Co2pro
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Denmark

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Customer No.: 25148614
Project Name: pvsol_demo-residential
Offer no.: 290820231138

19-09-2023

Your PV system from Co2pro

Address of Installation

Denmark

Project Description:

Residential pv system with integrated pv panels
Huawei inverter with battery mounted.
Simulated production year: 13.500 kWh

Project Overview

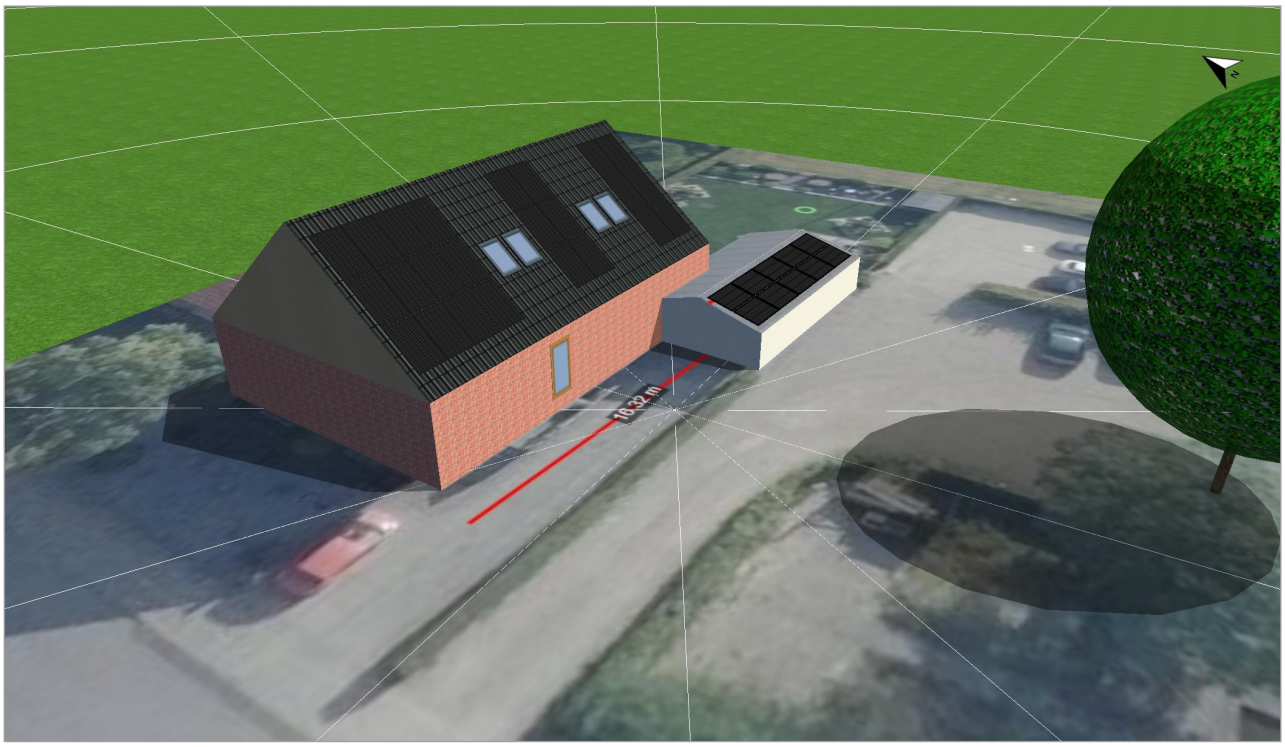


Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV system with Electrical Appliances, Electric Vehicles and Battery Systems	
Climate Data	Isenvad, DNK (1996 - 2015)
Values source	Meteonorm 8.1
PV Generator Output	13,94 kWp
PV Generator Surface	66,4 m²
Number of PV Modules	34
Number of Inverters	1
No. of battery systems	1
No. of vehicles	1

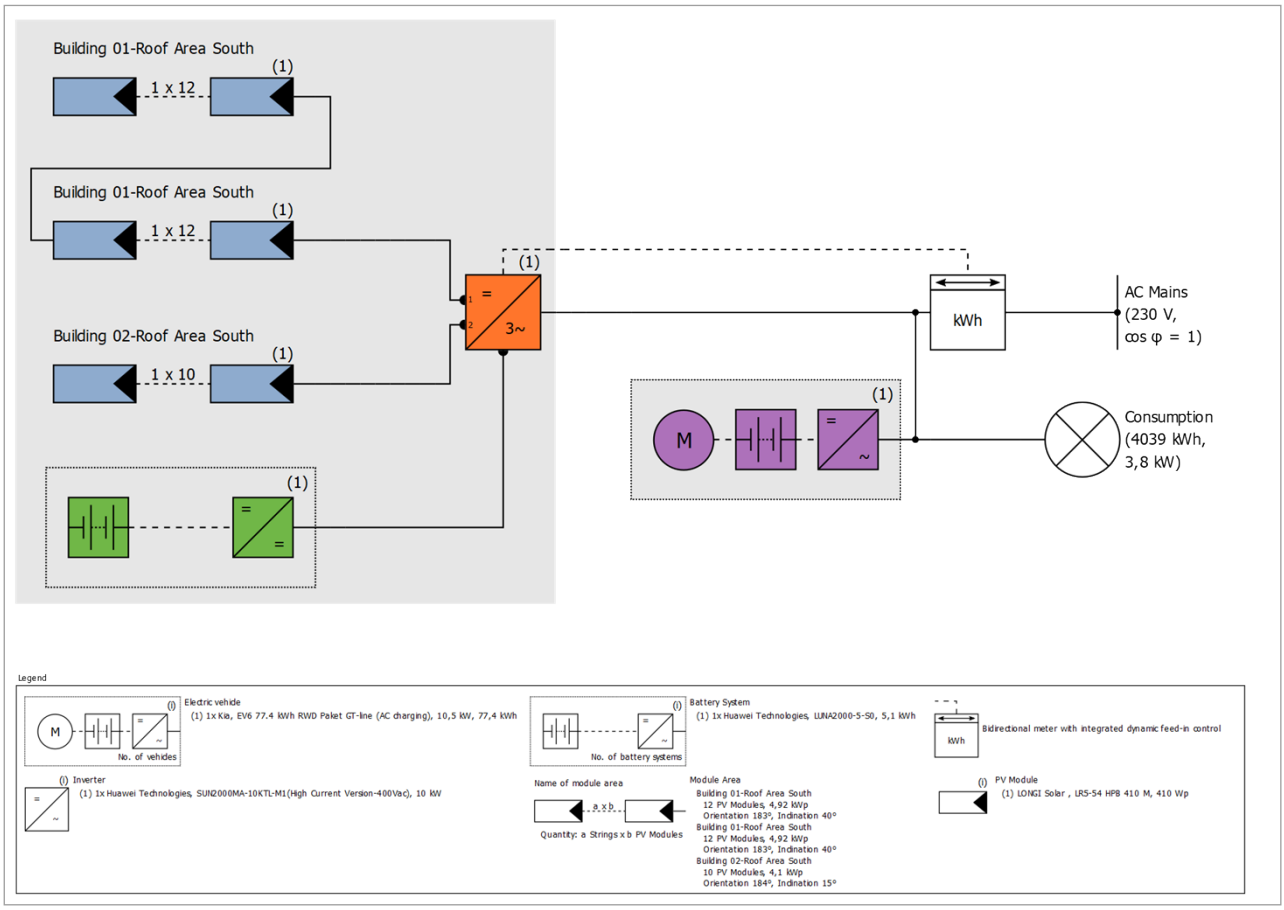


Figure: Schematic diagram

Production Forecast

Production Forecast		
PV Generator Output	13,94	kWp
Spec. Annual Yield	979,81	kWh/kWp
Performance Ratio (PR)	85,11	%
Yield Reduction due to Shading	7,4	%
PV Generator Energy (AC grid) with battery	13.509	kWh/Year
Direct Own Use	1.619	kWh/Year
Charge of the electric vehicle	4.719	kWh/Year
Down-regulation at Feed-in Point	0	kWh/Year
Grid Export	7.171	kWh/Year
Own Power Consumption	46,8	%
CO_2 Emissions avoided	6.257	kg / year
Level of Self-sufficiency	56,7	%

Financial Analysis

Your Gain

Total investment costs	180.000,00	kr.
Internal Rate of Return (IRR)	10,78	%
Amortization Period	8,6	Years
Electricity Production Costs	0,5338	kr./kWh
Energy Balance/Feed-in Concept	Surplus Feed-in	

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

Overview

System Data

Type of System	3D, Grid-connected PV system with Electrical Appliances, Electric Vehicles and Battery Systems

Climate Data

Location	Isenvad, DNK (1996 - 2015)
Values source	Meteonorm 8.1
Resolution of the data	1 h
Simulation models used:	
- Diffuse Irradiation onto Horizontal Plane	Hofmann
- Irradiance onto tilted surface	Hay & Davies

Consumption

Total Consumption	4039 kWh
Privathus forbrug 2021	4039 kWh
Load Peak	3,8 kW

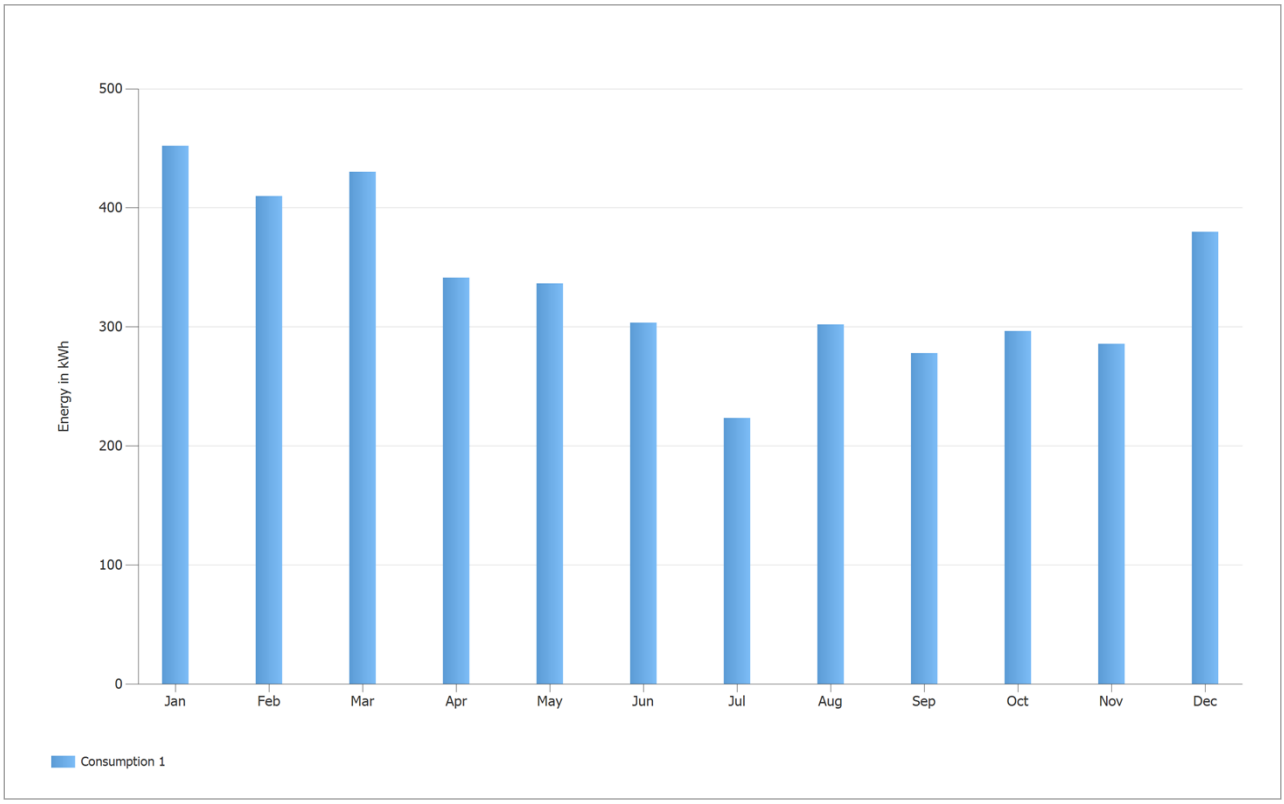


Figure: Consumption

Module Areas

1. Module Area - Building 01-Roof Area South

PV Generator, 1. Module Area - Building 01-Roof Area South

Name	Building 01-Roof Area South
PV Modules	12 x LR5-54 HPB 410 M (v1)
Manufacturer	LONGI Solar
Inclination	40 °
Orientation	South 183 °
Installation Type	Roof integrated - rear ventilation
PV Generator Surface	23,4 m²

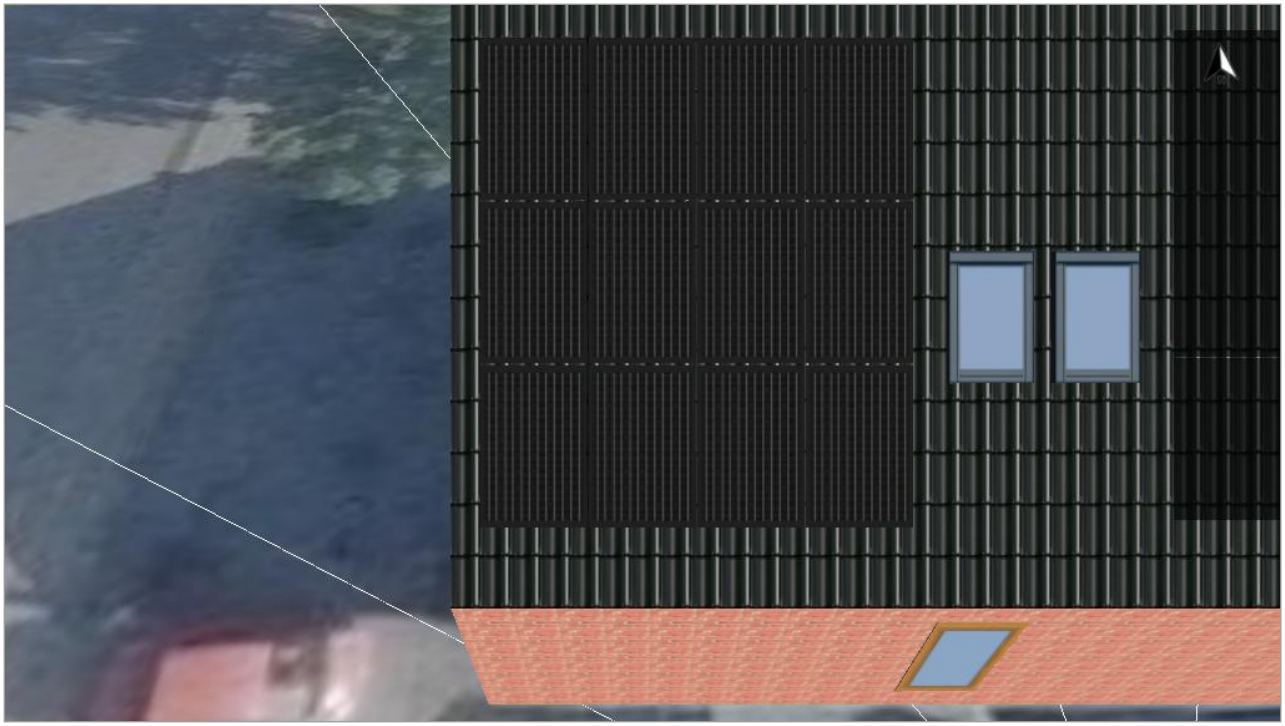


Figure: 1. Module Area - Building 01-Roof Area South

2. Module Area - Building 01-Roof Area South

PV Generator, 2. Module Area - Building 01-Roof Area South

Name	Building 01-Roof Area South
PV Modules	12 x LR5-54 HPB 410 M (v1)
Manufacturer	LONGI Solar
Inclination	40 °
Orientation	South 183 °
Installation Type	Roof parallel
PV Generator Surface	23,4 m²

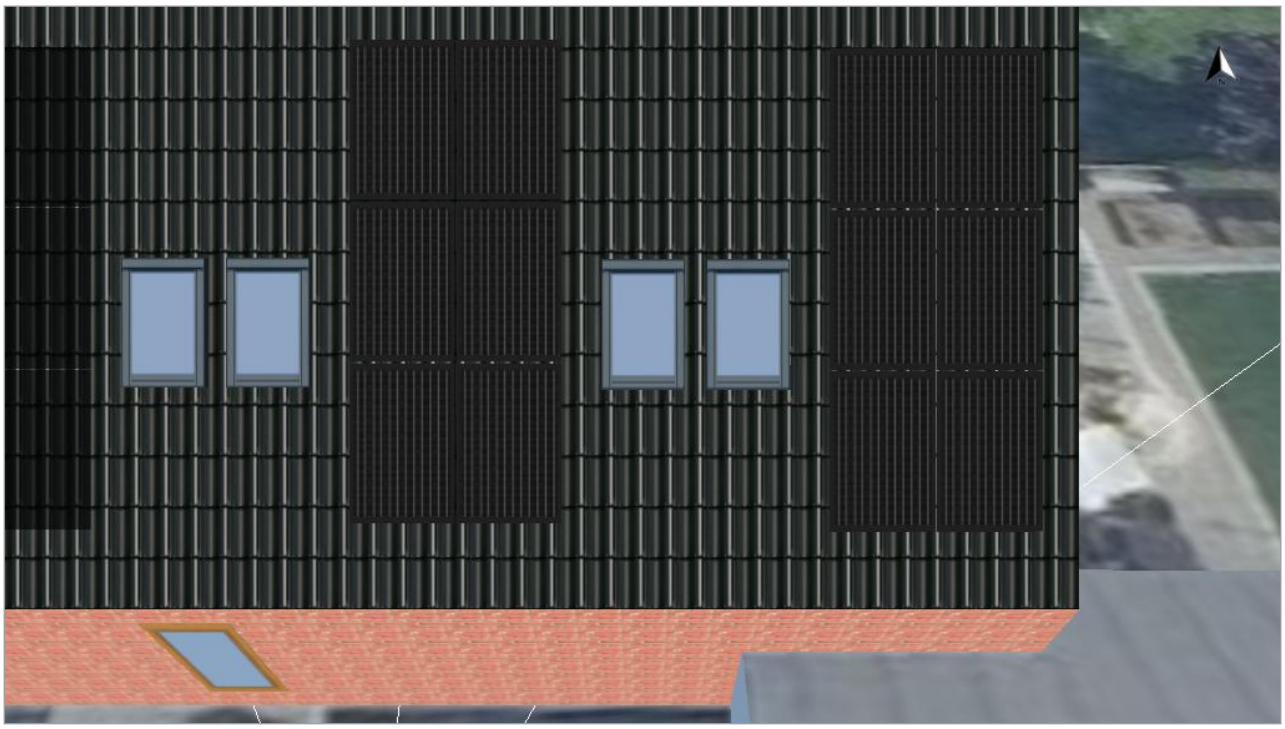


Figure: 2. Module Area - Building 01-Roof Area South

3. Module Area - Building 02-Roof Area South

PV Generator, 3. Module Area - Building 02-Roof Area South

Name	Building 02-Roof Area South
PV Modules	10 x LR5-54 HPB 410 M (v1)
Manufacturer	LONGI Solar
Inclination	15 °
Orientation	South 184 °
Installation Type	Roof parallel
PV Generator Surface	19,5 m²

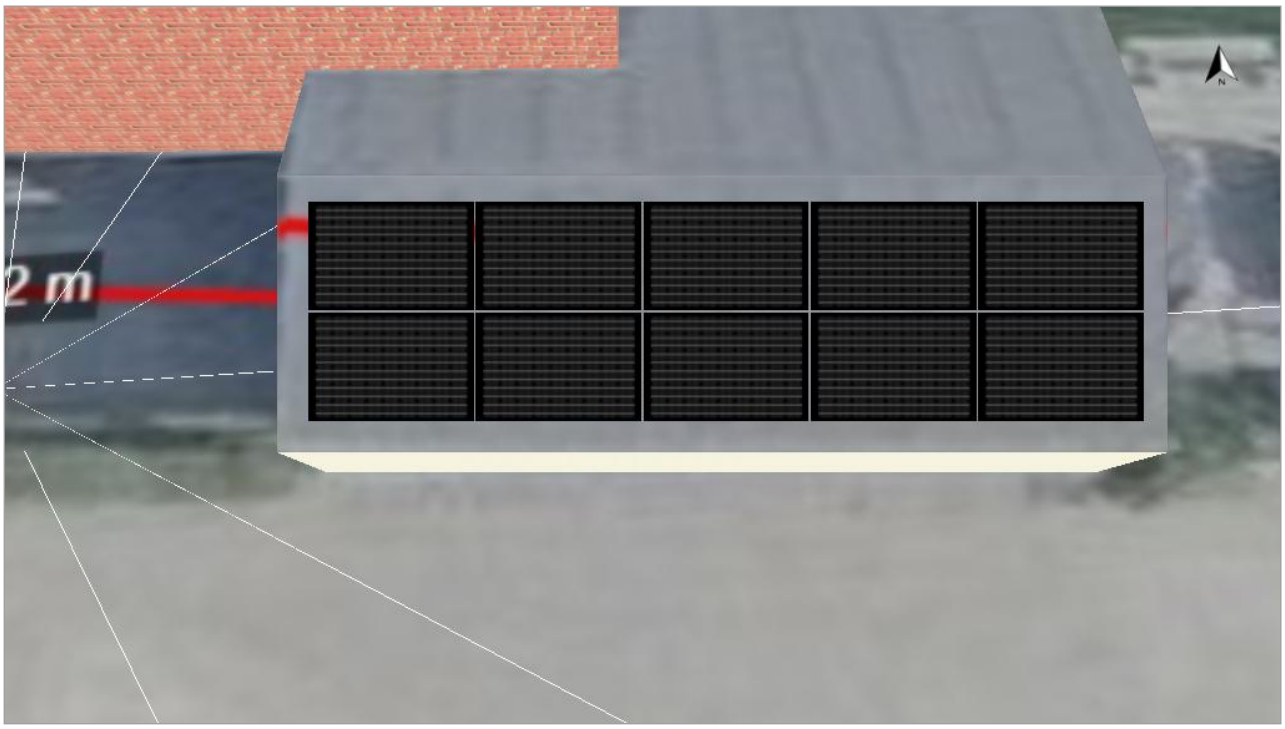


Figure: 3. Module Area - Building 02-Roof Area South

Horizon Line, 3D Design

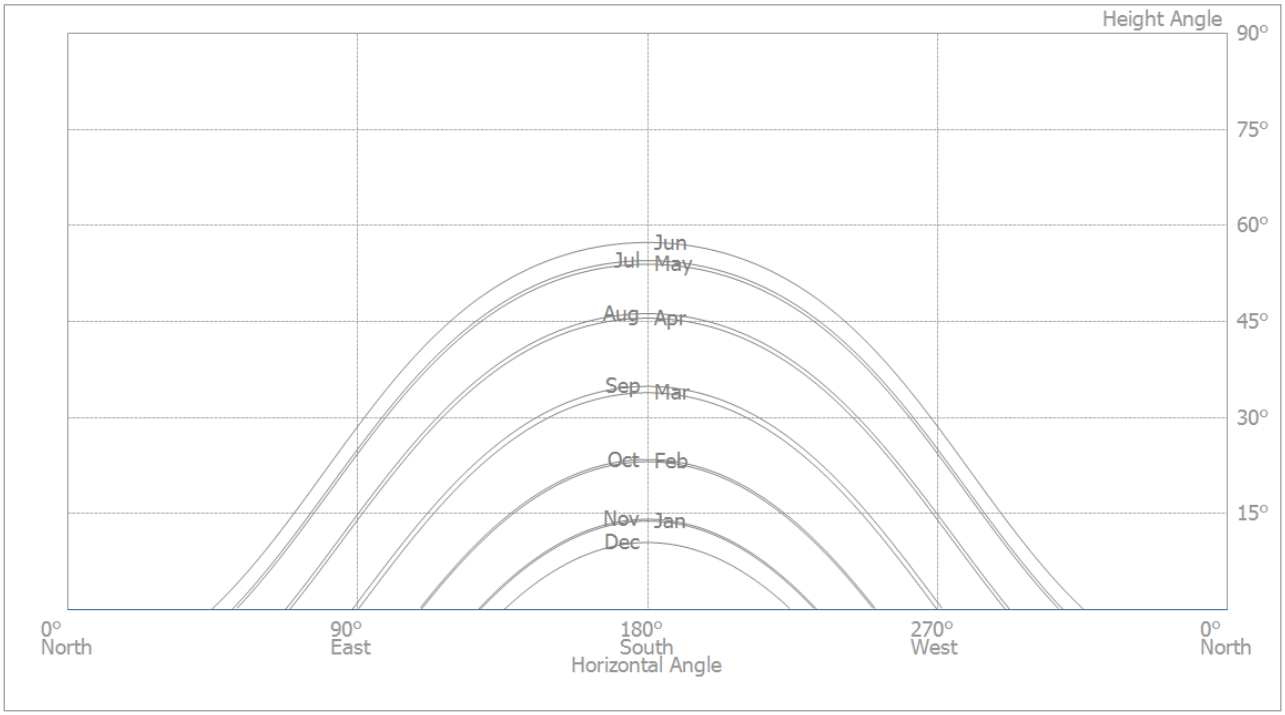


Figure: Horizon (3D Design)

Inverter configuration

Configuration 1

Module Areas	Building 01-Roof Area South + Building 01-Roof Area South + Building 02-Roof Area South
Inverter 1	
Model	SUN2000MA-10KTL-M1(High Current Version-400Vac) (v2)
Manufacturer	Huawei Technologies
Quantity	1
Sizing Factor	139,4 %
Configuration	MPP 1:
	1 x 12 + 1 x 12
	MPP 2:
	1 x 10

AC Mains

AC Mains

Number of Phases	3
Mains voltage between phase and neutral	230 V
Displacement Power Factor (cos phi)	+/- 1

Battery Systems

Battery System

Model	LUNA2000-5-S0 (v4)	
Manufacturer	Huawei Technologies	
Quantity	1	
Battery Inverter		
Type of Coupling	DC intermediate circuit coupling	
Nominal output	2,5	kW
Battery		
Manufacturer	Huawei Technologies	
Model	LUNA2000-5KW-E0 (v2)	
Quantity	1	
Battery Energy	5,1	kWh
Battery Type	Lithium iron phosphate	

Electric Vehicles

Electric vehicle - Group 1

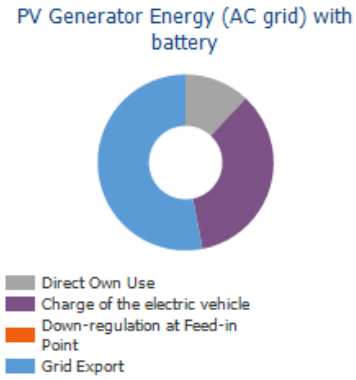
Electric vehicle		
Model	EV6 77.4 kWh RWD Paket GT-line (AC charging) (v1)	
Manufacturer	Kia	
No. of vehicles	1	
Range in accordance with WLTP	528	km
Battery Capacity	77,4	kWh
Consumption	16,5	kWh / 100km
Charging station		
Charging Power	10,5	kW
Charging technology	AC Typ 2	
Charging mode	PV optimized	
Discharge for covering consumption	No	
Use		
Desired range per week	700	km
Mileage per year	36500	km

Simulation Results

Results Total System

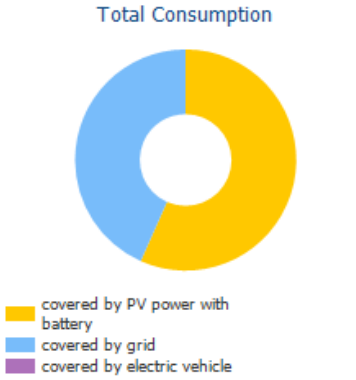
PV System

PV Generator Output	13,94	kWp
Spec. Annual Yield	979,81	kWh/kWp
Performance Ratio (PR)	85,11	%
Yield Reduction due to Shading	7,4	%
PV Generator Energy (AC grid) with battery	13.509	kWh/Year
Direct Own Use	1.619	kWh/Year
Charge of the electric vehicle	4.719	kWh/Year
Down-regulation at Feed-in Point	0	kWh/Year
Grid Export	7.171	kWh/Year
Own Power Consumption	46,8	%
CO_2 Emissions avoided	6.257	kg / year



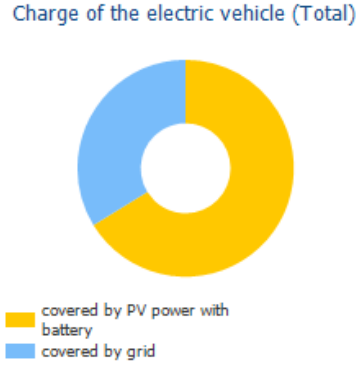
Appliances

Appliances	4.039	kWh/Year
Standby Consumption (Inverter)	21	kWh/Year
Charge of the electric vehicle	7.127	kWh/Year
Total Consumption	11.186	kWh/Year
covered by PV power with battery	6.338	kWh/Year
covered by grid	4.848	kWh/Year
covered by electric vehicle	0	kWh/Year
Solar Fraction	56,7	%



Electric vehicle

Charge at beginning	77	kWh
Charge of the electric vehicle (Total)	7.127	kWh/Year
covered by PV power with battery	4.719	kWh/Year
covered by grid	2.408	kWh/Year
Discharging the electric vehicle for consumption	0	kWh/Year
Losses due to charging/discharging	544	kWh/Year
Losses in Battery	637	kWh/Year
Consumption due to kilometres driven	6023	kWh/Year
Mileage per year	36500	km/Year
of which is solar	24168	km/Year



Battery System

Charge at beginning	5	kWh
Battery Charge (Total)	1.433	kWh/Year
Battery Energy for the Covering of Consumption	1.263	kWh/Year
Losses due to charging/discharging	150	kWh/Year
Losses in Battery	25	kWh/Year
Cycle Load	8,6	%
Service Life	12	Years

Level of Self-sufficiency

Total Consumption	11.186	kWh/Year
covered by grid	4.848	kWh/Year
Level of Self-sufficiency	56,7	%

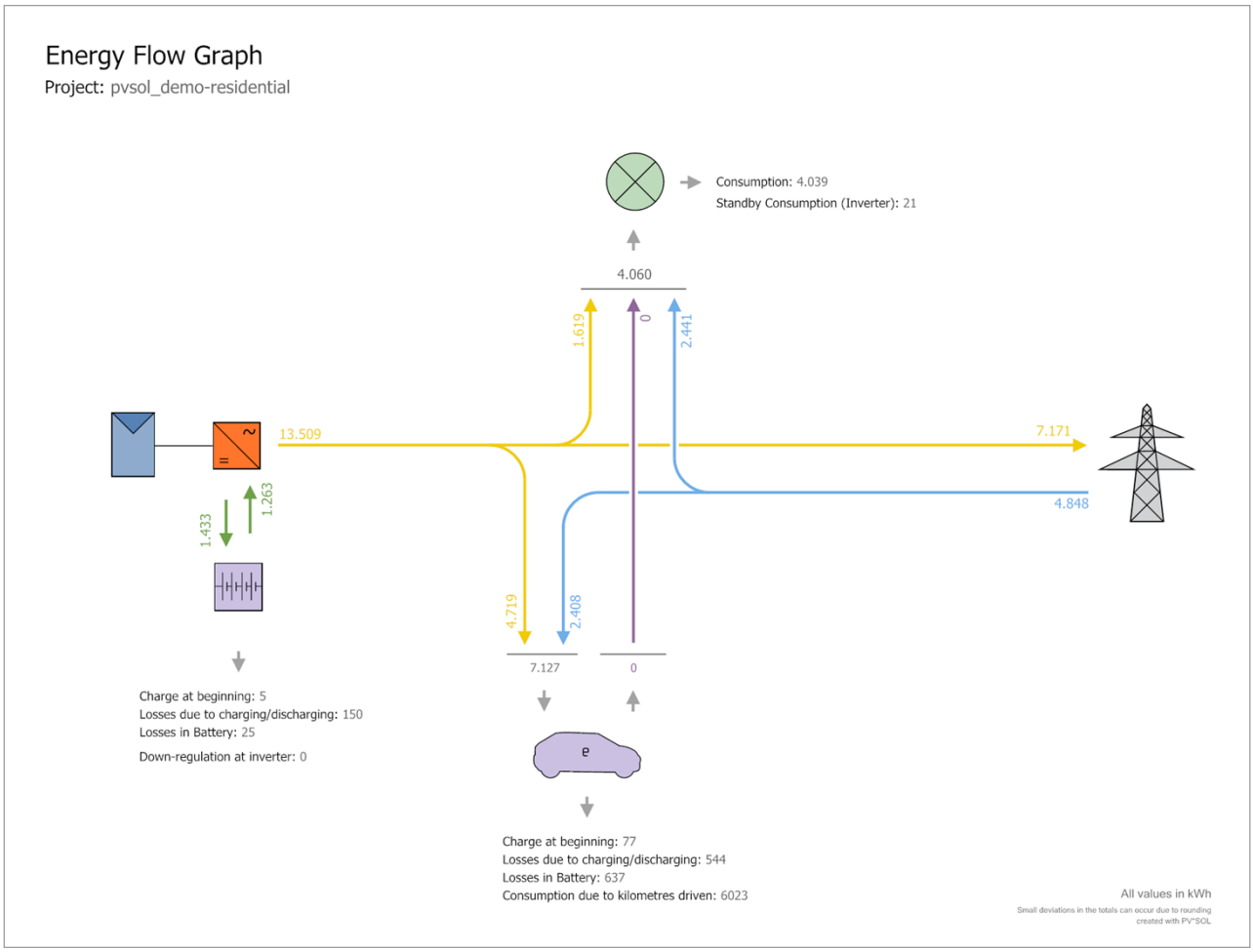


Figure: Energy flow

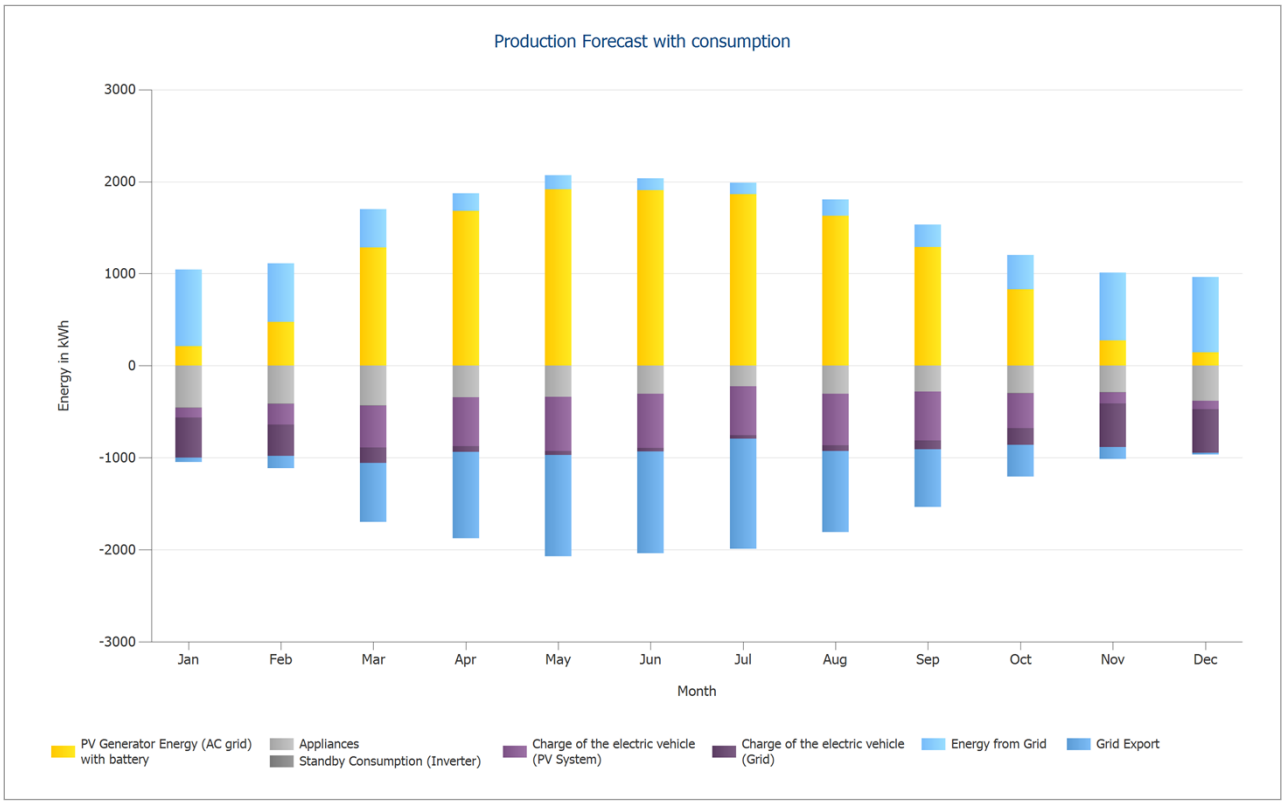


Figure: Production Forecast with consumption

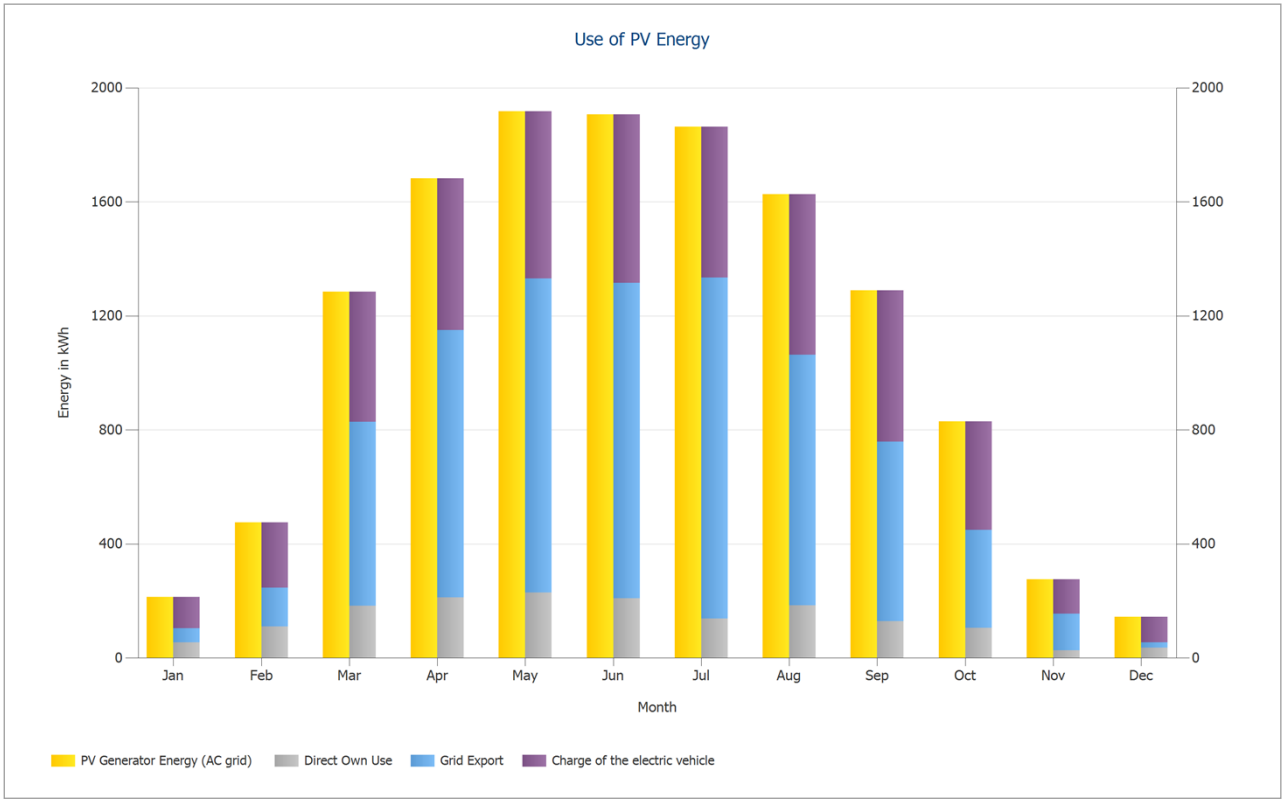


Figure: Use of PV Energy

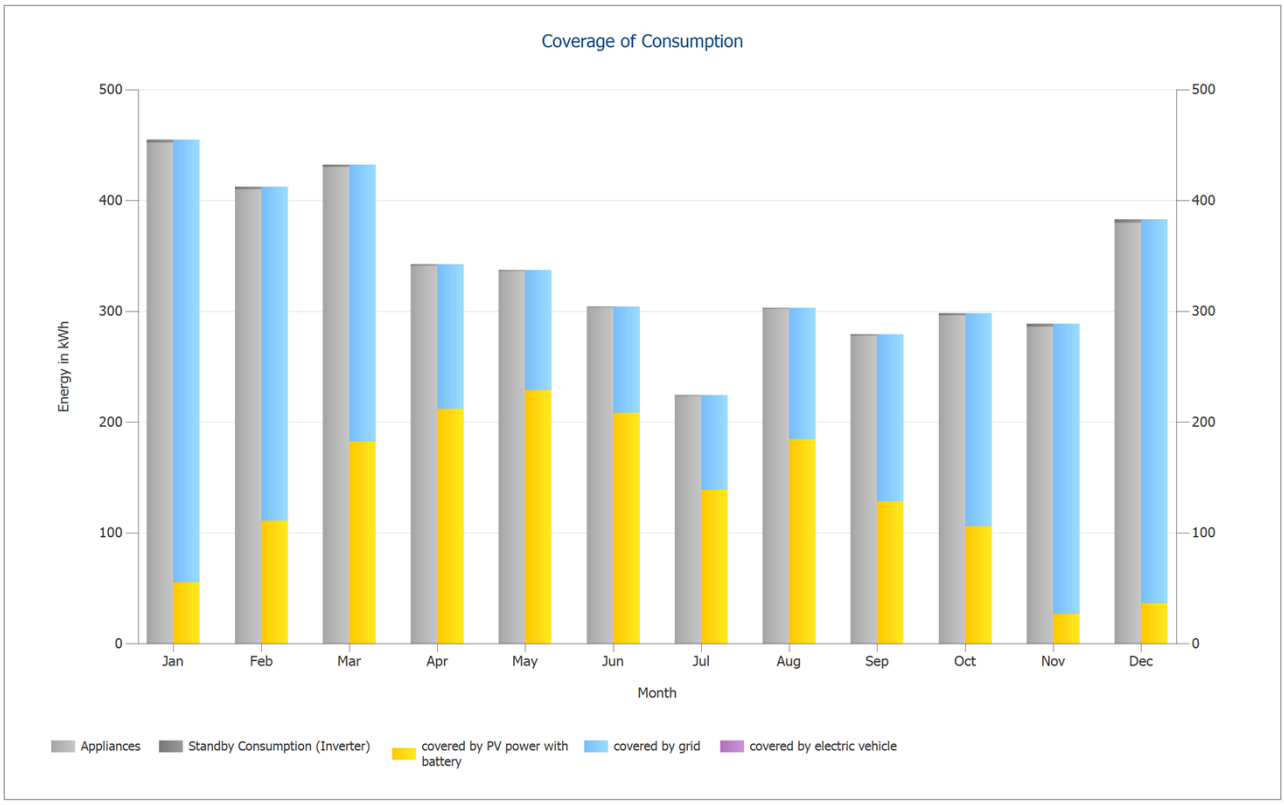


Figure: Coverage of Consumption

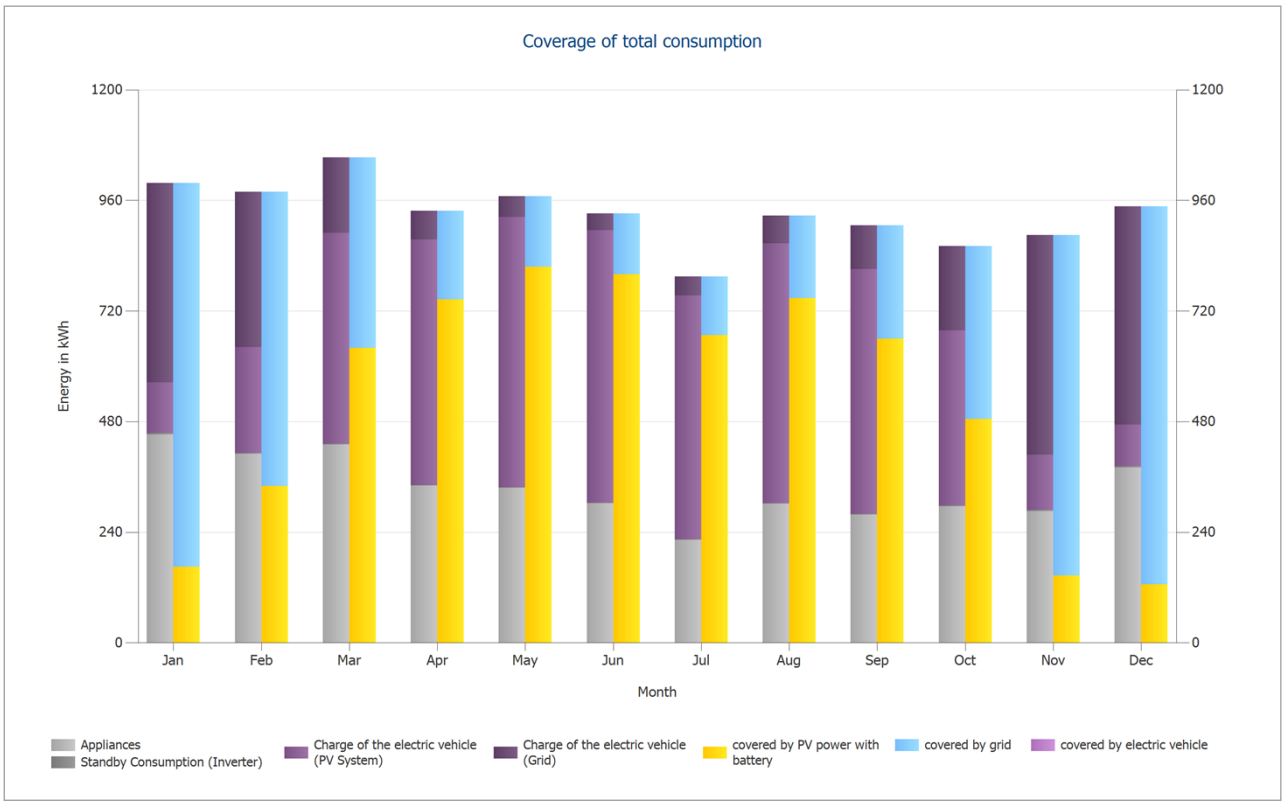


Figure: Coverage of total consumption

Financial Analysis

Overview

System Data

Grid Export in the first year (incl. module degradation)	7.171	kWh/Year
PV Generator Output	13,9	kWp
Start of Operation of the System	18-09-2022	
Assessment Period	25	Years
Interest on Capital	0	%

Economic Parameters

Internal Rate of Return (IRR)	10,78	%
Accrued Cash Flow (Cash Balance)	364.016,61	kr.
Amortization Period	8,6	Years
Electricity Production Costs	0,5338	kr./kWh
Travel cost without PV	58,58	kr./100 km
Travel cost with PV	26,69	kr./100 km

Payment Overview

Specific Investment Costs	12.912,48	kr./kWp
Investment Costs	180.000,00	kr.
One-off Payments	0,00	kr.
Incoming Subsidies	0,00	kr.
Annual Costs	0,00	kr./Year
Other Revenue or Savings	0,00	kr./Year

Remuneration and Savings

Total Payment from Utility in First Year	0,00	kr./Year
First year savings	18.951,98	kr./Year
Salg af El 0,45 - Building System		
Validity	01-01-2026 - 31-12-2050	
Specific feed-in / export Remuneration	0,45	kr./kWh
Feed-in / Export Tariff	3227,0772	kr./Year
3 kr. pr. kwh (Elselskab)		
Energy Price	3	kr./kWh

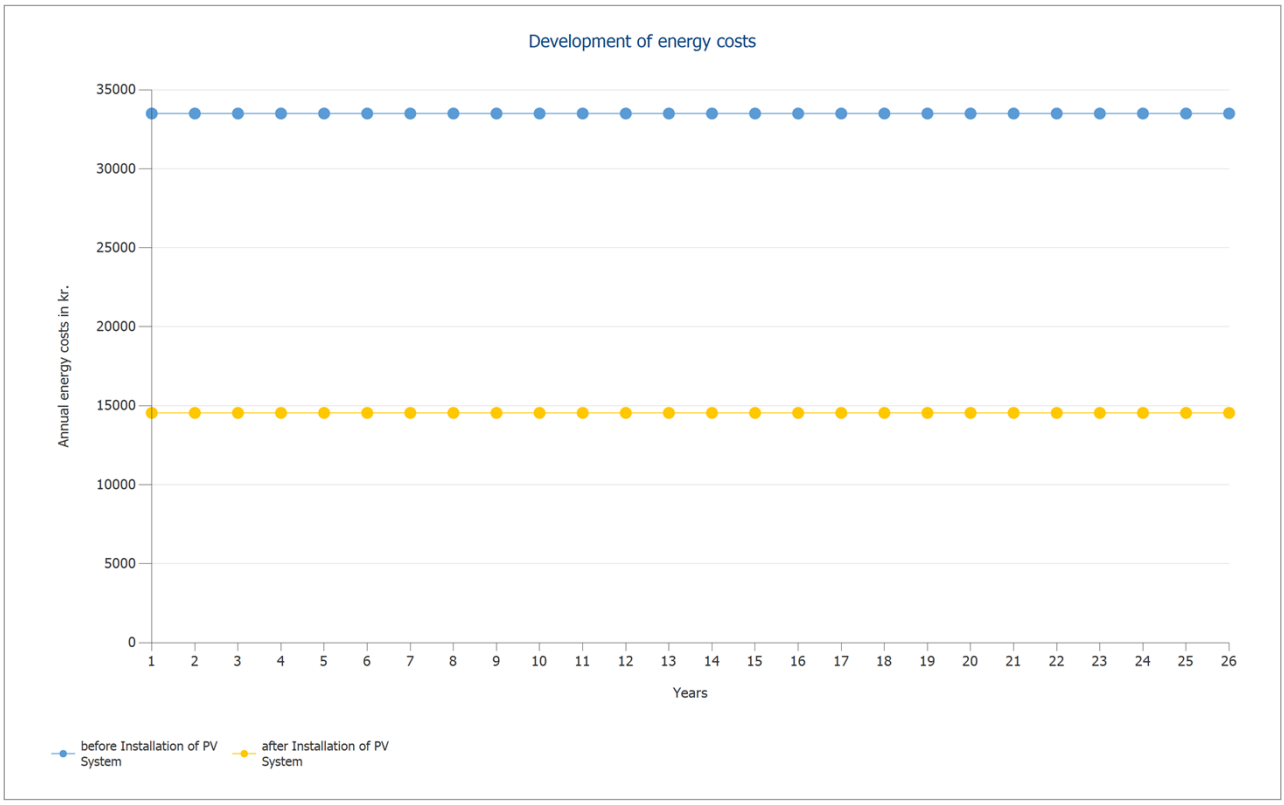


Figure: Development of energy costs

Cash flow

Cash flow

	Year 1	Year 2	Year 3	Year 4	Year 5
Investments	-180.000,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.
Feed-in / Export Tariff	0,00 kr.	0,00 kr.	0,00 kr.	2.723,22 kr.	3.227,08 kr.
Electricity Savings	18.677,22 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.
Annual Cash Flow	**-161.322,78 kr.**	**18.951,98 kr.**	**18.951,98 kr.**	**21.675,20 kr.**	**22.179,06 kr.**
Accrued Cash Flow (Cash Balance)	-161.322,78 kr.	-142.370,80 kr.	-123.418,82 kr.	-101.743,62 kr.	-79.564,56 kr.

Cash flow

	Year 6	Year 7	Year 8	Year 9	Year 10
Investments	0,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.
Feed-in / Export Tariff	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.
Electricity Savings	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.
Annual Cash Flow	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**
Accrued Cash Flow (Cash Balance)	-57.385,50 kr.	-35.206,44 kr.	-13.027,39 kr.	9.151,67 kr.	31.330,73 kr.

Cash flow

	Year 11	Year 12	Year 13	Year 14	Year 15
Investments	0,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.
Feed-in / Export Tariff	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.
Electricity Savings	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.
Annual Cash Flow	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**
Accrued Cash Flow (Cash Balance)	53.509,79 kr.	75.688,85 kr.	97.867,91 kr.	120.046,96 kr.	142.226,02 kr.

Cash flow

	Year 16	Year 17	Year 18	Year 19	Year 20
Investments	0,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.
Feed-in / Export Tariff	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.
Electricity Savings	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.
Annual Cash Flow	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**
Accrued Cash Flow (Cash Balance)	164.405,08 kr.	186.584,14 kr.	208.763,20 kr.	230.942,26 kr.	253.121,31 kr.

Cash flow

	Year 21	Year 22	Year 23	Year 24	Year 25
Investments	0,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.	0,00 kr.
Feed-in / Export Tariff	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.	3.227,08 kr.
Electricity Savings	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.	18.951,98 kr.
Annual Cash Flow	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**	**22.179,06 kr.**
Accrued Cash Flow (Cash Balance)	275.300,37 kr.	297.479,43 kr.	319.658,49 kr.	341.837,55 kr.	364.016,61 kr.

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

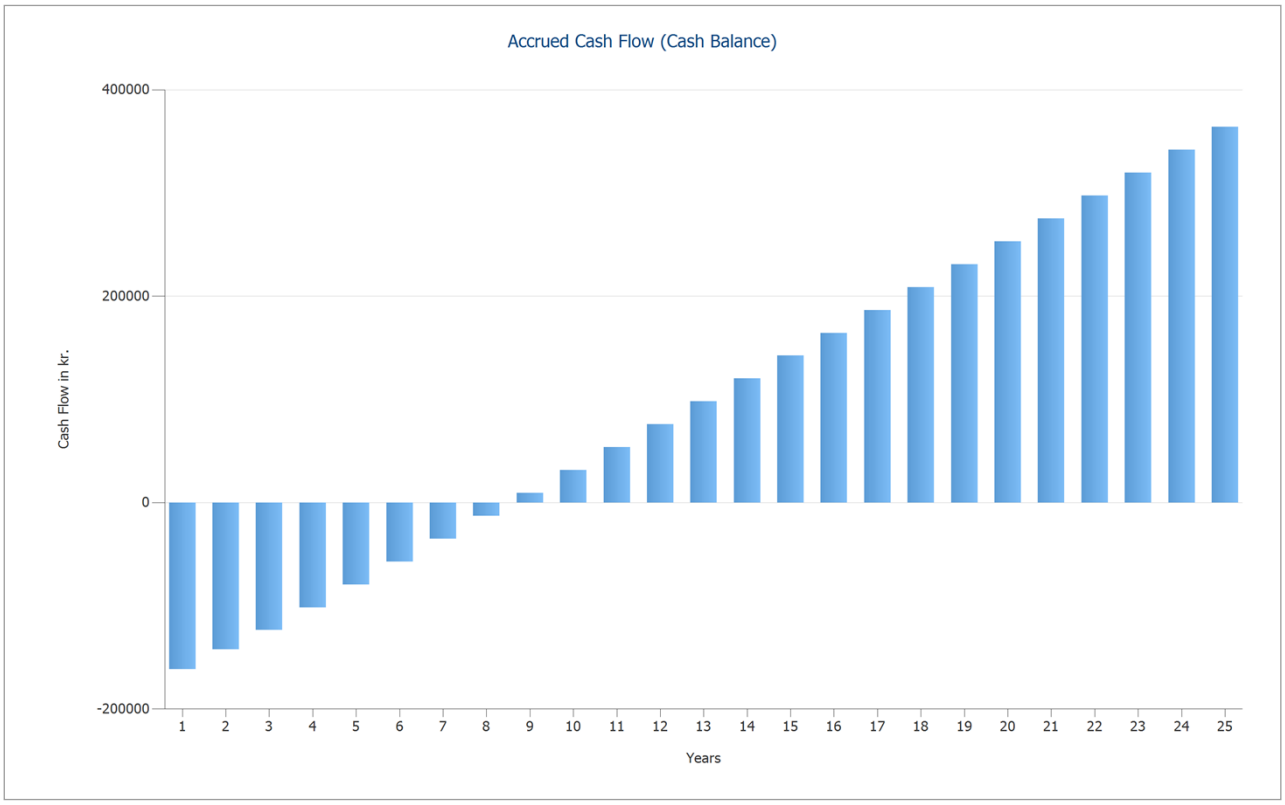


Figure: Accrued Cash Flow (Cash Balance)

Plans and parts list

Circuit Diagram

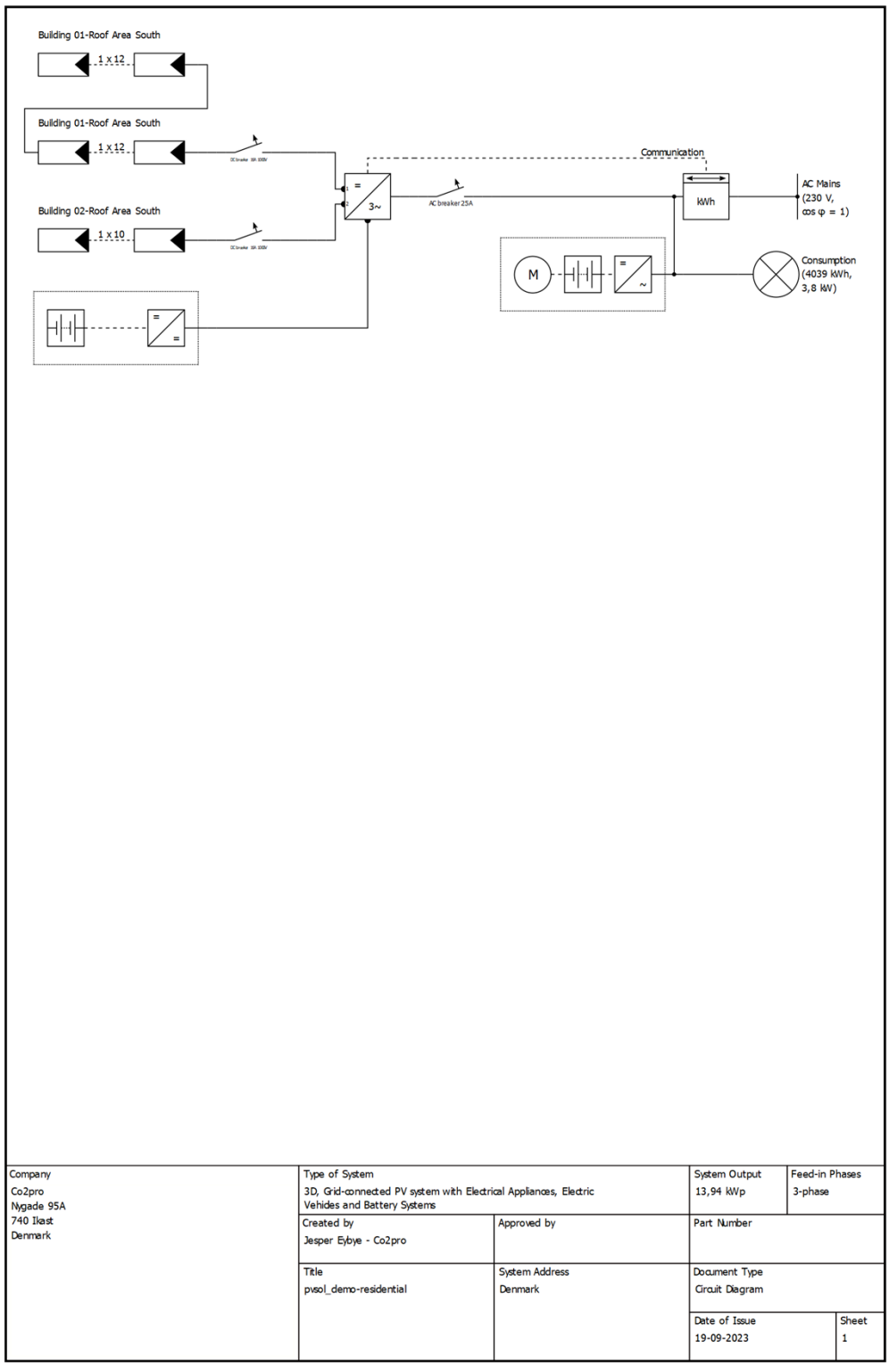


Figure: Circuit Diagram

Overview plan

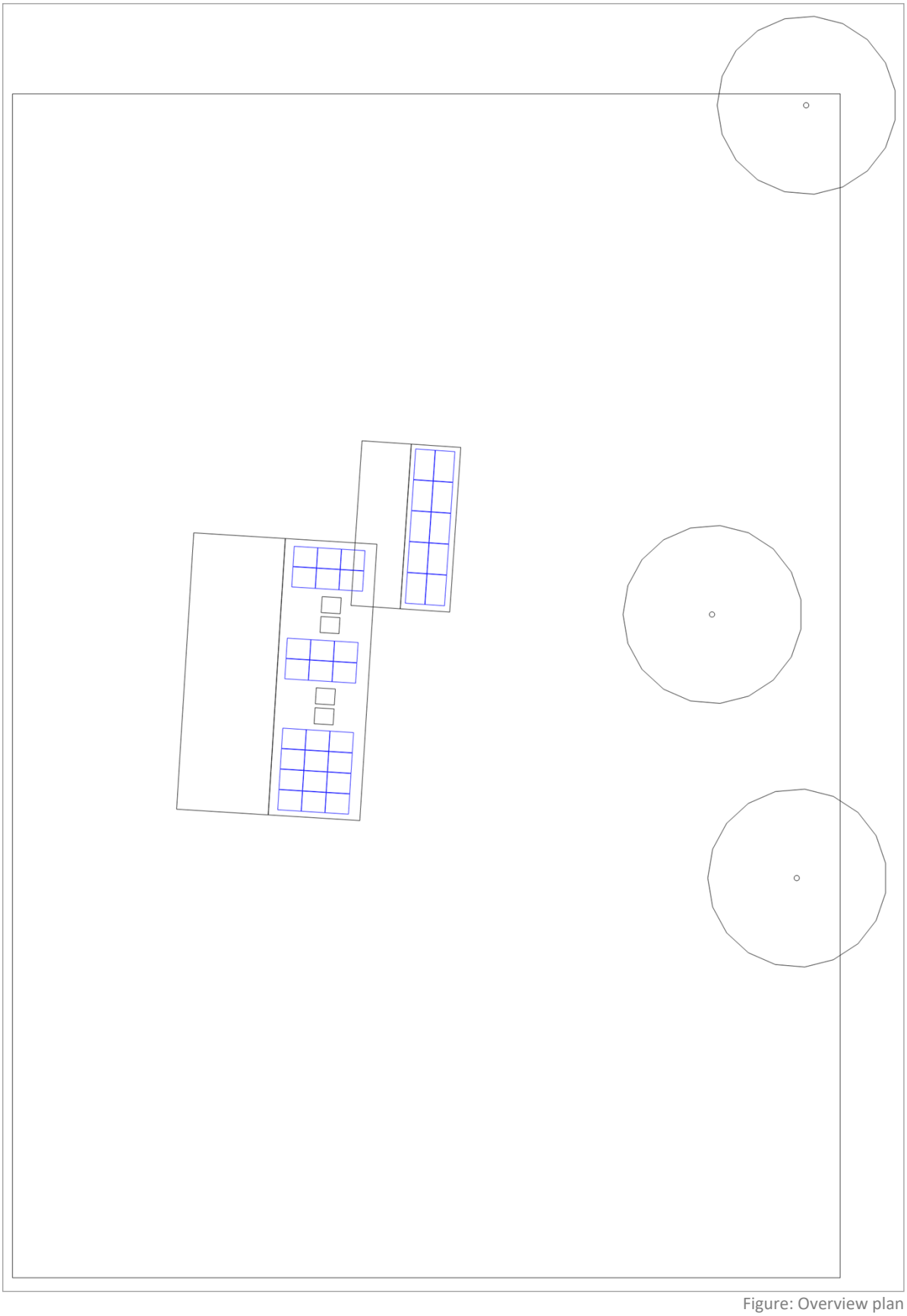


Figure: Overview plan

Parts list

Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		LONGI Solar	LR5-54 HPB 410 M	34	Piece
2	Inverter		Huawei Technologies	SUN2000MA-10KTL-M1(High Current Version-400Vac)	1	Piece
3	Battery System		Huawei Technologies	LUNA2000-5-S0	1	Piece
4	Electric vehicle		Kia	EV6 77.4 kWh RWD Paket GT-line (AC charging)	1	Piece
5	Components			Bidirectional meter with integrated dynamic feed-in control Communication	1	Piece
6	Components			Circuit Breaker AC breaker 25A	1	Piece
7	Components			Circuit Breaker DC breaker 16A 1000V	2	Piece

Screenshots, 3D Design

Environment

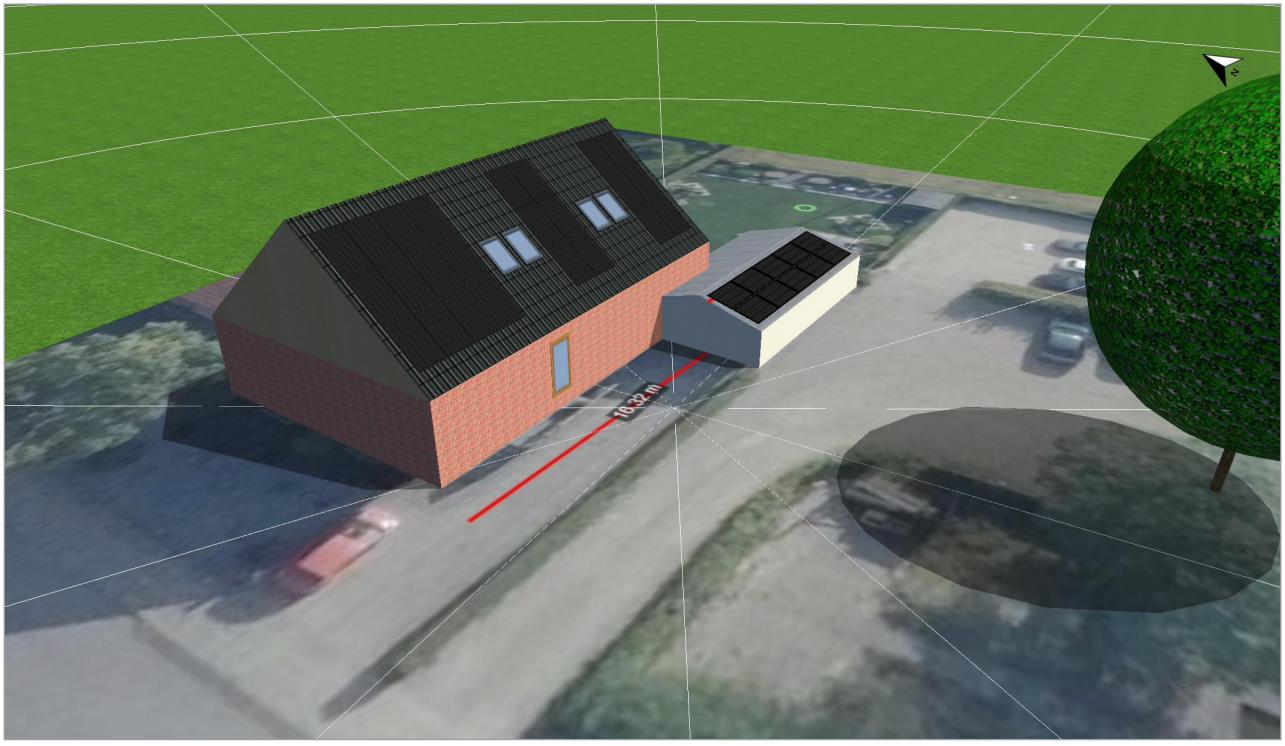


Figure: Screenshot02

Configuration

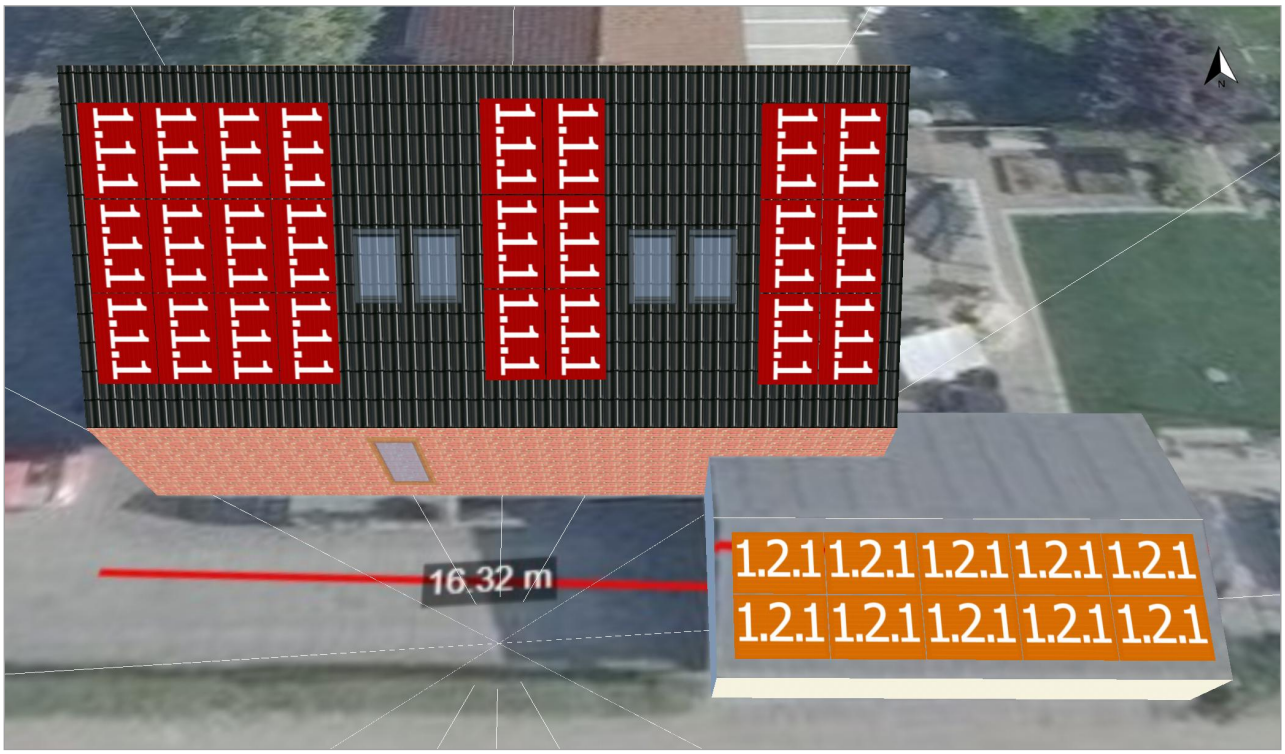


Figure: Opstrengning