Grid-Connected System: Simulation parameters

Project : **Pune**

Geographical Site	**Chauk**		Country	**India**
Situation	Latitude	18.86° N	Longitude	73.20° E
Time defined as	Legal Time	Time zone UT+5.5	Altitude	27 m
	Albedo	0.20		
Meteo data:	**Chauk**	Meteonorm 7.3 (1981-1990), Sat=12% - Synthetic		

Simulation variant : **pune**

	Simulation date	30/06/20 13h35

Simulation parameters	System type	**Sheds on ground**			
Collector Plane Orientation	Tilt	18°		Azimuth	0°
Sheds configuration	Nb. of sheds	90		Identical arrays	
	Sheds spacing	7.20 m		Collector width	4.01 m
Shading limit angle	Limit profile angle	20.1°		Ground Cov. Ratio (GCR)	55.7%
Models used	Transposition	Perez		Diffuse	Perez, Meteonorm
				Circumsolar	separate
Horizon	Free Horizon				
Near Shadings	Linear shadings				
User's needs :	Unlimited load (grid)				

PV Array Characteristics

PV module	Si-poly	Model	**TSM-PEG14-330**		
Original PVsyst database		Manufacturer	Trina Solar		
Number of PV modules		In series	18 modules	In parallel	101 strings
Total number of PV modules		nb. modules	1818	Unit Nom. Power	330 Wp
Array global power		Nominal (STC)	**600 kWp**	At operating cond.	538 kWp (50°C)
Array operating characteristics (50°C)		U mpp	604 V	I mpp	891 A
Total area		Module area	**3600 m²**	Cell area	3181 m²
Inverter		Model	**SG50KTL-M**		
Original PVsyst database		Manufacturer	Sungrow		
Characteristics		Unit Nom. Power	**50.0 kWac**	Oper. Voltage	300-950 V
Inverter pack		Total power	**500 kWac**	Pnom ratio	1.20
		Nb. of inverters	10 units		
Total		Total power	**500 kWac**	Pnom ratio	1.20

PV Array loss factors

Array Soiling Losses			Loss Fraction	1.0 %
Thermal Loss factor	Uc (const)	29.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s
Wiring Ohmic Loss	Global array res.	11 mΩ	Loss Fraction	1.5 % at STC
Serie Diode Loss	Voltage drop	0.7 V	Loss Fraction	0.1 % at STC
Module Quality Loss			Loss Fraction	-0.8 %
Module mismatch losses			Loss Fraction	1.0 % at MPP
Strings Mismatch loss			Loss Fraction	0.10 %

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	0.962	0.892	0.816	0.681	0.440	0.000

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System loss factors

AC loss, inverter to injection

Inverter voltage 400 Vac tri
Wires: 3 x 700 mm² 75 m Loss Fraction 0.7 % at STC

Grid-Connected System: Near shading definition

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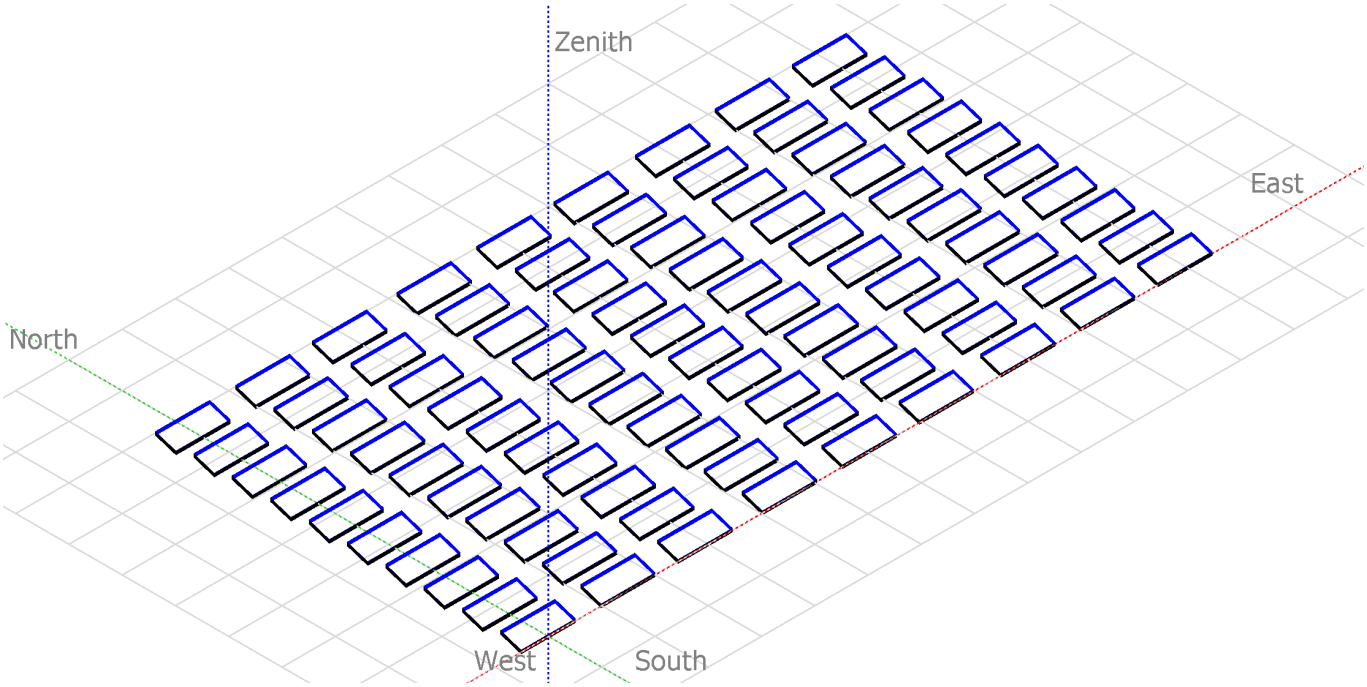
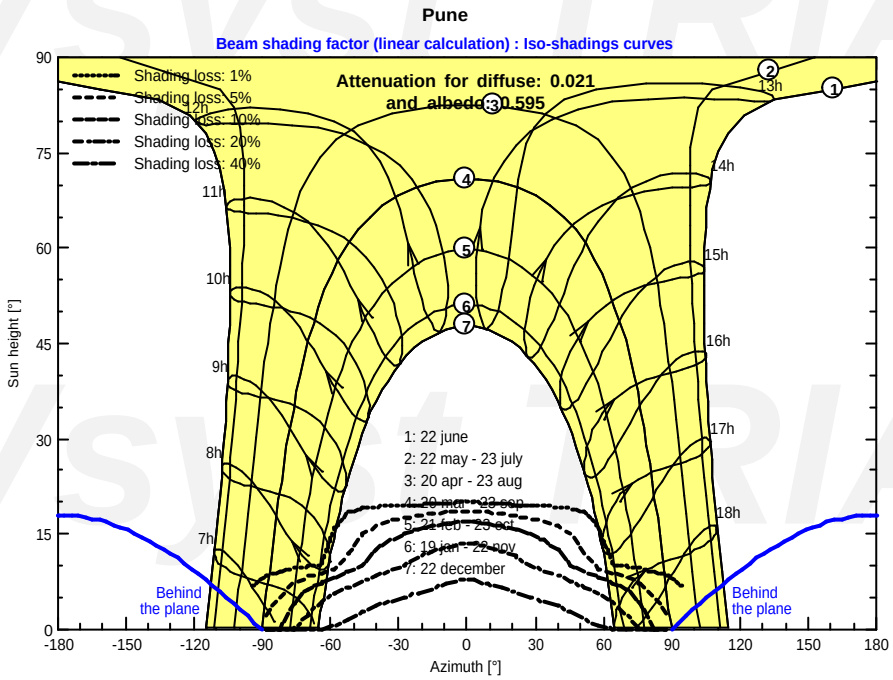
Main system parameters	System type	**Sheds on ground**		
Near Shadings	Linear shadings			
PV Field Orientation	tilt	18°	azimuth	0°
PV modules	Model	TSM-PEG14-330	Pnom	330 Wp
PV Array	Nb. of modules	1818	Pnom total	**600 kWp**
Inverter	Model	SG50KTL-M	Pnom	50.0 kW ac
Inverter pack	Nb. of units	10.0	Pnom total	**500 kW ac**
User's needs	Unlimited load (grid)			

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram



Grid-Connected System: Main results

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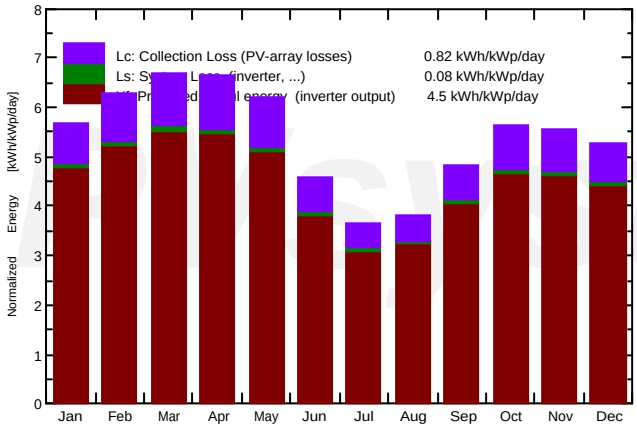
User's needs	Unlimited load (grid)			

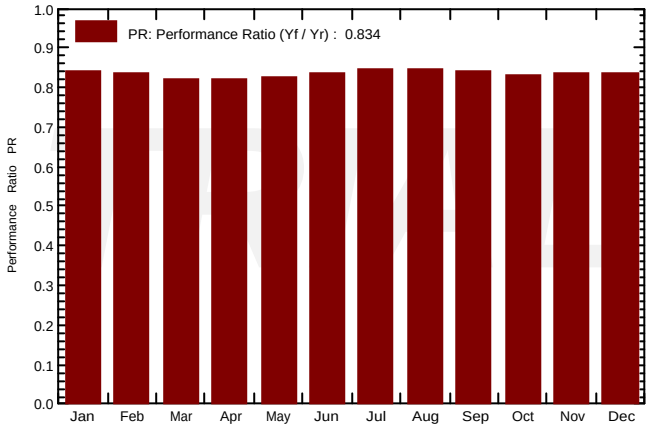
Main simulation results

System Production	**Produced Energy**	**984.9 MWh/year**	Specific prod.	1642 kWh/kWp/year
	Performance Ratio PR	83.36 %		

Normalized productions (per installed kWp): Nominal power 600 kWp



Performance Ratio PR



pune

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	144.6	51.76	24.26	175.8	168.3	90.4	88.8	0.842
February	153.0	54.78	25.36	175.4	168.2	89.3	87.7	0.834
March	194.2	71.05	27.60	207.9	198.8	104.6	102.6	0.823
April	199.3	80.06	28.72	199.0	189.9	100.0	98.2	0.823
May	203.5	91.60	29.87	192.5	182.9	96.9	95.1	0.824
June	146.8	91.90	28.56	137.1	130.1	70.2	68.9	0.838
July	120.0	85.64	27.99	113.5	107.7	58.6	57.5	0.845
August	122.3	83.14	27.59	118.7	113.0	61.4	60.2	0.846
September	141.1	80.84	27.55	144.7	138.0	74.4	73.1	0.842
October	158.5	78.31	28.90	174.7	166.8	88.6	87.1	0.831
November	140.9	59.77	27.56	166.2	159.0	84.6	83.1	0.834
December	133.8	52.12	25.81	163.8	156.9	83.8	82.3	0.838
Year	1858.0	880.95	27.49	1969.2	1879.6	1002.8	984.9	0.834

Legends:

GlobHor	Global horizontal irradiation	GlobEff	Effective Global, corr. for IAM and shadings
DiffHor	Horizontal diffuse irradiation	EArray	Effective energy at the output of the array
T_Amb	T amb.	E_Grid	Energy injected into grid
GlobInc	Global incident in coll. plane	PR	Performance Ratio

Grid-Connected System: Special graphs

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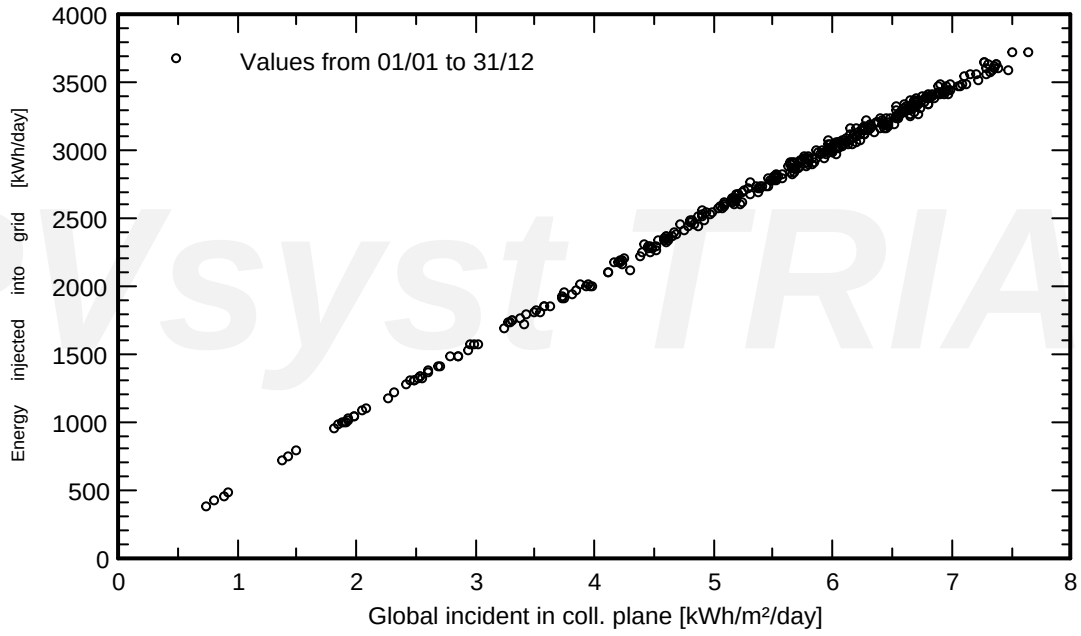
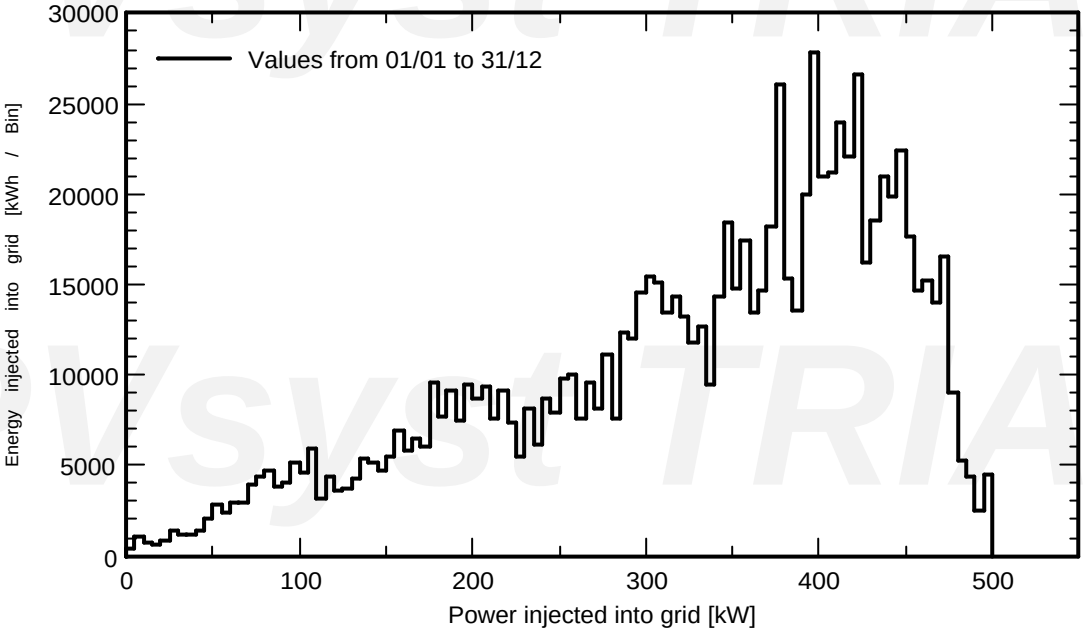
Daily Input/Output diagram



System Output Power Distribution



Grid-Connected System: Loss diagram

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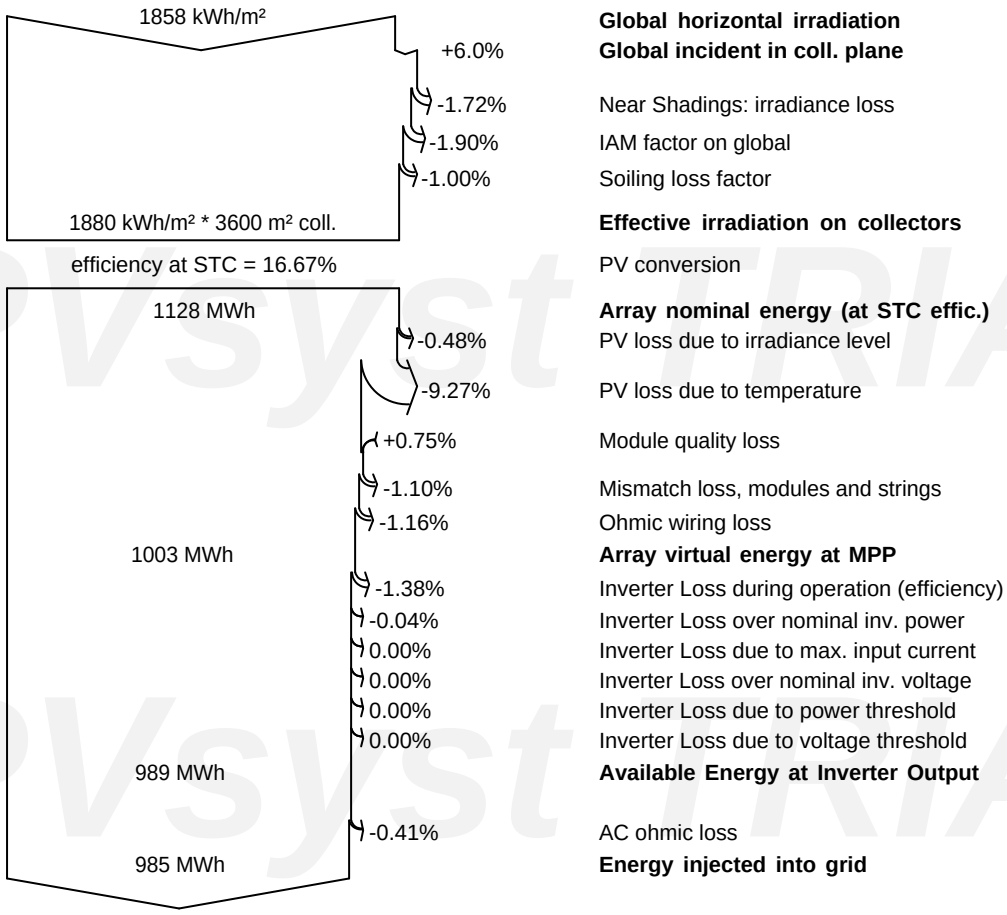
Loss diagram over the whole year



Global horizontal irradiation
Global incident in coll. plane
Near Shadings: irradiance loss
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
Module quality loss
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
Available Energy at Inverter Output
AC ohmic loss
Energy injected into grid