PVsyst

PHOTOVOLTAIC SOFTWARE

PVsyst - Simulation report

Grid-Connected System

Project: Waterloo-2.5MW

Variant: Mahya Shahshahani - 810199598

Sheds, single array

System power: 2497 kWp

Waterloo - Canada

Author

PVsyst V7.4.8
VC0, Simulation date:
05/29/25 18:39
with V7.4.8

Project summary

Geographical Site	Situation		Project settings	
Waterloo	Latitude	43.47 °N	Albedo	0.20
Canada	Longitude	-80.53 °W		
	Altitude	313 m		
	Time zone	UTC-5		

Weather data

Waterloo

Meteonorm 8.1 (1991-2000), Sat=46% - Synthetic

System summary

Grid-Connected System   **Sheds, single array**

PV Field Orientation		Near Shadings	User's needs
Fixed plane		Linear shadings : Fast (table)	Unlimited load (grid)
Tilt/Azimuth	30 / 0 °		

System information

PV Array		Inverters	
Nb. of modules	3842 units	Nb. of units	19 units
Pnom total	2497 kWp	Pnom total	2090 kWac
		Pnom ratio	1.195

Results summary

Produced Energy	3230632 kWh/year	Specific production	1294 kWh/kWp/year	Perf. Ratio PR	86.06 %

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General parameters

Grid-Connected System

PV Field Orientation

Orientation		**Sheds configuration**		**Models used**	
Fixed plane		Nb. of sheds	226 units	Transposition	Perez
Tilt/Azimuth	30 / 0 °	Single array		Diffuse	Perez, Meteonorm
		Sizes		Circumsolar	separate
		Sheds spacing	5.00 m		
		Collector width	1.30 m		
		Ground Cov. Ratio (GCR)	26.1 %		
		Top inactive band	0.02 m		
		Bottom inactive band	0.02 m		
		Shading limit angle			
		Limit profile angle	9.7 °		

Sheds, single array

Horizon	**Near Shadings**	**User's needs**
Free Horizon	Linear shadings : Fast (table)	Unlimited load (grid)

PV Array Characteristics

PV module		**Inverter**	
Manufacturer	Trina Solar	Manufacturer	Sungrow
Model	TSM-DEG21C-20-650Wp Vertex	Model	SG110-CX
(Original PVsyst database)		(Original PVsyst database)	
Unit Nom. Power	650 Wp	Unit Nom. Power	110 kWac
Number of PV modules	3842 units	Number of inverters	19 units
Nominal (STC)	2497 kWp	Total power	2090 kWac
Modules	226 string x 17 In series	Operating voltage	200-850 V
At operating cond. (50°C)		Pnom ratio (DC:AC)	1.19
Pmpp	2288 kWp	Power sharing within this inverter	
U mpp	583 V		
I mpp	3928 A		

Total PV power		**Total inverter power**	
Nominal (STC)	2497 kWp	Total power	2090 kWac
Total	3842 modules	Number of inverters	19 units
Module area	11935 m²	Pnom ratio	1.19

Array losses

Thermal Loss factor		**DC wiring losses**		**Module Quality Loss**	
Module temperature according to irradiance		Global array res.	2.4 mΩ	Loss Fraction	-0.4 %
Uc (const)	20.0 W/m²K	Loss Fraction	1.5 % at STC		
Uv (wind)	0.0 W/m²K/m/s				

Module mismatch losses

Loss Fraction   2.0 % at MPP

IAM loss factor

Incidence effect (IAM): Fresnel, AR coating, n(glass)=1.526, n(AR)=1.290

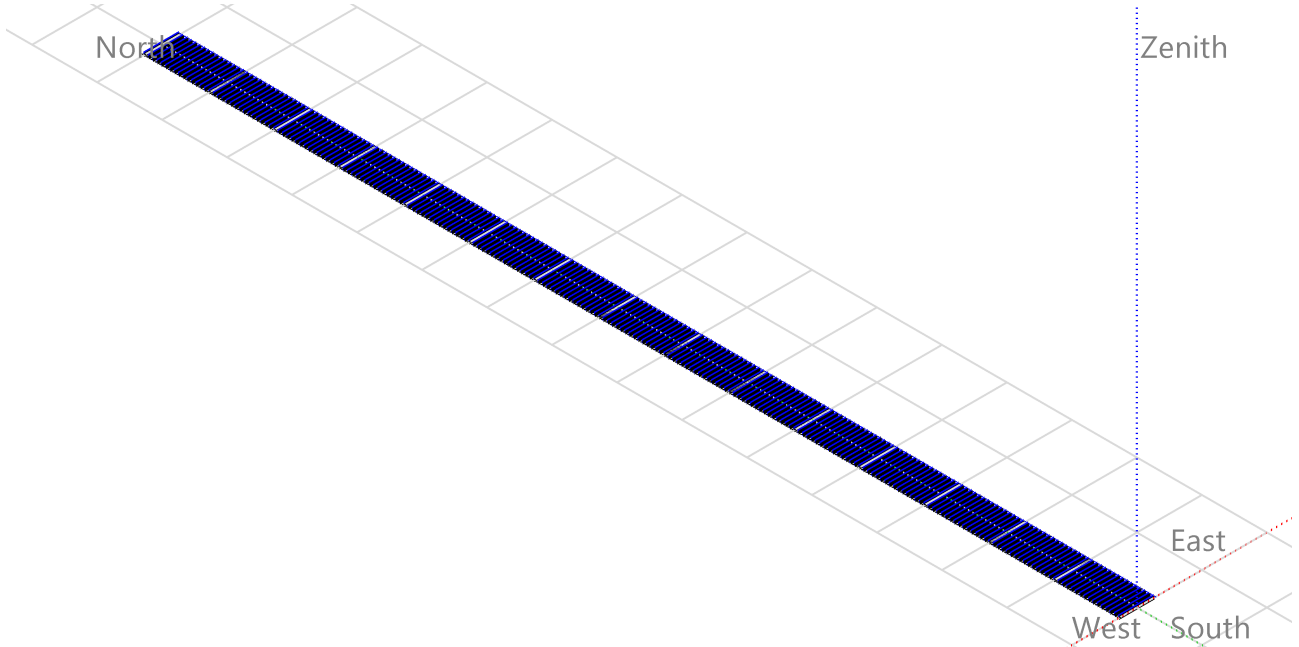| 0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.962	0.892	0.816	0.681	0.440	0.000

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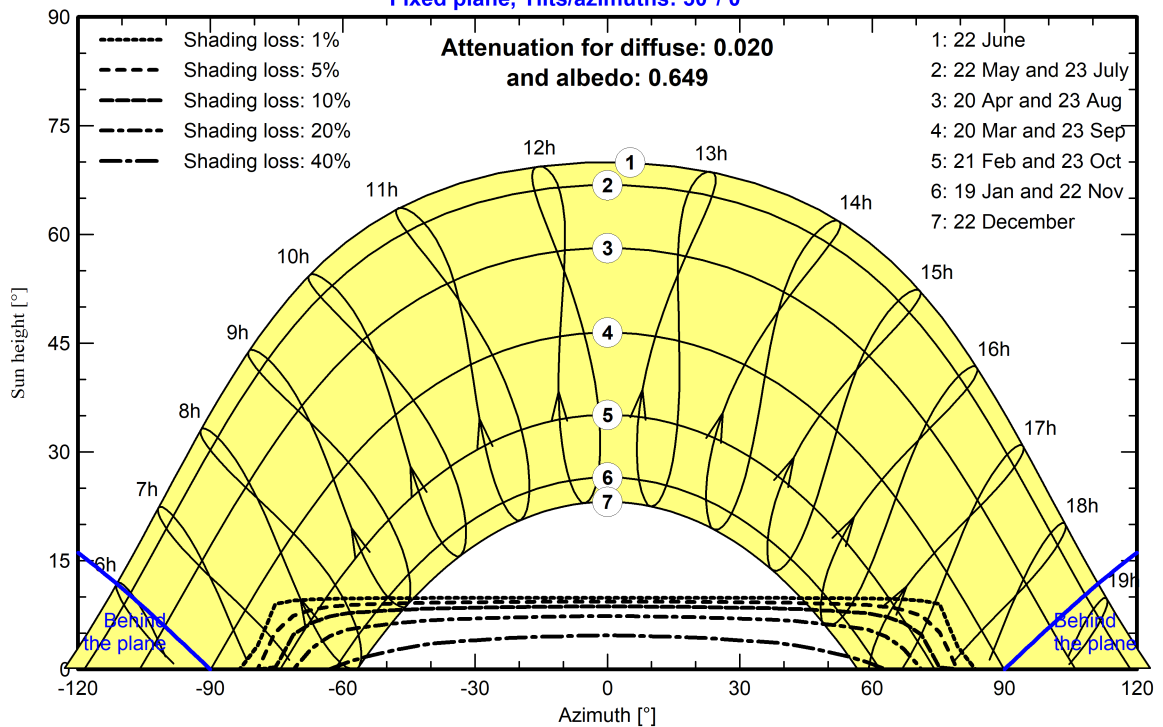05/29/25 18:39
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Near shadings parameter

Perspective of the PV-field and surrounding shading scene

Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 30°/ 0°

Attenuation for diffuse: 0.020 and albedo: 0.649

Shading loss: 1%
Shading loss: 5%
Shading loss: 10%
Shading loss: 20%
Shading loss: 40%

1: 22 June
2: 22 May and 23 July
3: 20 Apr and 23 Aug
4: 20 Mar and 23 Sep
5: 21 Feb and 23 Oct
6: 19 Jan and 22 Nov
7: 22 December

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Main results

System Production

Produced Energy	3230632 kWh/year	Specific production	1294 kWh/kWp/year
		Perf. Ratio PR	86.06 %

Normalized productions (per installed kWp)

Lc: Collection Loss (PV-array losses) 0.5 kWh/kWp/day
Ls: System Loss (inverter, ...) 0.07 kWh/kWp/day
Yf: Produced useful energy (inverter output) 3.54 kWh/kWp/day

Performance Ratio PR

PR: Performance Ratio (Yf / Yr) : 0.861
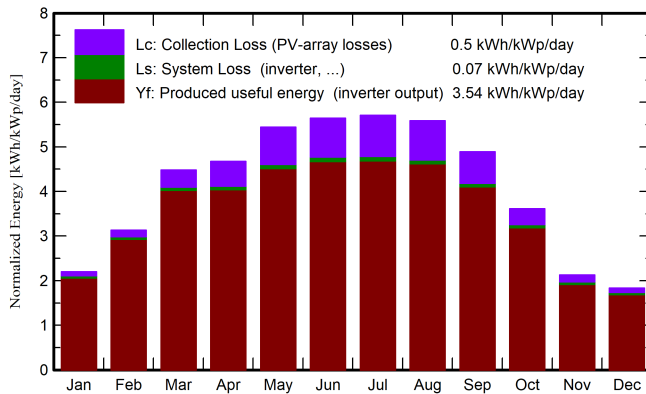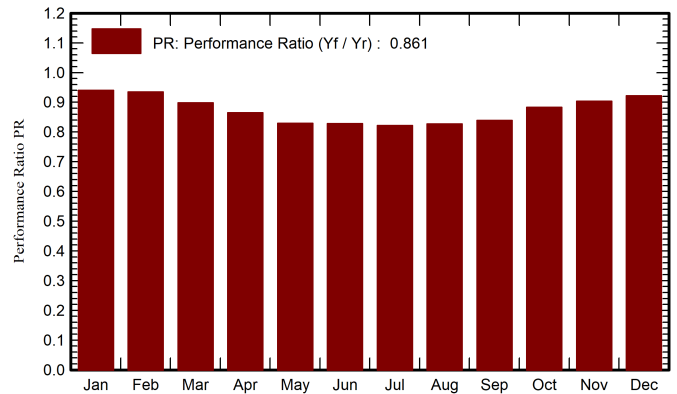
Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m²	kWh/m²	°C	kWh/m²	kWh/m²	kWh	kWh	ratio
January	42.9	23.90	-5.76	68.1	65.5	163822	159894	0.940
February	62.1	32.50	-5.53	87.8	85.1	209217	204900	0.935
March	110.4	50.18	-0.53	139.0	134.6	317747	311804	0.898
April	129.5	66.37	6.15	140.2	134.9	309081	302832	0.865
May	169.0	74.38	13.11	168.9	162.1	356847	349614	0.829
June	176.0	80.65	17.72	169.3	162.3	357631	350356	0.829
July	180.2	81.83	20.28	177.0	169.8	370652	363234	0.822
August	163.1	74.15	19.30	173.3	166.8	364827	357940	0.827
September	124.1	52.94	15.41	146.8	142.0	313780	307705	0.839
October	84.1	42.56	9.27	112.0	108.5	252291	247203	0.884
November	42.2	23.50	3.06	63.8	61.6	147884	144083	0.904
December	35.2	20.18	-2.45	56.9	54.8	134655	131067	0.922
Year	1318.6	623.13	7.57	1503.1	1448.0	3298434	3230632	0.861

### 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		

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Loss diagram
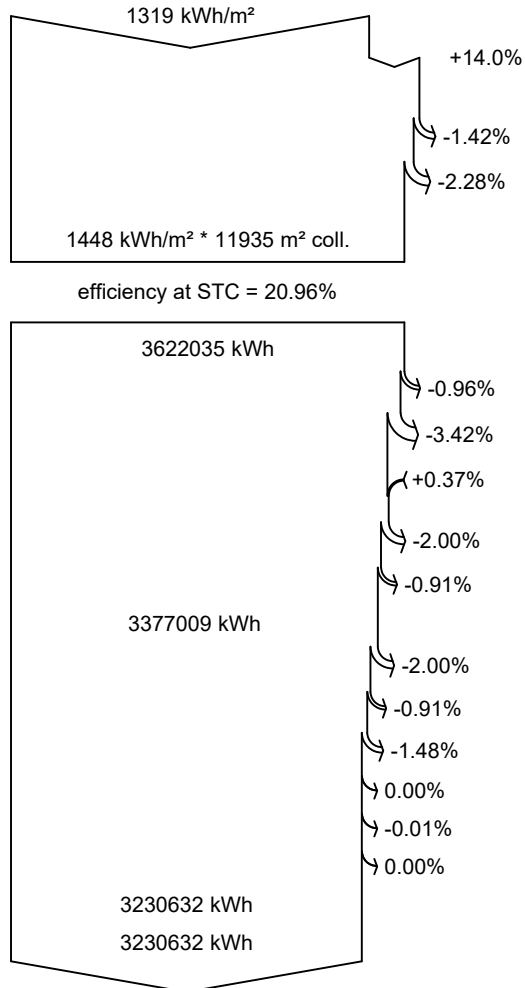
1319 kWh/m²	**Global horizontal irradiation**
+14.0%	**Global incident in coll. plane**
-1.42%	Near Shadings: irradiance loss
-2.28%	IAM factor on global
1448 kWh/m² * 11935 m² coll.	**Effective irradiation on collectors**
efficiency at STC = 20.96%	PV conversion
3622035 kWh	**Array nominal energy (at STC effic.)**
-0.96%	PV loss due to irradiance level
-3.42%	PV loss due to temperature
+0.37%	Module quality loss
-2.00%	Module array mismatch loss
-0.91%	Ohmic wiring loss
3377009 kWh	**Array virtual energy at MPP**
-2.00%	Inverter Loss during operation (efficiency)
-0.91%	Inverter Loss over nominal inv. power
-1.48%	Inverter Loss due to max. input current
0.00%	Inverter Loss over nominal inv. voltage
-0.01%	Inverter Loss due to power threshold
0.00%	Inverter Loss due to voltage threshold
3230632 kWh	**Available Energy at Inverter Output**
3230632 kWh	**Energy injected into grid**

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Predef. graphs

Daily Input/Output diagram
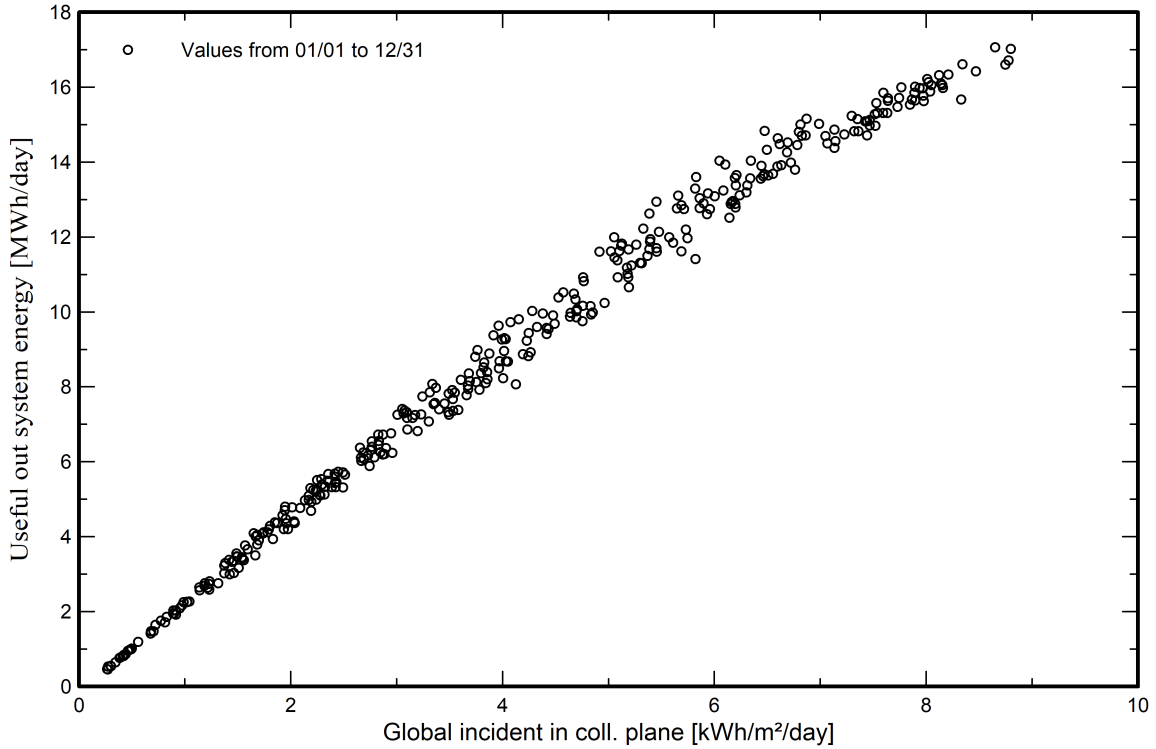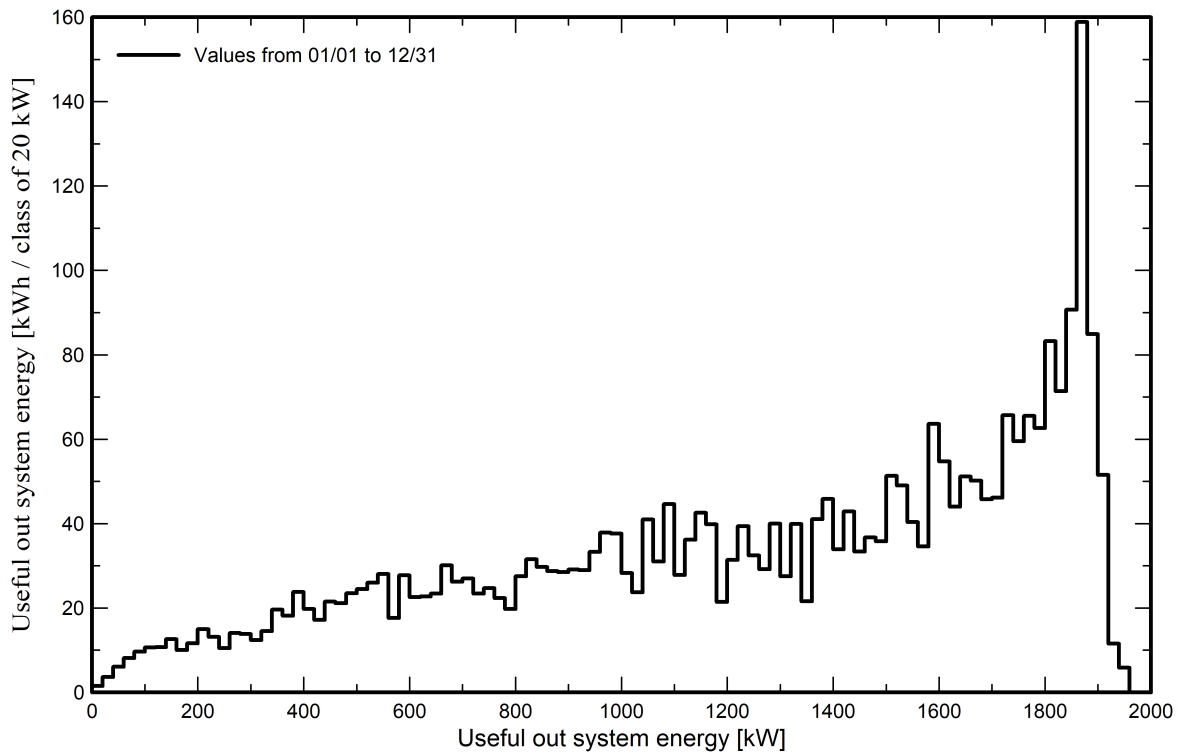
Daily Input/Output diagram — Useful out system energy [MWh/day] vs Global incident in coll. plane [kWh/m²/day]. Values from 01/01 to 12/31

System Output Power Distribution

System Output Power Distribution — Useful out system energy [kWh / class of 20 kW] vs Useful out system energy [kW]. Values from 01/01 to 12/31

Single-line diagram

17 x TSM-DEG21C-20-650Wp Vertex
11 Strings

2 Inverter (220 kVA)

kWh

Injection point

17 x TSM-DEG21C-20-650Wp Vertex
12 Strings

17 Inverter (1870 kVA)
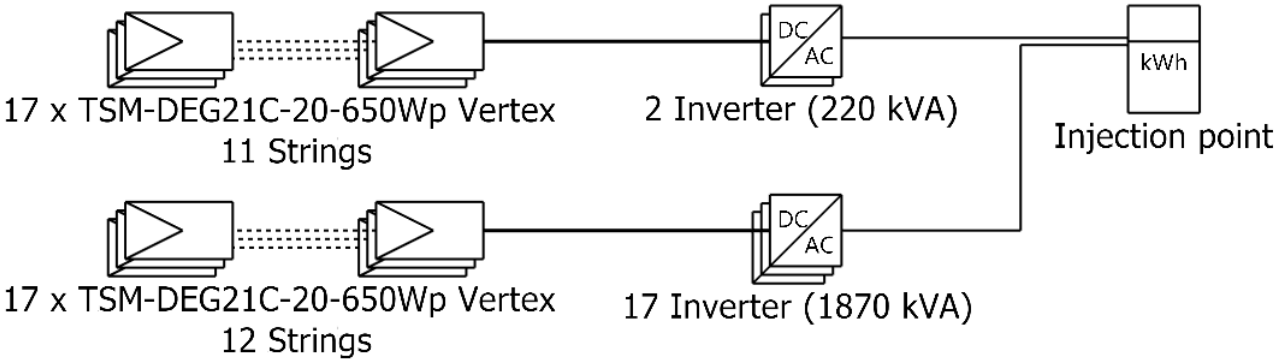
PV module	TSM-DEG21C-20-650Wp Vertex
Inverter	SG110-CX
String	17 x TSM-DEG21C-20-650Wp Vertex

Waterloo-2	
VC0 : Mahya Shahshahani - 810199598	05/29/25