

PVsyst - Simulation report

Grid-Connected System

Project: Balarampur Hospital

Variant: New simulation variant

Unlimited sheds

System power: 746 kWp

Hasanganj - India

Author

Jakson Limited (India)

**PVsyst V8.0.2**

VC0, Simulation date:
27/11/24 17:16
with V8.0.2

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Project summary**Geographical Site**

Hasanganj

India

Situation

Latitude 26.86 °N

Longitude 80.93 °E

Altitude 117 m

Time zone UTC+5.5

Project settings

Albedo 0.20

Weather data

Hasanganj

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

System summary**Grid-Connected System****Orientation #1****Sheds**

Tilt 10 °

Azimuth 8 °

Unlimited sheds**Near Shadings**

Mutual shadings of sheds

User's needs

Unlimited load (grid)

System information**PV Array**

Nb. of modules

1287 units

Pnom total

746 kWp

Inverters

Nb. of units

14 units

Pnom total

665 kWac

Pnom ratio

1.122

Results summary

Produced Energy 1119473 kWh/year Specific production 1500 kWh/kWp/year Perf. Ratio PR 93.73 %

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General parameters

Grid-Connected System

Unlimited sheds

Orientation #1

Sheds

Tilt	10 °
Azimuth	8 °

Sheds configuration

Nb. of sheds	5 units
Unlimited sheds	
Shading limit angle	
Limit profile angle	9 °

Sizes

Sheds spacing	6.30 m
Collector width	3.00 m
Average GCR	47.6 %
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	6.30 m
Sheds width	3.04 m
Limit profile angle	9.0 °
GCR	48.3 %
Height above ground	1.50 m
Nb. of sheds	5 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	27 units
Nominal (STC)	15.66 kWp
Modules	3 string x 9 In series

At operating cond. (50°C)

Pmpp	14.52 kWp
U mpp	370 V
I mpp	39 A

Inverter

Manufacturer	Growatt New Energy
Model	MID 20KTL3-XL
(Original PVsyst database)	
Unit Nom. Power	20.0 kWac
Number of inverters	1 unit
Total power	20.0 kWac
Operating voltage	200-850 V
Pnom ratio (DC:AC)	0.78
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 modules42 units
Nominal (STC)24.36 kWp
Modules3 string x 14 In series

At operating cond. (50°C)

Pmpp22.59 kWp
U mpp575 V
I mpp39 A

Inverter

Manufacturer

Growatt New Energy

Model

MID 25KTL3-X

(Original PVsyst database)

Unit Nom. Power25.0 kWac
Number of inverters1 unit
Total power25.0 kWac
Operating voltage160-1000 V
Pnom ratio (DC:AC)0.97
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 modules560 units
Nominal (STC)325 kWp
Modules40 string x 14 In series

At operating cond. (50°C)

Pmpp301 kWp
U mpp575 V
I mpp524 A

Inverter

Manufacturer

Growatt New Energy

Model

MID 40KTL3-X

(Original PVsyst database)

Unit Nom. Power40.0 kWac
Number of inverters7 units
Total power280 kWac
Operating voltage200-1000 V
Pnom ratio (DC:AC)1.16
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 modules350 units
Nominal (STC)203 kWp
Modules25 string x 14 In series

At operating cond. (50°C)

Pmpp188 kWp
U mpp575 V
I mpp327 A

Inverter

Manufacturer

Growatt New Energy

Model

MAX 60KTL3 LV

(Original PVsyst database)

Unit Nom. Power60.0 kWac
Number of inverters3 units
Total power180 kWac
Operating voltage200-1000 V
Pnom ratio (DC:AC)1.13
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 modules308 units
Nominal (STC)179 kWp
Modules22 string x 14 In series

At operating cond. (50°C)

Pmpp166 kWp
U mpp575 V
I mpp288 A

Inverter

Manufacturer

Growatt New Energy

Model

MAX 80KTL3 LV

(Original PVsyst database)

Unit Nom. Power80.0 kWac
Number of inverters2 units
Total power160 kWac
Operating voltage200-1000 V
Pnom ratio (DC:AC)1.12
Power sharing within this inverter

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PV Array Characteristics**Total PV power**

Nominal (STC) 746 kWp
Total 1287 modules
Module area 3322 m²

Total inverter power

Total power 665 kWac
Number of inverters 14 units
Pnom ratio 1.12

Array losses**Array Soiling Losses**

Loss Fraction 2.0 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 29.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

Serie Diode Loss

Voltage drop 0.7 V
Loss Fraction 0.2 % 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 7.6 mΩ
Loss Fraction 1.5 % at STC

Array #1 - PV Array

Global array res. 153 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sub-array #3

Global array res. 18 mΩ
Loss Fraction 1.5 % at STC

Array #5 - Sub-array #5

Global array res. 33 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sub-array #2

Global array res. 238 mΩ
Loss Fraction 1.5 % at STC

Array #4 - Sub-array #4

Global array res. 29 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 220 Vac tri
Loss Fraction 0.01 % at STC

Inverters: MID 20KTL3-XL, MAX 60KTL3 LV

Wire section (4 Inv.) Alu 4 x 3 x 35 mm²
Average wires length 6 m

Inverter: MID 40KTL3-X

Wire section (7 Inv.) Alu 7 x 3 x 25 mm²
Average wires length 0 m

Inverter: MID 25KTL3-X

Wire section (1 Inv.) Alu 1 x 3 x 10 mm²
Wires length 0 m

Inverter: MAX 80KTL3 LV

Wire section (2 Inv.) Alu 2 x 3 x 70 mm²
Average wires length 0 m



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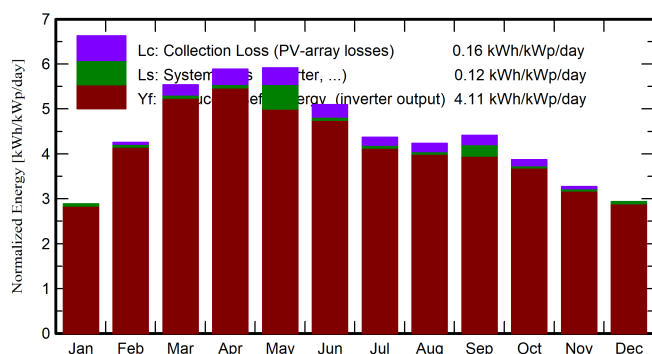
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Main results

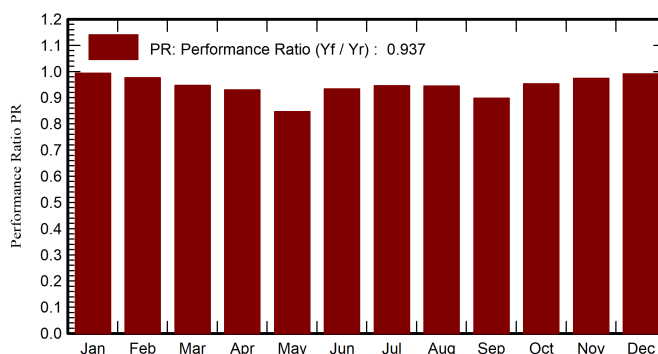
System Production

Produced Energy (P50)	1119473 kWh/year	Specific production (P50)	1500 kWh/kWp/year	Perf. Ratio PR	93.73 %
Produced Energy (P90)	1093594 kWh/year	Specific production (P90)	1465 kWh/kWp/year		
Produced Energy (P75)	1105867 kWh/year	Specific production (P75)	1481 kWh/kWp/year		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

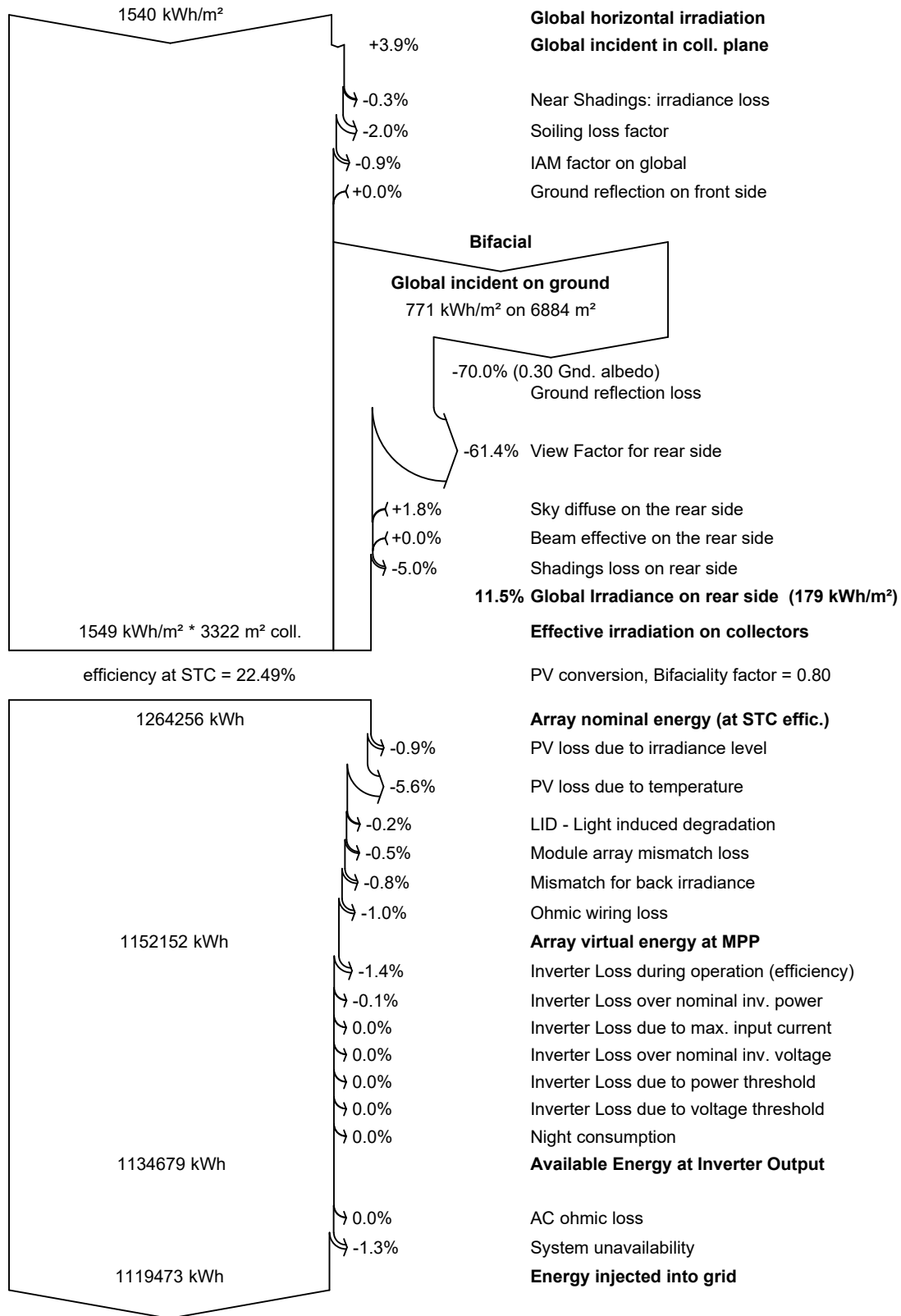
	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	kWh	kWh	ratio
January	80.2	49.9	14.12	88.7	85.7	66779	65765	0.994
February	108.8	58.4	18.43	119.2	115.6	88172	86918	0.977
March	161.1	74.2	24.12	171.7	166.6	123083	121360	0.947
April	172.5	88.6	29.85	176.5	171.2	124277	122564	0.930
May	183.9	100.5	32.64	183.4	177.8	128425	115864	0.846
June	154.8	99.2	32.15	152.8	148.0	108106	106517	0.934
July	137.4	93.6	29.95	135.5	131.0	97165	95722	0.946
August	130.8	88.4	29.44	131.2	126.8	93898	92522	0.944
September	127.4	73.4	28.48	132.3	127.9	94408	88623	0.897
October	112.5	69.6	26.25	120.0	116.3	86663	85382	0.953
November	89.2	57.1	20.53	98.1	94.8	72298	71272	0.974
December	81.2	53.7	15.71	90.6	87.5	67948	66964	0.990
Year	1539.9	906.5	25.17	1600.1	1549.2	1151221	1119473	0.937

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		



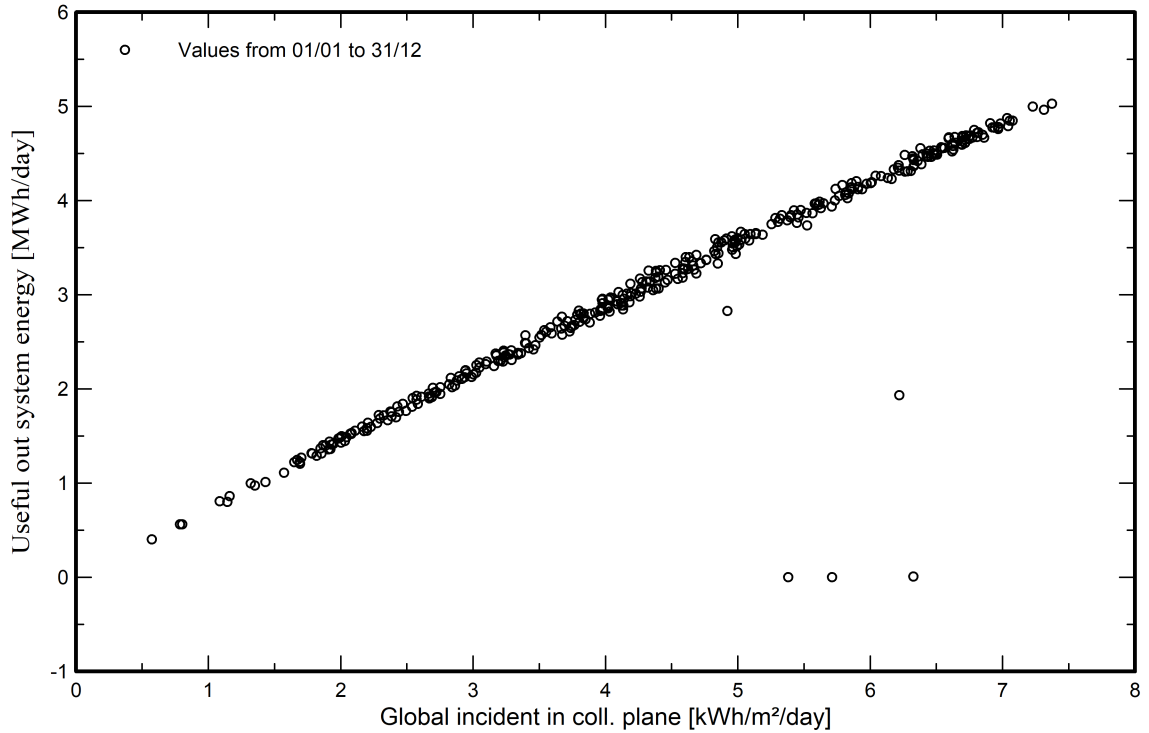
Loss diagram



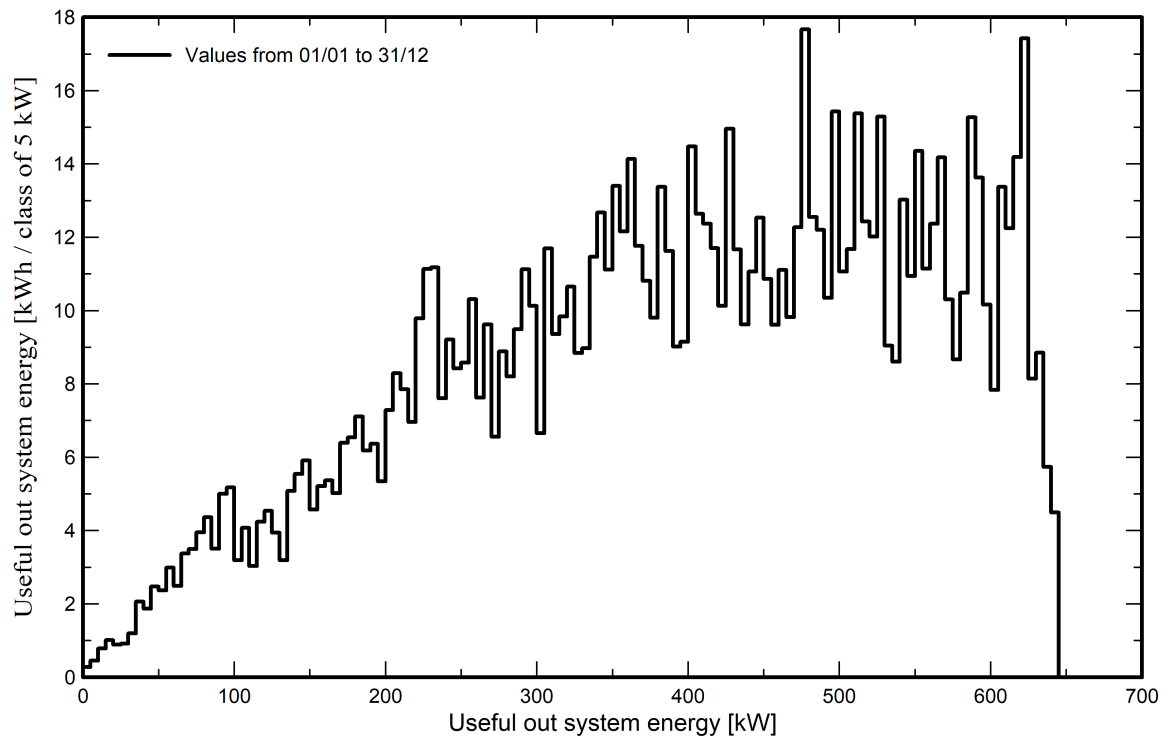


Predef. graphs

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 %

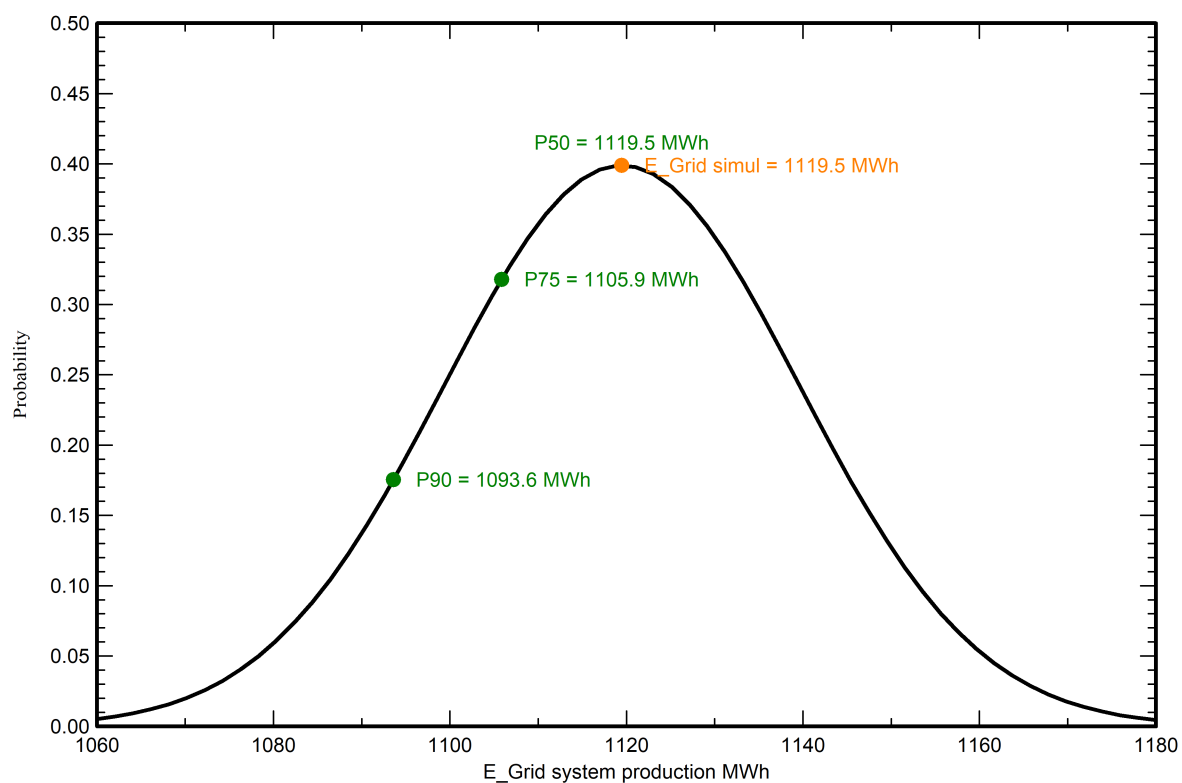
Simulation and parameters uncertainties

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 20.2 MWh
P50 1119.5 MWh
P90 1093.6 MWh
P75 1105.9 MWh

Probability distribution

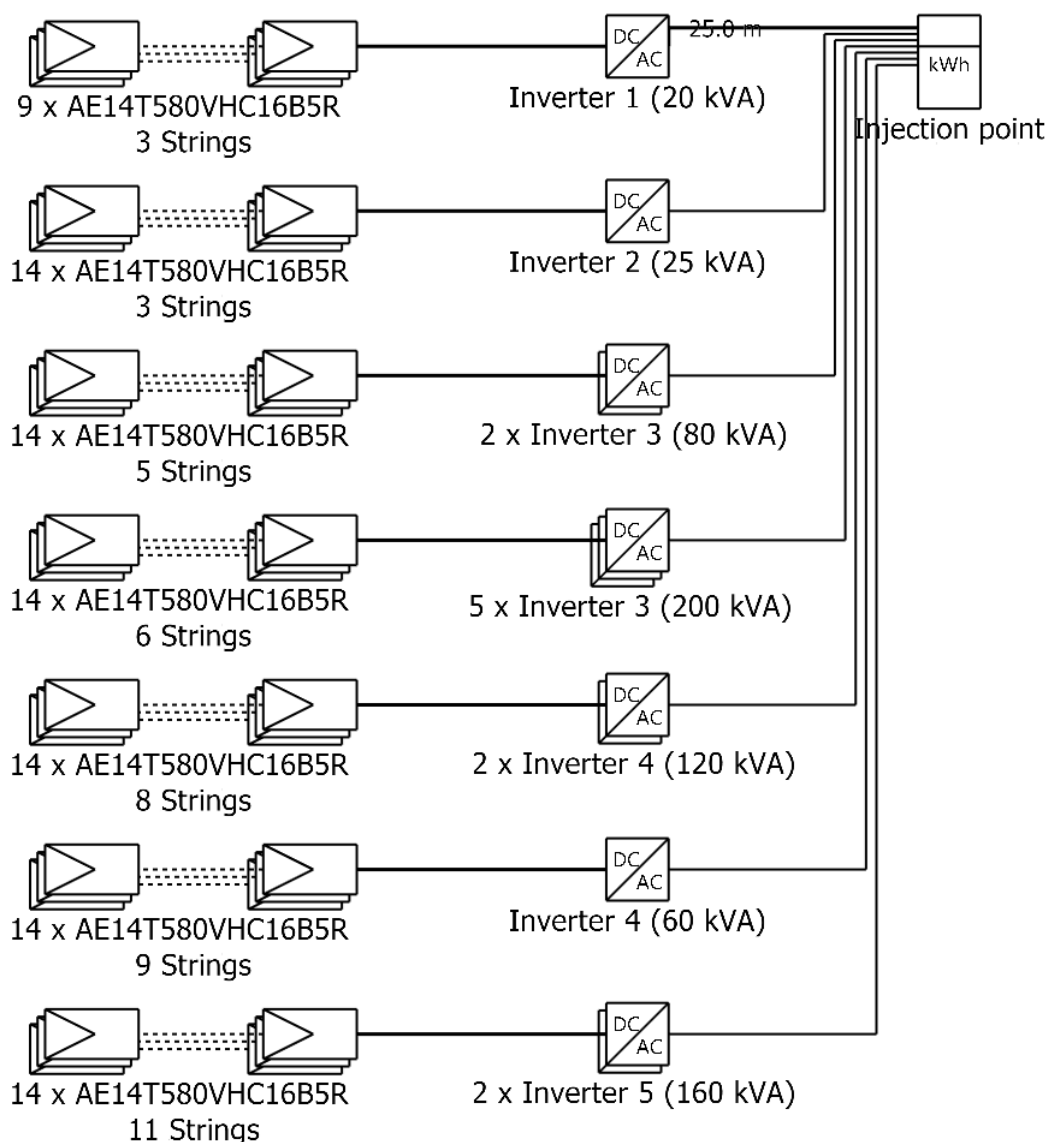




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Single-line diagram



PV module	AE14T580VHC16B5R
Inverter 1	MID 20KTL3-XL
Inverter 2	MID 25KTL3-X
Inverter 3	MID 40KTL3-X
Inverter 4	MAX 60KTL3 LV
Inverter 5	MAX 80KTL3 LV
String 1	9 x AE14T580VHC16B5R
String 2	14 x AE14T580VHC16B5R

Balarampur Hospital

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VC0 : New simulation variant

27/11/24