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"Designing and Simulation using Software's PV SYST & HELIOSCOPE for Mitigating Challenges of Grid Connected PV Based Solar Plant"

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Abstract : ***India is having large potential of renewable energy for which Govt of India has a plan to develop 100GW solar generation. Out of which commissioning of 60 GW Distributed RE generation has been the beginning of an era of de-licensed generation. Paper emphasis on the need for active involvement of distribution companies (DISCOMS) for strong scalability of pilot projects concept under clustered solar agriculture feeder in rural areas and its power evacuation with high degree of performance indicators. In this paper we have discussed various issues regarding grid connected ground mounted solar plant with its energy generation, solar insolation, project sizing/designing tools like PV SYST & HELIOSCOPE software with simulation analysis. Paper covers analysis of above software results for critically study annual energy generation & to mitigate its challenges.***

Keywords: RE, DER, DG, SLDC, MSEDCL, MSPGCL,CEA ,MERC, PV SYST, DISCOMS, HELIOSCOPE

I. INTRODUCTION

In today's changing scenario of development of power market, integration of Renewable Generation and increase in transmission congestion, there is a need for active involvement of distribution companies (DISCOMS) in Transmission Planning process, keeping in view the spirit of National Electricity Plan and National Tariff Policy. A change is taking place, or will to take place from large power generation units towards small generation connected to distribution areas. The term "distributed generation" (DG) is being used to refer to this small generation. The paper example is referred to as "centralized generation".

Electricity consumption by agriculture consumers constitutes almost 1/5th of total electricity consumption in India.

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In most of the agriculture dominant states, the sale of electricity for agriculture is reported to be in the range upwards of 30%. The per unit gap (ABR - ACoS) for AG consumer is in excess of Rs. 2 per unit in most of the states, thus appropriate accounting of energy catered to AG consumption has great influence on the financial health and on the cash flows of the distribution utility. Agricultural demand for electricity is one of the largest burdens on India's power sector as irrigation systems are largely undeveloped, and farmers are dependent on electricity to power the pumps. Solar can mitigate this entire portion of demand by generating power at the source and converting users into suppliers.

In India as a vital part of all schemes, rural electrification which bringing electricity to remote and rural areas, results into the development of the rural areas. So to cater Challenges head-on, looking at past challenges, and creating opportunities, govt. of Maharashtra has launched project for MSEDCL consumers which feeds electric power to agricultural pumps consumers and some rural domestic consumers. P ilot project scalability under solar PV based agriculture feeders policy can also be helpful for newly launched Central government scheme KUSUM for farmers. Farmers can development solar power projects on their barren land and can utilise the generated energy. For that subsidy will be provided by government. Farmers can also sell the excess power to local discoms through grid to generate additional income. Paper consist of five sections. Section I comprises of Introduction, Section II of 1.6MW Solar Plant & its Evacuation/ Grid Connectivity ideaology, section III discusse Photovoltaic array modeling & manual analysis of performance indicators, Section IV is all about PV SYST V6.81 Software designing & simulation, Section V discusses HELIOSCOPE Software designing & simulation results, Section VI tells us about conclusion.

Fig. 1 Site photos of S/Stn Yard & PV Solar plant at Ralegan siddhi Area

II. EVACUATION/ GRID CONNECTIVITY IDEOLOGY OF 1.6MW SOLAR PLANT.

Basically grid connected PV based project under clustered solar agriculture feeder at Ralegan Siddhi consist of HT power supply at 11kv level with Start Up power having contract demand of 40KVA for purpose of solar generation evacuation and also having installation of special Import/ Export ABT meter having continuous communication facility with SLDC & to provide real time visibility of electricity generation to MSEDCL. Regarding grid connectivity, committee was formed for incorporation of private company as a start up power in association with MSPGCL. Also connectivity to the distribution network was governed by CEA (Technical Standards of Grid Connectivity) Regulation 2007 & MERC (Distribution Open Access) Regulation 2016. Likewise MSPGCL has tendered 750 MW of grid-connected solar photovoltaic (PV) projects to cater to the agricultural (AG) feeder load of various substations across the state. MSPGCL has fixed Rs. 3.25 (~$0.0477)/kWh as the upper tariff ceiling for this tender. A single bidder can bid for the entire capacity tendered. The scope of work includes the design, engineering, manufacture, supply, installation, testing and commissioning of the grid-connected solar PV projects.

III. PHOTOVOLTAIC ARRAY MODELING

WAAREE WS260[4] panels are used . Panels connections are in series and parallel to obtain required amount of power. -40 to 85 degree Celsius is Operating temperature range. The electrical characteristics of the panel is mentioned below in figure.

ELECTRICAL CHARACTERISTICS							
Model	WS-240	WS-245	WS-250	WS-255	WS-260	WS-265	WS-270
Nominal Maximum Power, P_m(W)	240	245	250	255	260	265	270
Power tolerance	0/+5 W						
Open Circuit Voltage, V_{oc}(V)	37	37.1	37.2	37.3	37.4	37.5	37.6
Short Circuit Current, I_{sc}(A)	8.65	8.81	8.96	9.12	9.27	9.42	9.58
Voltage at Maximum Power, V_{mp}(V)	30.6	30.7	30.8	30.9	31	31.05	31.1
Current at Maximum Power, I_{mp}(A)	7.85	7.99	8.12	8.26	8.39	8.54	8.69
Maximum System Voltage (V)	1000						
Module Efficiency(%)	14.78	15.09	15.4	15.71	16.01	16.32	16.63
Maximum Series Fuse Rating(A)	15	15	15	15	15	15	15
Limiting Reverse Current(A)	15	15	15	15	15	15	15
*Under Standard Test Conditions(STC) of 1000W/m² irradiance, AM 1.5 spectrum and 25° C Cell Temperature							

Fig..2 PV module Electrical Characteristics

MANUAL ANALYSIS

Performance Indicators ;

Manual calculations :

No of Panels (size 1.640m x 0.990 m) =5960 nos.

Total plant Capacity = Inverter 1 (100 strings) + Inverter 2 (148 strings)

= (270 watts x 2400 nos. + 260 watts x 3552 nos.)

= 1571520watts

= 1.57 MW

(*** 24 modules =1 string)

*Annual Energy Generated = A x r x H x PR

A = Total solar Panels Area (sq.m)= 1.640m x 0.990 m =1.623 sq.m.

r = Solar Panel Yield or Efficiency (16.1 %)

H= Annual Average Solar Radiation on Tilted Panels

= 5.61 kwh /sqm / day x 365 days

***Performance Ratio (PR)** = Total Energy generated by solar PV plant / Estimated energy generated by solar PV plant

= Total Energy generated by solar PV plant in kwh

Solar insolation in kwh per sq. Meter x Net active area in Sq. Meter x Efficiency (%)

= Total Energy generated by solar PV plant in kwh

Solar radiation in kwh per sq. Meter x sun shine hours x Net active area in Sq. Meter x Efficiency (%)

= 2052310 / {5.61 x 365x (1.623 x5960) x 0.160}

= 2052310 / 3169133

= 0.64 ie 64%

***Annual Energy Generated** = A x r x H x PR

=(1.62 x 5960) x (0.160) x (5.61x365)x 0.64

= 2020245 kwh/year

***Capacity Utilization Factor** = System Annual Avg. Energy Yield (KWH) / Plant Capacity(kw) x 24 hrs x 365 days

= 2052310 / 1573 x 24x 365 =0.14 ie 14%

*Actual Energy Generation chart :

Jan 2019 to Dec 2019

MONTH	MWH
JAN 19	197.28
FEB 19	169.52
MAR 19	150.69
APRIL 19	190.90
MAY 19	226.48
JUNE 19	159.60
JULY 19	140.60
AUG 19	156.21
SEPT 19	146.85
OCT 19	165.00
NOV 19	182.82
DEC 19	166.36
TOTAL	**2052.31**

***Solar Insolation at Proposed site :**

Ralegan siddhi, Ta. Parner Dist. Ahmednagar India.

Latitude : 19.1N Longitude: 74.8 E

Month	Solar Insolation (DNI) Kwh/sqm/day	Solar Insolation (GHI) Kwh/sqm/day
JAN	5.91	5.15
FEB	6.56	6.02
MAR	6.24	6.66

APR	5.81	6.97
MAY	5.69	7.03
JUN	3.62	5.66
JUL	2.35	4.81
AUG	2.21	4.56
SEP	3.82	5.20
OCT	4.80	5.41
NOV	5.22	5.02
DEC	5.56	4.84
AVG.	**4.69Kwh/sqm/day**	**5.61 Kwh/sqm/day**

(Source :NREL)

***Losses Analysis :**

*Shadow loss 1-3%
*Module Mismatch loss 1%
*Module Quality Loss 1.5%
*Temp. Loss 10-15%
*Cabling Losses 1-3%
*Soiling Losses 1-2%
*Inverter loss 1-3%

***Location and PV System Details:**

1. Lat(deg N):	**17.45**
2. Long(deg E):	**78.55**
3. Module Type:	**Standard**
4. Array Type:	**Fixed (open rack)**
5. Array Tilt (deg):	**20**
6. Array Azimuth (deg):	**180**
7. System Losses:	**14.08**
8. Invert Efficiency:	**96**
9. DC to AC Size Ratio:	**1.2**

IV. PV SYST SOFTWARE DESIGNING & SIMULATION:

PV SYST Software V6.81

PVSYST V6.81 is the software to study, sizing and analyzing of grid connected, stand alone, pumping and DC grid solar system. It is facilitated with technical, economical and environmental analysis of solar system. It consist of three stages ie. Preliminary design, Project Design & Measured data analysis. Preliminary design involves quickly pre-sizing step of a project with few system characteristics. & a rough estimation of the system cost . Project Design consist of thorough system design using detailed hourly simulations & can perform different system simulation runs and comparison. Effects like incidence angle losses, horizon (far shading), or partial shadings of near objects on the array, thermal behavior, wiring, module quality, mismatch can also be find out. Results including several phases of simulation variables & "Loss Diagram" is useful for identifying the weaknesses of the system design..In Measured data analysis close comparisons with the simulated variables is possible with analysing the real running parameters of the system, and identifies even very little misrunnings.

Fig .3. PVSYST V6.81 Photovoltaic systems software

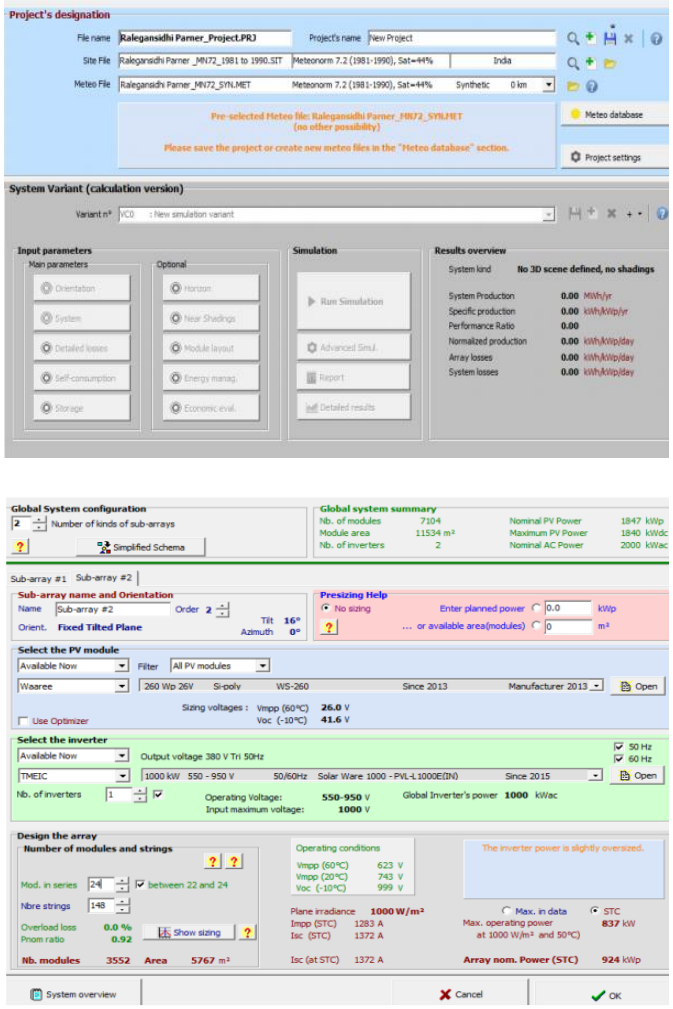
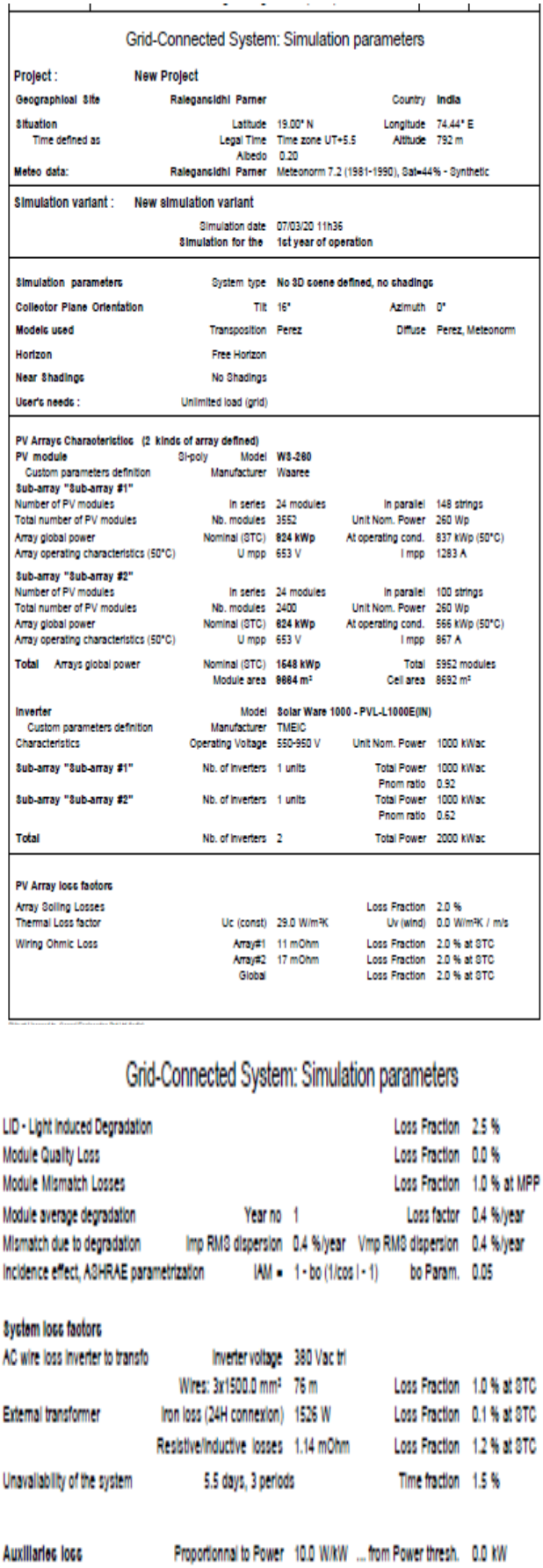


Fig. 4. PVSYST V6.81 Projects Designation & Global System Configuration



Grid-Connected System: Simulation parameters

Project :	New Project			
Geographical Site	Raleganadhi Parner		Country	India
Situation		Latitude	19.00° N	Longitude 74.44° E
Time defined as		Legal Time	Time zone UT+5.5	Altitude 792 m
		Albedo	0.20	
Meteo data:	Raleganadhi Parner	Meteonorm 7.2 (1981-1990), Sat=44% - Synthetic		

Simulation variant :	New simulation variant			
		Simulation date	07/03/20 11h36	
		Simulation for the	1st year of operation	
Simulation parameters	System type	No 3D scene defined, no shadings		
Collector Plane Orientation	Tilt	16°	Azimuth	0°
Models used	Transposition	Perez	Diffuse	Perez, Meteonorm
Horizon	Free Horizon			
Near Shadings	No Shadings			
User's needs :	Unlimited load (grid)			

PV Arrays Characteristics (2 kinds of array defined)				
PV module	Si-poly	Model	W8-280	
Custom parameters definition		Manufacturer	Waaree	
Sub-array "Sub-array #1"				
Number of PV modules		In series	24 modules	In parallel 148 strings
Total number of PV modules		Nb. modules	3552	Unit Nom. Power 260 Wp
Array global power		Nominal (STC)	924 kWp	At operating cond. 837 kWp (50°C)
Array operating characteristics (50°C)		U mpp	653 V	I mpp 1283 A
Sub-array "Sub-array #2"				
Number of PV modules		In series	24 modules	In parallel 100 strings
Total number of PV modules		Nb. modules	2400	Unit Nom. Power 260 Wp
Array global power		Nominal (STC)	624 kWp	At operating cond. 566 kWp (50°C)
Array operating characteristics (50°C)		U mpp	653 V	I mpp 867 A
Total Arrays global power		Nominal (STC)	1548 kWp	Total 5952 modules
		Module area	9884 m²	Cell area 8692 m²
Inverter		Model	Solar Ware 1000 - PVL-L1000E(IN)	
Custom parameters definition		Manufacturer	TMEIC	
Characteristics		Operating Voltage	550-950 V	Unit Nom. Power 1000 kWac
Sub-array "Sub-array #1"		Nb. of inverters	1 units	Total Power 1000 kWac
				Pnom ratio 0.92
Sub-array "Sub-array #2"		Nb. of inverters	1 units	Total Power 1000 kWac
				Pnom ratio 0.62
Total		Nb. of inverters	2	Total Power 2000 kWac

PV Array loss factors				
Array Soiling Losses			Loss Fraction	2.0 %
Thermal Loss factor	Uc (const)	29.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s
Wiring Ohmic Loss	Array#1	11 mOhm	Loss Fraction	2.0 % at STC
	Array#2	17 mOhm	Loss Fraction	2.0 % at STC
	Global		Loss Fraction	2.0 % at STC

Grid-Connected System: Simulation parameters

LID - Light Induced Degradation			Loss Fraction	2.5 %
Module Quality Loss			Loss Fraction	0.0 %
Module Mismatch Losses			Loss Fraction	1.0 % at MPP
Module average degradation	Year no	1	Loss factor	0.4 %/year
Mismatch due to degradation	Imp RMS dispersion	0.4 %/year	Vmp RMS dispersion	0.4 %/year
Incidence effect, ASHRAE parametrization	IAM =	1 - bo (1/cos i - 1)	bo Param.	0.05

System loss factors				
AC wire loss inverter to transfo	Inverter voltage	380 Vac tri		
	Wires: 3x1500.0 mm²	76 m	Loss Fraction	1.0 % at STC
External transformer	Iron loss (24H connexion)	1526 W	Loss Fraction	0.1 % at STC
	Resistive/Inductive losses	1.14 mOhm	Loss Fraction	1.2 % at STC
Unavailability of the system	5.5 days, 3 periods		Time fraction	1.5 %
Auxiliaries loss	Proportionnal to Power	10.0 W/kW	... from Power thresh.	0.0 kW

Fig. 5. Grid Connected System : Simulation parameters

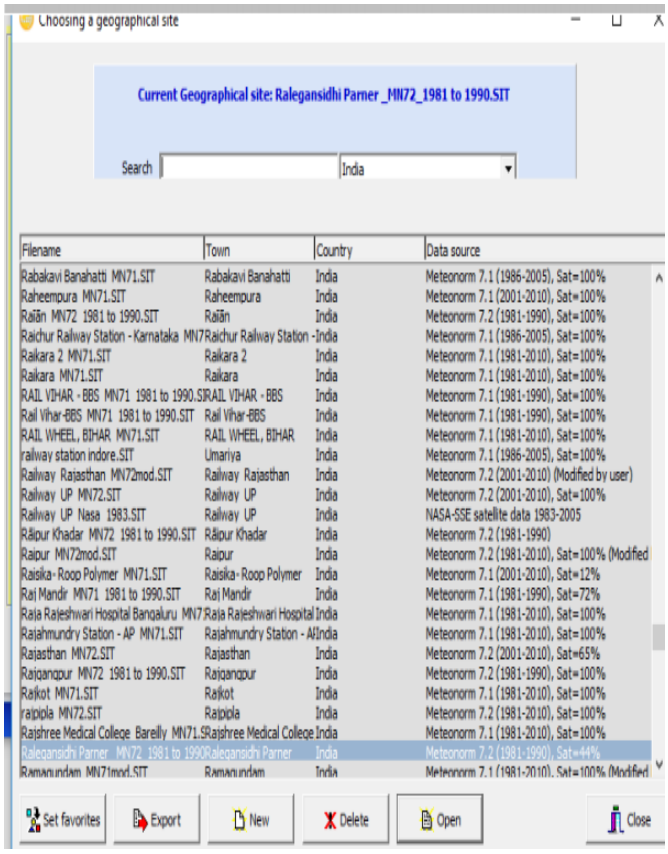


Fig. 6. Geographical Site configuration

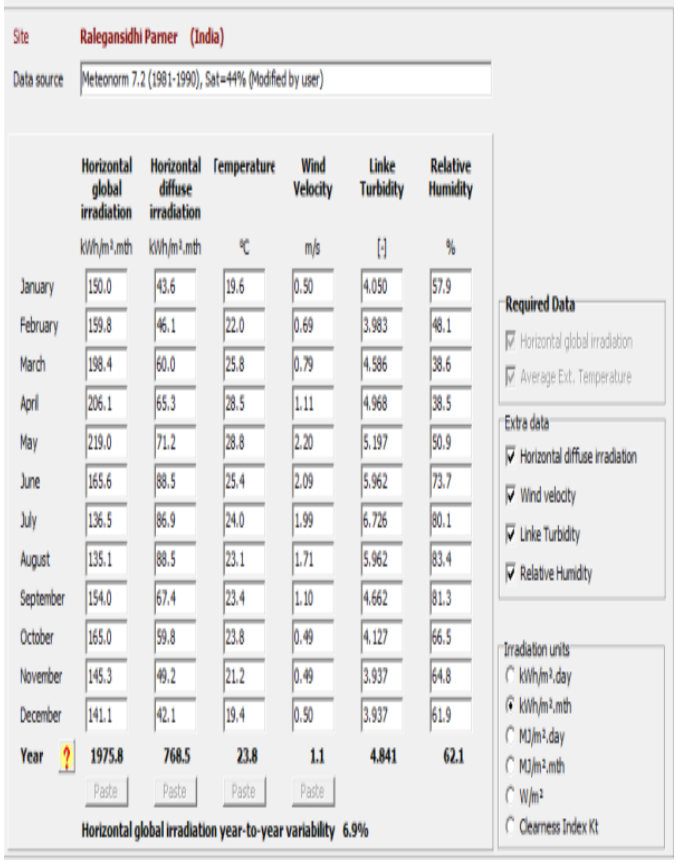


Fig. 7. Global irradiance of site

Grid-Connected System: Main results

Project : New Project

Simulation variant : New simulation variant

Simulation for the 1st year of operation

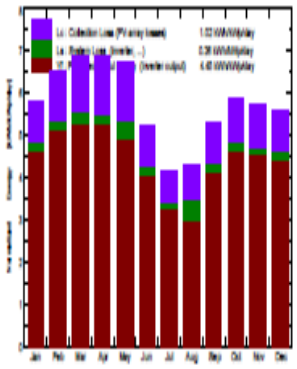
Main system parameters				
System type	No 3D scene defined, no shadings			
PV Field Orientation	tilt	16°	azimuth	0°
PV modules	Model	WS-260	Pnom	260 Wp
PV Array	Nb. of modules	5952	Pnom total	1548 kWp
Inverter	Solar Ware 1000 - PVL-L1000E(IN)		Pnom	1000 kW ac
Inverter pack	Nb. of units	2.0	Pnom total	2000 kW ac
User's needs	Unlimited load (grid)			

Main simulation results

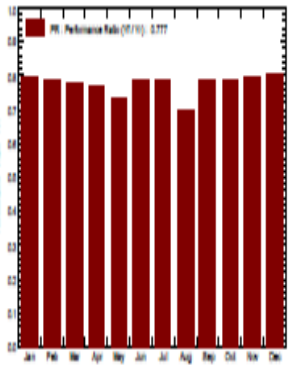
System Production — Produced Energy 2612 MWh/year — Specific prod. 1623 kWh/kWp/year

Performance Ratio PR 77.66 %

Normalized productions (per installed kWp): Nominal power 1548 kWp



Performance Ratio PR



New simulation variant

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
January	150.0	43.58	19.64	180.3	171.9	232.9	222.6	0.798
February	159.0	46.09	21.98	182.0	174.7	233.6	223.4	0.790
March	198.4	59.97	25.75	212.3	202.6	266.1	254.6	0.775
April	206.1	65.35	28.55	206.6	197.1	256.3	245.1	0.766
May	219.0	71.23	28.75	207.8	197.7	250.8	236.1	0.734
June	165.6	88.48	25.41	155.2	146.9	187.6	189.1	0.707
July	136.5	86.88	23.99	128.4	122.1	166.1	158.7	0.792
August	135.1	88.50	23.06	132.1	124.7	170.4	142.1	0.696
September	154.0	67.37	23.44	158.1	150.4	202.7	193.8	0.792
October	165.0	59.80	23.77	181.8	173.2	231.6	221.6	0.788
November	145.3	49.19	21.23	171.4	163.4	221.1	211.4	0.797
December	141.1	42.09	19.44	172.2	164.4	223.3	213.4	0.801
Year	1975.8	760.53	23.76	2090.1	1989.1	2660.4	2512.1	0.777

Legends:
- GlobHor — Horizontal global 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

Fig. 8. Grid Connected System : Main Results

Grid-Connected System: Special graphs

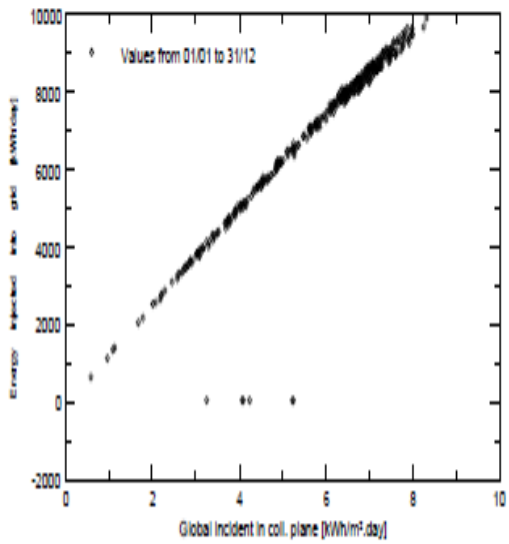
Project : New Project

Simulation variant : New simulation variant

Simulation for the 1st year of operation

Main system parameters				
System type	No 3D scene defined, no shadings			
PV Field Orientation	tilt	16°	azimuth	0°
PV modules	Model	WS-260	Pnom	260 Wp
PV Array	Nb. of modules	5952	Pnom total	1548 kWp
Inverter	Solar Ware 1000 - PVL-L1000E(IN)		Pnom	1000 kW ac
Inverter pack	Nb. of units	2.0	Pnom total	2000 kW ac
User's needs	Unlimited load (grid)			

Daily Input/Output diagram



System Output Power Distribution

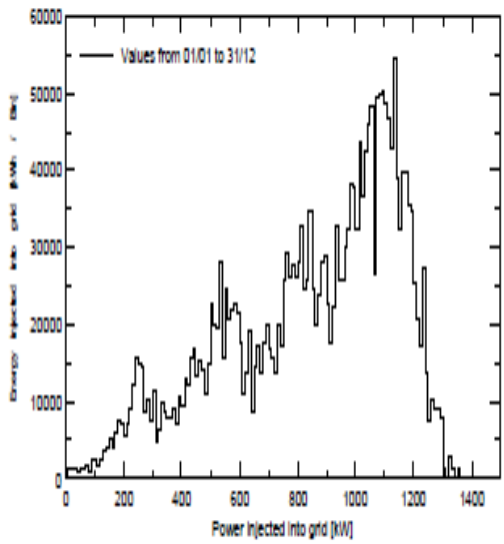


Fig. 9.Grid-Connected System: Special graphs : System output Power Distribution

Grid-Connected System: P50 - P90 evaluation

Project :	New Project
Simulation variant :	New simulation variant
	Simulation for the 1st year of operation

Main system parameters				
	System type	No 3D scene defined, no shadings		
PV Field Orientation	tilt	16°	azimuth	0°
PV modules	Model	WS-260	Pnom	260 Wp
PV Array	Nb. of modules	5952	Pnom total	1548 kWp
Inverter		Solar Ware 1000 - PVL-L1000E(IN)	Pnom	1000 kW ac
Inverter pack	Nb. of units	2.0	Pnom total	2000 kW ac
User's needs		Unlimited load (grid)		

Evaluation of the Production probability forecast

The probability distribution of the system production forecast for different years is mainly dependent on the meteo data used for the simulation, and depends on the following choices:

Meteo data source		Meteonorm 7.2 (1981-1990), Sat=44%		
Meteo data	Kind	Not defined	Year	1995
Specified Deviation	Year deviation from aver.	3 %		
Year-to-year variability	Variance	2.5 %		

The probability distribution variance is also depending on some system parameters uncertainties

Specified Deviation	PV module modelling/parameters	1.0 %	
	Inverter efficiency uncertainty	0.5 %	
	Soiling and mismatch uncertainties	1.0 %	
	Degradation uncertainty	1.0 %	
Global variability (meteo + system)	Variance	3.1 %	(quadratic sum)

Annual production probability		
	Variability	77 MWh
	P50	2512 MWh
	P90	2413 MWh
	P70	2472 MWh

Probability distribution

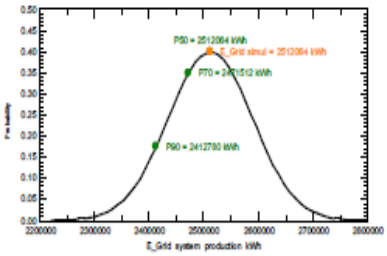


Fig. 10 Grid-Connected System:P50 –P90 Evaluation.

Loss diagram over the whole year

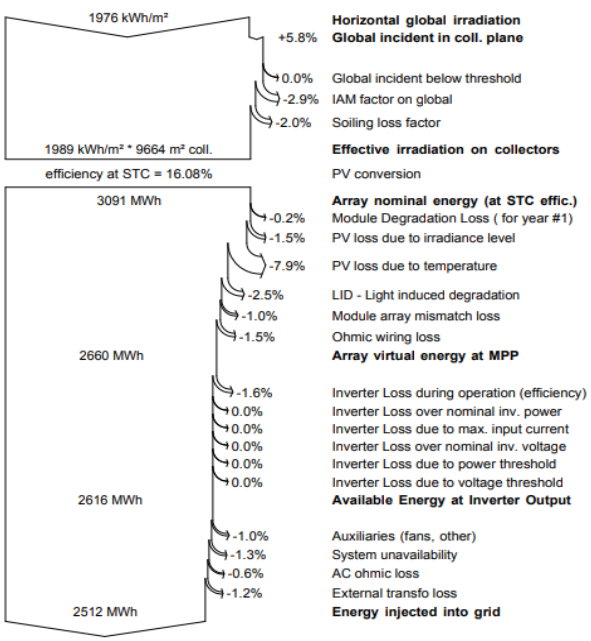


Fig. 11.Grid-Connected System: Loss diagram

V. HELIOSCOPE SOFTWARE DESIGNING & SIMULATION :

HelioScope software involves all the features of PVSyst and adds the design functionality of AutoCad, allowing designers to do a complete design with one package.

When using HelioScope, user selects the roof area for the array, specifies a PV module, and chooses an inverter model and also user enters the location's address,. You can use Google Earth for a free drawing program. Based on that 3D model, HelioScope will perform its shading analysis. Site assessment and design without setting foot on the actual property is also possible.

HelioScope uses the same models that PVSyst uses, so they're not reinventing the wheel with the simulation algorithms.

Fig 12. Detailed Layout : HELIOSCOPE

Shading by Field Segment

Description	Tilt	Azimuth	Modules	Nameplate	Shaded Irradiance	AC Energy	TOF[2]	Solar Access	Avg TSRF[2]
Field Segment 1	16.0°	220.0°	6,296	1.57 MWp	2,002.6kWh/m²	2.39 GWh[1]	93.5%	99.2%	92.8%
Totals, weighted by kWp			6,296	1.57 MWp	2,002.6kWh/m²	2.39 GWh	93.5%	99.2%	92.8%

[1] approximate, varies based on inverter performance

[2] based on location Optimal POA Irradiance of 2,158.2kWh/m² at 24.7° tilt and 175.0° azimuth

Solar Access by Month

Description	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Field Segment 1	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Solar Access, weighted by kWp	99.4%	99.4%	99.3%	99.3%	99.2%	99.1%	99.0%	99.0%	99.1%	99.3%	99.4%	99.4%
AC Power (kWh)	202,590.0	201,807.8	230,672.4	226,607.5	236,765.8	187,809.4	161,374.8	159,017.1	185,272.6	205,768.3	195,061.7	196,699.8

Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	2,004.5	
	POA Irradiance	2,017.9	0.7%
	Shaded Irradiance	2,003.1	-0.7%
	Irradiance after Reflection	1,939.7	-3.2%
	Irradiance after Soiling	1,862.1	-4.0%
	Total Collector Irradiance	**1,862.1**	**0.0%**
Energy (kWh)	Nameplate	2,930,237.3	
	Output at Irradiance Levels	2,918,038.4	-0.4%
	Output at Cell Temperature Derate	2,599,099.2	-10.9%
	Output After Mismatch	2,529,200.1	-2.7%
	Optimal DC Output	2,514,181.9	-0.6%
	Constrained DC Output	2,459,305.8	-2.2%
	Inverter Output	2,412,500.0	-1.9%
	Energy to Grid	**2,388,380.0**	**-1.0%**
Temperature Metrics			
	Avg. Operating Ambient Temp		27.1 °C
	Avg. Operating Cell Temp		39.2 °C
Simulation Metrics			
	Operating Hours		4668
	Solved Hours		4668

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	5°C								
	Flush Mount	-2.81	-0.0455	0°C								
	East-West	-3.56	-0.075	3°C								
	Carport	-3.56	-0.075	3°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	4	4	4	4	4	4	4	4	4	4	4	4
Irradiation Variance	5%											
Cell Temperature Spread	5° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	1.00%											
Module Characterizations	Module	Uploaded By	Characterization									
	WS-280 (Waaree)	Folsom Labs	Spec Sheet Characterization, PAN									
Component Characterizations	Device	Uploaded By	Characterization									
	Solar Ware 1000 - PVL-L1000E(IN) (TMEIC)	Folsom Labs	Default Characterization									

Components

Component	Name	Count
Inverters	Solar Ware 1000 - PVL-L1000E(IN) (TMEIC)	1 (1,000.0 kW)
Home Runs	300 mm2 (Copper)	23 (5,877.2 m)
Combiners	11 input Combiner	4
Combiners	12 input Combiner	19
Strings	4 mm2 (Copper)	272 (27,039.3 m)
Module	Waaree, WS-280 (280W)	5,620 (1.57 MW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
w1	12	17-21	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Portrait (Vertical)	16°	220°	4.3 m	2x1	2,810	5,620	1.57 MW

Fig13.Shading by field segment, Solar Access by month, Annual production, Condition set, Components & Wiring details.

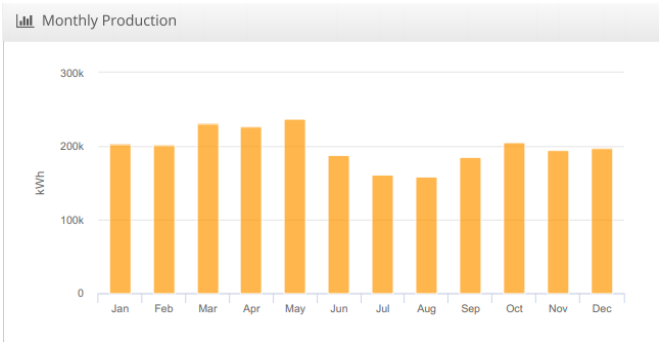


Fig. 14. Monthly Production HELIOSCOPE

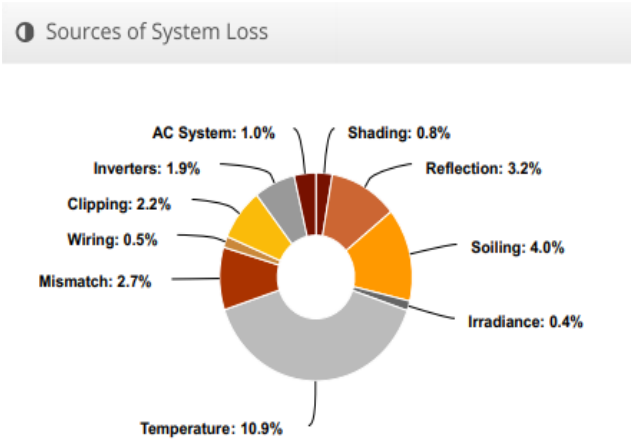


Fig. 15. System Loss HELIOSCOPE

VI. CONCLUSION

A performance and Simulation analysis of grid connected solar PV power plant installed at Ralegan siddhi was evaluated on annual basis using PV SYST & Helioscope Simulation software with high degree of performance indicators like maximum energy been generated in the month of March is 254.6 MWh and minimum energy generated in the month of Aug is 142.1MWh.The available energy obtained through software after the inverter losses at the inverter output is 2616 MWh /year with overall simulation output of 2512 MWh/Year ,DC wiring losses between PV and inverter are 1.5%, and the performance ratio is 0.77. Both PV SYST & Helioscope Simulation softwares are applied through common data irradiation Meteonorm 7.2. Hence Production probability forecast in energy generation is 90% at STC 16.08%. But actual site real time measured energy over all output of solar grid connected roof top power plant was 2052.31MWh/Year with maximum energy is generated in the month of May 226.48MWh and minimum energy generated in the month of July 140.60 MWh. Actual site values vary by 15% due to Grid availability/ Grid failure factors.

By using tools like PV SYST & Helioscope software for grid connected system simulation parameters, graphs, losses and results including annual production reports can help DISCOMS to critically analyze and match the actual energy generation of solar plant with software simulations leading to benefits like reduction in T & D losses of the Solar Plant located near to the selected feeder, giving supply to the agriculture sector in day time & last but not the least increasing overall efficiency of a solar plantwith improvement in the revenue recovery with minimizing the cross-subsidy burden.

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