

# PVsyst - Simulation report

## Grid-Connected System

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Project: Pyare Lal Hospital\_Meerut

Variant: New simulation variant

Unlimited sheds

System power: 450 kWp

Meerut - India

**Author**

Jakson Limited (India)



# Project: Pyare Lal Hospital\_Meerut

Variant: New simulation variant

## PVsyst V8.0.2

VC0, Simulation date:  
27/11/24 16:24  
with V8.0.2

Jakson Limited (India)

### Project summary

#### Geographical Site

##### Meerut

India

#### Situation

Latitude 28.98 °N

Longitude 77.70 °E

Altitude 241 m

Time zone UTC+5.5

#### Project settings

Albedo 0.20

#### Weather data

Meerut

Meteonorm 8.2 (1996-2015), Sat=100% - Synthetic

### System summary

#### Grid-Connected System

##### Orientation #1

##### Sheds

Tilt 10 °

Azimuth 33 °

#### Unlimited sheds

##### Near Shadings

Mutual shadings of sheds

#### User's needs

Unlimited load (grid)

#### System information

##### PV Array

Nb. of modules

775 units

Pnom total

450 kWp

##### Inverters

Nb. of units

7 units

Pnom total

390 kWac

Pnom ratio

1.153

### Results summary

Produced Energy 688859 kWh/year Specific production 1533 kWh/kWp/year Perf. Ratio PR 94.21 %

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## PVsyst V8.0.2

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## General parameters

## Grid-Connected System

## Unlimited sheds

## Orientation #1

## Sheds

Tilt	10 °
Azimuth	33 °

## Sheds configuration

Nb. of sheds	10 units
Unlimited sheds	
Shading limit angle	
Limit profile angle	8.2 °

## Sizes

Sheds spacing	6.60 m
Collector width	3.00 m
Average GCR	45.5 %
Top inactive band	0.02 m
Bottom inactive band	0.02 m

## Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

## Horizon

Free Horizon

## Near Shadings

Mutual shadings of sheds

## Bifacial system definition

## Orientation #1

## Bifacial system

Model	Unlimited Sheds 2D Model
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## Bifacial model geometry

Sheds spacing	6.60 m
Sheds width	3.04 m
Limit profile angle	8.2 °
GCR	46.1 %
Height above ground	1.50 m
Nb. of sheds	10 units

## Bifacial model definitions

Ground albedo	0.30
Bifaciality factor	80 %
Rear shading factor	5.0 %
Rear mismatch loss	10.0 %
Shed transparent fraction	0.0 %

## User's needs

Unlimited load (grid)

## PV Array Characteristics

## Array #1 - PV Array

## PV module

Manufacturer	Panasonic Life Solutions India Pvt. Ltd
Model	AE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power	580 Wp
Number of PV modules	60 units
Nominal (STC)	34.8 kWp
Modules	4 string x 15 In series

## At operating cond. (50°C)

Pmpp	32.3 kWp
U mpp	616 V
I mpp	52 A

## Inverter

Manufacturer	Growatt New Energy
Model	MAC 30KTL3-X LV

(Original PVsyst database)

Unit Nom. Power	30.0 kWac
Number of inverters	1 unit
Total power	30.0 kWac
Operating voltage	200-1000 V
Pnom ratio (DC:AC)	1.16
Power sharing within this inverter	



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## PV Array Characteristics

## Array #2 - Sub-array #2

## PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp  
Number of PV modules240 units  
Nominal (STC)139 kWp  
Modules16 string x 15 In series

## At operating cond. (50°C)

Pmpp129 kWp  
U mpp616 V  
I mpp210 A

## Inverter

Manufacturer

Growatt New Energy

Model

MID 40KTL3-X

(Original PVsyst database)

Unit Nom. Power40.0 kWac  
Number of inverters3 units  
Total power120 kWac  
Operating voltage200-1000 V  
Pnom ratio (DC:AC)1.16  
Power sharing within this inverter

## Array #3 - Sub-array #3

## PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp  
Number of PV modules130 units  
Nominal (STC)75.4 kWp  
Modules10 string x 13 In series

## At operating cond. (50°C)

Pmpp69.9 kWp  
U mpp534 V  
I mpp131 A

## Inverter

Manufacturer

Growatt New Energy

Model

MAX 60KTL3 LV

(Original PVsyst database)

Unit Nom. Power60.0 kWac  
Number of inverters1 unit  
Total power60.0 kWac  
Operating voltage200-1000 V  
Pnom ratio (DC:AC)1.26  
Power sharing within this inverter

## Array #4 - Sub-array #4

## PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp  
Number of PV modules150 units  
Nominal (STC)87.0 kWp  
Modules10 string x 15 In series

## At operating cond. (50°C)

Pmpp80.7 kWp  
U mpp616 V  
I mpp131 A

## Inverter

Manufacturer

Growatt New Energy

Model

MAX 80KTL3 LV

(Original PVsyst database)

Unit Nom. Power80.0 kWac  
Number of inverters1 unit  
Total power80.0 kWac  
Operating voltage200-1000 V  
Pnom ratio (DC:AC)1.09  
Power sharing within this inverter

## Array #5 - Sub-array #5

## PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd

ModelAE14T580VHC16B5R

(Custom parameters definition)

Unit Nom. Power580 Wp  
Number of PV modules195 units  
Nominal (STC)113 kWp  
Modules13 string x 15 In series

## At operating cond. (50°C)

Pmpp105 kWp  
U mpp616 V  
I mpp170 A

## Inverter

Manufacturer

Growatt New Energy

Model

MAX 100KTL3-X LV

(Original PVsyst database)

Unit Nom. Power100 kWac  
Number of inverters1 unit  
Total power100 kWac  
Operating voltage180-1000 V  
Pnom ratio (DC:AC)1.13  
Power sharing within this inverter

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**PV Array Characteristics****Total PV power**

Nominal (STC) 450 kWp  
Total 775 modules  
Module area 2000 m<sup>2</sup>

**Total inverter power**

Total power 390 kWac  
Number of inverters 7 units  
Pnom ratio 1.15

**Array losses****Array Soiling Losses**

Loss Fraction 2.0 %

**Thermal Loss factor**

Module temperature according to irradiance  
Uc (const) 29.0 W/m<sup>2</sup>K  
Uv (wind) 0.0 W/m<sup>2</sup>K/m/s

**Serie Diode Loss**

Voltage drop 0.7 V  
Loss Fraction 0.1 % at STC

**LID - Light Induced Degradation**

Loss Fraction 0.3 %

**Module Quality Loss**

Loss Fraction 0.0 %

**Module mismatch losses****Array #1 - PV Array**

Loss Fraction 0.5 % at MPP

**Array #2 - Sub-array #2**

Loss Fraction 0.5 % at MPP

**Array #3 - Sub-array #3**

Loss Fraction 0.5 % at MPP

**Array #4 - Sub-array #4**

Loss Fraction 0.5 % at MPP

**Array #5 - Sub-array #5**

Loss Fraction 0.5 % at MPP

**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	0.963	0.917	0.812	0.567	0.000

**DC wiring losses**

Global wiring resistance 10 mΩ  
Loss Fraction 1.5 % at STC

**Array #1 - PV Array**

Global array res. 192 mΩ  
Loss Fraction 1.5 % at STC

**Array #3 - Sub-array #3**

Global array res. 66 mΩ  
Loss Fraction 1.5 % at STC

**Array #5 - Sub-array #5**

Global array res. 59 mΩ  
Loss Fraction 1.5 % at STC

**Array #2 - Sub-array #2**

Global array res. 48 mΩ  
Loss Fraction 1.5 % at STC

**Array #4 - Sub-array #4**

Global array res. 77 mΩ  
Loss Fraction 1.5 % at STC

**System losses****Unavailability of the system**

Time fraction 1.0 %  
3.7 days,  
3 periods



### AC wiring losses

#### Inv. output line up to injection point

Inverter voltage 400 Vac tri  
Loss Fraction 0.04 % at STC

#### Inverters: MAC 30KTL3-X LV, MAX 80KTL3 LV

Wire section (2 Inv.) Alu 2 x 3 x 70 mm<sup>2</sup>  
Average wires length 25 m

#### Inverter: MAX 60KTL3 LV

Wire section (1 Inv.) Alu 1 x 3 x 50 mm<sup>2</sup>  
Wires length 0 m

#### Inverter: MID 40KTL3-X

Wire section (3 Inv.) Alu 3 x 3 x 25 mm<sup>2</sup>  
Average wires length 0 m

#### Inverter: MAX 100KTL3-X LV

Wire section (1 Inv.) Alu 1 x 3 x 95 mm<sup>2</sup>  
Wires length 0 m

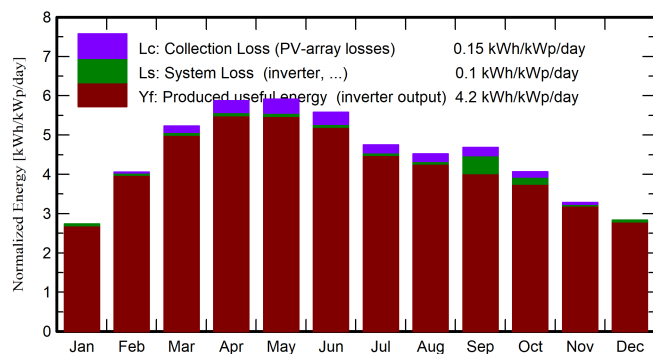


## Main results

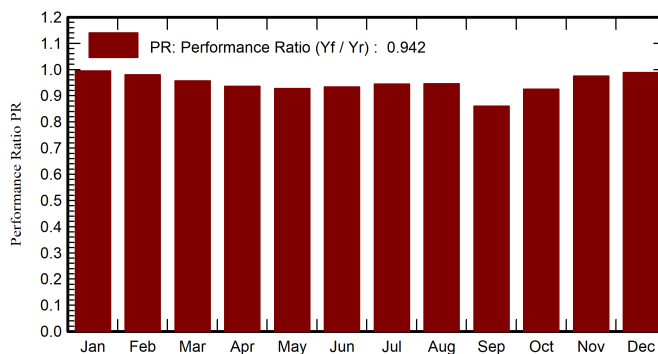
## System Production

Produced Energy (P50)	688859 kWh/year	Specific production (P50)	1533 kWh/kWp/year	Perf. Ratio PR	94.21 %
Produced Energy (P90)	672935 kWh/year	Specific production (P90)	1497 kWh/kWp/year		
Produced Energy (P75)	680487 kWh/year	Specific production (P75)	1514 kWh/kWp/year		

## Normalized productions (per installed kWp)



## Performance Ratio PR



## Balances and main results

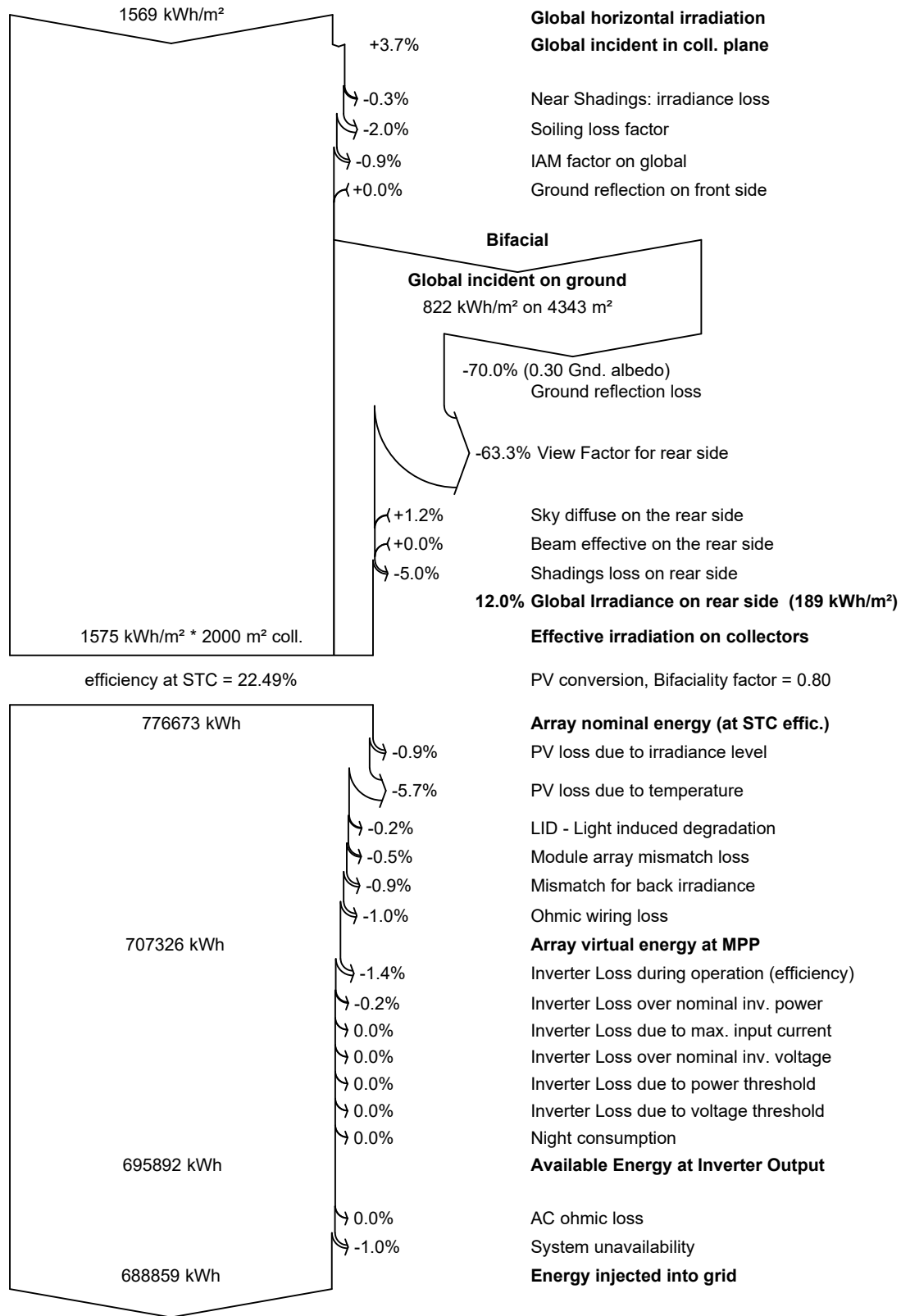
	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	°C	kWh/m <sup>2</sup>	kWh/m <sup>2</sup>	kWh	kWh	ratio
January	77.0	46.1	13.49	84.0	81.2	38167	37571	0.995
February	104.4	54.6	17.53	113.7	110.1	50830	50100	0.980
March	153.7	75.2	23.51	162.0	157.1	70674	69684	0.957
April	171.9	84.7	29.53	176.1	170.9	75194	74111	0.936
May	182.9	101.1	33.36	183.4	177.8	77508	76399	0.927
June	168.8	102.0	32.97	167.3	162.0	71182	70168	0.933
July	148.6	96.7	31.32	147.3	142.5	63497	62561	0.945
August	139.5	88.8	30.27	140.1	135.5	60407	59510	0.945
September	135.0	68.6	29.00	140.6	136.2	60397	54315	0.860
October	118.7	70.7	26.35	126.1	122.0	54883	52377	0.924
November	89.8	54.0	20.15	98.5	95.1	43780	43154	0.975
December	78.3	44.8	15.04	87.6	84.7	39512	38910	0.988
Year	1568.6	887.2	25.24	1626.8	1575.1	706031	688859	0.942

## 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		



### Loss diagram

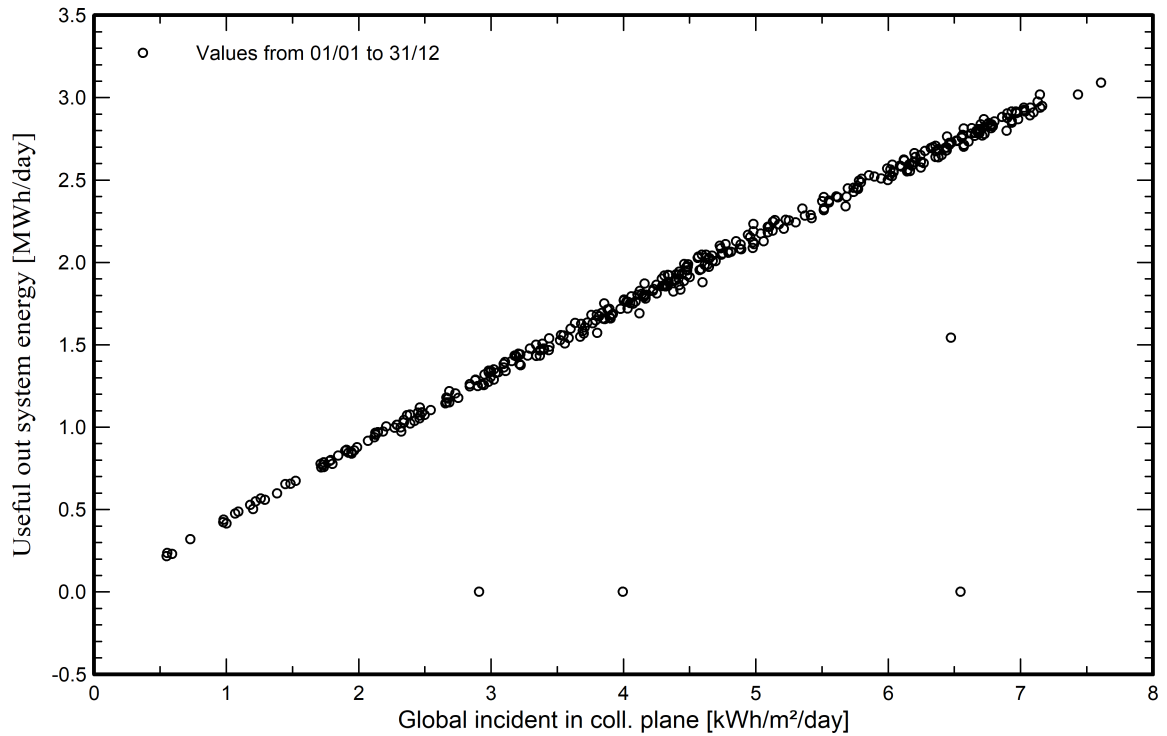




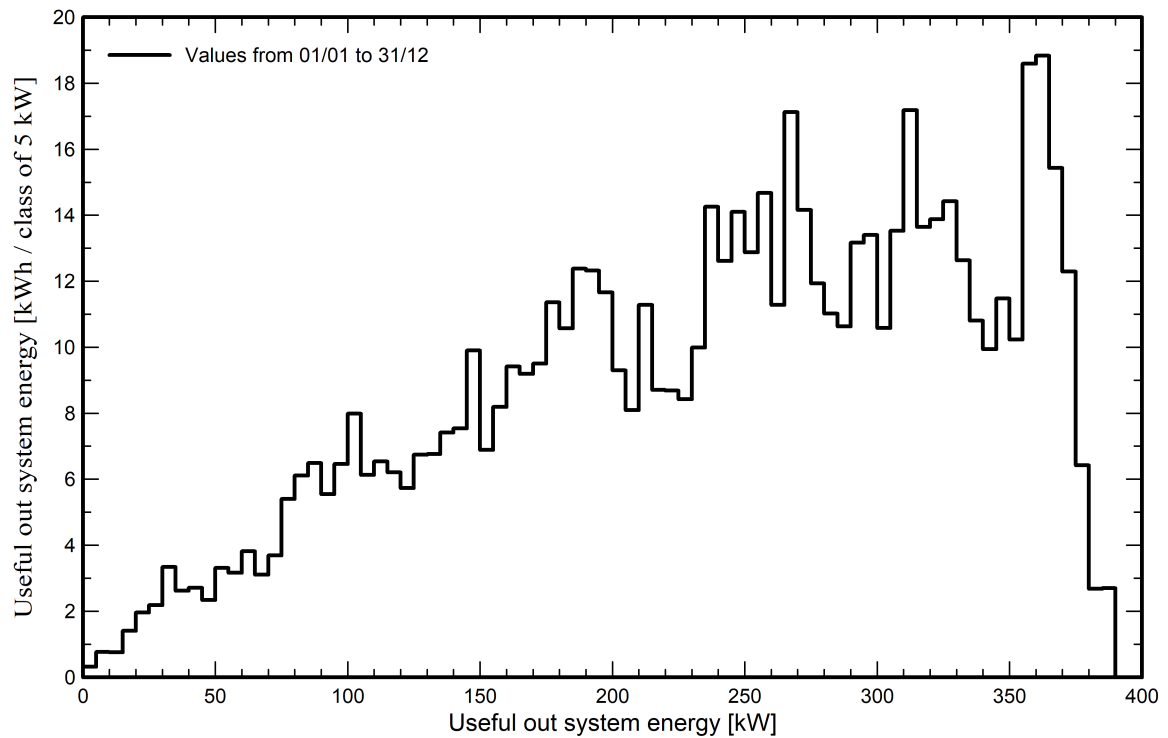


### Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





### P50 - P90 evaluation

#### Weather data

Source Meteonorm 8.2 (1996-2015), Sat=100%  
Kind Not defined  
Year-to-year variability(Variance) 0.0 %

#### Specified Deviation

#### Global variability (weather data + system)

Variability (Quadratic sum) 1.8 %

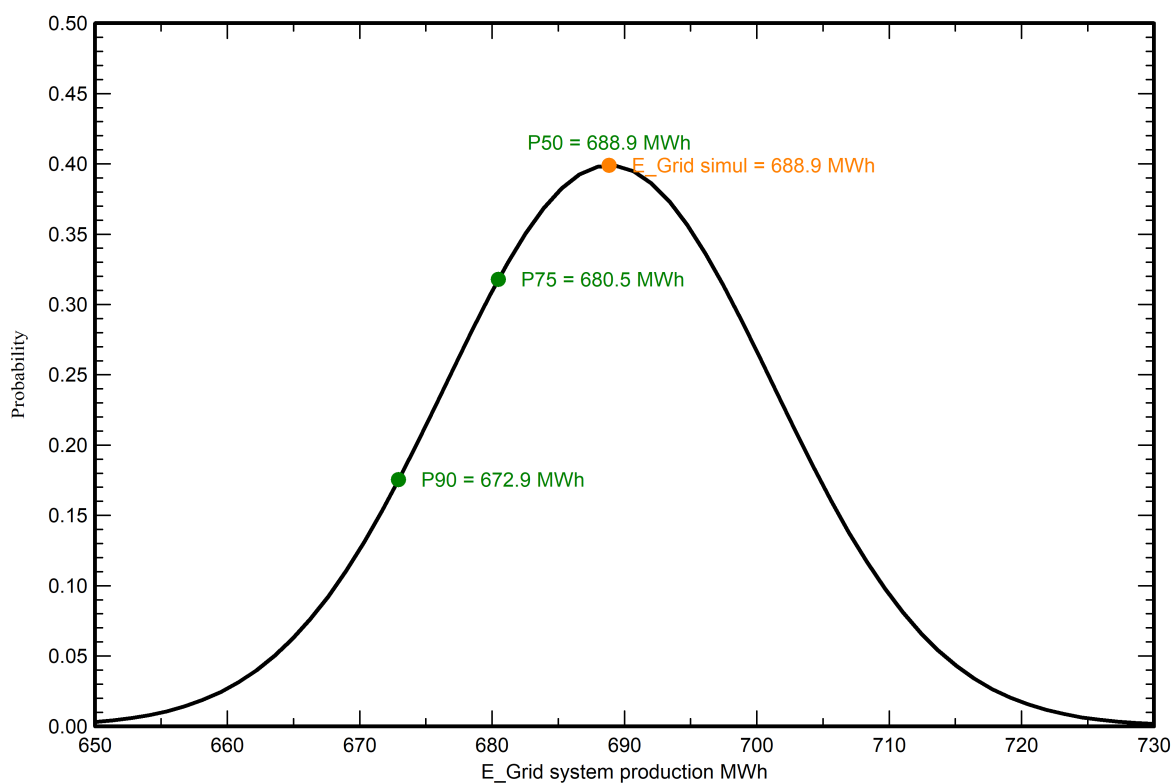
#### Simulation and parameters uncertainties

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 12.4 MWh  
P50 688.9 MWh  
P90 672.9 MWh  
P75 680.5 MWh

### Probability distribution

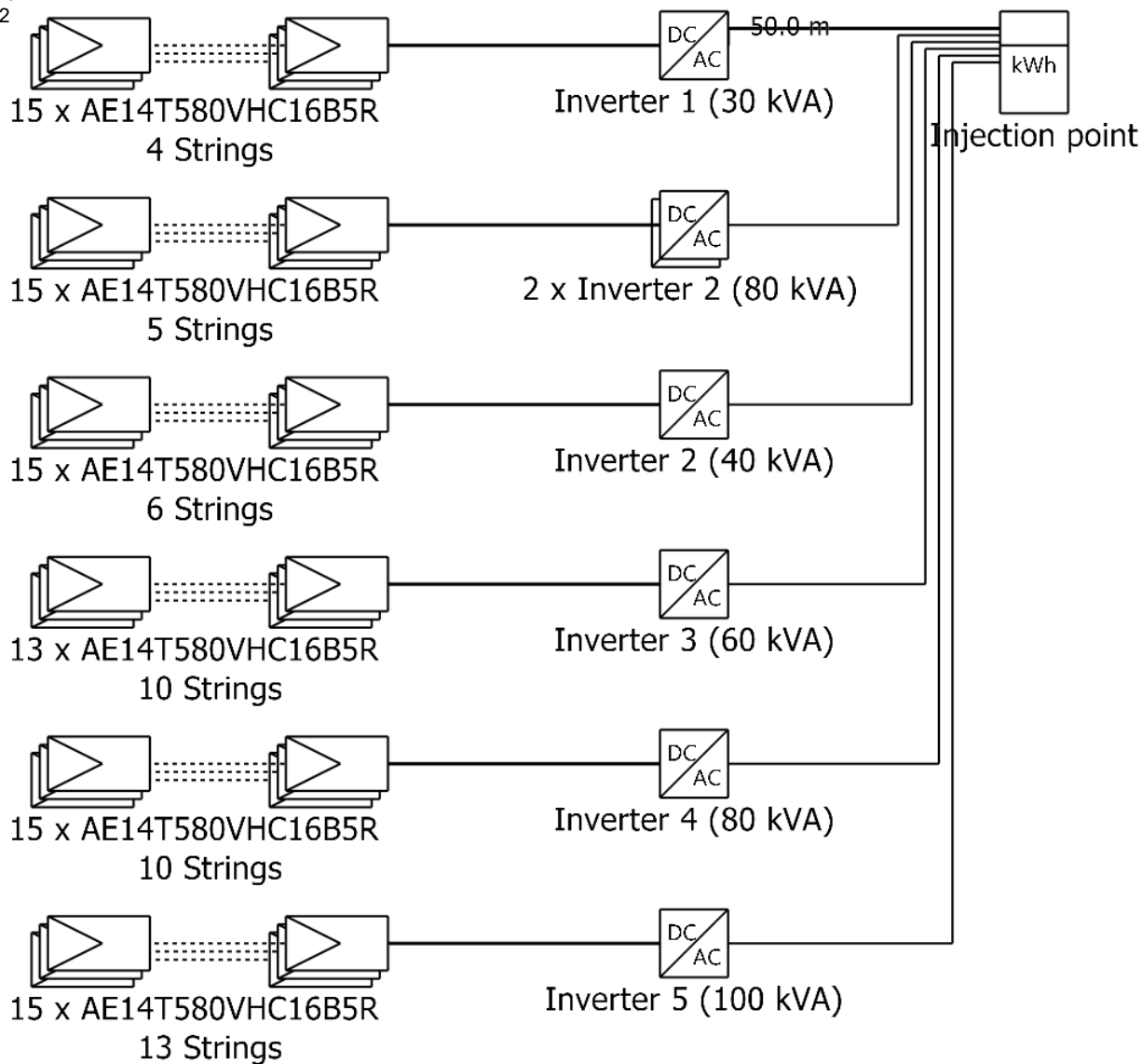




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# Single-line diagram



PV module	AE14T580VHC16B5R
Inverter 1	MAC 30KTL3-X LV
Inverter 2	MID 40KTL3-X
Inverter 3	MAX 60KTL3 LV
Inverter 4	MAX 80KTL3 LV
Inverter 5	MAX 100KTL3-X LV
String 1	15 x AE14T580VHC16B5R
String 2	13 x AE14T580VHC16B5R

Pyare Lal Hospital\_Meerut

Jakson Limited (In  
dia)

VC0 : New simulation variant

27/11/24