

ภาคผนวก ช

ผลการประเมินค่าสัดส่วนสมรรถภาพของระบบผลิตไฟฟ้า

ระยะที่ 1



Project: SCS Siam Construction Steel (Tata)

Variant: VC7. Admi Building (36.5 kWp)

CONSTANT ENERGY

PVsyst V7.3.2

VC7, Simulation date:
24/02/23 15:35
with v7.3.2

CONSTANT ENERGY SERVICES (THAILAND) CO., LTD.

Project summary

Geographical Site

Map Ta Phut IE

Thailand

Situation

Latitude 12.69 °N

Longitude 101.14 °E

Altitude 19 m

Time zone UTC+7

Project settings

Albedo 0.20

Meteo data

Map Ta Phut IE

SolarGIS Monthly aver. , period not spec. - Synthetic

System summary

Grid-Connected System

No 3D scene defined, no shadings

PV Field Orientation

Fixed plane

Tilt/Azimuth 15 / -45 °

Near Shadings

No Shadings

User's needs

Unlimited load (grid)

System information

PV Array

Nb. of modules

140 units

Pnom total

36.4 kWp

Inverters

Nb. of units

2 units

Pnom total

40.0 kWac

Pnom ratio

0.910

Results summary

Produced Energy 52.55 MWh/year Specific production 1444 kWh/kWp/year Perf. Ratio PR 78.06 %

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General parameters

Grid-Connected System

No 3D scene defined, no shadings

PV Field Orientation

Orientation

Fixed plane

Tilt/Azimuth 15 / -45 °

Sheds configuration

No 3D scene defined

Models used

Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

Horizon

Free Horizon

Near Shadings

No Shadings

User's needs

Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer

Jinkosolar

Model

JKM 260PP-60 (Plus)

(Original PVsyst database)

Unit Nom. Power

260 Wp

Number of PV modules

140 units

Nominal (STC)

36,4 kWp

Inverter

Manufacturer

Delta Energy

Model

Solar Inverter RPI M20A

(Original PVsyst database)

Unit Nom. Power

20.0 kWac

Number of inverters

2 units

Total power

40,0 kWac

Array #1 - PV Array

Number of PV modules

80 units

Nominal (STC)

20,80 kWp

Modules

4 Strings x 20 In series

Number of inverters

1 unit

Total power

20,0 kWac

At operating cond. (50°C)

Pmpp

18,79 kWp

U mpp

556 V

I mpp

34 A

Operating voltage

200-820 V

Max. power (=>40°C)

21,0 kWac

Pnom ratio (DC:AC)

1,04

Power sharing within this inverter

Array #2 - Sub-array #2

Number of PV modules

60 units

Nominal (STC)

15,60 kWp

Modules

3 Strings x 20 In series

Number of inverters

1 unit

Total power

20,0 kWac

At operating cond. (50°C)

Pmpp

14,10 kWp

U mpp

556 V

I mpp

25 A

Operating voltage

200-820 V

Max. power (=>40°C)

21,0 kWac

Pnom ratio (DC:AC)

0,78

Power sharing within this inverter

Total PV power

Nominal (STC)

36 kWp

Total

140 modules

Module area

229 m²

Cell area

204 m²

Total inverter power

Total power

40 kWac

Max. power

42 kWac

Number of inverters

2 units

Pnom ratio

0,91

Array losses

Array Soiling Losses

Loss Fraction 2,0 %

Thermal Loss factor

Module temperature according to irradiance

Uc (const)

20,0 W/m²K

Uv (wind)

0,0 W/m²K/m/s

LID - Light Induced Degradation

Loss Fraction 2,0 %

Module Quality Loss

Loss Fraction -0,8 %

Module mismatch losses

Loss Fraction 2,0 % at MPP

Strings Mismatch loss

Loss Fraction 0,1 %

IAM loss factor

ASHRAE Param.: IAM = 1 - bo (1/cosi -1)

bo Param. 0,05



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DC wiring losses

Global wiring resistance 10 mΩ
Loss Fraction 1.5 % at STC

Array #1 - PV Array

Global array res. 275 mΩ
Loss Fraction 1.5 % at STC

Array #2 - Sub-array #2

Global array res. 367 mΩ
Loss Fraction 1.5 % at STC

AC wiring losses

Inv. output line up to injection point

Inverter voltage 230 Vac tri
Loss Fraction 0.90 % at STC

Inverter: Solar Inverter RPI M20A

Wire section (2 Inv.) Copper 2 x 3 x 10 mm²
Average wires length 14 m



PVsyst V7.3.2

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Main results

System Production

Produced Energy

52.55 MWh/year

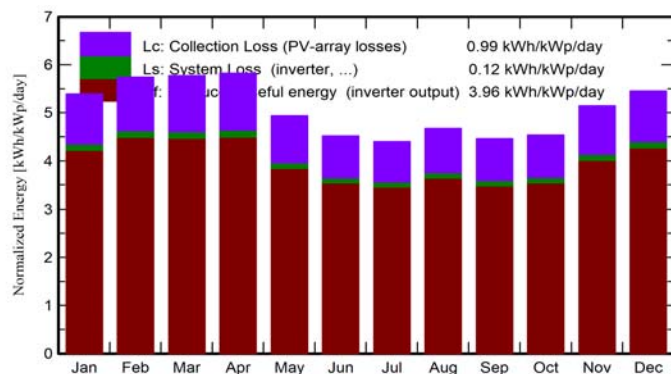
Specific production

1444 kWh/kWp/year

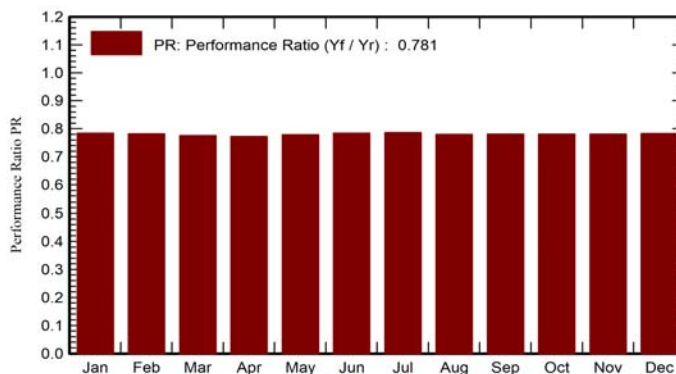
Performance Ratio PR

78.06 %

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 MWh	E_Grid MWh	PR ratio
January	152.3	68.10	26.70	167.1	159.2	4.913	4.767	0.784
February	151.5	72.40	27.40	160.8	153.7	4.718	4.578	0.782
March	176.8	83.50	28.40	179.0	171.0	5.207	5.049	0.775
April	177.6	80.00	29.30	174.7	167.1	5.069	4.914	0.773
May	157.4	76.00	29.40	153.1	145.9	4.478	4.343	0.779
June	142.6	72.90	29.20	135.5	128.8	3.988	3.869	0.785
July	143.8	76.30	28.80	136.4	129.6	4.023	3.903	0.786
August	149.8	78.40	28.80	144.9	138.3	4.244	4.115	0.780
September	133.1	71.40	28.30	133.8	127.8	3.923	3.803	0.781
October	135.8	73.50	27.90	140.7	134.3	4.129	4.003	0.781
November	142.7	65.20	27.70	154.4	147.2	4.522	4.386	0.781
December	152.2	63.30	26.79	169.1	161.4	4.972	4.824	0.784
Year	1815.6	881.00	28.23	1849.6	1764.3	54.186	52.554	0.781

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

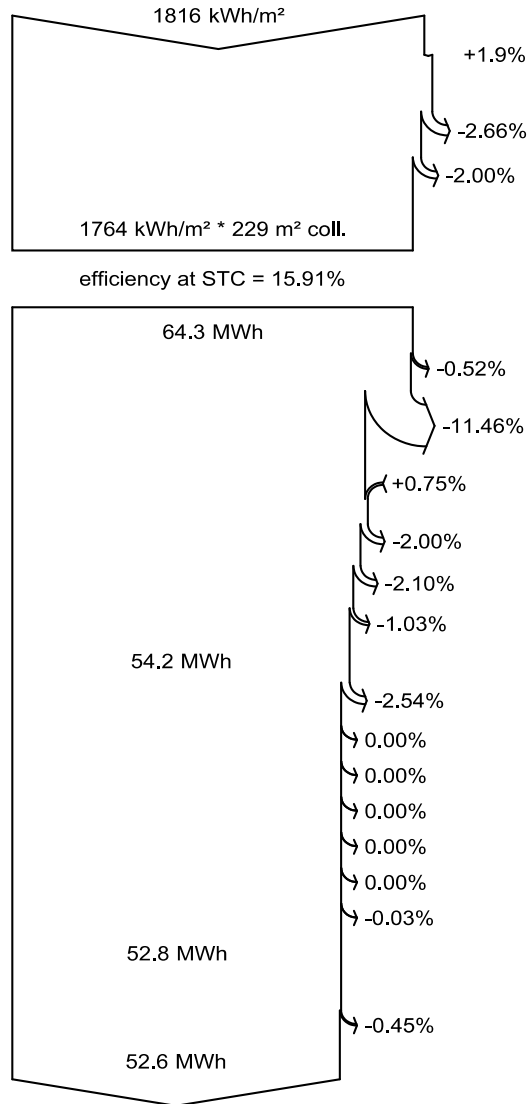


PVsyst V7.3.2

VC7, Simulation date:
24/02/23 15:35
with v7.3.2

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Loss diagram



Global horizontal irradiation

Global incident in coll. plane

IAM factor on global

Soiling loss factor

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

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

Energy injected into grid

ระยะที่ 2

PVSYST V6.52					19/12/17	Page 1/5
Grid-Connected System: Simulation parameters						
Project : Grid-Connected Project at Siam construction steel co						
Geographical Site		Siam construction steel co		Country	Thailand	
Situation		Latitude	12.67° N	Longitude	101.14° E	
Time defined as		Legal Time	Time zone UT+7	Altitude	9 m	
		Albedo	0.20			
Meteo data:		Siam construction steel co	Synthetic			
Simulation variant : New simulation variant						
			Simulation date	19/12/17 15h52		
Simulation parameters						
2 orientations		Tilts/Azimuths	15°/0° and 15°/180°			
Models used		Transposition	Perez	Diffuse	Perez, Meteonorm	
Horizon		Free Horizon				
Near Shadings		No Shadings				
PV Arrays Characteristics (2 kinds of array defined)						
PV module		Si-poly	Model	TSM-325PD14		
Custom parameters definition		Manufacturer	Trina Solar			
Sub-array "Sub-array #1"		Orientation	#1	Tilt/Azimuth	15°/0°	
Number of PV modules		In series	20 modules	In parallel	96 strings	
Total number of PV modules		Nb. modules	1920	Unit Nom. Power	325 Wp	
Array global power		Nominal (STC)	624 kWp	At operating cond.	569 kWp (50°C)	
Array operating characteristics (50°C)		U mpp	678 V	I mpp	838 A	
Sub-array "Sub-array #2"		Orientation	#2	Tilt/Azimuth	15°/180°	
Number of PV modules		In series	20 modules	In parallel	120 strings	
Total number of PV modules		Nb. modules	2400	Unit Nom. Power	325 Wp	
Array global power		Nominal (STC)	780 kWp	At operating cond.	711 kWp (50°C)	
Array operating characteristics (50°C)		U mpp	678 V	I mpp	1048 A	
Total Arrays global power		Nominal (STC)	1404 kWp	Total	4320 modules	
		Module area	8382 m²	Cell area	7571 m²	
Inverter						
Original PVsyst database		Model	Sunny Tripower 60-10			
Characteristics		Manufacturer	SMA			
		Operating Voltage	570-800 V	Unit Nom. Power	60 kWac	
Sub-array "Sub-array #1"		Nb. of inverters	8 units	Total Power	480 kWac	
Sub-array "Sub-array #2"		Nb. of inverters	11 units	Total Power	660 kWac	
Total		Nb. of inverters	19	Total Power	1140 kWac	
PV Array loss factors						
Array Soiling Losses				Loss Fraction	3.0 %	
Thermal Loss factor		Uc (const)	20.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s	
Wiring Ohmic Loss		Array#1	25 mOhm	Loss Fraction	2.8 % at STC	
		Array#2	18 mOhm	Loss Fraction	2.5 % at STC	
		Global		Loss Fraction	2.6 % at STC	

Grid-Connected System: Simulation parameters (continued)

LID - Light Induced Degradation

Loss Fraction 2.0 %

Module Quality Loss

Loss Fraction 0.0 %

Module Mismatch Losses

Loss Fraction 1.0 % at MPP

Incidence effect, user defined profile

0°	40°	50°	60°	70°	80°	90°
1.00	1.00	1.00	1.00	0.94	0.76	0.00

System loss factors

Wiring Ohmic Loss

Wires: 3x1500.0 mm² 373 m

Loss Fraction 4.0 % at STC

Unavailability of the system

10.9 days, 3 periods

Time fraction 3.0 %

User's needs :

Unlimited load (grid)

Grid-Connected System: Main results

Project : **Grid-Connected Project at Siam construction steel co**

Simulation variant : **New simulation variant**

Main system parameters

PV Field Orientation

PV modules

PV Array

Inverter

Inverter pack

User's needs

System type

2 orientations

Model

Nb. of modules

Model

Nb. of units

Unlimited load (grid)

Grid-Connected

Tilt/Azimuth = 15°/0° and 15°/180°

TSM-325PD14

4320

Sunny Tripower 60-10

19.0

Pnom 325 Wp

Pnom total **1404 kWp**

Pnom 60.0 kW ac

Pnom total **1140 kW ac**

Main simulation results

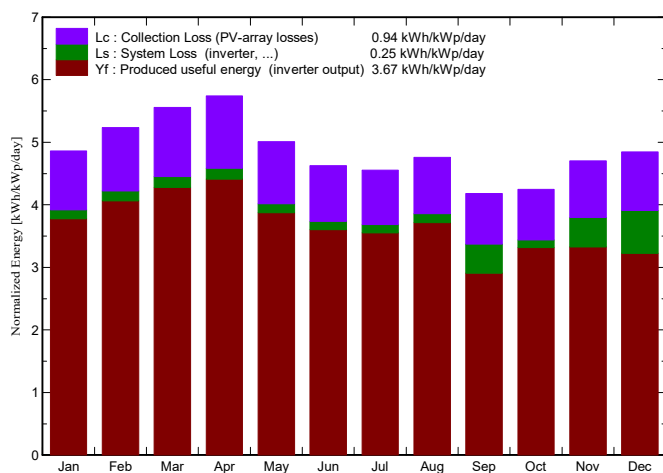
System Production

Produced Energy 1880 MWh/year

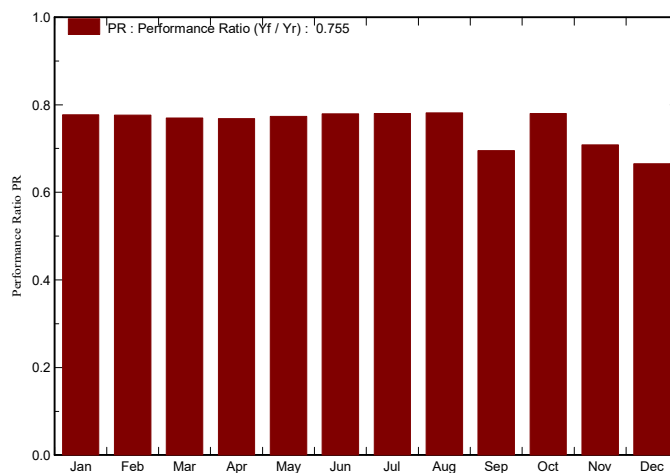
Performance Ratio PR 75.53 %

Specific prod. 1339 kWh/kWp/year

Normalized productions (per installed kWp): Nominal power 1404 kWp



Performance Ratio PR



New simulation variant

Balances and main results

	GlobHor	T Amb	GlobInc	GlobEff	EArray	E_Grid	EffArrR	EffSysR
	kWh/m²	°C	kWh/m²	kWh/m²	MWh	MWh	%	%
January	156.0	26.40	150.6	143.7	170.7	164.4	13.52	13.02
February	151.0	27.10	146.6	140.0	165.9	159.7	13.50	13.00
March	176.6	28.00	172.3	164.8	193.7	186.3	13.41	12.90
April	175.3	29.00	172.2	164.8	193.2	185.8	13.38	12.87
May	157.4	28.60	155.3	148.4	175.0	168.5	13.44	12.95
June	140.5	28.20	138.9	132.6	157.5	151.9	13.53	13.05
July	143.0	27.80	141.2	134.9	160.4	154.6	13.55	13.06
August	149.9	27.60	147.5	141.0	167.9	161.8	13.57	13.08
September	128.6	27.30	125.5	119.8	142.0	122.4	13.50	11.64
October	135.5	26.80	131.7	125.7	149.6	144.3	13.56	13.07
November	145.9	26.50	141.0	134.8	159.9	140.2	13.53	11.86
December	156.1	26.20	150.2	143.4	170.1	140.4	13.51	11.15
Year	1815.8	27.46	1773.0	1694.1	2005.9	1880.3	13.50	12.65

Legends:

GlobHor

Horizontal global 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

EffArrR

Effic. Eout array / rough area

EffSysR

Effic. Eout system / rough area

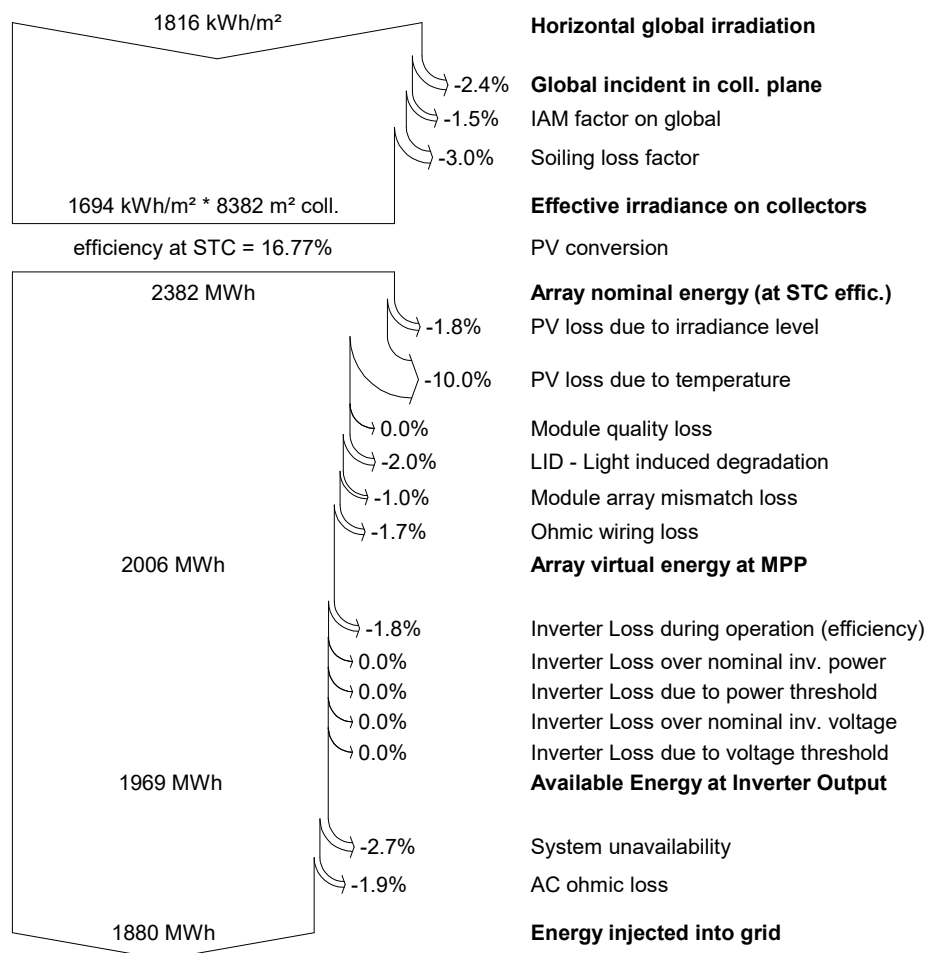
Grid-Connected System: Loss diagram

Project : **Grid-Connected Project at Siam construction steel co**

Simulation variant : **New simulation variant**

Main system parameters	System type	Grid-Connected		
PV Field Orientation	2 orientations	Tilt/Azimuth = 15°/0° and 15°/180°		
PV modules	Model	TSM-325PD14	Pnom	325 Wp
PV Array	Nb. of modules	4320	Pnom total	1404 kWp
Inverter	Model	Sunny Tripower 60-10	Pnom	60.0 kW ac
Inverter pack	Nb. of units	19.0	Pnom total	1140 kW ac
User's needs	Unlimited load (grid)			

Loss diagram over the whole year



Grid-Connected System: P50 - P90 evaluation

Project : **Grid-Connected Project at Siam construction steel co**

Simulation variant : **New simulation variant**

Main system parameters		System type	Grid-Connected		
PV Field Orientation		2 orientations	Tilt/Azimuth = 15°/0° and 15°/180°		
PV modules		Model	TSM-325PD14	Pnom	325 Wp
PV Array		Nb. of modules	4320	Pnom total	1404 kWp
Inverter		Model	Sunny Tripower 60-10	Pnom	60.0 kW ac
Inverter pack		Nb. of units	19.0	Pnom total	1140 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:

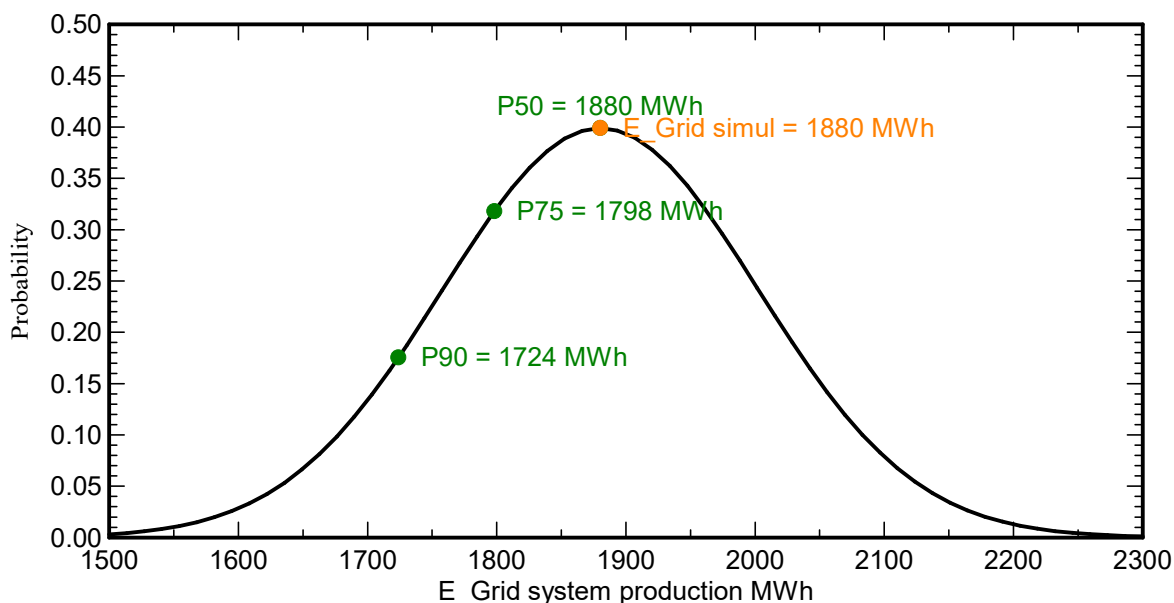
Meteo data source				
Meteo data		Kind	Not defined	Year 1995
Specified Deviation	Year deviation from aver.		3 %	
Year-to-year variability	Variance		4.5 %	

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

Specified Deviation	PV module modelling/parameters	0.0 %	
	Custom variability	4.7 %	
Global variability (meteo + system)	Variance	6.5 %	(quadratic sum)

Annual production probability	Variability	122 MWh
	P50	1880 MWh
	P90	1724 MWh
	P75	1798 MWh

Probability distribution



ระยะที่ 3

PVsyst - Simulation report

Grid-Connected System

Project: TATA_SCS

Variant: TATA_SCS_Map th phut_CE

Tables on a building

System power: 2400 kWp

Map Ta Phut IE - Thailand



Project: TATA_SCS

Variant: TATA_SCS_Map th phut_CE

PVsyst V7.2.4

VC1, Simulation date:
29/07/22 16:45
with v7.2.4

Project summary

Geographical Site

Map Ta Phut IE

Thailand

Situation

Latitude 12.69 °N

Longitude 101.14 °E

Altitude 19 m

Time zone UTC+7

Project settings

Albedo 0.20

Meteo data

Map Ta Phut IE

SolarGIS Monthly aver. , period not spec. - Synthetic

System summary

Grid-Connected System

PV Field Orientation

Fixed planes 2 orientations

Tilts/azimuths 3 / 90 °

3 / -90 °

Tables on a building

Near Shadings

Linear shadings

User's needs

Unlimited load (grid)

System information

PV Array

Nb. of modules 4412 units

Pnom total 2400 kWp

Inverters

Nb. of units 19 units

Pnom total 1900 kWac

Pnom ratio 1.263

Results summary

Produced Energy 3584 MWh/year Specific production 1493 kWh/kWp/year Perf. Ratio PR 82.18 %

Table of contents

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Near shading definition - Iso-shadings diagram	7
Main results	8
Loss diagram	9
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Project: TATA_SCS

Variant: TATA_SCS_Map th phut_CE

PVsyst V7.2.4

VC1, Simulation date:
29/07/22 16:45
with v7.2.4

General parameters

Grid-Connected System

PV Field Orientation

Orientation

Fixed planes 2 orientations
Tilts/azimuths 3 / 90 °
3 / -90 °

Horizon

Free Horizon

Tables on a building

Sheds configuration

Nb. of sheds 7 units
Sizes
Sheds spacing 42.8 m
Collector width 28.4 m
Ground Cov. Ratio (GCR) 66.2 %
Shading limit angle
Limit profile angle 5.8 °

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 JA Solar
Model JAM72S30-540/MR
(Original PVsyst database)
Unit Nom. Power 540 Wp
Number of PV modules 862 units
Nominal (STC) 465 kWp

Array #1 - PV Array_East_20PV

Orientation #1
Tilt/Azimuth 3/90 °
Number of PV modules 520 units
Nominal (STC) 281 kWp
Modules 26 Strings x 20 In series

At operating cond. (50°C)

Pmpp 257 kWp
U mpp 746 V
I mpp 344 A

Array #2 - PV Array_East_18PV

Orientation #1
Tilt/Azimuth 3/90 °
Number of PV modules 234 units
Nominal (STC) 126 kWp
Modules 13 Strings x 18 In series

At operating cond. (50°C)

Pmpp 116 kWp
U mpp 672 V
I mpp 172 A

Array #3 - PV Array_East_18V

Orientation #1
Tilt/Azimuth 3/90 °
Number of PV modules 108 units
Nominal (STC) 58.3 kWp
Modules 6 Strings x 18 In series

Inverter

Manufacturer Huawei Technologies
Model SUN2000-100KTL-M1-400Vac
(Original PVsyst database)
Unit Nom. Power 100 kWac
Number of inverters 3.5 units
Total power 350 kWac

Operating voltage 200-1000 V
Max. power (=>30°C) 110 kWac
Pnom ratio (DC:AC) 1.40

Number of inverters 1 units
Total power 100 kWac

Operating voltage 200-1000 V
Max. power (=>30°C) 110 kWac
Pnom ratio (DC:AC) 1.26

Number of inverters 5 * MPPT 10% 0.5 units
Total power 50.0 kWac



PVsyst V7.2.4

VC1, Simulation date:
29/07/22 16:45
with v7.2.4

PV Array Characteristics

At operating cond. (50°C)

Pmpp 53.3 kWp
U mpp 672 V
I mpp 79 A

Operating voltage 200-1000 V
Max. power (=>30°C) 110 kWac
Pnom ratio (DC:AC) 1.17

PV module

Manufacturer JA Solar
Model JAM72S30-545/MR
(Original PVsyst database)

Unit Nom. Power 545 Wp
Number of PV modules 3550 units
Nominal (STC) 1935 kWp

Inverter

Manufacturer Huawei Technologies
Model SUN2000-100KTL-M1-400Vac
(Original PVsyst database)

Unit Nom. Power 100 kWac
Number of inverters 15.5 units
Total power 1550 kWac

Array #4 - PV Array_EW_20PV

Mixed orient.

#1/2: 1/69 strings

Tilt/Azimuth 3/90 °
3/-90 °
Number of PV modules 1400 units
Nominal (STC) 763 kWp
Modules 70 Strings x 20 In series

Number of inverters 6 unit
Total power 600 kWac

At operating cond. (50°C)

Pmpp 698 kWp
U mpp 749 V
I mpp 931 A

Operating voltage 200-1000 V
Max. power (=>30°C) 110 kWac
Pnom ratio (DC:AC) 1.27

Array #5 - PV Array_EW_18PV

Mixed orient.

#1/2: 1/72 strings

Tilt/Azimuth 3/90 °
3/-90 °
Number of PV modules 1314 units
Nominal (STC) 716 kWp
Modules 73 Strings x 18 In series

Number of inverters 6 unit
Total power 600 kWac

At operating cond. (50°C)

Pmpp 655 kWp
U mpp 674 V
I mpp 971 A

Operating voltage 200-1000 V
Max. power (=>30°C) 110 kWac
Pnom ratio (DC:AC) 1.19

Array #6 - PV Array_EW_19PV

Mixed orient.

#1/2: 1/38 strings

Tilt/Azimuth 3/90 °
3/-90 °
Number of PV modules 741 units
Nominal (STC) 404 kWp
Modules 39 Strings x 19 In series

Number of inverters 3 unit
Total power 300 kWac

At operating cond. (50°C)

Pmpp 369 kWp
U mpp 712 V
I mpp 519 A

Operating voltage 200-1000 V
Max. power (=>30°C) 110 kWac
Pnom ratio (DC:AC) 1.35

**PVsyst V7.2.4**

VC1, Simulation date:
29/07/22 16:45
with v7.2.4

PV Array Characteristics**Array #7 - PV Array_East_19PV**

Orientation	#1		
Tilt/Azimuth	3/90 °		
Number of PV modules	95 units	Number of inverters	5 * MPPT 10% 0.5 units
Nominal (STC)	51.8 kWp	Total power	50.0 kWac
Modules	5 Strings x 19 In series		
At operating cond. (50°C)		Operating voltage	200-1000 V
Pmpp	47.3 kWp	Max. power (=>30°C)	110 kWac
U mpp	712 V	Pnom ratio (DC:AC)	1.04
I mpp	67 A		
Total PV power		Total inverter power	
Nominal (STC)	2400 kWp	Total power	1900 kWac
Total	4412 modules	Nb. of inverters	19 units
Module area	11402 m²	Pnom ratio	1.26
Cell area	10496 m²		

**PVsyst V7.2.4**

VC1, Simulation date:
29/07/22 16:45
with v7.2.4

Array losses**Array Soiling Losses**

Loss Fraction 2.3 %

Thermal Loss factor

Module temperature according to irradiance
Uc (const) 20.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

LID - Light Induced Degradation

Loss Fraction 2.0 %

Module Quality Loss

Loss Fraction -0.8 %

Module mismatch losses

Loss Fraction 2.0 % at MPP

Strings Mismatch loss

Loss Fraction 0.1 %

IAM loss factor

Incidence effect (IAM): User defined profile

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	1.000	1.000	0.985	0.943	0.840	0.000

DC wiring losses

Global wiring resistance 3.8 mΩ
Loss Fraction 1.5 % at STC

Array #1 - PV Array_East_20PV

Global array res. 36 mΩ
Loss Fraction 1.5 % at STC

Array #3 - PV Array_East_18V

Global array res. 139 mΩ
Loss Fraction 1.5 % at STC

Array #5 - PV Array_EW_18PV

Global array res. 11 mΩ
Loss Fraction 1.5 % at STC

Array #7 - PV Array_East_19PV

Global array res. 176 mΩ
Loss Fraction 1.5 % at STC

Array #2 - PV Array_East_18PV

Global array res. 64 mΩ
Loss Fraction 1.5 % at STC

Array #4 - PV Array_EW_20PV

Global array res. 13 mΩ
Loss Fraction 1.5 % at STC

Array #6 - PV Array_EW_19PV

Global array res. 23 mΩ
Loss Fraction 1.5 % at STC

AC wiring losses**Inv. output line up to injection point**

Inverter voltage 400 Vac tri
Loss Fraction 1.00 % at STC

Inverter: SUN2000-100KTL-M1-400Vac

Wire section (19 Inv.) Copper 19 x 3 x 95 mm²
Average wires length 66 m



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Near shadings parameter

Perspective of the PV-field and surrounding shading scene

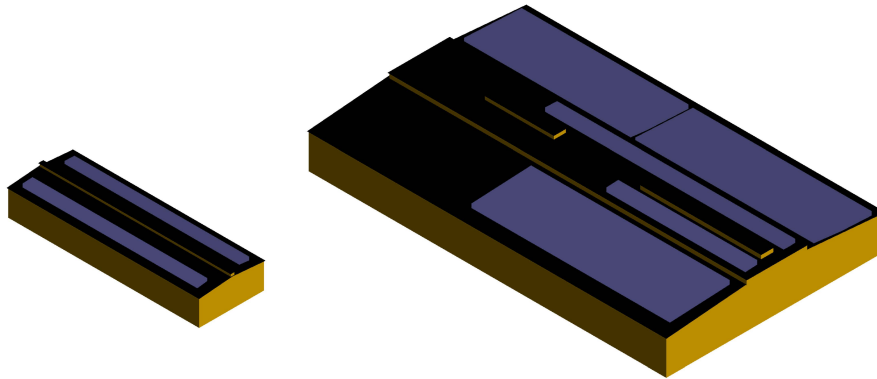
North

Zenith

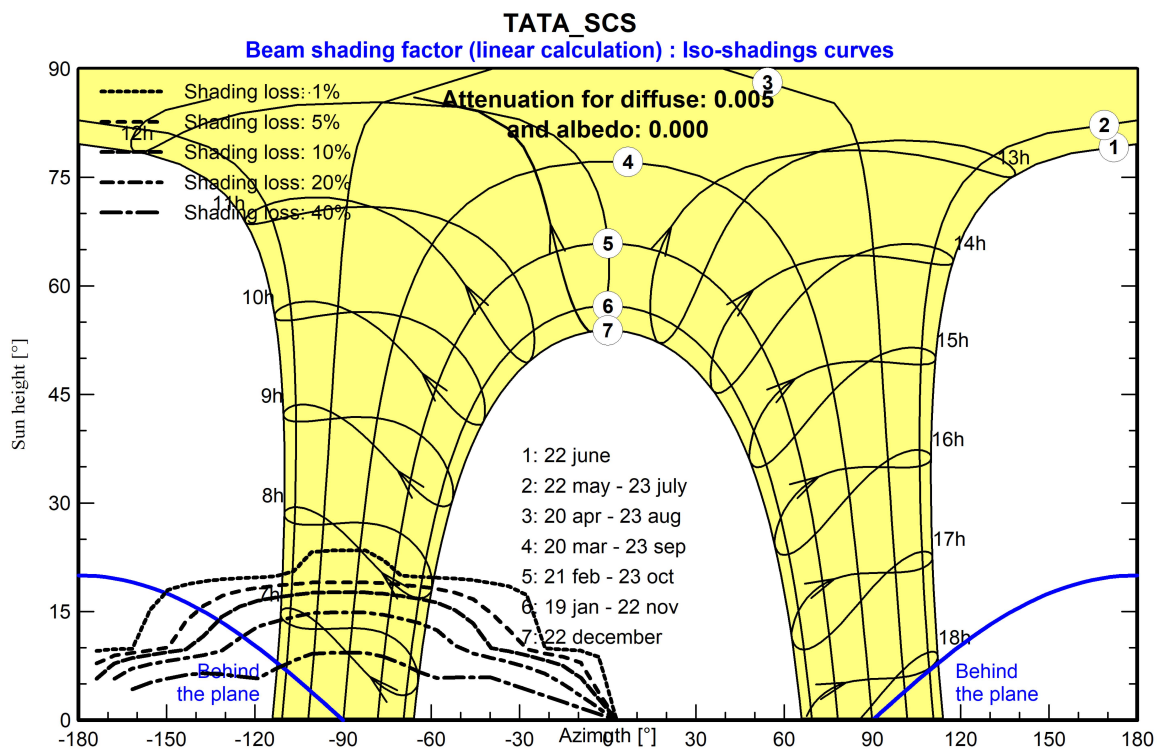
East

West

South



Iso-shadings diagram





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Main results

System Production

Produced Energy

3584 MWh/year

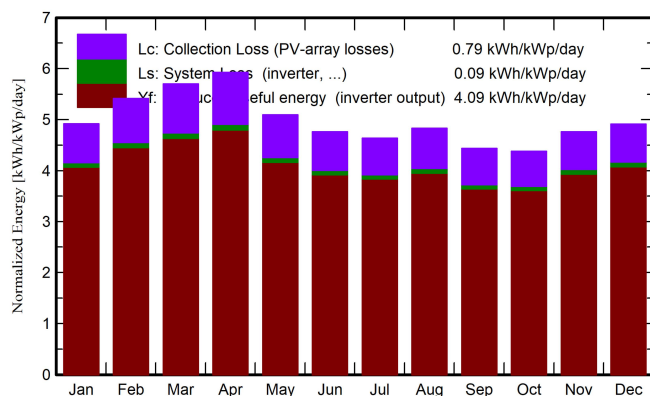
Specific production

1493 kWh/kWp/year

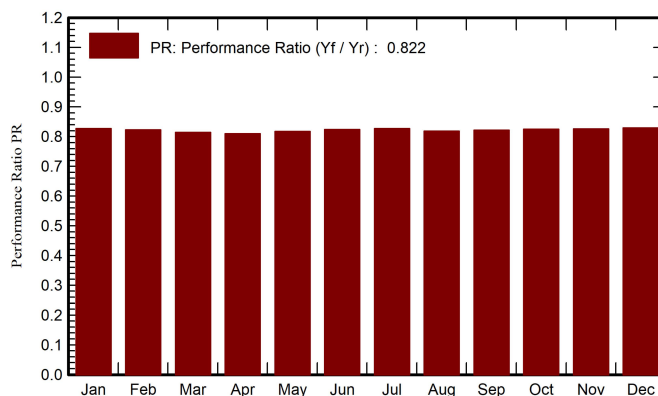
Performance Ratio PR

82.18 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m²	kWh/m²	°C	kWh/m²	kWh/m²	MWh	MWh	ratio
January	152.3	68.10	26.70	152.5	147.8	309.8	302.9	0.828
February	151.5	72.40	27.40	151.7	147.1	306.4	299.5	0.823
March	176.8	83.50	28.40	176.6	171.3	353.2	345.1	0.814
April	177.6	80.00	29.30	177.8	172.5	353.8	345.6	0.810
May	157.4	76.00	29.40	158.0	153.3	317.2	310.2	0.818
June	142.6	72.90	29.20	142.8	138.6	288.9	282.5	0.824
July	143.8	76.30	28.80	143.8	139.6	291.9	285.5	0.827
August	149.8	78.40	28.80	149.7	145.3	301.1	294.3	0.819
September	133.1	71.40	28.30	133.2	129.0	268.5	262.6	0.821
October	135.8	73.50	27.90	135.8	131.7	275.1	269.0	0.825
November	142.7	65.20	27.70	142.8	138.6	289.9	283.4	0.827
December	152.2	63.30	26.79	152.4	148.0	310.4	303.5	0.830
Year	1815.6	881.00	28.23	1817.1	1762.8	3666.2	3584.2	0.822

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

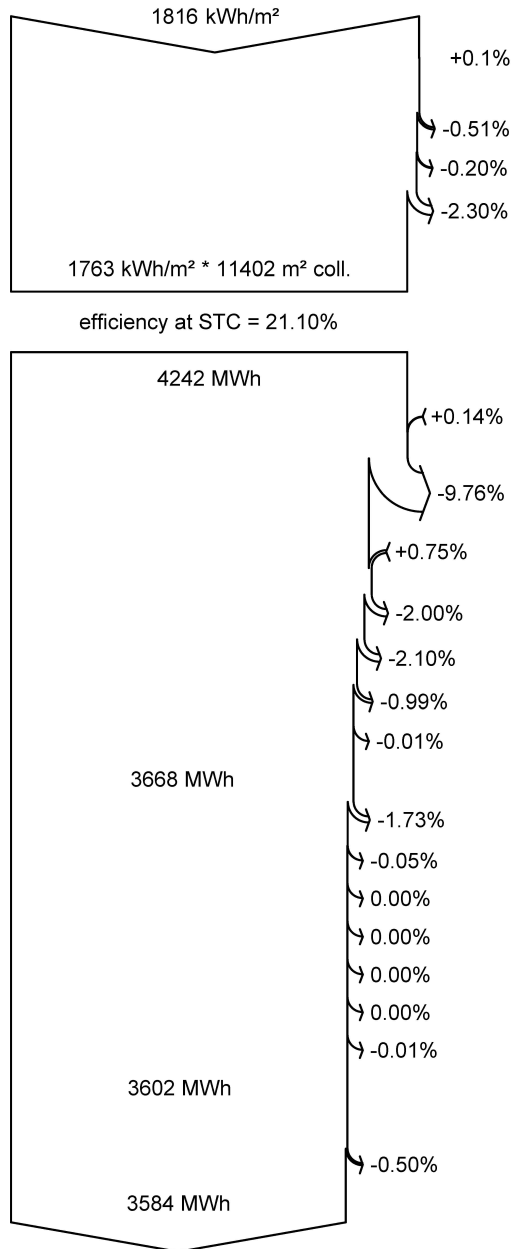
PR Performance Ratio



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Loss diagram



Global horizontal irradiation

Global incident in coll. plane

Near Shadings: irradiance loss

IAM factor on global

Soiling loss factor

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

LID - Light induced degradation

Mismatch loss, modules and strings

Ohmic wiring loss

Mixed orientation mismatch 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

Energy injected into grid

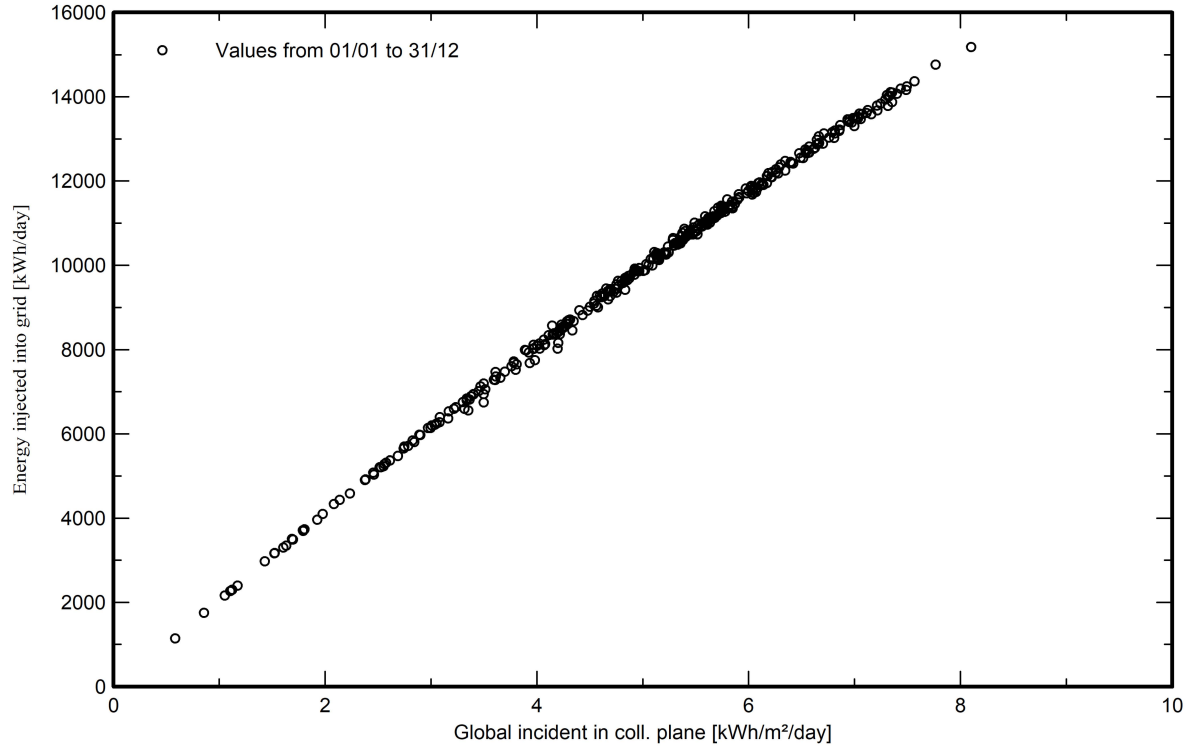


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Special graphs

Daily Input/Output diagram



System Output Power Distribution

