

MARCHÉ GLOBAL DE CONCEPTION - REALISATION POUR L'EXTENSION DU CENTRE HOSPITALIER DU FRANCOIS ET LA CONSTRUCTION D'UN LOGIPOLE INTER-SITE SUR LE NOUVEAU SITE DU CENTRE HOSPITALIER DU SAINT-ESPRIT



## ANNEXE 9 : CALCUL PV CHEWA

**PRO**

# PVsyst - Simulation report

## Grid-Connected System

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Project: PV CHEWA

Variant: CHEWA 60 kWc

Tables on a building

System power: 59.9 kWp

Fort de France/Aime Cesaire/Four à Chaux - France Martinique

**Auteur**

H3C-CARAÏBES (Martinique)



## Project: PV CHEWA

Variant: CHEWA 60 kWc

### PVsyst V7.4.0

VC0, Simulation date:  
20/07/23 09:25  
with v7.4.0

H3C-CARAÏBES (Martinique)

### Project summary

#### Geographical Site

Fort de France/Aime Cesaire/Four à Chaux  
France Martinique

#### Situation

Latitude 14.59 °N  
Longitude -61.00 °W  
Altitude 7 m  
Time zone UTC-4

#### Project settings

Albedo 0.20

#### Meteo data

Fort de France/Aime Cesaire/Four à Chaux  
MeteoNorm 8.0 station - Synthétique

### System summary

#### Grid-Connected System

#### PV Field Orientation

Fixed plane  
Tilt/Azimuth 15 / 15 °

#### Tables on a building

#### Near Shadings

Linear shadings

#### User's needs

Unlimited load (grid)

#### System information

##### PV Array

Nb. of modules 146 units  
Pnom total 59.9 kWp

##### Inverters

Nb. of units 4 units  
Pnom total 56.0 kWac  
Pnom ratio 1.069

### Results summary

Produced Energy 96737 kWh/year Specific production 1616 kWh/kWp/year Perf. Ratio PR 80.53 %

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### General parameters

#### Grid-Connected System

#### PV Field Orientation

##### Orientation

Fixed plane  
Tilt/Azimuth 15 / 15 °

#### Horizon

Free Horizon

#### Tables on a building

#### Sheds configuration

Nb. of sheds 15 units  
Averages of diff. arrays

#### Sizes

Sheds spacing 2.05 m  
Collector width 1.13 m  
Ground Cov. Ratio (GCR) 55.2 %  
Top inactive band 0.02 m  
Bottom inactive band 0.02 m

#### Shading limit angle

Limit profile angle 17.6 °

#### Near Shadings

Linear shadings

#### Models used

Transposition Perez  
Diffuse Perez, Meteonorm  
Circumsolar separate

#### User's needs

Unlimited load (grid)

### PV Array Characteristics

#### PV module

Manufacturer Jinkosolar  
Model JKM-410M-54HL4  
(Original PVsyst database)  
Unit Nom. Power 410 Wp  
Number of PV modules 80 units  
Nominal (STC) 32.8 kWp

#### Array #1 - Champ PV

Number of PV modules 40 units  
Nominal (STC) 16.40 kWp  
Modules 2 Strings x 20 In series

#### At operating cond. (50°C)

Pmpp 14.99 kWp  
U mpp 563 V  
I mpp 27 A

#### Array #3 - Sous-champ #3

Number of PV modules 40 units  
Nominal (STC) 16.40 kWp  
Modules 2 Strings x 20 In series

#### At operating cond. (50°C)

Pmpp 14.99 kWp  
U mpp 563 V  
I mpp 27 A

#### Inverter

Manufacturer SMA  
Model Sunny Tripower 15000TL  
(Original PVsyst database)  
Unit Nom. Power 15.0 kWac  
Number of inverters 2 units  
Total power 30.0 kWac

Number of inverters 2 \* MPPT 50% 1 unit  
Total power 15.0 kWac

Operating voltage 240-800 V  
Pnom ratio (DC:AC) 1.09  
No power sharing between MPPTs

Number of inverters 2 \* MPPT 50% 1 unit  
Total power 15.0 kWac

Operating voltage 240-800 V  
Pnom ratio (DC:AC) 1.09  
No power sharing between MPPTs



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## PV Array Characteristics

## Array #2 - Sous-champ #2

## PV module

Manufacturer Jinkosolar  
Model JKM-410M-54HL4

(Original PVsyst database)

Unit Nom. Power 410 Wp  
Number of PV modules 18 units  
Nominal (STC) 7.38 kWp  
Modules 2 Strings x 9 In series

## At operating cond. (50°C)

Pmpp 6.74 kWp  
U mpp 253 V  
I mpp 27 A

## Array #4 - Sous-champ #4

## PV module

Manufacturer Jinkosolar  
Model JKM-410M-54HL4

(Original PVsyst database)

Unit Nom. Power 410 Wp  
Number of PV modules 48 units  
Nominal (STC) 19.68 kWp  
Modules 2 Strings x 24 In series

## At operating cond. (50°C)

Pmpp 17.99 kWp  
U mpp 675 V  
I mpp 27 A

## Total PV power

Nominal (STC) 60 kWp  
Total 146 modules  
Module area 285 m<sup>2</sup>

## Inverter

Manufacturer SMA  
Model Sunny Boy 6000 US-12-208

(Original PVsyst database)

Unit Nom. Power 6.00 kWac  
Number of inverters 1 unit  
Total power 6.0 kWac  
Operating voltage 250-480 V  
Pnom ratio (DC:AC) 1.23

## Inverter

Manufacturer SMA  
Model Sunny Tripower 20000TL-30

(Original PVsyst database)

Unit Nom. Power 20.0 kWac  
Number of inverters 2 \* MPPT 50% 1 unit  
Total power 20.0 kWac  
Operating voltage 320-800 V  
Pnom ratio (DC:AC) 0.98  
No power sharing between MPPTs

## Total inverter power

Total power 56 kWac  
Number of inverters 4 units  
Pnom ratio 1.07  
No power sharing

## Array losses

## Thermal Loss factor

Module temperature according to irradiance  
Uc (const) 20.0 W/m<sup>2</sup>K  
Uv (wind) 0.0 W/m<sup>2</sup>K/m/s

## Module Quality Loss

Loss Fraction -0.8 %

## Module mismatch losses

## Array #1 - Champ PV

Loss Fraction 2.0 % at MPP

## Array #2 - Sous-champ #2

Loss Fraction 2.0 % at MPP

## Array #3 - Sous-champ #3

Loss Fraction 2.0 % at MPP

## Array #4 - Sous-champ #4

Loss Fraction 2.0 % at MPP

## IAM loss factor

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



### DC wiring losses

Global wiring resistance 10 mΩ

Loss Fraction 1.5 % at STC

#### Array #1 - Champ PV

Global array res. 351 mΩ

Loss Fraction 1.5 % at STC

#### Array #3 - Sous-champ #3

Global array res. 351 mΩ

Loss Fraction 1.5 % at STC

#### Array #2 - Sous-champ #2

Global array res. 158 mΩ

Loss Fraction 1.5 % at STC

#### Array #4 - Sous-champ #4

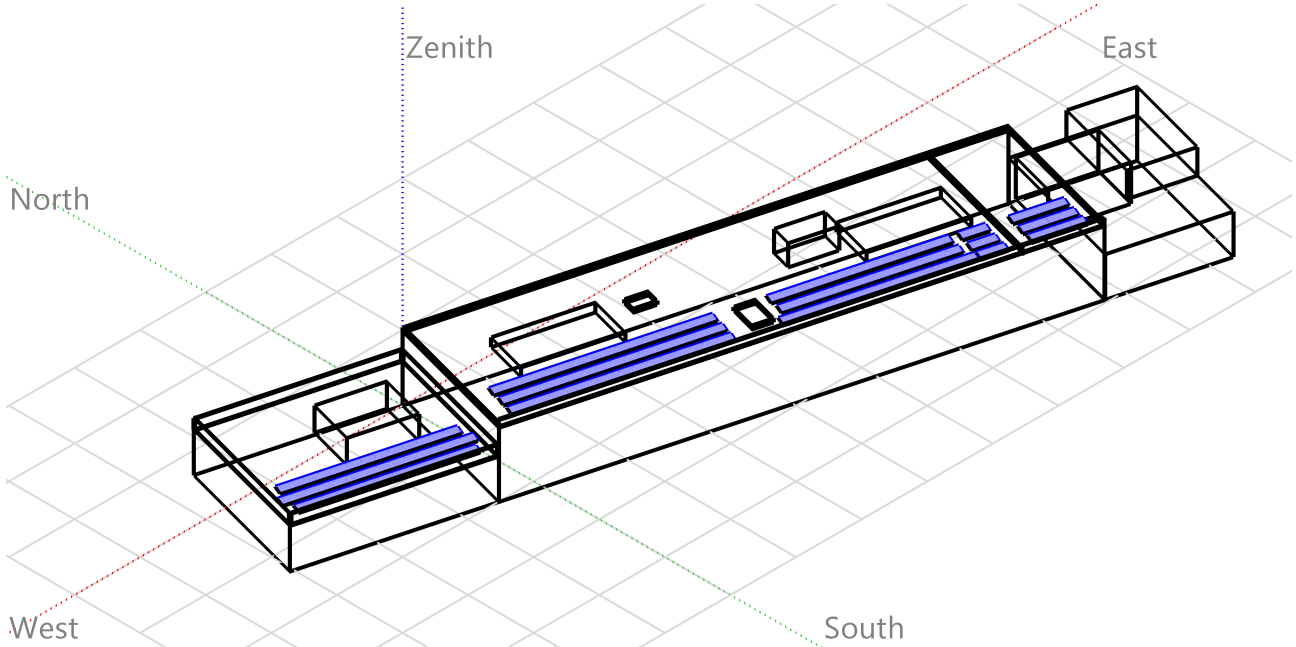
Global array res. 421 mΩ

Loss Fraction 1.5 % at STC



### Near shadings parameter

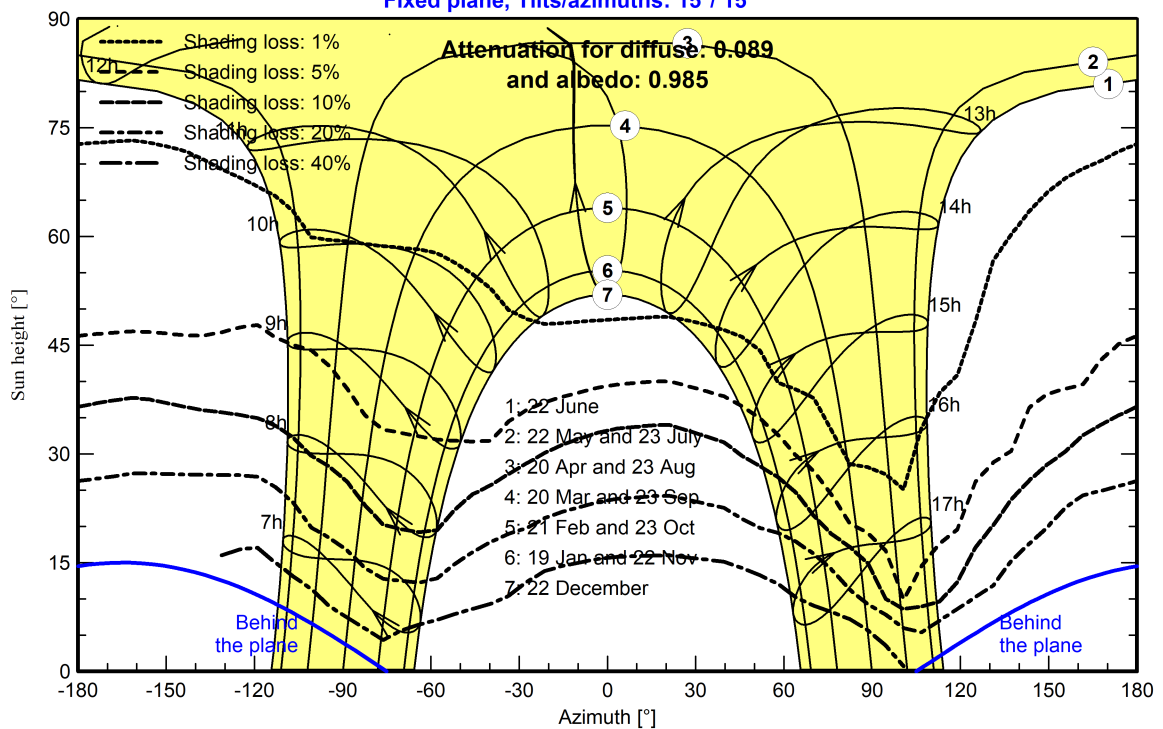
Perspective of the PV-field and surrounding shading scene



### Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 15°/ 15°







## Main results

## System Production

Produced Energy

96737 kWh/year

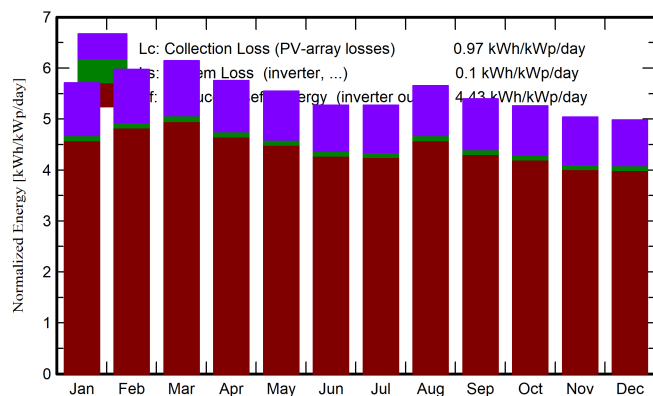
Specific production

1616 kWh/kWp/year

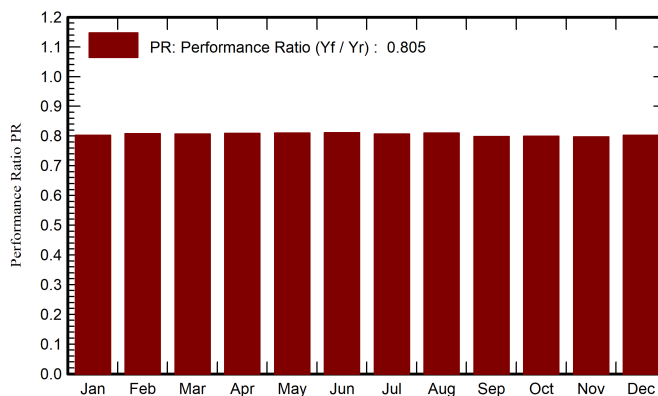
Perf. Ratio PR

80.53 %

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	155.1	62.90	26.00	177.0	165.6	8692	8505	0.803
February	151.4	59.70	25.10	167.4	157.5	8272	8096	0.808
March	182.9	70.40	25.60	190.4	180.4	9406	9201	0.807
April	176.1	74.50	26.10	172.7	163.3	8547	8359	0.809
May	182.7	80.90	27.10	172.0	161.9	8520	8333	0.810
June	170.1	89.40	27.20	158.2	148.1	7853	7681	0.811
July	175.1	89.90	27.60	163.4	152.9	8069	7890	0.807
August	181.3	91.10	27.70	175.3	165.4	8684	8496	0.810
September	159.8	76.80	27.00	161.9	152.3	7916	7738	0.799
October	153.2	68.40	27.00	163.0	153.3	7979	7801	0.799
November	135.5	61.80	26.10	151.2	140.7	7381	7215	0.797
December	133.8	56.90	25.10	154.4	142.6	7588	7421	0.803
Year	1957.0	882.70	26.48	2006.9	1884.0	98908	96737	0.805

## Legends

GlobHor Global horizontal 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

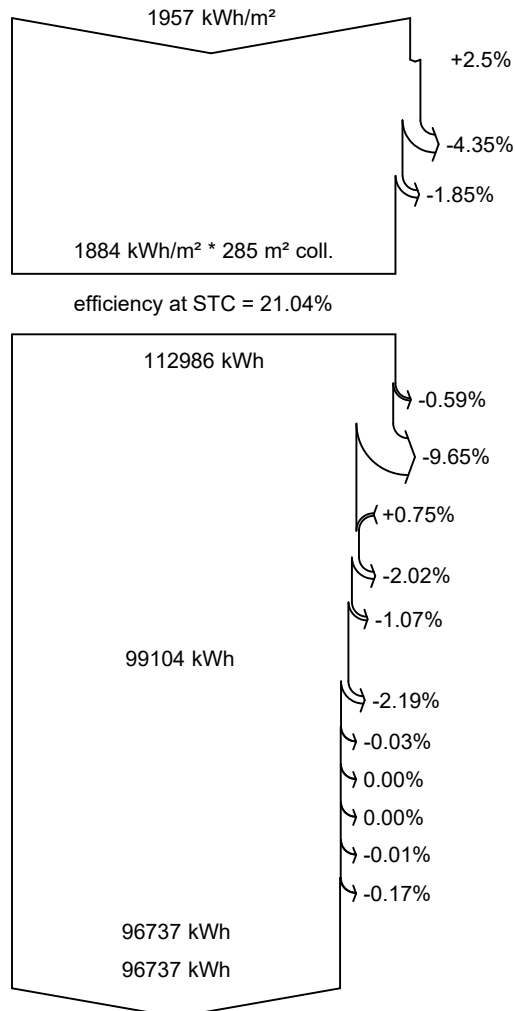
E\_Grid Energy injected into grid

PR Performance Ratio





### Loss diagram



**Global horizontal irradiation**

**Global incident in coll. plane**

Near Shadings: irradiance loss

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

Module quality loss

Module array mismatch loss

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

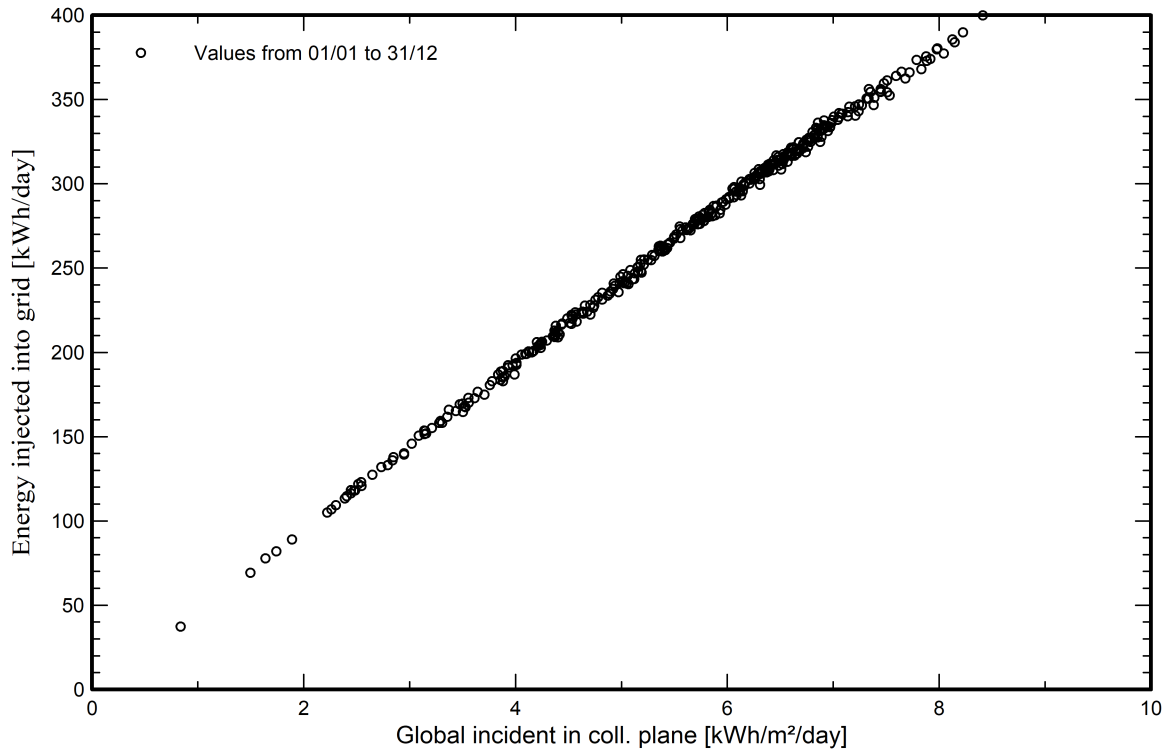
**Available Energy at Inverter Output**

**Energy injected into grid**

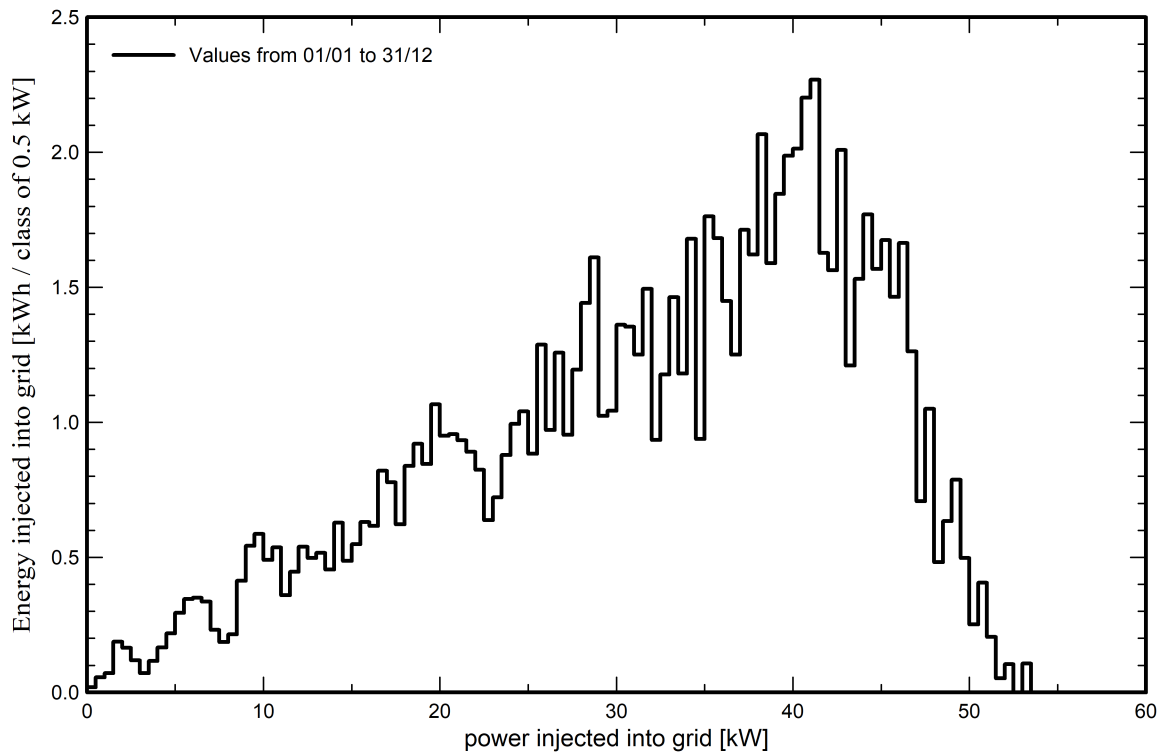


Predef. graphs

Diagramme d'entrée/sortie journalier



Distribution de la puissance de sortie système





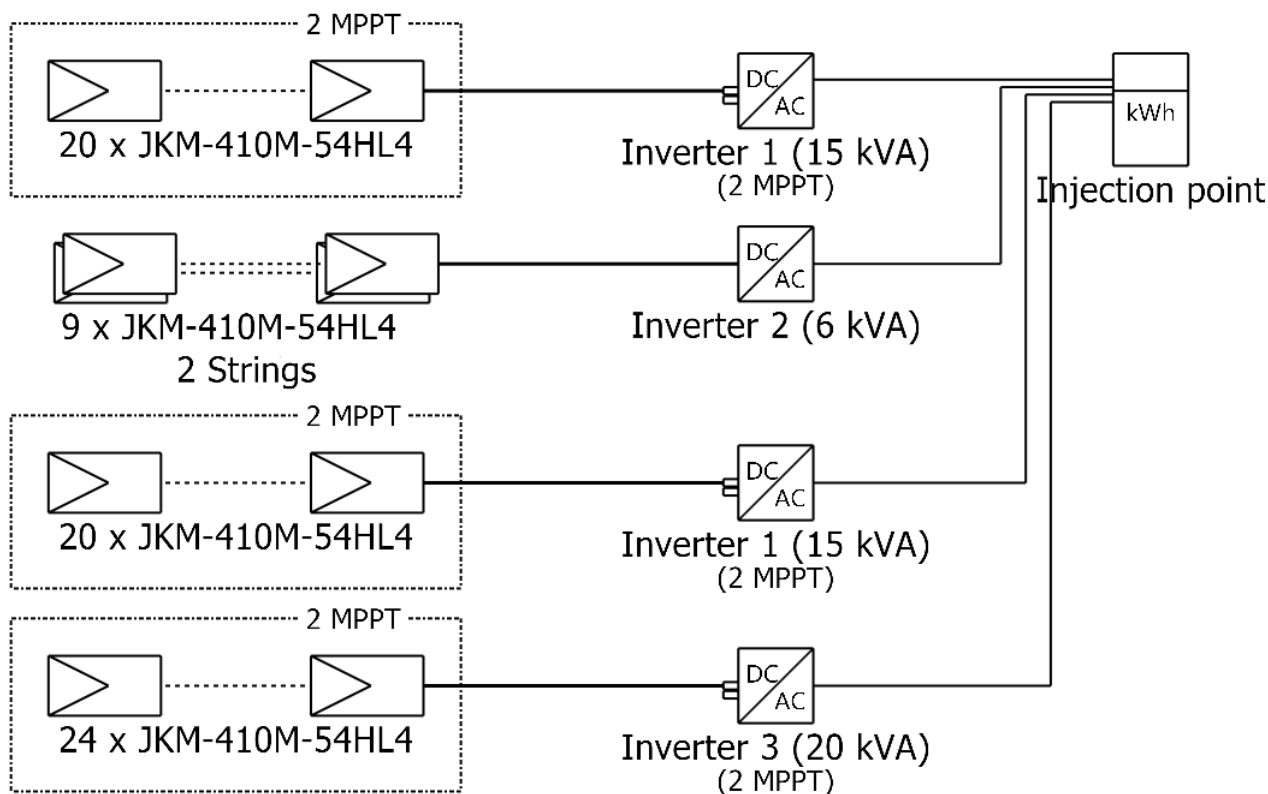
**PVsyst V7.4.0**

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# Single-line diagram



PV module	JKM-410M-54HL4
Inverter 1	Sunny Tripower 15000TL
Inverter 2	Sunny Boy 6000 US-12-208
Inverter 3	Sunny Tripower 20000TL-30
String 1	20 x JKM-410M-54HL4
String 2	9 x JKM-410M-54HL4
String 3	24 x JKM-410M-54HL4

PV CHEWA

H3C-CARAÏBES (M  
artinique)

VC0 : CHEWA 60 kWc

20/07/23