

PVSYST V6.84	Innovative Power Systems (United States)			15/11/19	Page 1/5
Grid-Connected System: Simulation parameters					
Project :		Stassen			
Geographical Site		Minneapolis		Country	United States
Situation		Latitude	44.88° N	Longitude	-93.22° W
Time defined as		Legal Time	Time zone UT-6	Altitude	251 m
		Albedo	0.20		
Meteo data:		Minneapolis	MeteoNorm 7.1 station - Synthetic		
Simulation variant :		As Built 151kWdc_120kWac_180azi			
		Simulation date	15/11/19 13h16		
Simulation parameters		System type	Unlimited sheds		
Collector Plane Orientation		Tilt	10°	Azimuth	0°
Sheds configuration		Nb. of sheds	16	Unlimited sheds	
		Sheds spacing	1.50 m	Collector width	1.00 m
Inactive band		Top	0.02 m	Bottom	0.20 m
Shading limit angle		Limit profile angle	19.7°	Ground cov. Ratio (GCR)	66.7 %
Models used		Transposition	Perez	Diffuse	Perez, Meteonorm
Horizon		Free Horizon			
Near Shadings		Mutual shadings of sheds			
User's needs :		Unlimited load (grid)			
PV Arrays Characteristics (2 kinds of array defined)					
PV module		Si-mono	Model	72M-365	
Custom parameters definition		Manufacturer		Heliene Inc	
Sub-array "Sub-array #1"					
Number of PV modules		In series	17 modules	In parallel	14 strings
Total number of PV modules		Nb. modules	238	Unit Nom. Power	365 Wp
Array global power		Nominal (STC)	86.9 kWp	At operating cond.	78.7 kWp (50°C)
Array operating characteristics (50°C)		U mpp	607 V	I mpp	130 A
Sub-array "Sub-array #2"					
Number of PV modules		In series	16 modules	In parallel	11 strings
Total number of PV modules		Nb. modules	176	Unit Nom. Power	365 Wp
Array global power		Nominal (STC)	64.2 kWp	At operating cond.	58.2 kWp (50°C)
Array operating characteristics (50°C)		U mpp	571 V	I mpp	102 A
Total Arrays global power		Nominal (STC)	151 kWp	Total	414 modules
		Module area	803 m²	Cell area	715 m²
Inverter					
Original PVsyst database		Model	Symo 24.0-3 / 480		
Characteristics		Manufacturer	Fronius USA		
		Operating Voltage	200-800 V	Unit Nom. Power	24.0 kWac
Sub-array "Sub-array #1"		Nb. of inverters	5 * MPPT 0.57	Total Power	69 kWac
				Pnom ratio	1.26
Sub-array "Sub-array #2"		Nb. of inverters	5 * MPPT 0.43	Total Power	51 kWac
				Pnom ratio	1.26
Total		Nb. of inverters	5	Total Power	120 kWac
PV Array loss factors					

Grid-Connected System: Simulation parameters

Array Soiling Losses						Average loss Fraction						6.8 %	
Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.		
13.0%	10.0%	7.0%	5.0%	3.0%	2.0%	2.0%	2.0%	4.0%	7.0%	10.0%	16.0%		
Thermal Loss factor			Uc (const)			20.0 W/m²K			Uv (wind)			0.0 W/m²K / m/s	
Wiring Ohmic Loss			Array#1			79 mOhm			Loss Fraction			1.5 % at STC	
			Array#2			94 mOhm			Loss Fraction			1.5 % at STC	
			Global						Loss Fraction			1.5 % at STC	
LID - Light Induced Degradation									Loss Fraction			0.5 %	
Module Quality Loss									Loss Fraction			-0.3 %	
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	
System loss factors													
			Wires: 3x185.0 mm²			59 m			Loss Fraction			1.2 % at STC	
Unavailability of the system			7.3 days, 5 periods						Time fraction			2.0 %	

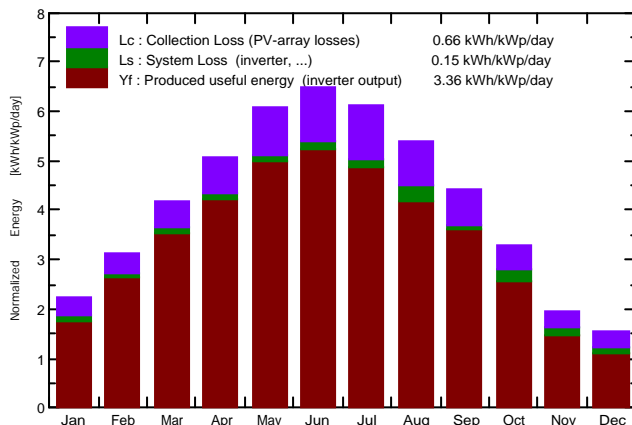
Grid-Connected System: Main results

Project : Stassen
Simulation variant : As Built 151kWdc_120kWac_180azi

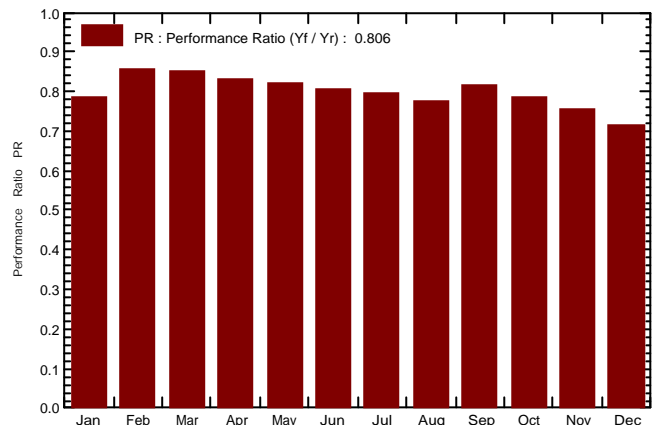
Main system parameters		System type	Unlimited sheds
PV Field Orientation	Sheds disposition, tilt	10°	azimuth 0°
PV modules	Model	72M-365	Pnom 365 Wp
PV Array	Nb. of modules	414	Pnom total 151 kWp
Inverter	Model	Symo 24.0-3 / 480	Pnom 24.00 kW ac
Inverter pack	Nb. of units	5.0	Pnom total 120 kW ac
User's needs	Unlimited load (grid)		

Main simulation results			
System Production	Produced Energy	185.1 MWh/year	Specific prod. 1225 kWh/kWp/year
	Performance Ratio PR	80.57 %	

Normalized productions (per installed kWp): Nominal power 151 kWp



Performance Ratio PR



As Built 151kWdc_120kWac_180azi 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
January	53.4	22.20	-7.98	69.0	56.0	8.78	8.20	0.786
February	72.5	30.50	-6.62	87.2	74.5	11.59	11.28	0.856
March	114.4	46.30	0.43	129.2	114.9	17.12	16.65	0.853
April	142.9	63.10	8.97	152.7	139.1	19.77	19.20	0.832
May	182.9	75.20	14.91	188.3	175.3	24.04	23.32	0.820
June	192.5	80.70	20.53	195.0	183.5	24.46	23.72	0.805
July	186.5	80.80	24.01	190.0	178.9	23.52	22.79	0.794
August	160.1	78.00	22.23	167.4	157.2	21.18	19.58	0.774
September	120.7	53.50	17.44	132.5	121.8	16.83	16.34	0.816
October	87.3	37.50	9.62	102.1	90.4	13.07	12.10	0.784
November	47.8	23.20	2.45	58.7	49.7	7.43	6.71	0.756
December	37.5	20.20	-6.28	48.2	37.1	5.79	5.22	0.717
Year	1398.5	611.19	8.39	1520.3	1378.3	193.58	185.11	0.806

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 :

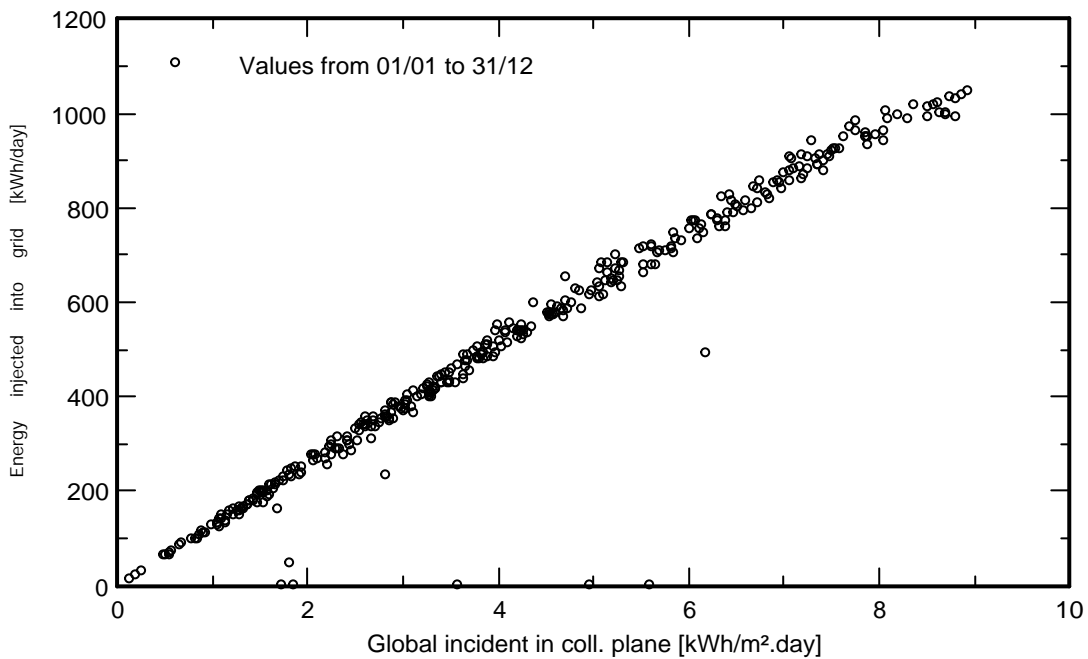
Stassen

Simulation variant :

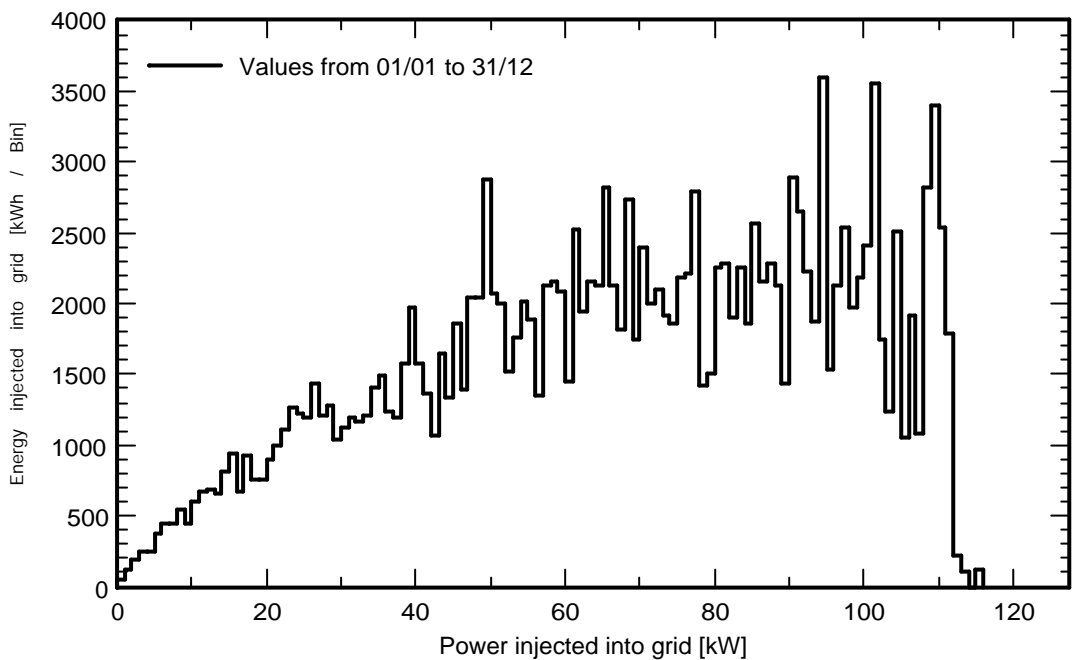
As Built 151kWdc_120kWac_180azi

Main system parameters	System type	Unlimited sheds	
PV Field Orientation	Sheds disposition, tilt	10°	azimuth 0°
PV modules	Model	72M-365	Pnom 365 Wp
PV Array	Nb. of modules	414	Pnom total 151 kWp
Inverter	Model	Symo 24.0-3 / 480	Pnom 24.00 kW ac
Inverter pack	Nb. of units	5.0	Pnom total 120 kW ac
User's needs	Unlimited load (grid)		

Daily Input/Output diagram



System Output Power Distribution



Grid-Connected System: Loss diagram

Project : Stassen
Simulation variant : As Built 151kWdc_120kWac_180azi

Main system parameters	System type	Unlimited sheds		
PV Field Orientation	Sheds disposition, tilt	10°	azimuth	0°
PV modules	Model	72M-365	Pnom	365 Wp
PV Array	Nb. of modules	414	Pnom total	151 kWp
Inverter	Model	Symo 24.0-3 / 480	Pnom	24.00 kW ac
Inverter pack	Nb. of units	5.0	Pnom total	120 kW ac
User's needs	Unlimited load (grid)			

Loss diagram over the whole year

