

Trieu

Company

Please enter in Options > User data.

Client

Project





3D, Grid Connected PV System

Climate Data

Soquel (1991 - 2010)

PV Generator Output

5.2 kWp

PV Generator Surface

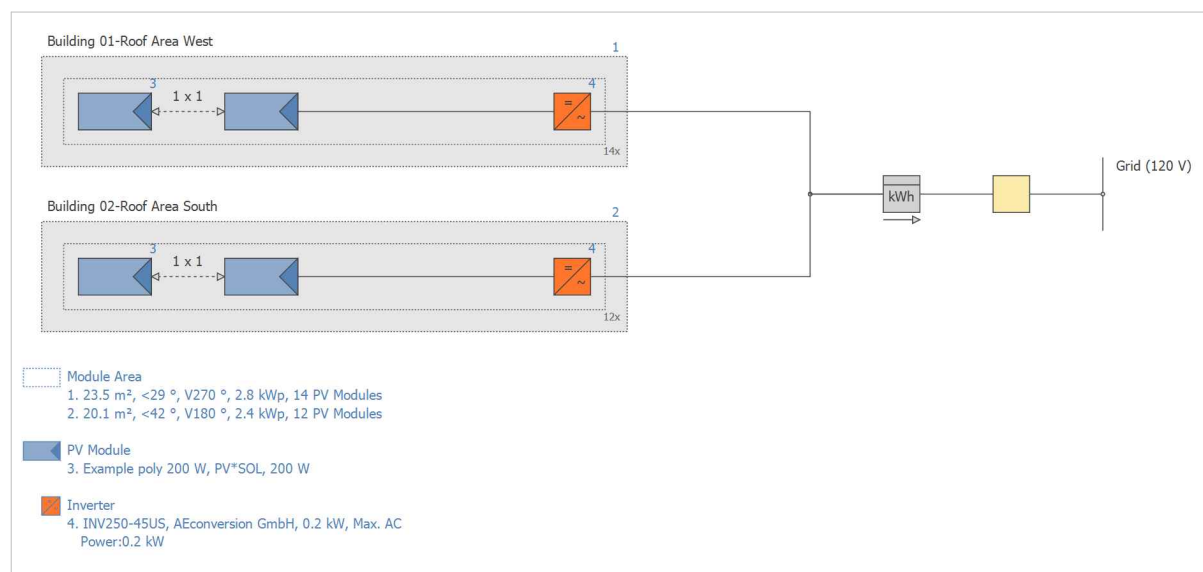
43.6 m²

Number of PV Modules

26

Number of Inverters

26



Date of Offer: 8/8/2016

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The yield

PV Generator Energy (AC grid)	6,898 kWh
Spec. Annual Yield	1,326.50 kWh/kWp
Performance Ratio (PR)	76.0 %
Calculation of Shading Losses	7.6 %/year
CO ₂ Emissions avoided	4,137 kg / year

Your Gain

Total investment costs	7,800.00 \$
Return on Assets	3.79 %
Amortization Period	15.4 Years
Electricity Production Costs	0.06 \$/kWh

The results have been calculated with a mathematical model calculation from Valentin Software GmbH (PV*SOL algorithms). The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Set-up of the system

Climate Data	Soquel
Type of System	3D, Grid Connected PV System

PV Generator 1. Module Area

Name	Building 01-Roof Area West
PV Modules*	14 x Example poly 200 W
Manufacturer	PV*SOL
Inclination	29 °
Orientation	West 270 °
Installation Type	Roof parallel
PV Generator Surface	23.5 m ²

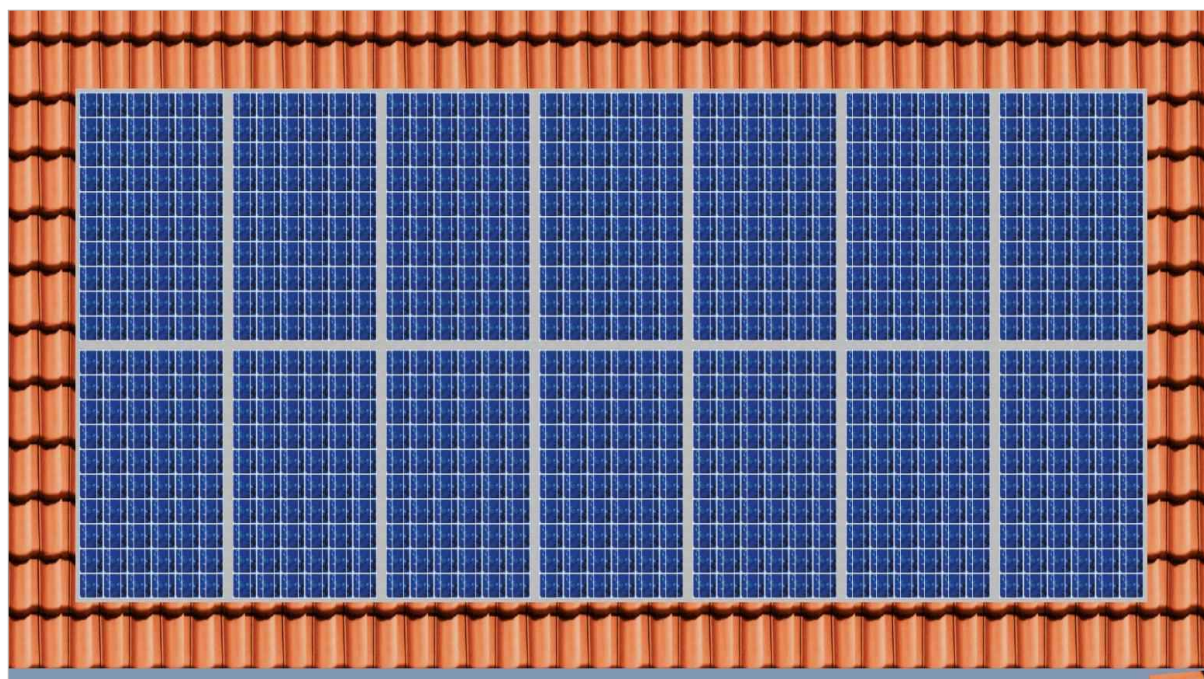


Figure: 3D Design for Building 01-Roof Area West

Losses**PV Generator 2. Module Area**

Name	Building 02-Roof Area South
PV Modules*	12 x Example poly 200 W
Manufacturer	PV*SOL
Inclination	42 °
Orientation	South 180 °
Installation Type	Roof parallel
PV Generator Surface	20.1 m ²

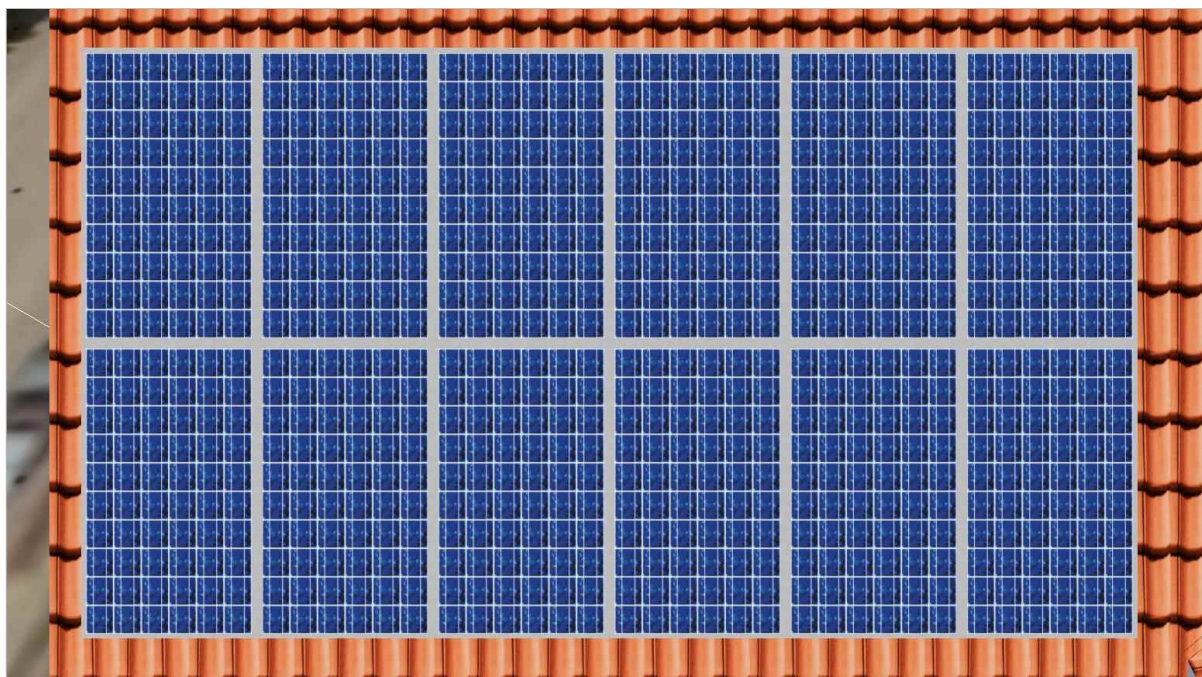


Figure: 3D Design for Building 02-Roof Area South

Losses

Inverter

1. Module Area

Inverter 1*
Manufacturer
Configuration

Building 01-Roof Area West

14 x INV250-45US
AEconversion GmbH
MPP 1: 1 x 1

2. Module Area

Inverter 1*
Manufacturer
Configuration

Building 02-Roof Area South

12 x INV250-45US
AEconversion GmbH
MPP 1: 1 x 1

AC Mains

Number of Phases	3
Mains Voltage (1-phase)	120 V
Displacement Power Factor (cos phi)	+/- 1

Cable

Max. Total Loss	0 %
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* The guarantee provisions of the respective manufacturer apply

Simulation Results**PV System**

PV Generator Output	5.2 kWp
Spec. Annual Yield	1,326.50 kWh/kWp
Performance Ratio (PR)	76.0 %
Yield Reduction due to Shading	7.6 %/year

Grid Feed-in	6,898 kWh/year
Grid Feed-in in the first year (incl. module degradation)	6,898 kWh/year
Stand-by Consumption	3 kWh/year
CO ₂ Emissions avoided	4,137 kg / year

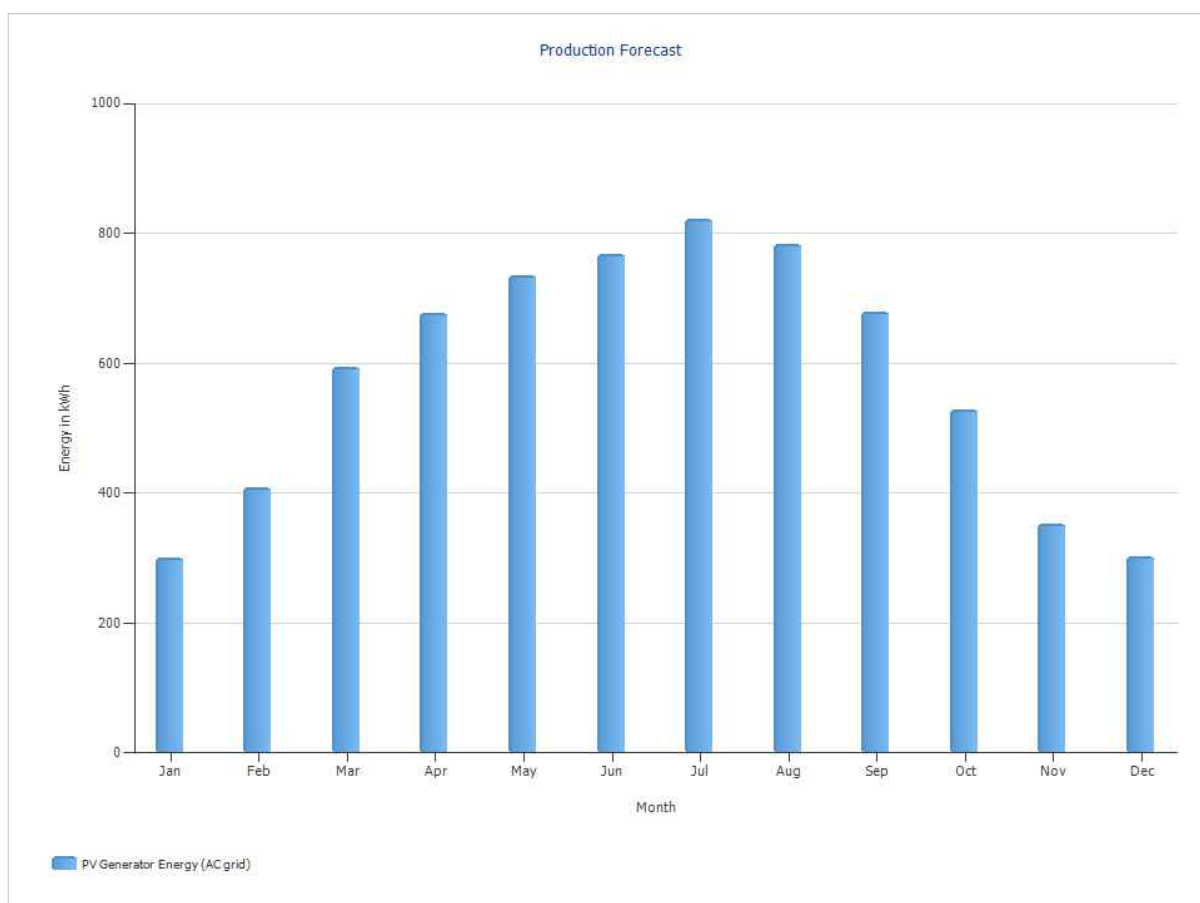


Figure: Production Forecast

PV System Energy Balance

Global radiation - horizontal	1,787.7 kWh/m²	
Deviation from standard spectrum	-17.88 kWh/m ²	-1.00 %
Orientation and inclination of the module surface	-1.61 kWh/m ²	-0.09 %
Shading of diffuse radiation by horizon	-23.15 kWh/m ²	-1.31 %
Reflection on the Module Interface	-81.40 kWh/m ²	-4.66 %

Global Radiation at the Module	1,663.7 kWh/m²	
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$$\begin{aligned}
 &1,663.7 \text{ kWh/m}^2 \\
 &\times 43.59 \text{ m}^2 \\
 &= 72,527.5 \text{ kWh}
 \end{aligned}$$

Global PV Radiation	72,527.5 kWh	
Soiling	0.00 kWh	0.00 %
STC Conversion (Rated Efficiency of Module 11.93 %)	-63,872.03 kWh	-88.07 %

Rated PV Energy	8,655.5 kWh	
Module-specific Partial Shading	-226.40 kWh	-2.62 %
Low-light performance	-413.37 kWh	-4.90 %
Deviation from the nominal module temperature	-354.49 kWh	-4.42 %
Diodes	-12.22 kWh	-0.16 %
Mismatch (Manufacturer Information)	0.00 kWh	0.00 %
Mismatch (Configuration/Shading)	0.00 kWh	0.00 %

PV Energy (DC) without inverter regulation	7,649.0 kWh	
Regulation on account of the MPP Voltage Range	-41.31 kWh	-0.54 %
Regulation on account of the max. DC Current	0.00 kWh	0.00 %
Regulation on account of the max. DC Power	0.00 kWh	0.00 %
Regulation on account of the max. AC Power/cos phi	0.00 kWh	0.00 %
MPP Matching	-27.48 kWh	-0.36 %

PV energy (DC)	7,580.2 kWh	
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Energy at the Inverter Input	7,580.2 kWh	
Input voltage deviates from rated voltage	-1.14 kWh	-0.02 %
DC/AC Conversion	-681.29 kWh	-8.99 %
Stand-by Consumption	-3.33 kWh	-0.05 %
Total Cable Losses	0.00 kWh	0.00 %

PV energy (AC) minus standby use	6,894.4 kWh	
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Grid Feed-in	6,897.8 kWh	
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Financial Analysis

System Data

Grid Feed-in in the first year (incl. module degradation)	6,898 kWh/year
PV Generator Output	5.2 kWp
Start of Operation of the System	1/1/2015
Assessment Period	20 Years

Economic Parameters

Return on Assets	3.79 %
Accrued Cash Flow (Cash Balance)	2,855.14 \$
Amortization Period	15.4 Years
Electricity Production Costs	0.06 \$/kWh

Payment Overview

Specific Investment Costs	1,500.00 \$/kWp
Investment Costs	7,800.00 \$
One-off Payments	0.00 \$
Incoming Subsidies	0.00 \$
Annual Costs	0.00 \$/year
Other Revenue or Savings	0.00 \$/year

Remuneration and Savings

Total Payment from Utility in First Year	0.00 \$
California feed-in tariff program - 20 year term - All	
Validity	8/8/2016 - 8/7/2036
Specific feed-in / export Remuneration	0.0895 \$/kWh
Feed-in / Export Tariff	617.35 \$/year

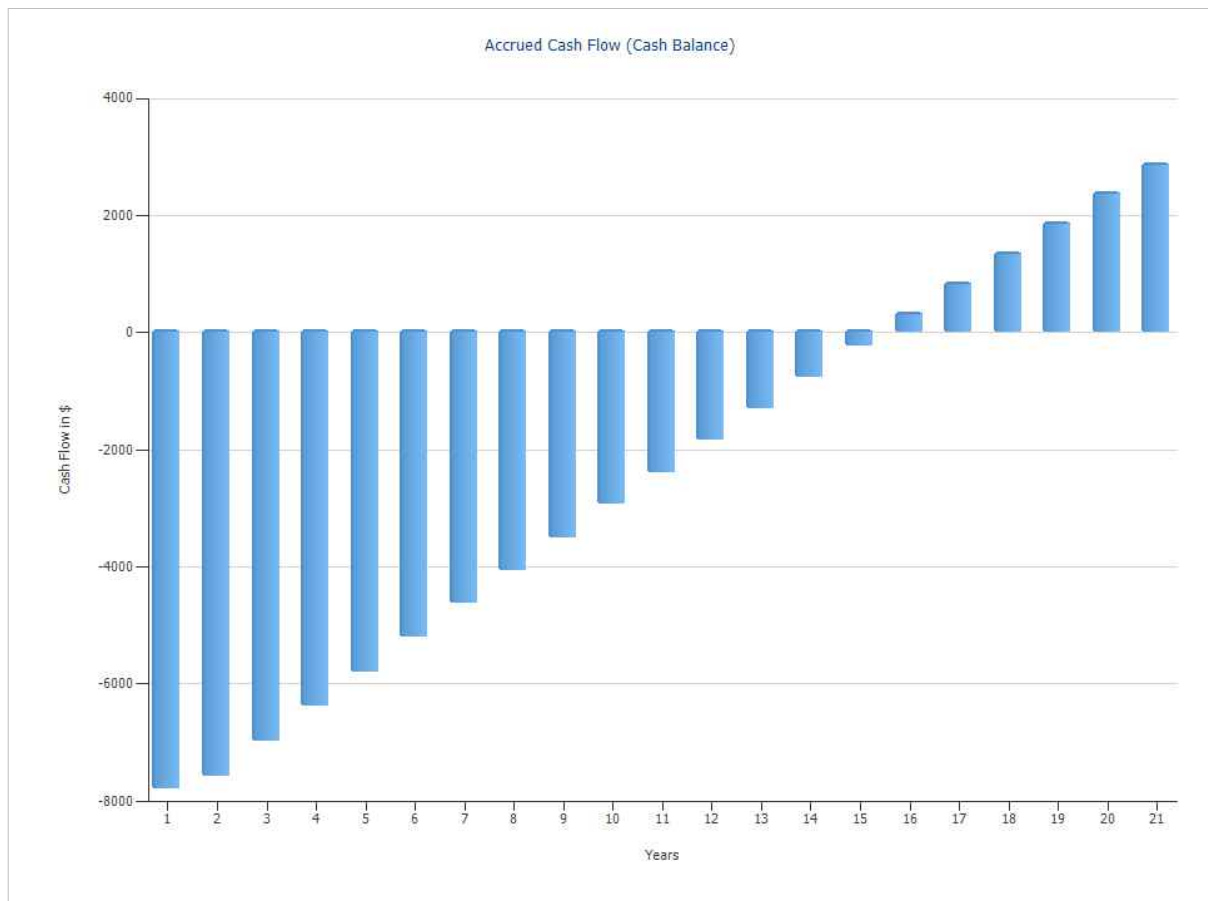


Figure: Accrued Cash Flow (Cash Balance)

Cashflow Table

	year 1	year 2	year 3	year 4	year 5
Investments	(\$7,800.00)	\$0.00	\$0.00	\$0.00	\$0.00
Feed-in / Export Tariff	\$0.00	\$230.19	\$599.19	\$593.26	\$587.39
Annual Cash Flow	(\$7,800.00)	\$230.19	\$599.19	\$593.26	\$587.39
Accrued Cash Flow (Cash Balance)	(\$7,800.00)	(\$7,569.81)	(\$6,970.61)	(\$6,377.35)	(\$5,789.96)

	year 6	year 7	year 8	year 9	year 10
Investments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Feed-in / Export Tariff	\$581.57	\$575.81	\$570.11	\$564.47	\$558.88
Annual Cash Flow	\$581.57	\$575.81	\$570.11	\$564.47	\$558.88
Accrued Cash Flow (Cash Balance)	(\$5,208.39)	(\$4,632.58)	(\$4,062.46)	(\$3,498.00)	(\$2,939.12)

	year 11	year 12	year 13	year 14	year 15
Investments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Feed-in / Export Tariff	\$553.35	\$547.87	\$542.44	\$537.07	\$531.75
Annual Cash Flow	\$553.35	\$547.87	\$542.44	\$537.07	\$531.75
Accrued Cash Flow (Cash Balance)	(\$2,385.77)	(\$1,837.90)	(\$1,295.46)	(\$758.39)	(\$226.63)

	year 16	year 17	year 18	year 19	year 20
Investments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Feed-in / Export Tariff	\$526.49	\$521.28	\$516.12	\$511.01	\$505.95
Annual Cash Flow	\$526.49	\$521.28	\$516.12	\$511.01	\$505.95
Accrued Cash Flow (Cash Balance)	\$299.86	\$821.14	\$1,337.25	\$1,848.26	\$2,354.20

	year 21
Investments	\$0.00
Feed-in / Export Tariff	\$500.94
Annual Cash Flow	\$500.94
Accrued Cash Flow (Cash Balance)	\$2,855.14

Degradation and inflation rates are applied on a monthly basis over the entire observation period.
This is done in the first year.

PV Module: Example poly 200 W

Manufacturer	PV*SOL
Available	Yes

Electrical Data

Cell Type	Si polycrystalline
Only Transformer Inverters suitable	No
Number of Cells	60
Number of Bypass Diodes	3

Mechanical Data

Width	1001 mm
Height	1675 mm
Depth	38 mm
Frame Width	30 mm
Weight	22 kg
Framed	No

I/V Characteristics at STC

MPP Voltage	28.3 V
MPP Current	7.07 A
Power Rating	200 W
Open Circuit Voltage	36.1 V
Short-Circuit Current	7.7 A
Increase open circuit voltage before stabilisation	0 %

I/V Part Load Characteristics (calculated)

Values source	Standard (Two-diode Model)
Series resistance Rs	7.51e-03 Ω
Parallel Resistance Rp	1.802 Ω
Saturation Current Parameters Cs1	195.8 A/K ³
Saturation Current Parameters Cs2	-1.459e-13 A/K ^(2,5)
Photocurrent Parameters C1	6.957e-03 m ² /V
Photocurrent Parameters C2	2.6e-06 m ² /V
Photocurrent	7.732 A

Further

Voltage Coefficient	-123 mV/K
Electricity Coefficient	2.6 mA/K
Output Coefficient	-0.4 %/K
Incident Angle Modifier	95 %
Maximum System Voltage	1000 V
Spec. Heat Capacity	920 J/(kg*K)
Absorption Coefficient	70 %
Emissions Coefficient	85 %

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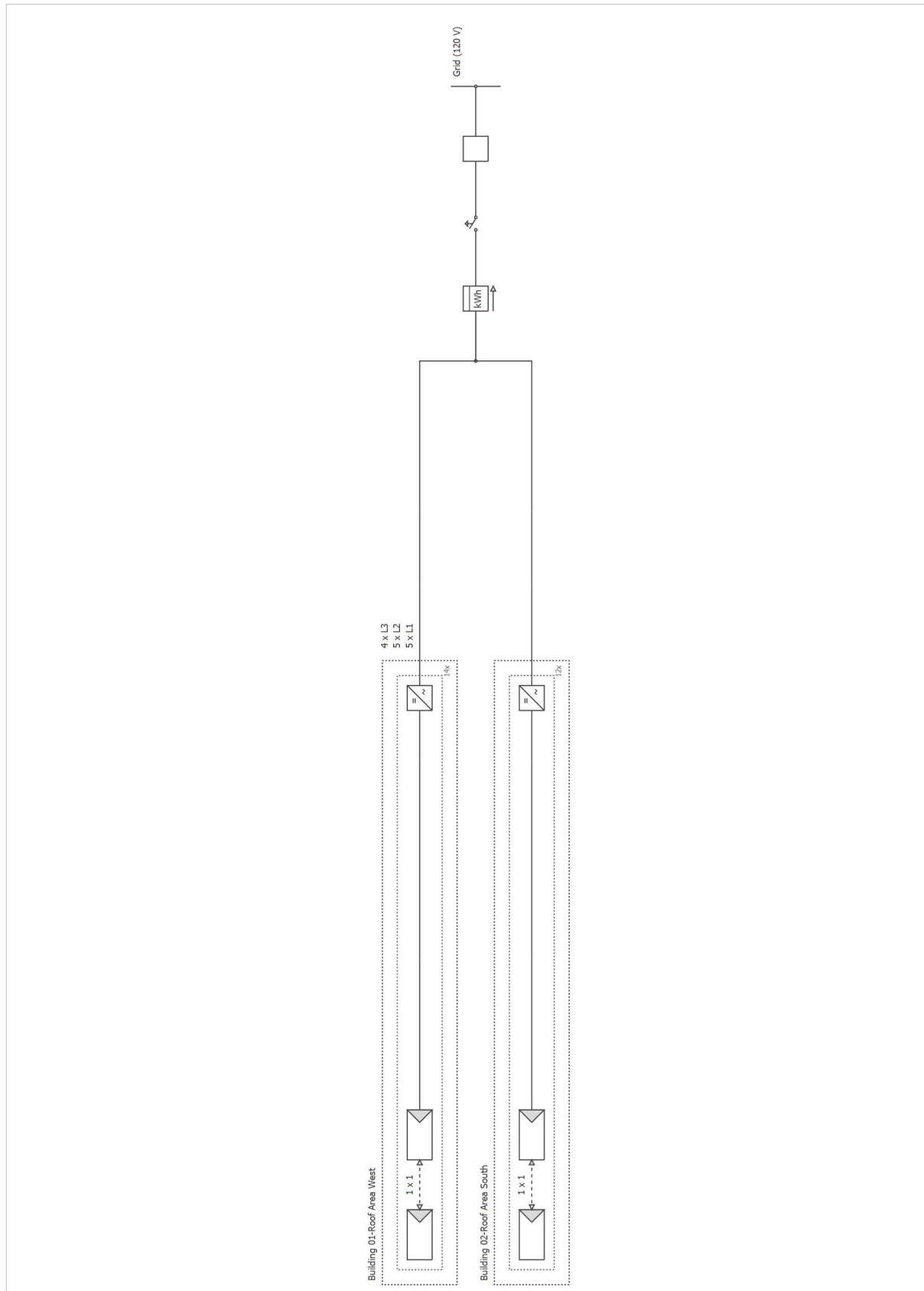
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Inverter: INV250-45US

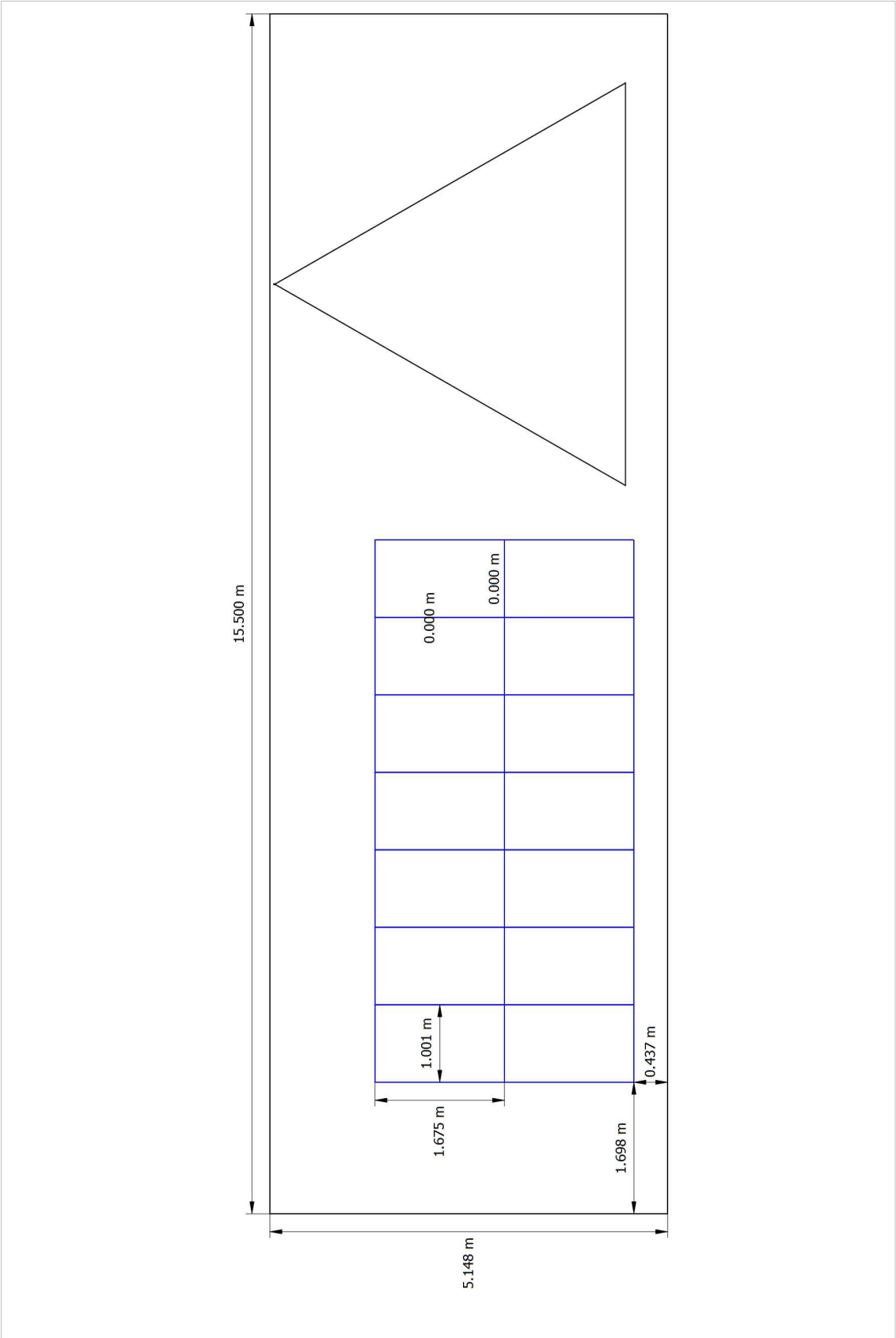
Manufacturer	AEconversion GmbH
Available	Yes
Electrical Data	
DC Power Rating	0.25 kW
AC Power Rating	0.24 kW
Max. DC Power	0.26 kW
Max. AC Power	0.24 kW
Stand-by Consumption	0.03 W
Night Consumption	0.03 W
Feed-in from	3 W
Max. Input Current	11 A
Max. Input Voltage	60 V
Nom. DC Voltage	30 V
Number of Feed-in Phases	1
Number of DC Inlets	1
With Transformer	Yes
Change in Efficiency when Input Voltage deviates from Rated Voltage	0.5 %/100V

MPP Tracker

Output Range < 20% of Power Rating	99.98 %
Output Range > 20% of Power Rating	99.6 %
No. of MPP Trackers	1
Max. Input Current per MPP Tracker	11 A
Max. Input Power per MPP Tracker	0.25 kW
Min. MPP Voltage	20 V
Max. MPP Voltage	45 V



Building 01-Roof Area West



Building 02-Roof Area South

