

PVsyst - Simulation report

Grid-Connected System

Project: NetaJi Subhash College Gorakhpur

Variant: New simulation variant

Unlimited sheds

System power: 450 kWp

Dāūdpur - India

Author

Jakson Limited (India)

**PVsyst V8.0.2**

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with V8.0.2

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Project summary**Geographical Site****Dāūdpur**

India

Situation

Latitude 26.75 °N

Longitude 83.37 °E

Altitude 75 m

Time zone UTC+5.5

Project settings

Albedo 0.20

Weather data

Dāūdpur

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

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

Tilt 10 °

Azimuth 10 °

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

6 units

Pnom total

390 kWac

Pnom ratio

1.153

Results summary

| | | | | | |
|-----------------|-----------------|---------------------|-------------------|----------------|---------|
| Produced Energy | 596310 kWh/year | Specific production | 1327 kWh/kWp/year | Perf. Ratio PR | 86.23 % |
|-----------------|-----------------|---------------------|-------------------|----------------|---------|

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General parameters

Grid-Connected System

Orientation #1

Sheds

| | |
|---------|------|
| Tilt | 10 ° |
| Azimuth | 10 ° |

Models used

| | |
|---------------|------------------|
| Transposition | Perez |
| Diffuse | Perez, Meteonorm |
| Circumsolar | separate |

User's needs

Unlimited load (grid)

Unlimited sheds

Sheds configuration

| | |
|---------------------|----------|
| Nb. of sheds | 10 units |
| Unlimited sheds | |
| Shading limit angle | |
| Limit profile angle | 11.7 ° |

Sizes

| | |
|----------------------|--------|
| Sheds spacing | 5.50 m |
| Collector width | 3.00 m |
| Average GCR | 54.5 % |
| Top inactive band | 0.02 m |
| Bottom inactive band | 0.02 m |

Horizon

Free Horizon

Near Shadings

Mutual shadings of sheds

PV Array Characteristics

Array #1 - PV Array

PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd
ModelAE14T580VHC16B5R
(Custom parameters definition)

| | |
|----------------------|-------------------------|
| Unit Nom. Power | 580 Wp |
| Number of PV modules | 70 units |
| Nominal (STC) | 40.6 kWp |
| Modules | 5 string x 14 In series |

At operating cond. (50°C)

| | |
|-------|----------|
| Pmpp | 37.6 kWp |
| U mpp | 575 V |
| I mpp | 65 A |

Array #2 - Sub-array #2

PV module

ManufacturePanasonic Life Solutions India Pvt. Ltd
ModelAE14T580VHC16B5R
(Custom parameters definition)

| | |
|----------------------|--------------------------|
| Unit Nom. Power | 580 Wp |
| Number of PV modules | 540 units |
| Nominal (STC) | 313 kWp |
| Modules | 36 string x 15 In series |

At operating cond. (50°C)

| | |
|-------|---------|
| Pmpp | 290 kWp |
| U mpp | 616 V |
| I mpp | 471 A |

Inverter

ManufacturerGrowatt New Energy
ModelMAC 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) | 1.35 |
| Power sharing within this inverter | |

Inverter

ManufacturerGrowatt New Energy
ModelMAX 70KTL3 LV
(Original PVsyst database)

| | |
|------------------------------------|------------|
| Unit Nom. Power | 70.0 kWac |
| Number of inverters | 4 units |
| Total power | 280 kWac |
| Operating voltage | 200-1000 V |
| Pnom ratio (DC:AC) | 1.12 |
| Power sharing within this inverter | |



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PV Array Characteristics

Array #3 - Sub-array #3

PV module

Manufacturer Panasonic Life Solutions India Pvt. Ltd
Model AE14T580VHC16B5R
(Custom parameters definition)

Unit Nom. Power 580 Wp
Number of PV modules 165 units
Nominal (STC) 95.7 kWp
Modules 11 string x 15 In series

At operating cond. (50°C)

Pmpp 88.7 kWp
U mpp 616 V
I mpp 144 A

Total PV power

Nominal (STC) 450 kWp
Total 775 modules
Module area 2000 m²

Inverter

Manufacturer Growatt New Energy
Model MAX 80KTL3 LV
(Original PVsyst database)

Unit Nom. Power 80.0 kWac
Number of inverters 1 unit
Total power 80.0 kWac
Operating voltage 200-1000 V
Pnom ratio (DC:AC) 1.20
Power sharing within this inverter

Total inverter power

Total power 390 kWac
Number of inverters 6 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/m²K
Uv (wind) 0.0 W/m²K/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 1.0 % at MPP

Array #2 - Sub-array #2

Loss Fraction 1.0 % at MPP

Array #3 - Sub-array #3

Loss Fraction 1.0 % 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. 143 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sub-array #2

Global array res. 21 mΩ
Loss Fraction 1.5 % at STC

Array #3 - Sub-array #3

Global array res. 70 mΩ
Loss Fraction 1.5 % at STC



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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 70KTL3 LV

Wire section (5 Inv.) Alu 5 x 3 x 50 mm²
Average wires length 6 m

Inverter: MAX 80KTL3 LV

Wire section (1 Inv.) Alu 1 x 3 x 70 mm²
Wires length 0 m



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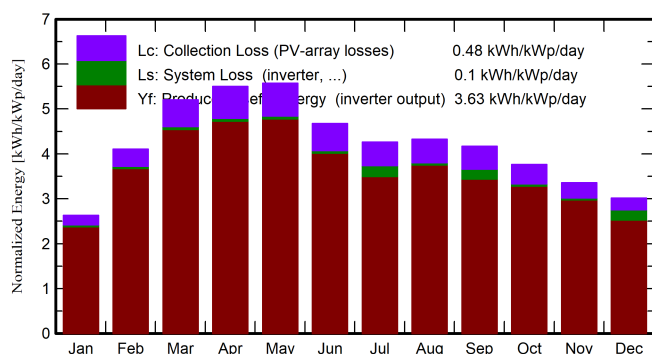
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Main results

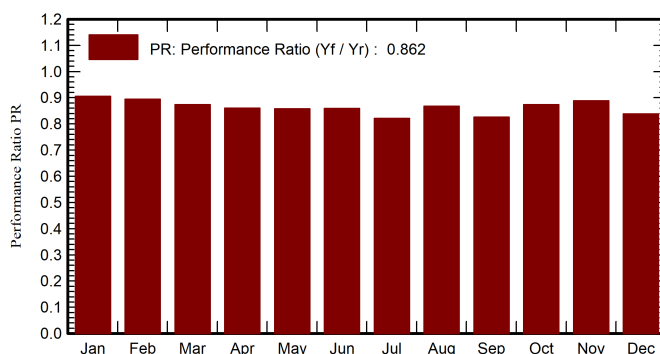
System Production

| | | | | | |
|-----------------------|-----------------|---------------------------|-------------------|----------------|---------|
| Produced Energy (P50) | 596310 kWh/year | Specific production (P50) | 1327 kWh/kWp/year | Perf. Ratio PR | 86.23 % |
| Produced Energy (P90) | 582525 kWh/year | Specific production (P90) | 1296 kWh/kWp/year | | |
| Produced Energy (P75) | 589062 kWh/year | Specific production (P75) | 1310 kWh/kWp/year | | |

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

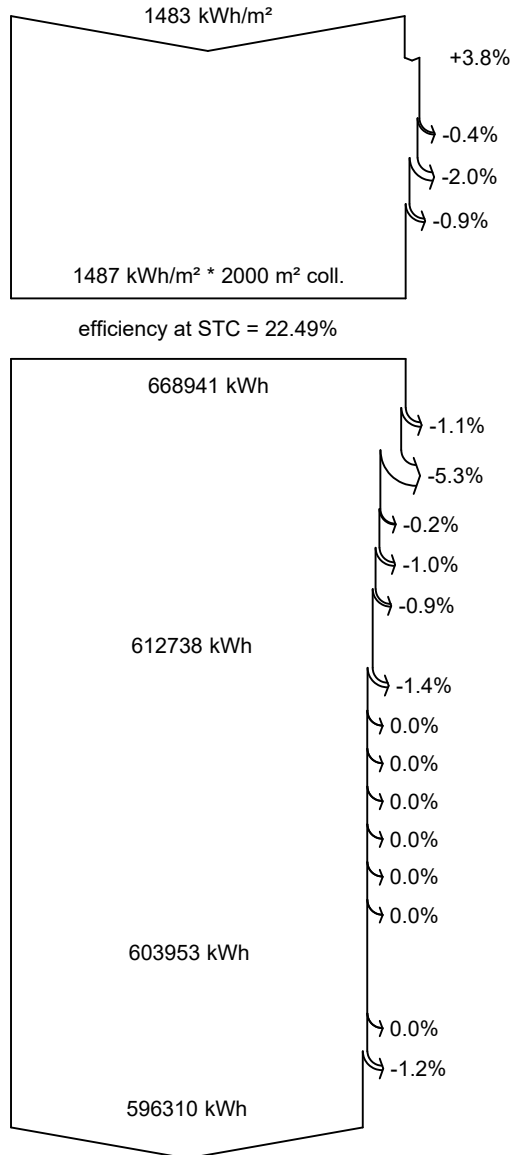
| | GlobHor kWh/m ² | DiffHor kWh/m ² | T_Amb °C | GlobInc kWh/m ² | GlobEff kWh/m ² | EArray kWh | E_Grid kWh | PR ratio |
|-----------|-------------------------------|-------------------------------|-------------|-------------------------------|-------------------------------|---------------|---------------|-------------|
| January | 74.4 | 49.0 | 14.53 | 81.6 | 78.7 | 33753 | 33225 | 0.906 |
| February | 105.5 | 58.9 | 19.24 | 115.0 | 111.3 | 46888 | 46258 | 0.895 |
| March | 152.0 | 75.4 | 24.74 | 161.3 | 156.3 | 64235 | 63353 | 0.874 |
| April | 161.7 | 91.4 | 29.33 | 165.2 | 159.8 | 64694 | 63841 | 0.860 |
| May | 173.6 | 105.3 | 31.03 | 172.8 | 167.3 | 67577 | 66651 | 0.858 |
| June | 142.3 | 92.7 | 30.61 | 140.3 | 135.6 | 55007 | 54182 | 0.859 |
| July | 133.8 | 86.7 | 29.49 | 132.1 | 127.5 | 52121 | 48776 | 0.822 |
| August | 133.7 | 90.9 | 29.32 | 134.1 | 129.4 | 53061 | 52310 | 0.868 |
| September | 120.9 | 73.0 | 28.36 | 125.0 | 120.7 | 49425 | 46430 | 0.826 |
| October | 109.8 | 71.1 | 26.20 | 116.7 | 112.7 | 46487 | 45826 | 0.874 |
| November | 91.6 | 56.6 | 21.03 | 100.8 | 97.3 | 40800 | 40222 | 0.888 |
| December | 83.5 | 52.8 | 16.46 | 93.5 | 90.3 | 38488 | 35235 | 0.838 |
| Year | 1482.8 | 903.9 | 25.05 | 1538.4 | 1486.9 | 612538 | 596310 | 0.862 |

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



Global horizontal irradiation

Global incident in coll. plane

Near Shadings: irradiance loss

Soiling loss factor

IAM factor on global

Effective irradiation on collectors

PV conversion

Array nominal energy (at STC effic.)

PV loss due to irradiance level

PV loss due to temperature

LID - Light induced degradation

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

Night consumption

Available Energy at Inverter Output

AC ohmic loss

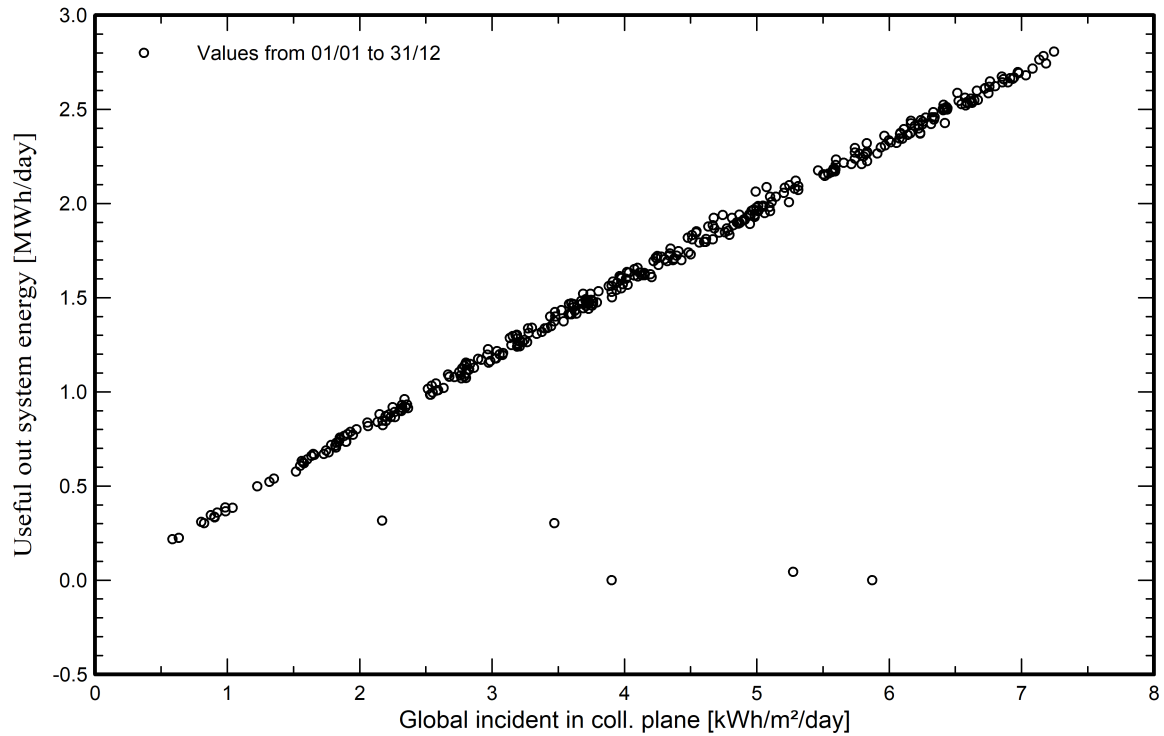
System unavailability

Energy injected into grid

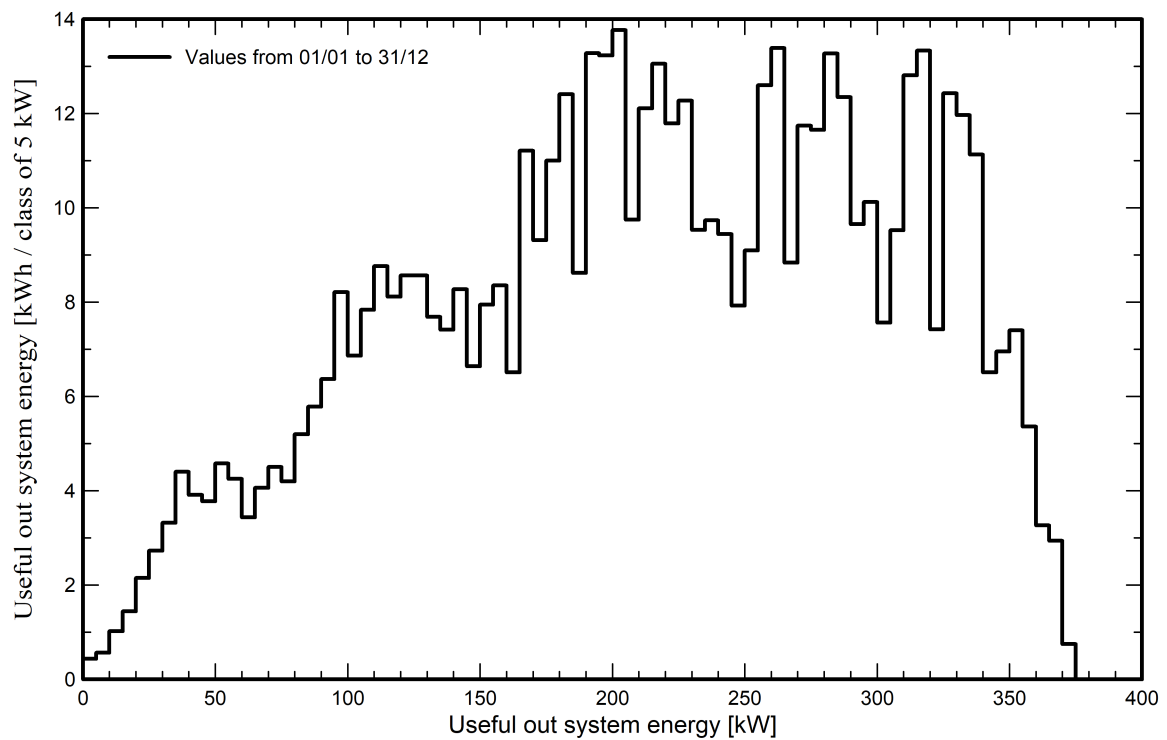


Predef. graphs

Daily Input/Output diagram



System Output Power Distribution





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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 %

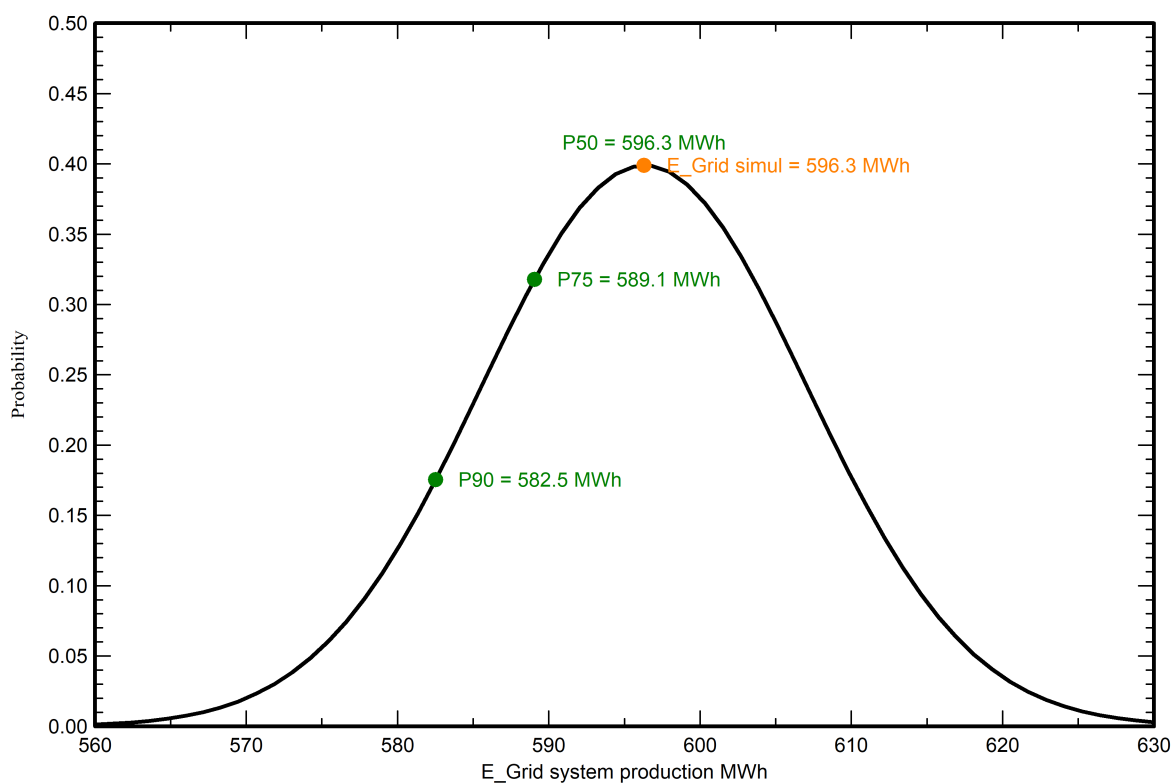
Simulation and parameters uncertainties

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 10.8 MWh
P50 596.3 MWh
P90 582.5 MWh
P75 589.1 MWh

Probability distribution

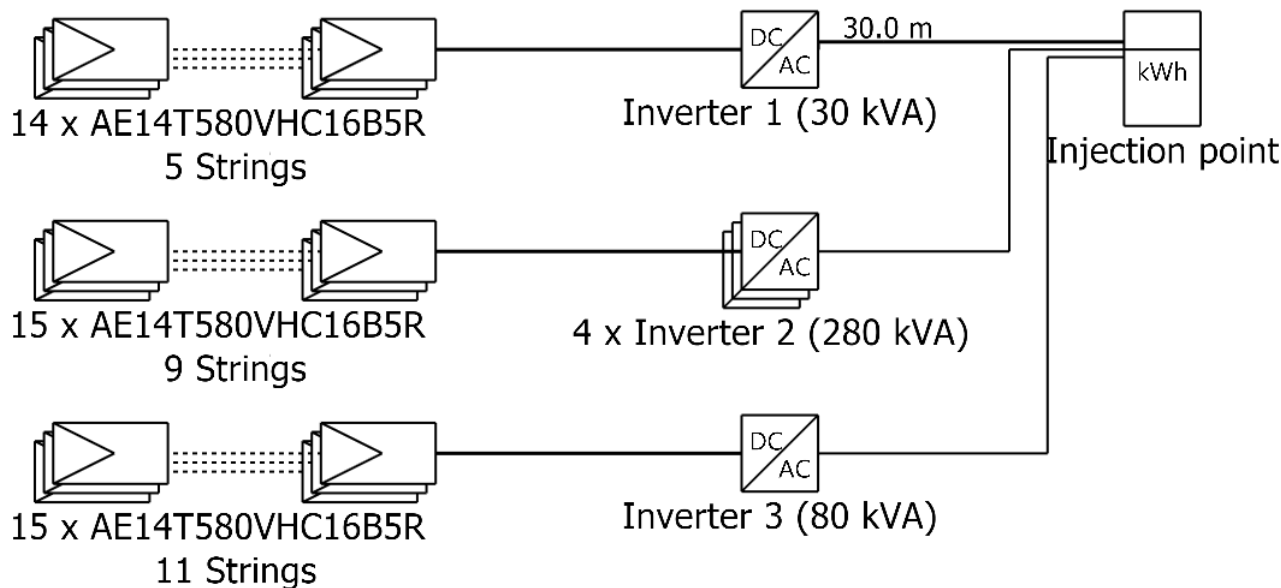




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Single-line diagram



| | |
|------------|-----------------------|
| PV module | AE14T580VHC16B5R |
| Inverter 1 | MAC 30KTL3-X LV |
| Inverter 2 | MAX 70KTL3 LV |
| Inverter 3 | MAX 80KTL3 LV |
| String 1 | 14 x AE14T580VHC16B5R |
| String 2 | 15 x AE14T580VHC16B5R |

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VC0 : New simulation variant

04/12/24