Grid-Connected System: Simulation parameters

Project : **Net Zero_rev0**

Geographical Site	**Syracuse Hancock Int'l Arpt**		Country	**United States**
Situation	Latitude	43.1°N	Longitude	76.1°W
Time defined as	Legal Time	Time zone UT-5	Altitude	125 m
	Albedo	0.20		
Meteo data:	**Syracuse Hancock Int'l Arpt**	TMY - NREL: TMY3 hourly DB (1991-2005)		

Simulation variant : **Net Zero Baseline_rev0**

Simulation date 23/03/14 00h33

Simulation parameters

Collector Plane Orientation	Tilt	40°	Azimuth	-3°
Models used	Transposition	Perez	Diffuse	Imported
Horizon	Free Horizon			
Near Shadings	According to strings		Electrical effect	100 %
	Shadings of thin objects		Electrical effect	40 %

PV Arrays Characteristics (2 kinds of array defined)

PV module	Si-mono	Model	**Sunmodule Plus SW 275 mono**		
		Manufacturer	SolarWorld AG		
Sub-array "Sub-array #1"		In series	9 modules	In parallel	1 strings
Total number of PV modules		Nb. modules	9	Unit Nom. Power	275 Wp
Array global power		Nominal (STC)	**2475 Wp**	At operating cond.	2209 Wp (50°C)
Array operating characteristics (50°C)		U mpp	250 V	I mpp	8.8 A
Sub-array "Sub-array #2"		In series	9 modules	In parallel	2 strings
Total number of PV modules		Nb. modules	18	Unit Nom. Power	275 Wp
Array global power		Nominal (STC)	**4950 Wp**	At operating cond.	4418 Wp (50°C)
Array operating characteristics (50°C)		U mpp	250 V	I mpp	18 A
Total	Arrays global power	Nominal (STC)	**7 kWp**	Total	27 modules
		Module area	**45.3 m²**		
Sub-array "Sub-array #1" : Inverter		Model	**Sunny Boy SB 3000TL-US-22 - 240V**		
		Manufacturer	SMA		
Characteristics		Operating Voltage	175-480 V	Unit Nom. Power	3.0 kW AC
Sub-array "Sub-array #2" : Inverter		Model	**Sunny Boy SB 5000TL-US-22 - 240V**		
		Manufacturer	SMA		
Characteristics		Operating Voltage	175-480 V	Unit Nom. Power	5 kW AC

PV Array loss factors

Array Soiling Losses

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
18.0%	14.0%	9.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	5.0%	16.0%

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

Grid-Connected System: Simulation parameters (continued)

Wiring Ohmic Loss	Array#1	477 mOhm	Loss Fraction	1.5 % at STC
	Array#2	239 mOhm	Loss Fraction	1.5 % at STC
	Global		Loss Fraction	1.5 % at STC
LID - Light Induced Degradation			Loss Fraction	1.0 %
Module Quality Loss			Loss Fraction	-0.8 %
Module Mismatch Losses			Loss Fraction	1.0 % at MPP
Incidence effect, ASHRAE parametrization	IAM =	1 - bo (1/cos i - 1)	bo Param.	0.05

System loss factors

	Wires	2 m 2x4 mm²	Loss Fraction	0.3 % at STC
Unavailability of the system	3.7 days, 3 periods		Time fraction	1.0 %

User's needs : Unlimited load (grid)

Grid-Connected System: Near shading definition

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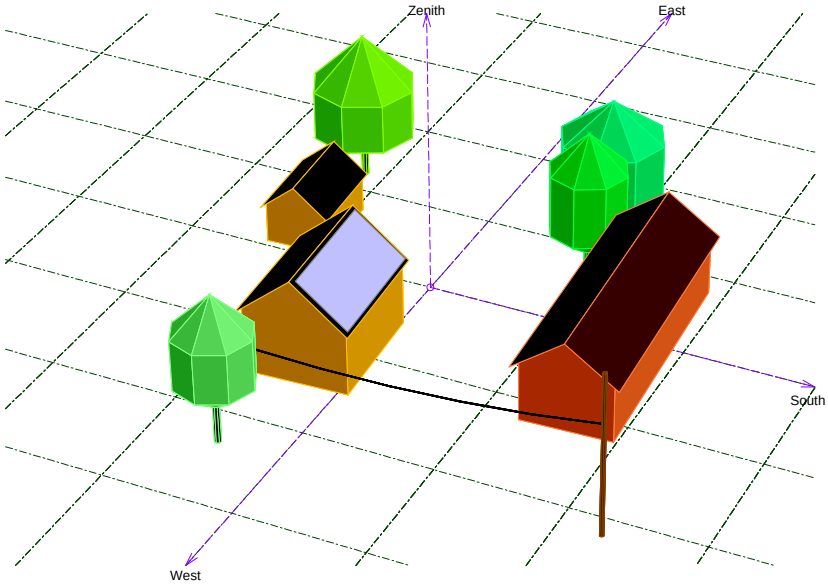
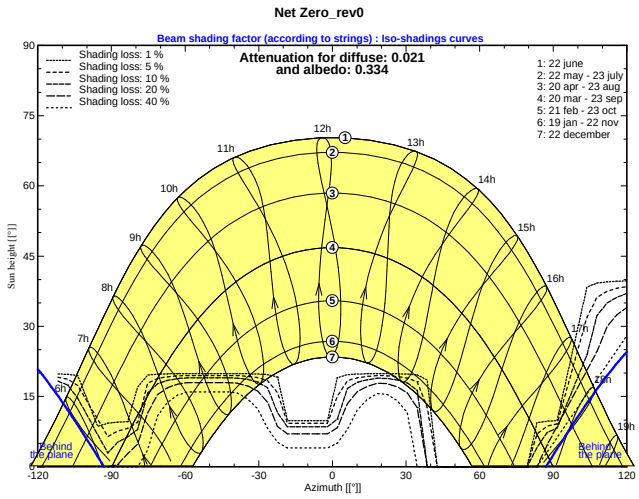
Simulation variant : **Net Zero Baseline_rev0**

Main system parameters	System type	**Grid-Connected**		
Near Shadings	According to strings		Electrical effect	100 %
	Shadings of thin objects		Electrical effect	40 %
PV Field Orientation	tilt	40°	azimuth	-3°
PV modules	Model	Sunmodule Plus SW 275 mono		275 Wp
PV Array	Nb. of modules	27	Pnom total	**7.43 kWp**
Inverter		Sunny Boy SB 3000TL-US-22 - 240V	Pnom	3000 W ac
Inverter		Sunny Boy SB 5000TL-US-22 - 240V	Pnom	5.00 kW ac
Inverter pack	Nb. of units	2.0	Pnom total	**8.00 kW ac**
User's needs	Unlimited load (grid)			

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram



Grid-Connected System: Main results

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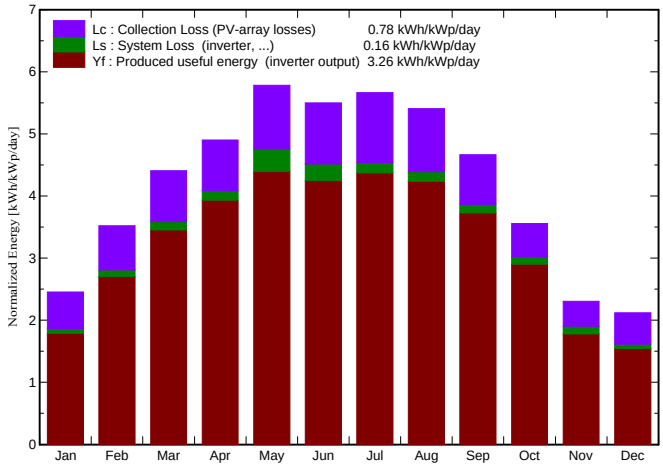
Inverter		Sunny Boy SB 5000TL-US-22 - 240V	Pnom	5.00 kW ac
Inverter pack	Nb. of units	2.0	Pnom total	**8.00 kW ac**
User's needs	Unlimited load (grid)			

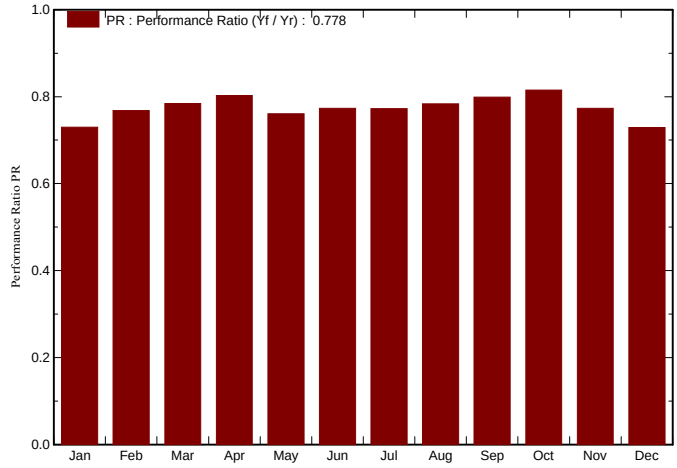
Main simulation results

System Production	**Produced Energy**	**8.84 MWh/year**	Specific prod.	1190 kWh/kWp/year
	Performance Ratio PR	77.8 %		

Normalized productions (per installed kWp): Nominal power 7.43 kWp



Performance Ratio PR



Net Zero Baseline_rev0

Balances and main results

	GlobHor kWh/m²	T Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	EffArrR %	EffSysR %
January	49.6	-3.34	76.1	59.1	0.430	0.412	12.49	11.97
February	71.3	-3.69	98.6	80.7	0.585	0.562	13.10	12.59
March	107.8	3.02	136.7	118.9	0.826	0.796	13.35	12.86
April	137.7	8.85	147.1	137.8	0.911	0.877	13.67	13.16
May	183.5	15.48	179.4	171.2	1.096	1.013	13.49	12.47
June	180.6	19.12	164.9	156.4	1.006	0.947	13.47	12.68
July	186.8	22.08	175.6	167.1	1.045	1.007	13.15	12.67
August	159.9	19.98	167.5	160.0	1.011	0.975	13.33	12.85
September	115.8	15.95	139.9	134.0	0.861	0.830	13.60	13.11
October	80.0	9.72	110.3	104.6	0.695	0.668	13.90	13.37
November	47.8	4.95	69.2	61.8	0.424	0.397	13.55	12.68
December	43.5	-2.36	65.7	52.0	0.372	0.355	12.51	11.96
Year	1364.2	9.22	1530.9	1403.7	9.260	8.838	13.36	12.75

Legends:			
GlobHor	Horizontal global irradiation	EArray	Effective energy at the output of the array
T Amb	Ambient Temperature	E_Grid	Energy injected into grid
GlobInc	Global incident in coll. plane	EffArrR	Effic. Eout array / rough area
GlobEff	Effective Global, corr. for IAM and shadings	EffSysR	Effic. Eout system / rough area

Grid-Connected System: Loss diagram

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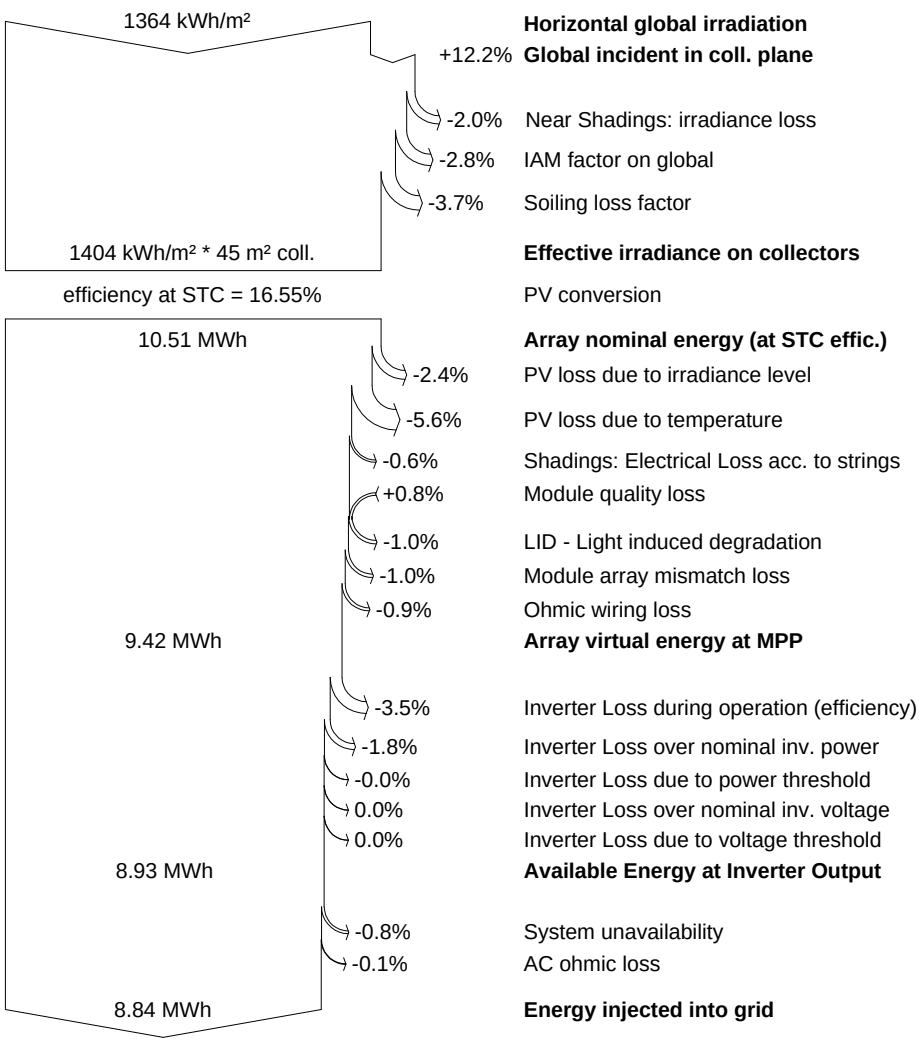
Loss diagram over the whole year