Grid-Connected System: Simulation parameters

Project : **New Project**

Geographical Site	**Franktanya**		Country	**Hungary**

Situation		Latitude	47.45° N	Longitude	18.97° E
Time defined as		Legal Time	Time zone UT+1	Altitude	121 m
		Albedo	0.20		
Meteo data:		**Franktanya**	PVGIS api TMY - TMY		

Simulation variant : **300Wp_112pv**

Simulation date 16/07/20 07h57

Simulation parameters	System type	**Tables on a building**	
2 orientations	tilts/azimuths	15°/90° and 15°/-90°	

Sheds configuration	Nb. of sheds	8		
	Sheds spacing	3.32 m	Collector width	1.00 m
Shading limit angle	Limit profile angle	6.3°	Ground cov. Ratio (GCR)	30.1 %

Models used	Transposition	Perez	Diffuse	Imported

Horizon	Free Horizon	
Near Shadings	Detailed electrical calculation	(acc. to module layout)
User's needs :	Unlimited load (grid)	

PV Arrays Characteristics **(2 kinds of array defined)**

PV module	Si-mono	Model	**LG 300 N1C-B3**		
Original PVsyst database		Manufacturer	LG Electronics		
Sub-array "Sub-array #1"		Orientation	#1	Tilt/Azimuth	15°/90°
Number of PV modules		In series	8 modules	In parallel	7 strings
Total number of PV modules		Nb. modules	56	Unit Nom. Power	300 Wp
Array global power		Nominal (STC)	**16.80 kWp**	At operating cond.	15.08 kWp (50°C)
Array operating characteristics (50°C)		U mpp	228 V	I mpp	66 A
Sub-array "Sub-array #2"		Orientation	#2	Tilt/Azimuth	15°/-90°
Number of PV modules		In series	8 modules	In parallel	7 strings
Total number of PV modules		Nb. modules	56	Unit Nom. Power	300 Wp
Array global power		Nominal (STC)	**16.80 kWp**	At operating cond.	15.08 kWp (50°C)
Array operating characteristics (50°C)		U mpp	228 V	I mpp	66 A

Total	Arrays global power	Nominal (STC)	**34 kWp**	Total	112 modules
		Module area	**184 m²**	Cell area	163 m²

Inverter		Model	**UNO-DM-2.0-TL-PLUS**		
Original PVsyst database		Manufacturer	ABB		
Characteristics		Operating Voltage	90-580 V	Unit Nom. Power	2.00 kWac

Sub-array "Sub-array #1"	Nb. of inverters	7 units	Total Power	14.0 kWac
			Pnom ratio	1.20
Sub-array "Sub-array #2"	Nb. of inverters	7 units	Total Power	14.0 kWac
			Pnom ratio	1.20

Total	Nb. of inverters	14	Total Power	28 kWac

PV Array loss factors

Thermal Loss factor	Uc (const)	20.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s

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Wiring Ohmic Loss	Array#1	58 mOhm	Loss Fraction	1.5 % at STC
	Array#2	58 mOhm	Loss Fraction	1.5 % at STC
	Global		Loss Fraction	1.5 % at STC
Module Quality Loss			Loss Fraction	-0.8 %
Module Mismatch Losses			Loss Fraction	1.0 % at MPP
Strings Mismatch loss			Loss Fraction	0.10 %
Incidence effect, ASHRAE parametrization	IAM =	$1 - bo (1/\cos i - 1)$	bo Param.	0.05

Grid-Connected System: Near shading definition

Project :   **New Project**

Simulation variant :   **300Wp_112pv**

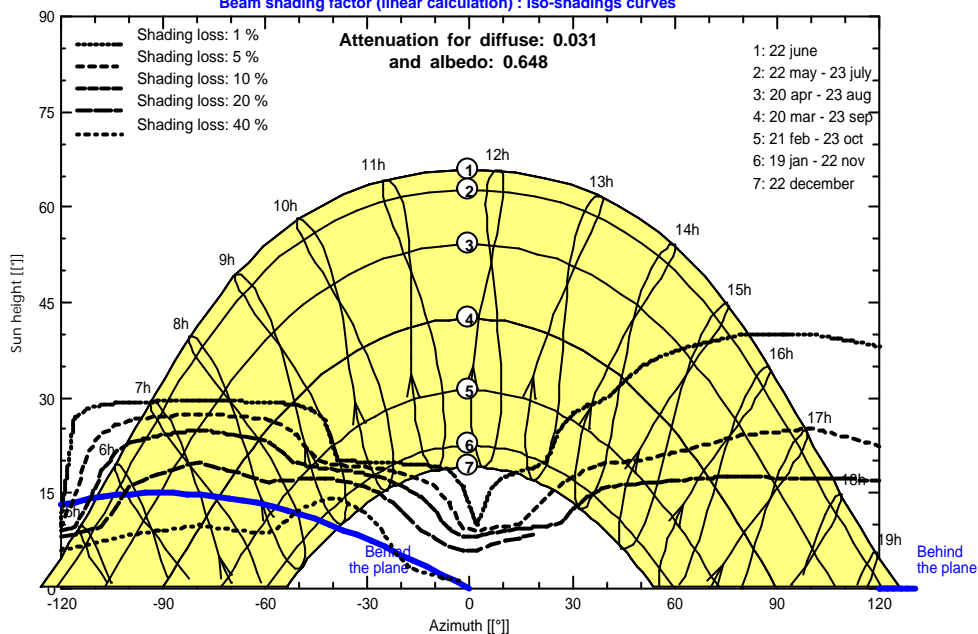| **Main system parameters**	System type	**Tables on a building**		
Near Shadings	Detailed electrical calculation	(acc. to module layout)		
PV Field Orientation	2 orientations	Tilt/Azimuth = 15°/90° and 15°/-90°		
PV modules	Model	LG 300 N1C-B3	Pnom	300 Wp
PV Array	Nb. of modules	112	Pnom total	**33.6 kWp**
Inverter	Model	UNO-DM-2.0-TL-PLUS	Pnom	2000 W ac
Inverter pack	Nb. of units	14.0	Pnom total	**28.00 kW ac**
User's needs	Unlimited load (grid)			

Perspective of the PV-field and surrounding shading scene
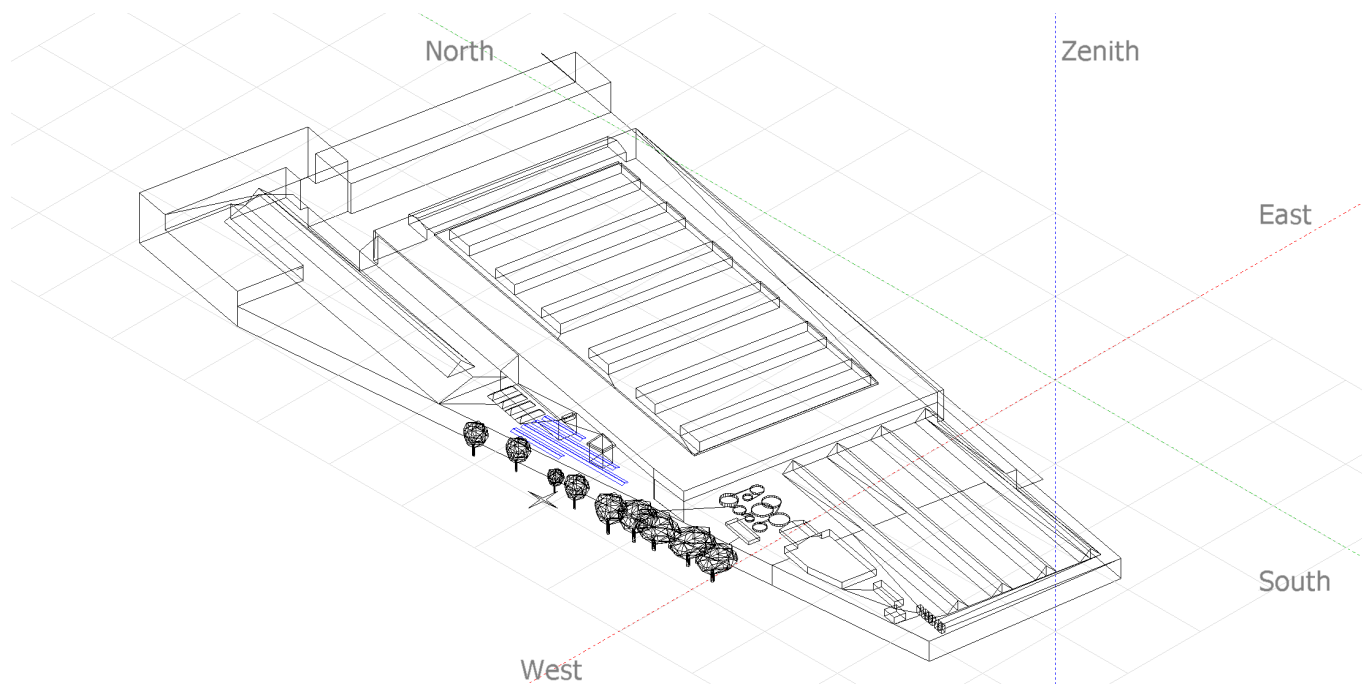
Iso-shadings diagram

New Project

Beam shading factor (linear calculation) : Iso-shadings curves

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

**Attenuation for diffuse: 0.031
and albedo: 0.648**

1: 22 june
2: 22 may - 23 july
3: 20 apr - 23 aug
4: 20 mar - 23 sep
5: 21 feb - 23 oct
6: 19 jan - 22 nov
7: 22 december

Grid-Connected System: Main results

Project :   **New Project**

Simulation variant :   **300Wp_112pv**

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Main simulation results

System Production   **Produced Energy** **36.10 MWh/year** Specific prod. 1074 kWh/kWp/year

Performance Ratio PR 80.08 %

Normalized productions (per installed kWp): Nominal power 33.6 kWp

Performance Ratio PR

Lc : Collection Loss (PV-array losses) 0.57 kWh/kWp/day
Ls : System Loss (inverter, ...) 0.16 kWh/kWp/day
Yf : Produced useful energy (inverter output) 2.94 kWh/kWp/day

PR : Performance Ratio (Yf / Yr) : 0.801
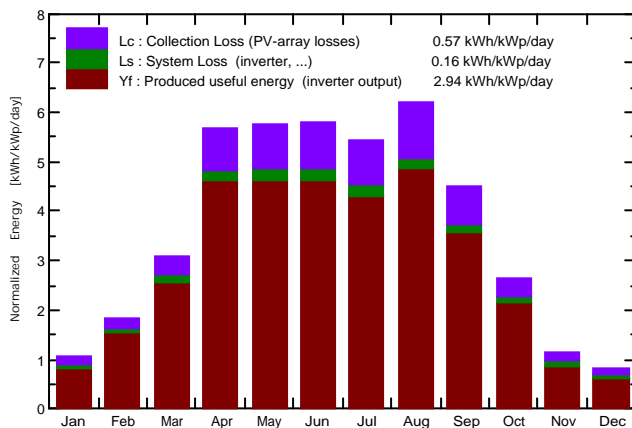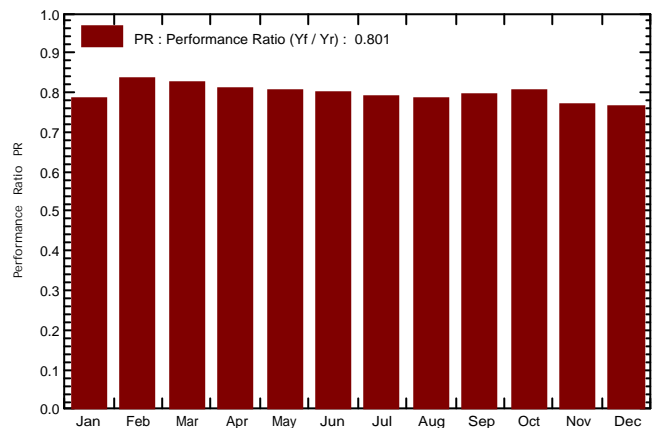
300Wp_112pv
Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m²	kWh/m²	°C	kWh/m²	kWh/m²	MWh	MWh	
January	33.2	18.30	-3.49	33.0	28.1	0.961	0.871	0.785
February	52.0	29.00	-0.36	51.5	45.7	1.545	1.445	0.835
March	97.5	41.57	7.86	96.4	87.9	2.828	2.675	0.826
April	172.9	57.08	14.68	170.5	158.8	4.866	4.651	0.812
May	181.4	77.01	17.39	178.6	166.7	5.059	4.825	0.804
June	176.7	79.11	19.51	173.8	162.7	4.914	4.682	0.802
July	171.7	75.07	21.07	168.8	158.2	4.721	4.493	0.792
August	194.5	63.13	23.36	191.8	179.9	5.291	5.056	0.785
September	136.2	48.80	17.97	134.8	123.7	3.786	3.612	0.797
October	83.3	36.28	12.40	82.5	74.1	2.366	2.240	0.808
November	34.6	20.58	6.79	34.4	29.8	0.982	0.891	0.772
December	25.6	18.50	-1.59	25.5	21.9	0.745	0.657	0.767
Year	1359.7	564.44	11.36	1341.7	1237.6	38.064	36.098	0.801

| Legends:	GlobHor	Horizontal global irradiation	GlobEff	Effective Global, corr. for IAM and shadings
	DiffHor	Horizontal diffuse irradiation	EArray	Effective energy at the output of the array
	T_Amb	T amb.	E_Grid	Energy injected into grid
	GlobInc	Global incident in coll. plane	PR	Performance Ratio

Grid-Connected System: Special graphs

Project :   **New Project**

Simulation variant :   **300Wp_112pv**

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User's needs	Unlimited load (grid)			

Daily Input/Output diagram
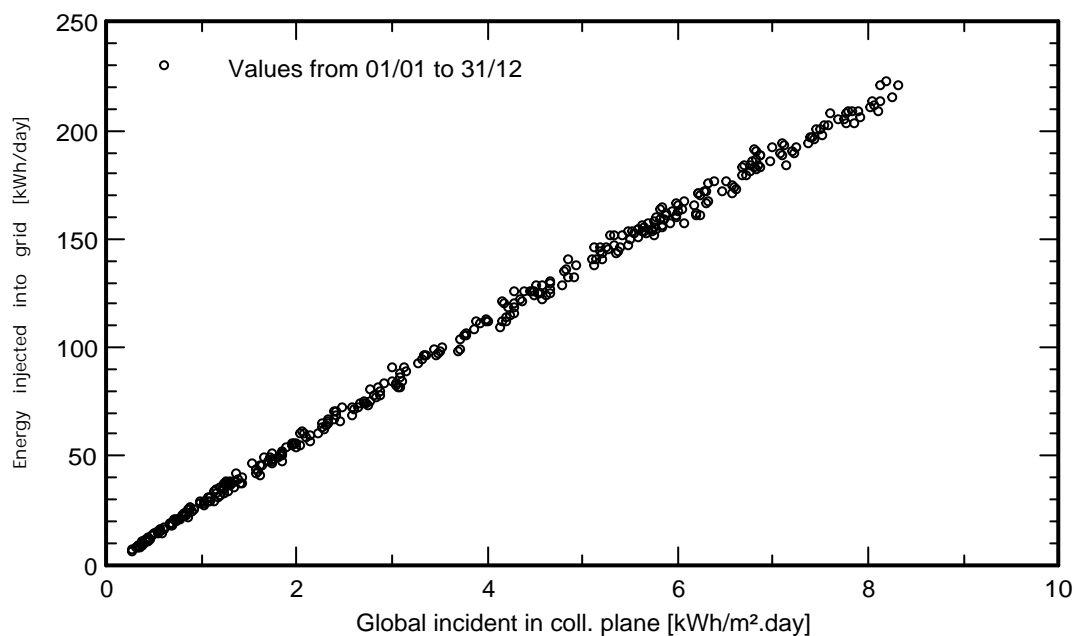
System Output Power Distribution
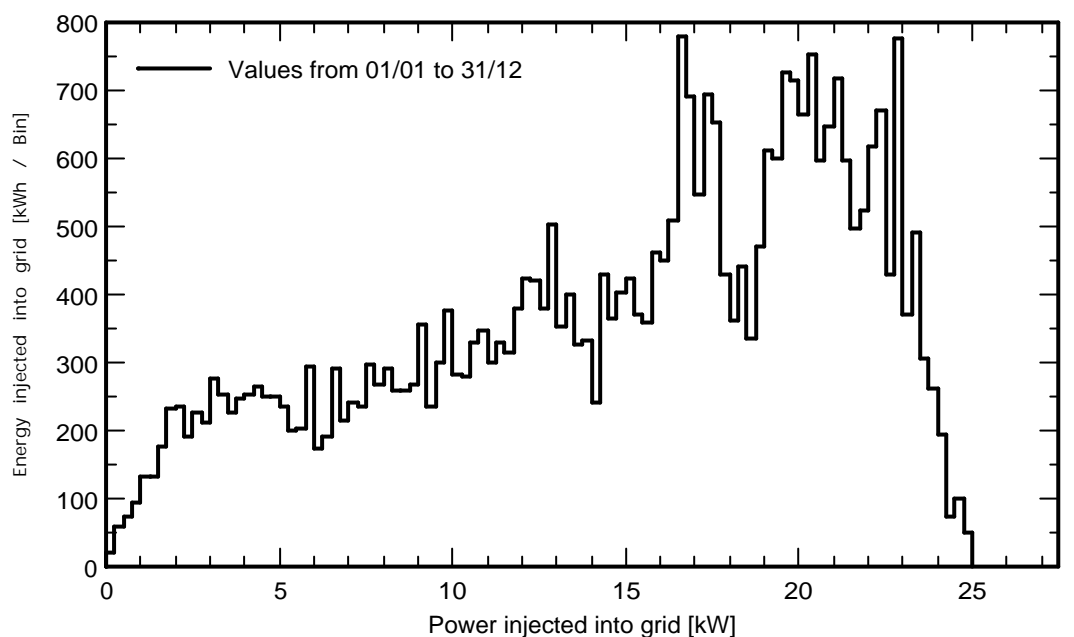
Grid-Connected System: Loss diagram

Project :　　　　　　　**New Project**

Simulation variant :　　**300Wp_112pv**

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User's needs	Unlimited load (grid)			

Loss diagram over the whole year

1360 kWh/m²	**Horizontal global irradiation**
-1.32%	**Global incident in coll. plane**
-0.02%	Global incident below threshold
-4.21%	Near Shadings: irradiance loss
-3.70%	IAM factor on global
1238 kWh/m² * 184 m² coll.	**Effective irradiation on collectors**
efficiency at STC = 18.30%	PV conversion
41.60 MWh	**Array nominal energy (at STC effic.)**
+0.18%	PV loss due to irradiance level
-6.03%	PV loss due to temperature
-1.60%	Shadings: Electrical Loss detailed module calc.
+0.75%	Module quality loss
-1.10%	Mismatch loss, modules and strings
-0.85%	Ohmic wiring loss
38.07 MWh	**Array virtual energy at MPP**
-5.16%	Inverter Loss during operation (efficiency)
0.00%	Inverter Loss over nominal inv. power
0.00%	Inverter Loss due to max. input current
0.00%	Inverter Loss over nominal inv. voltage
0.00%	Inverter Loss due to power threshold
-0.01%	Inverter Loss due to voltage threshold
36.10 MWh	**Available Energy at Inverter Output**
36.10 MWh	**Energy injected into grid**

Grid-Connected System: CO2 Balance

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User's needs	Unlimited load (grid)			

Produced Emissions   **Total:** **592.33 tCO2**

Source: Detailed calculation from table below

Replaced Emissions   **Total:** **354.1 tCO2**

System production: 36.10 MWh/yr   Lifetime: 30 years

Annual Degradation: 1.0 %

Grid Lifecycle Emissions: 327 gCO2/kWh

Source: IEA List   Country: Hungary

CO2 Emission Balance   **Total:** **-285.1 tCO2**

System Lifecycle Emissions Details:

Item	Modules	Supports
LCE	1855 kgCO2/kWp	2.18 kgCO2/kg
Quantity	307 kWp	10240 kg
Subtotal [kgCO2]	569993	22334

Saved CO2 Emission vs. Time