m
MV line up to Injection	
MV Voltage	33 kV
Wires	Alu 3 x 25 mm ²
Length	2500 m
Loss Fraction	1.00 % at STC

AC losses in transformers

MV transfo	
Medium voltage	33 kV
Transformer parameters	
Nominal power at STC	3.46 MVA
Iron Loss (night disconnect)	3.80 kVA
Iron loss fraction	0.11 % at STC
Copper loss	31.42 kVA
Copper loss fraction	0.91 % at STC
Coils equivalent resistance	3 x 1.68 mΩ



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Main results

System Production

Produced Energy 6847265 kWh/year

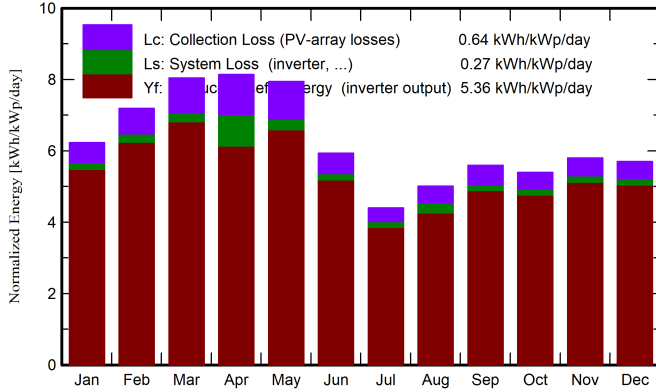
Specific production

1957 kWh/kWp/year

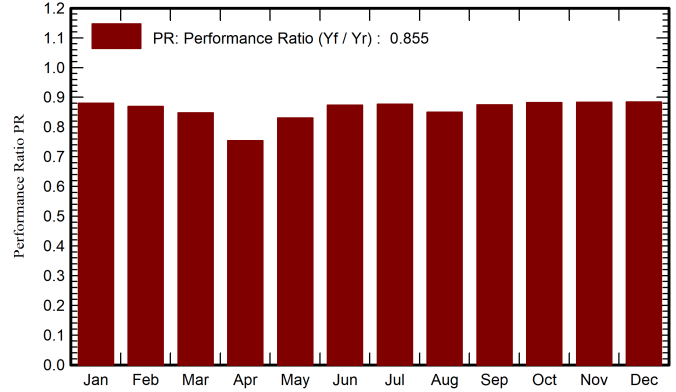
Perf. Ratio PR

85.45 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray kWh	E_Grid kWh	PR ratio
January	151.0	47.45	23.87	193.3	184.3	616361	594832	0.880
February	157.7	49.94	27.05	201.4	192.3	635000	612050	0.869
March	196.3	67.99	30.41	249.3	238.1	767587	739638	0.848
April	197.8	76.25	32.64	244.3	233.2	738107	644811	0.754
May	202.3	85.20	33.05	246.3	234.8	748519	715353	0.830
June	150.7	86.57	28.64	178.0	168.5	563814	544429	0.874
July	122.7	83.44	27.56	136.5	128.5	436394	418714	0.877
August	135.3	82.64	26.85	155.4	146.8	495100	462167	0.850
September	142.5	80.31	26.58	167.8	158.7	531635	513617	0.875
October	142.8	79.09	26.94	167.4	158.4	534718	516658	0.882
November	140.4	57.85	25.03	174.0	165.5	556787	537814	0.884
December	140.5	49.95	23.53	176.8	168.4	566366	547180	0.885
Year	1880.1	846.67	27.68	2290.4	2177.5	7190388	6847265	0.855

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

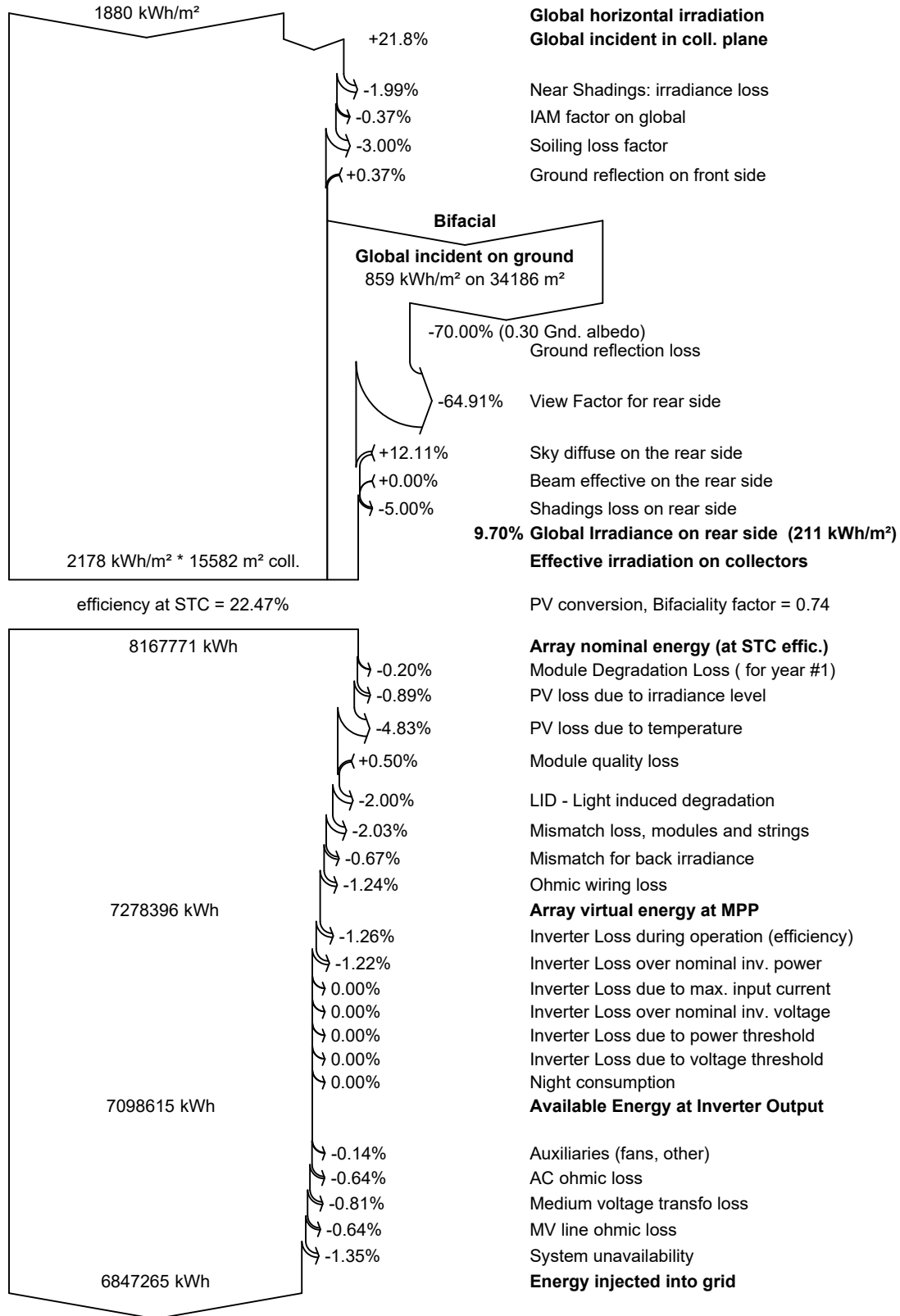


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Loss diagram





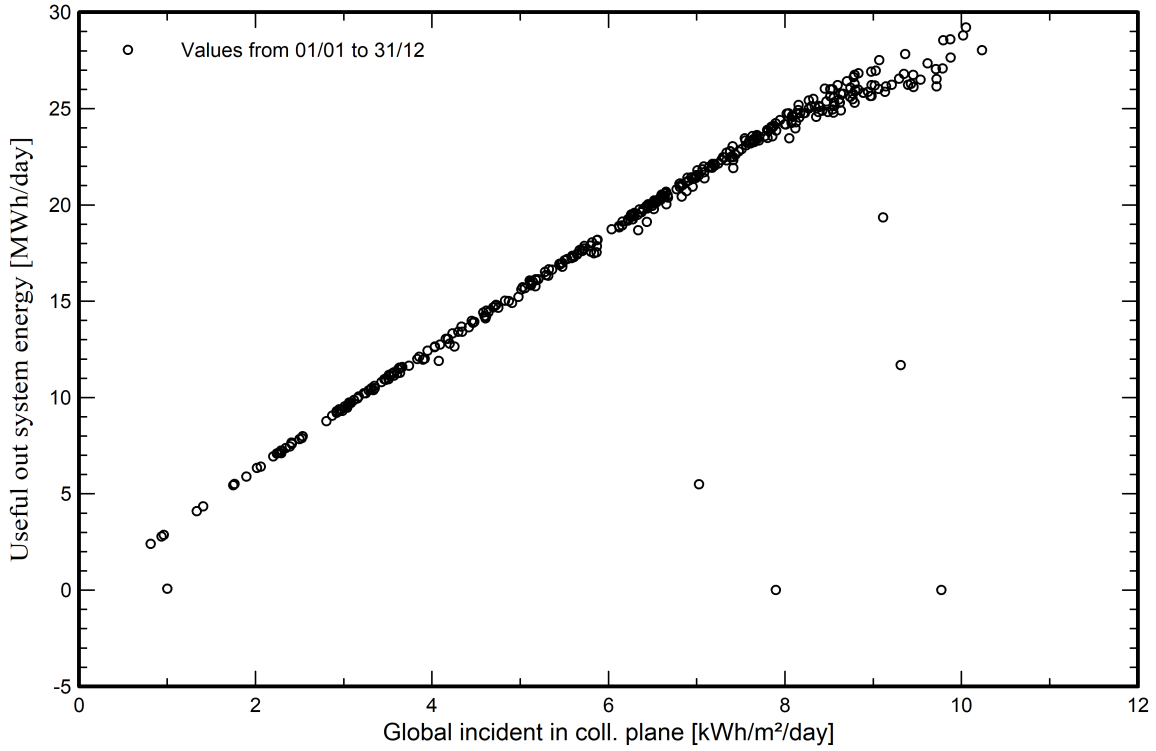
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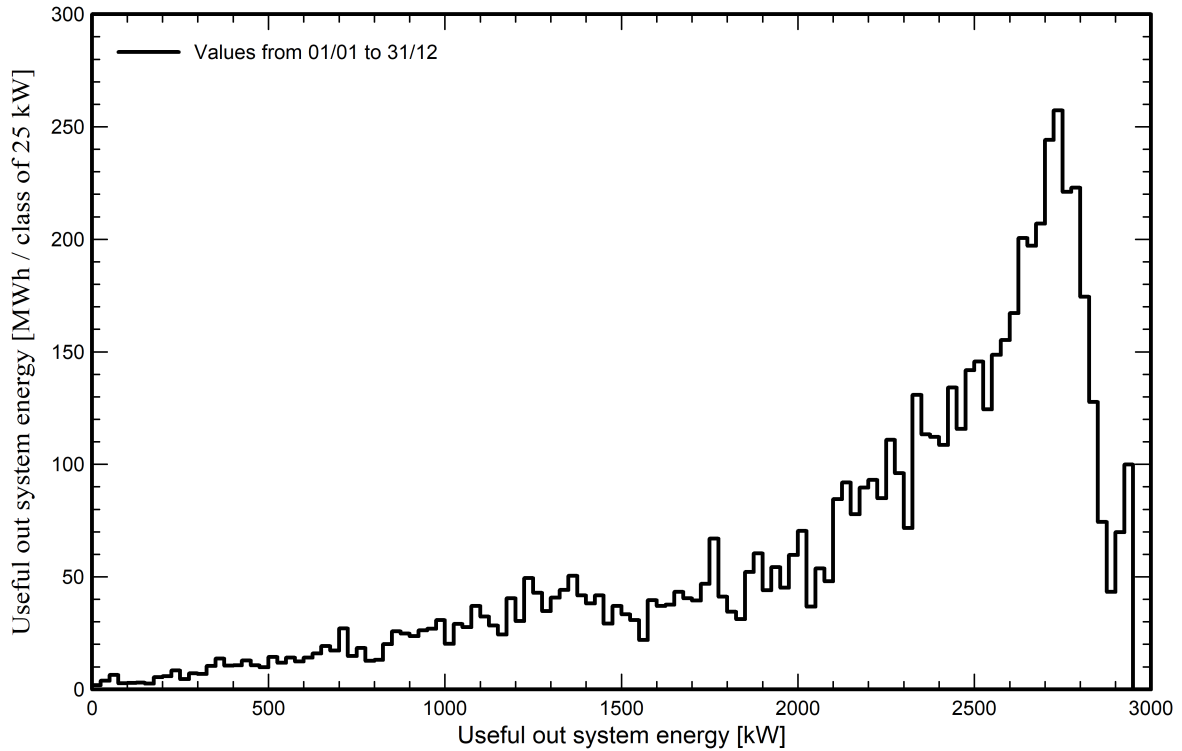
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Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





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P50 - P90 evaluation

Weather data

Source Meteororm 8.1 (1996-2015), Sat=100%
Kind Specific year
Year Synthetic
Year-to-year variability(Variance) 5.0 %

Specified Deviation

Year deviation from average 0.0 %

Global variability (weather data + system)

Variability (Quadratic sum) 5.3 %

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 364 MWh
P50 6847 MWh
P90 6381 MWh
P75 6602 MWh

Probability distribution

