Version 7.4.2

PVsyst - Simulation report

Grid-Connected System

Project: 12553 19th Ave NE

Variant: Maximum Solar Variant_option_silfab_enphase_33_treeremoval_genericloss

Building system

System power: 12.21 kWp

12553 19th Ave NE Seattle - United States

Author

Project: 12553 19th Ave NE

Variant: Maximum Solar
Variant_option_silfab_enphase_33_treeremoval_genericloss

Project summary

Geographical Site
12553 19th Ave NE Seattle
United States

Situation

Latitude	47.72 °N
Longitude	-122.31 °W
Altitude	113 m
Time zone	UTC-8

Project settings
Albedo 0.20

Meteo data
12553 19th Ave NE Seattle
NREL NSRDB Typ. Met. Year PSMv3_1998 to 2020 - TMY

System summary

Grid-Connected System
Simulation for year no 30

Building system

PV Field Orientation
Fixed plane
Tilt/Azimuth 10 / 0 °

Near Shadings
Detailed electrical calculation
acc. to module layout : Slow (simul.)

User's needs
Unlimited load (grid)

System information

PV Array		Inverters	
Nb. of modules	33 units	Nb. of units	33 units
Pnom total	12.21 kWp	Pnom total	9.57 kWac
		Pnom ratio	1.276

Results summary

Produced Energy	11049.67 kWh/year	Specific production	905 kWh/kWp/year	Perf. Ratio PR	68.53 %

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General parameters

Grid-Connected System

Building system

PV Field Orientation

Orientation	
Fixed plane	
Tilt/Azimuth	10 / 0 °

Sheds configuration

Models used

Transposition	Perez
Diffuse	Imported
Circumsolar	separate

Horizon
Free Horizon

Near Shadings
Detailed electrical calculation
acc. to module layout : Slow (simul.)

User's needs
Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	Generic
Model	SLG 370HC
(Original PVsyst database)	
Unit Nom. Power	370 Wp
Number of PV modules	33 units
Nominal (STC)	12.21 kWp
Modules	33 Strings x 1 In series
At operating cond. (50°C)	
Pmpp	11.12 kWp
U mpp	31 V
I mpp	355 A

Inverter

Manufacturer	Generic
Model	IQ7PLUS-72-x-INT
(Original PVsyst database)	
Unit Nom. Power	0.290 kWac
Number of inverters	33 units
Total power	9.6 kWac
Operating voltage	16-48 V
Max. power (=>60°C)	0.300 kWac
Pnom ratio (DC:AC)	1.28

Total PV power

Nominal (STC)	12 kWp
Total	33 modules
Module area	60.3 m²
Cell area	54.6 m²

Total inverter power

Total power	9.6 kWac
Max. power	9.9 kWac
Number of inverters	33 units
Pnom ratio	1.28

Array losses

Thermal Loss factor
Module temperature according to irradiance

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

DC wiring losses

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

Module Quality Loss

Loss Fraction	-0.4 %

Module mismatch losses

Loss Fraction	0.0 % at MPP

Module average degradation

Year no	30
Loss factor	0.59 %/year

Mismatch due to degradation

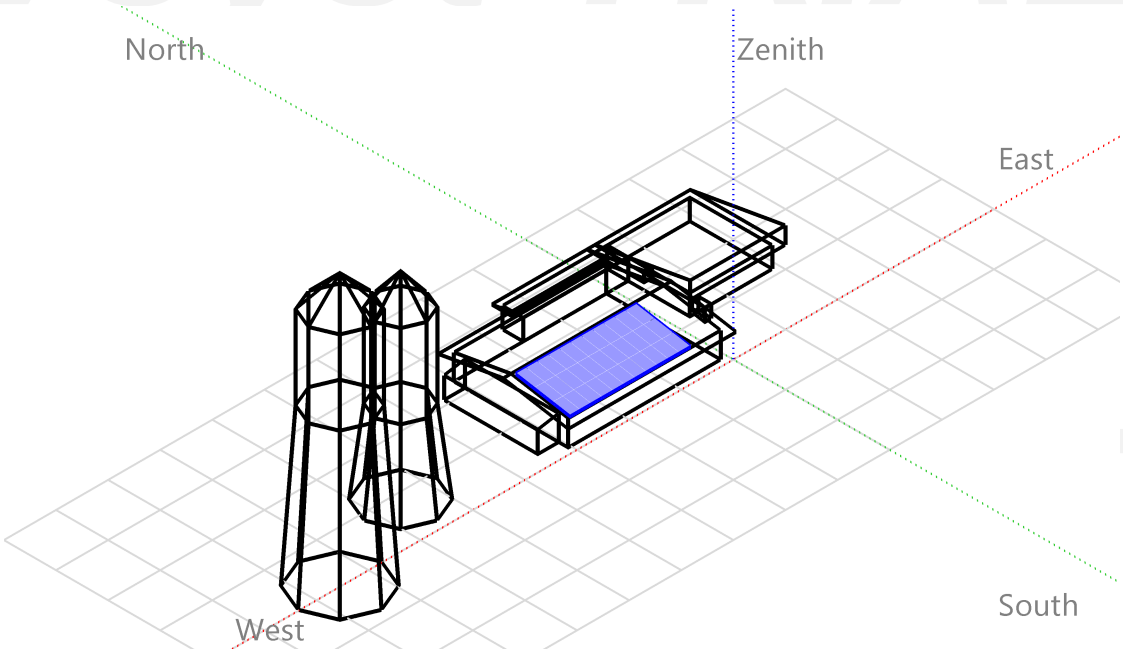
Imp RMS dispersion	0.4 %/year
Vmp RMS dispersion	0.4 %/year

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

Near shadings parameter

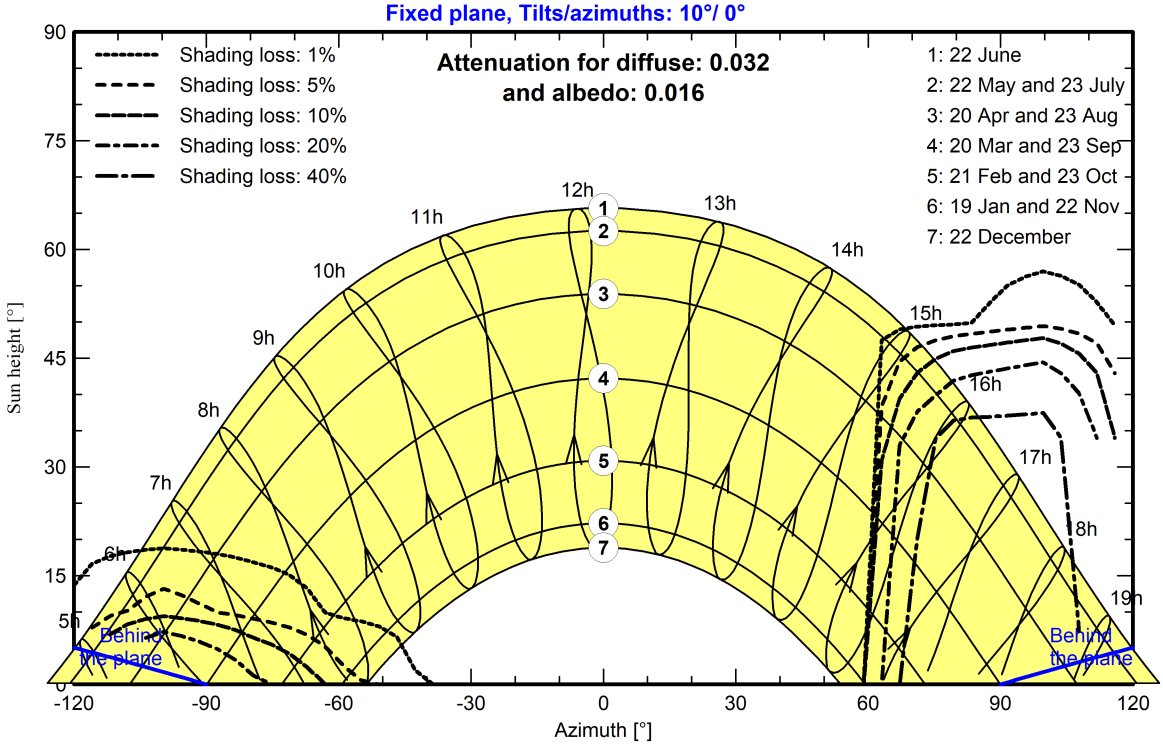
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Orientation #1

Fixed plane, Tilts/azimuths: 10° / 0°



Main results

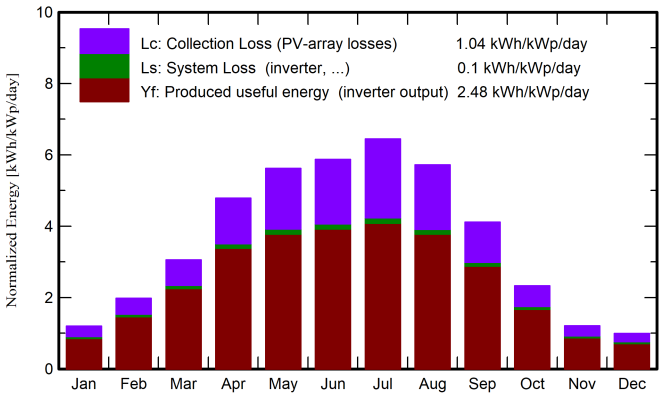
System Production

Produced Energy	11049.67 kWh/year	Specific production	905 kWh/kWp/year
		Perf. Ratio PR	68.53 %

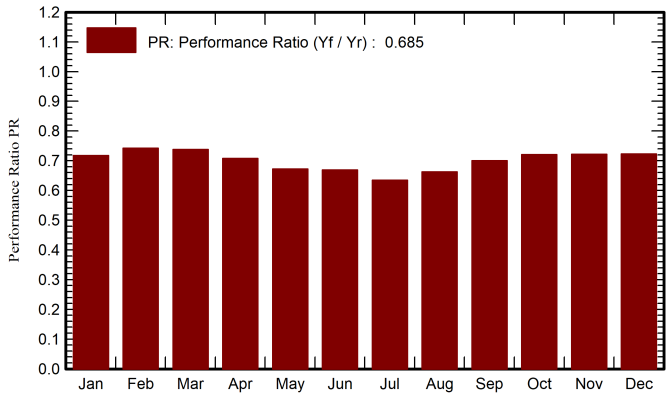
Economic evaluation

Investment		Yearly cost		LCOE	
Global	31,375.04 USD	Annuities	0.00 USD/yr	Energy cost	0.09 USD/kWh
Specific	2.57 USD/Wp	Run. costs	0.00 USD/yr		
		Payback period	12.0 years		

Normalized productions (per installed kWp)



Performance Ratio PR



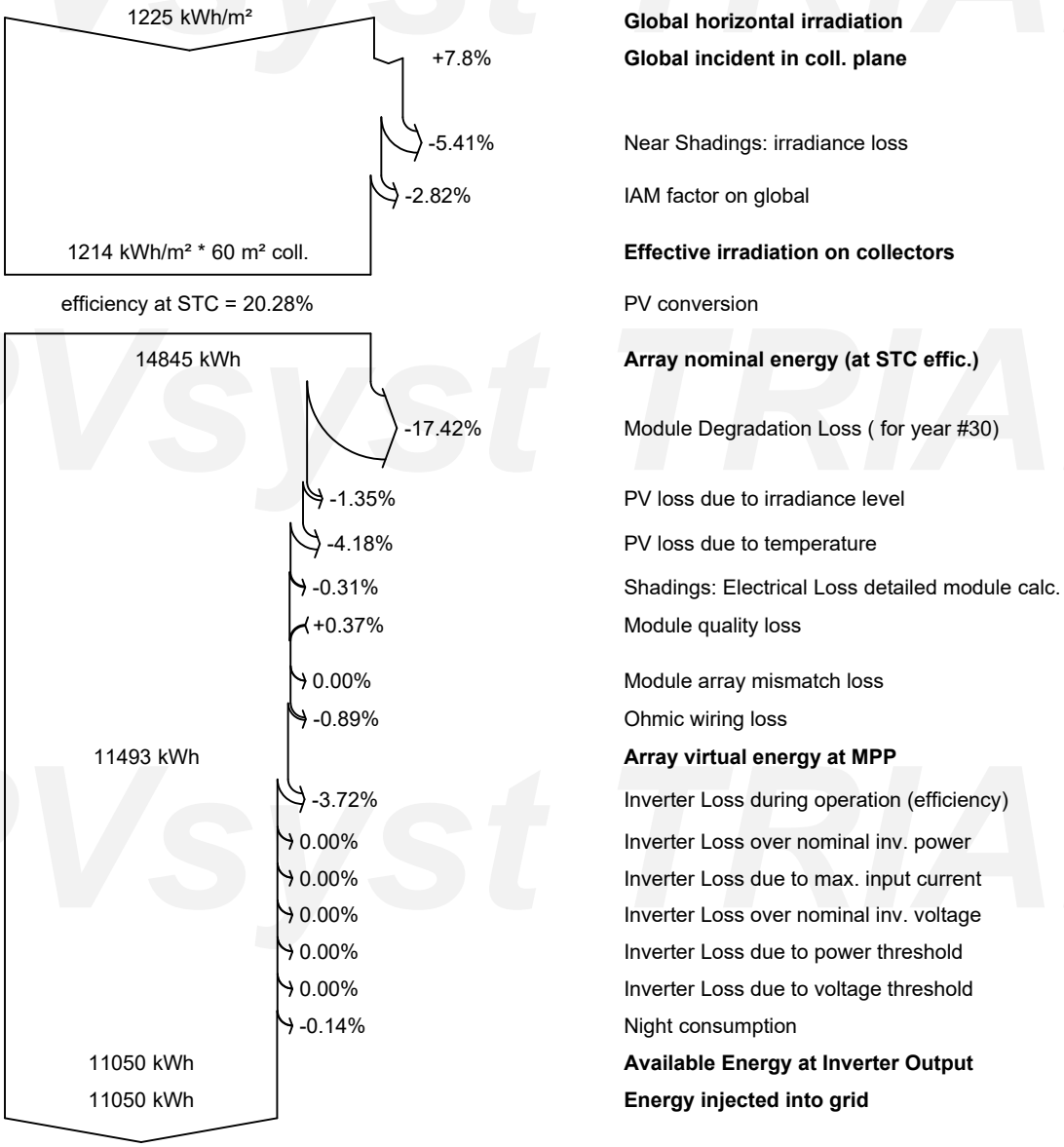
Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	PR ratio
January	29.3	16.25	3.91	37.1	34.5	346	326	0.718
February	46.4	22.90	4.33	55.4	52.5	525	502	0.742
March	85.2	43.34	5.77	94.7	90.1	886	853	0.738
April	134.1	58.96	8.54	143.6	134.6	1286	1241	0.708
May	168.1	71.71	12.01	174.2	158.0	1484	1431	0.673
June	172.8	78.22	14.27	176.0	159.9	1491	1437	0.669
July	194.9	60.31	16.76	199.7	176.1	1604	1547	0.634
August	167.4	61.60	16.62	177.2	160.5	1483	1432	0.662
September	111.1	40.74	14.76	123.5	116.7	1095	1056	0.701
October	61.8	25.50	9.98	72.1	68.7	663	634	0.721
November	30.0	18.60	6.09	36.3	33.9	339	320	0.722
December	24.0	14.36	3.10	30.8	28.5	289	272	0.722
Year	1225.1	512.48	9.71	1320.5	1213.9	11493	11050	0.685

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

Loss diagram



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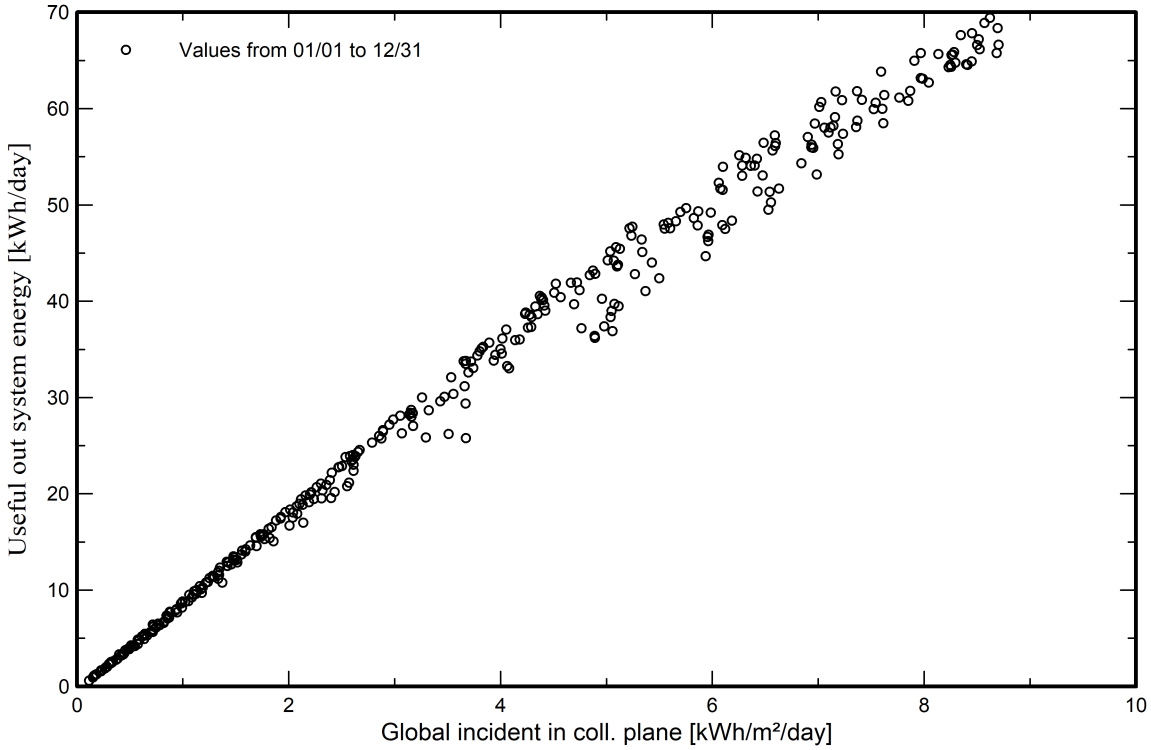
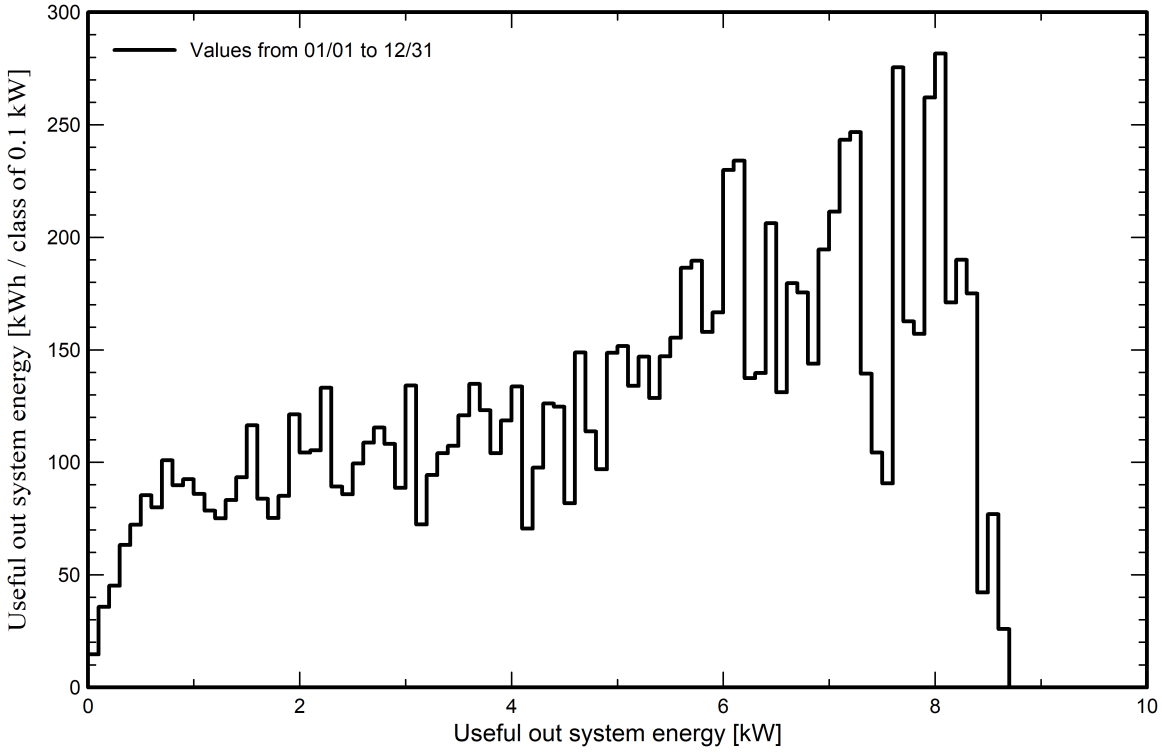
Predef. graphs

Daily Input/Output diagram



System Output Power Distribution



Aging Tool

Aging Parameters

Time span of simulation 30 years

Module average degradation

Loss factor 0.59 %/year

Mismatch due to degradation

Imp RMS dispersion 0.4 %/year

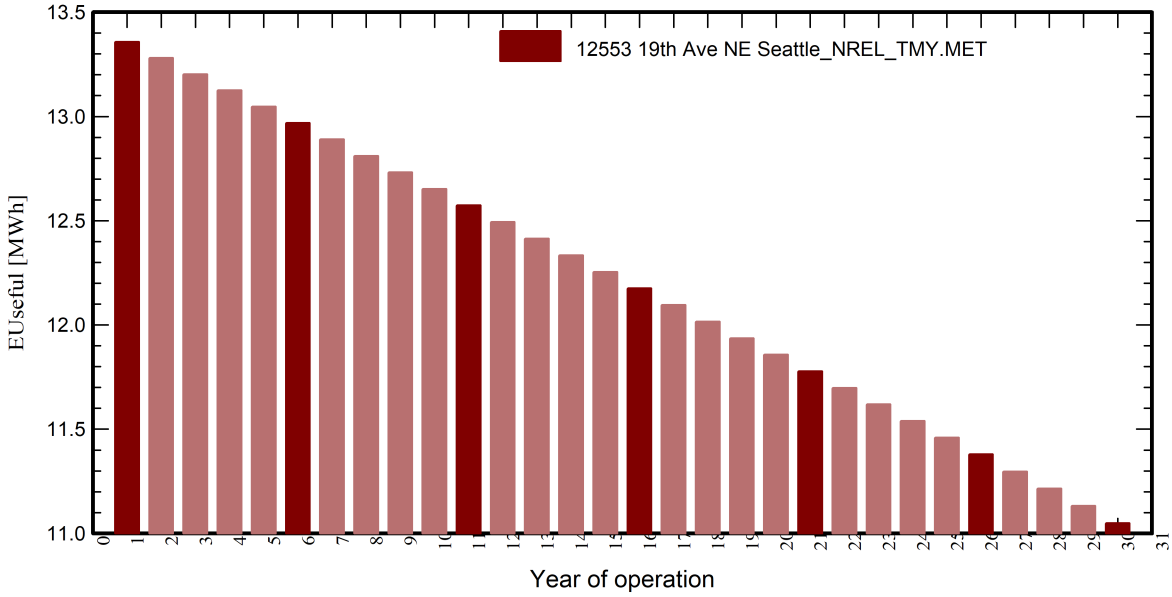
Vmp RMS dispersion 0.4 %/year

Meteo used in the simulation

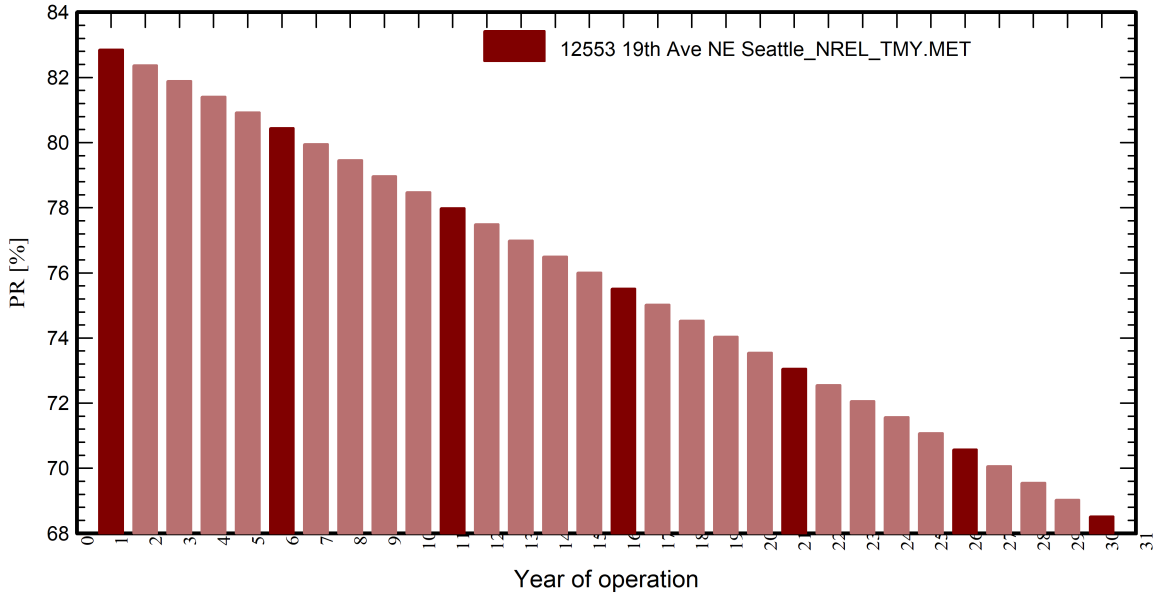
12553 19th Ave NE Seattle NREL TMY

Years reference year

Useful out system energy



Performance Ratio



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Meteo used in the simulation

12553 19th Ave NE Seattle NREL TMY

Years reference year

	EUseful	PR	PR loss
Year	MWh	%	%
1	13.36	82.85	-0.29
2	13.28	82.37	-0.87
3	13.20	81.89	-1.45
4	13.12	81.40	-2.03
5	13.05	80.92	-2.61
6	12.97	80.44	-3.19
7	12.89	79.95	-3.78
8	12.81	79.46	-4.37
9	12.73	78.96	-4.97
10	12.65	78.47	-5.56
11	12.57	77.98	-6.15
12	12.49	77.49	-6.75
13	12.41	76.99	-7.34
14	12.33	76.50	-7.93
15	12.25	76.00	-8.53
16	12.17	75.51	-9.12
17	12.10	75.02	-9.72
18	12.02	74.53	-10.31
19	11.94	74.03	-10.90
20	11.86	73.54	-11.49
21	11.78	73.05	-12.08
22	11.70	72.56	-12.68
23	11.62	72.06	-13.27
24	11.54	71.57	-13.87
25	11.46	71.07	-14.46
26	11.38	70.58	-15.06
27	11.30	70.07	-15.68
28	11.21	69.55	-16.30
29	11.13	69.04	-16.92
30	11.05	68.52	-17.54

P50 - P90 evaluation

Meteo data

Meteo	NREL NSRDB Typ. Met. Year PSMv3_1998 to 2020
Kind	TMY, multi-year
Year-to-year variability(Variance)	5.8 %
Specified Deviation	
Climate change	0.0 %

Simulation and parameters uncertainties

PV module modelling/parameters	1.0 %
Inverter efficiency uncertainty	0.5 %
Soiling and mismatch uncertainties	1.0 %
Degradation uncertainty	1.0 %

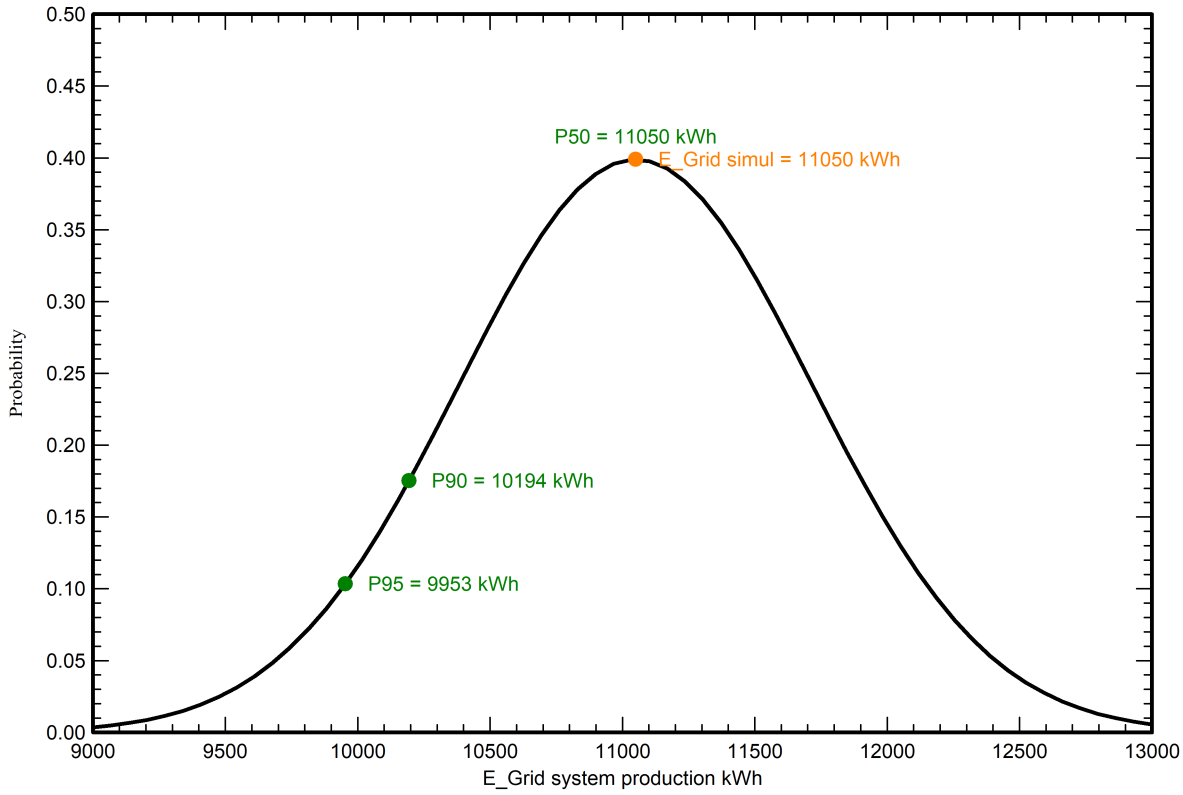
Global variability (meteo + system)

Variability (Quadratic sum)	6.0 %

Annual production probability

Variability	667 kWh
P50	11050 kWh
P90	10194 kWh
P95	9953 kWh

Probability distribution



Single-line diagram

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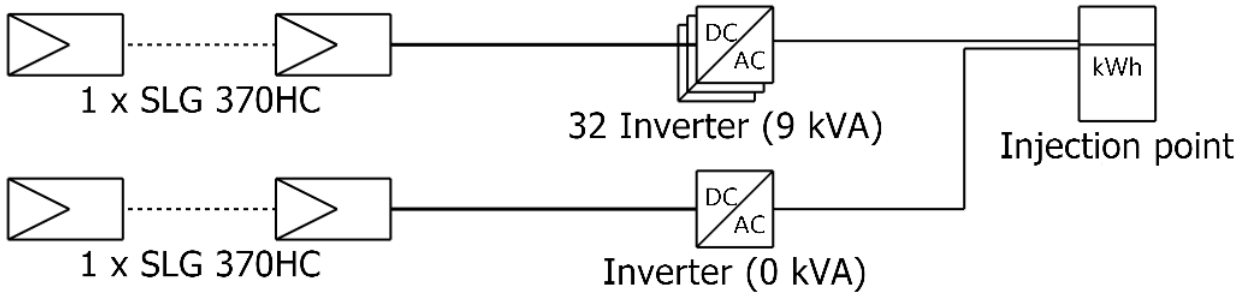


PV module	SLG 370HC
Inverter	IQ7PLUS-72-x-INT
String	1 x SLG 370HC

	12553 19th Ave NE	
	VCA : Maximum Solar Variant_option_silfab_enphase_33_treeremoval_generic	10/05/23

Cost of the system

Installation costs

Item	Quantity units	Cost USD	Total USD
PV modules			
SLG 370HC	33	190.37	6,282.05
Other components			
Structural BOS	1953	1.00	1,953.00
Electrical BOS	3940	1.00	3,940.40
Breaker Box Upgrade	2000	1.00	2,000.00
Studies and analysis			
Overhead	2060	1.00	2,060.00
Permitting and other admin. Fees	1628	1.00	1,628.00
Sales and Marketing	3139	1.00	3,139.00
Installation			
Labor	833	1.00	833.28
Electrical Installation	1206	1.00	1,206.30
Taxes and Profit			
Profit	1	0.00	5,386.96
Other taxes	1	0.00	2,946.05
		Total	31,375.04
		Depreciable asset	8,235.05

Operating costs

Item	Total USD/year
Total (OPEX)	0.00
Including inflation (5.00%)	0.00

System summary

Total installation cost	31,375.04 USD
Operating costs (incl. inflation 5.00%/year)	0.00 USD/year
Produced Energy	11.1 MWh/year
Cost of produced energy (LCOE)	0.086 USD/kWh

Financial analysis

Simulation period

Project lifetime	25 years	Start year	2024

Income variation over time

Inflation	5.00 %/year
Production variation (aging)	Aging tool results
Discount rate	0.00 %/year

Income dependent expenses

Income tax rate	0.00 %/year
Other income tax	0.00 %/year
Dividends	0.00 %/year

Depreciable assets

Asset	Depreciation method	Depreciation period (years)	Salvage value (USD)	Depreciable (USD)
PV modules				
SLG 370HC	Straight-line	20	0.00	6,282.05
Structural BOS	Straight-line	20	0.00	1,953.00
		Total	0.00	8,235.05

Financing

Own funds	21,962.53 USD
Subsidies	9,412.51 USD

Electricity sale

Feed-in tariff	0.1300 USD/kWh
Duration of tariff warranty	20 years
Annual connection tax	0.00 USD/kWh
Annual tariff variation	+5.0 %/year
Feed-in tariff decrease after warranty	0.00 %

Return on investment

Payback period	12.0 years
Net present value (NPV)	38,114.73 USD
Internal rate of return (IRR)	8.14 %
Return on investment (ROI)	173.5 %

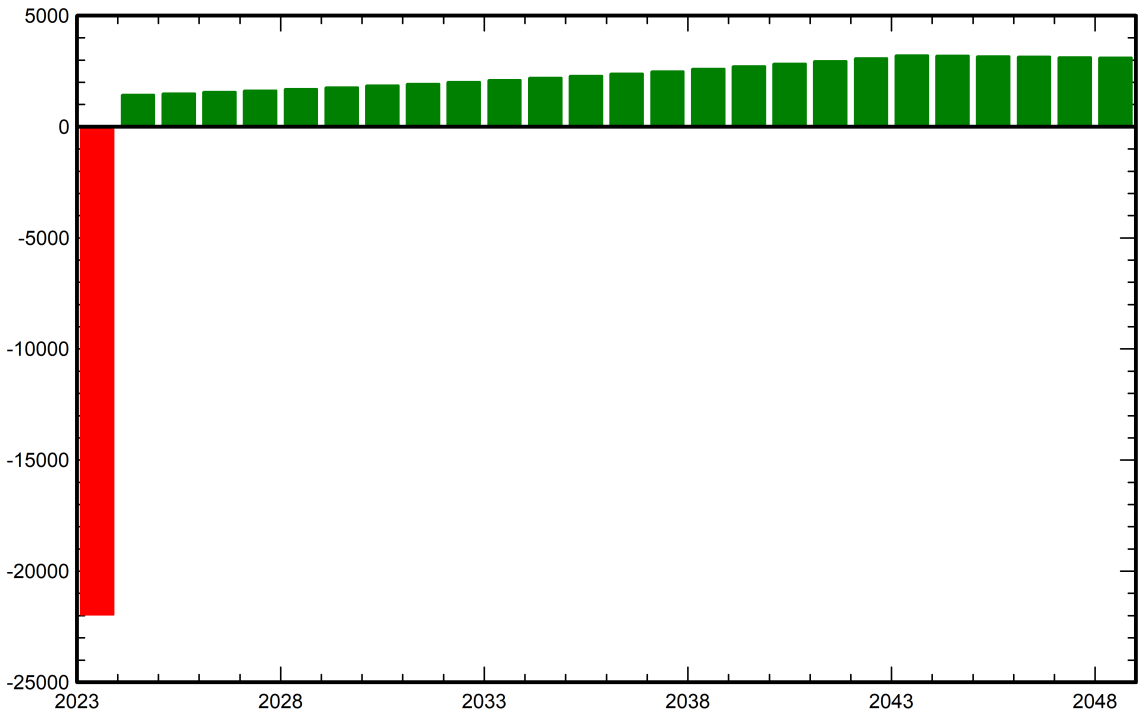
Financial analysis

Detailed economic results (USD)

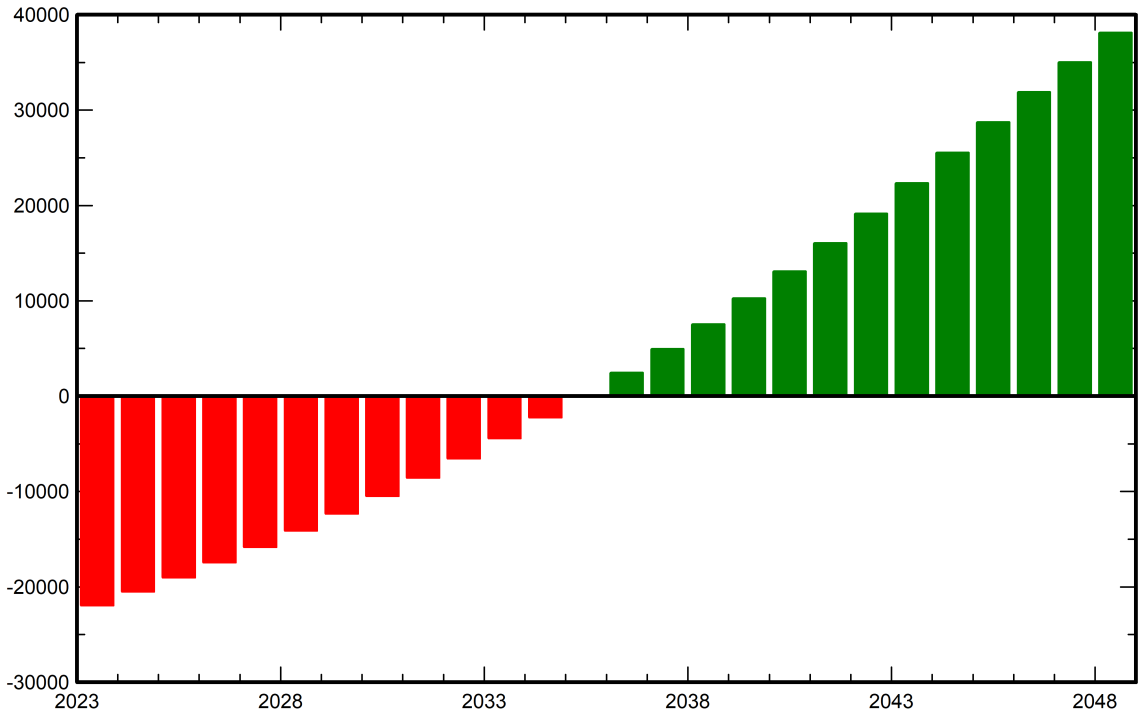
Year	Electricity sale	Own funds	Run. costs	Deprec. allow.	Taxable income	Taxes	After-tax profit	Cumul. profit	% amorti.
0	0	21,963	0	0	0	0	0	-21,963	0.0%
1	1,434	0	0	412	1,022	0	1,434	-20,528	6.5%
2	1,497	0	0	412	1,085	0	1,497	-19,031	13.3%
3	1,563	0	0	412	1,151	0	1,563	-17,469	20.5%
4	1,631	0	0	412	1,219	0	1,631	-15,838	27.9%
5	1,703	0	0	412	1,291	0	1,703	-14,135	35.6%
6	1,777	0	0	412	1,365	0	1,777	-12,358	43.7%
7	1,854	0	0	412	1,443	0	1,854	-10,504	52.2%
8	1,935	0	0	412	1,523	0	1,935	-8,568	61.0%
9	2,019	0	0	412	1,608	0	2,019	-6,549	70.2%
10	2,107	0	0	412	1,695	0	2,107	-4,442	79.8%
11	2,199	0	0	412	1,787	0	2,199	-2,243	89.8%
12	2,294	0	0	412	1,882	0	2,294	51	100.2%
13	2,393	0	0	412	1,982	0	2,393	2,444	111.1%
14	2,497	0	0	412	2,085	0	2,497	4,941	122.5%
15	2,605	0	0	412	2,193	0	2,605	7,546	134.4%
16	2,717	0	0	412	2,305	0	2,717	10,263	146.7%
17	2,834	0	0	412	2,423	0	2,834	13,097	159.6%
18	2,957	0	0	412	2,545	0	2,957	16,054	173.1%
19	3,084	0	0	412	2,672	0	3,084	19,138	187.1%
20	3,217	0	0	412	2,805	0	3,217	22,355	201.8%
21	3,195	0	0	0	3,195	0	3,195	25,550	216.3%
22	3,174	0	0	0	3,174	0	3,174	28,724	230.8%
23	3,152	0	0	0	3,152	0	3,152	31,876	245.1%
24	3,130	0	0	0	3,130	0	3,130	35,006	259.4%
25	3,109	0	0	0	3,109	0	3,109	38,115	273.5%
Total	**60,077**	**21,963**	**0**	**8,235**	**51,842**	**0**	**60,077**	**38,115**	**273.5%**

Financial analysis

Yearly net profit (USD)



Cumulative cashflow (USD)



CO_2 Emission Balance

Total: 118.3 tCO_2

Generated emissions

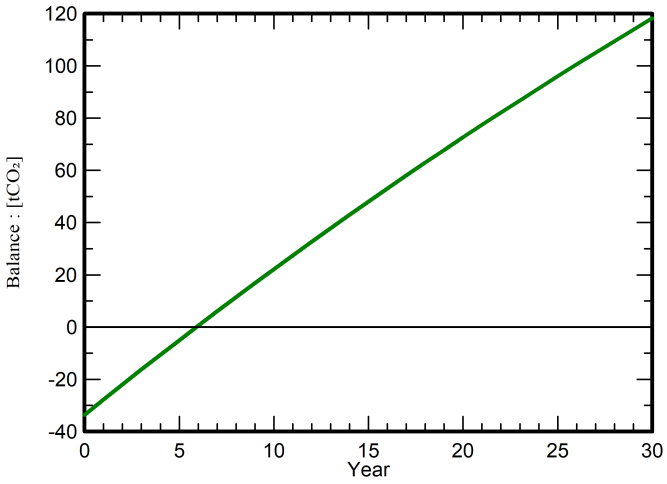
Total: 33.59 tCO_2

Source: Detailed calculation from table below

Replaced Emissions

Total:	175.0 tCO_2
System production:	11.05 MWh/yr
Grid Lifecycle Emissions:	528 gCO_2/kWh
Source:	IEA List
Country:	United States
Lifetime:	30 years
Annual degradation:	1.0 %

Saved CO_2 Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[$kgCO_2$]
Modules	1713 kgCO2/kWp	12.2 kWp	20912
Supports	3.52 kgCO2/kg	330 kg	1162
Inverters	349 kgCO2/	33.0	11514