



Cactus Energy Solutions Ltd

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YHB-030

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Customer No.: 11735

Project Name: YHB-030

Offer no.: 4

10/10/2023

Your PV system from Cactus Energy Solutions Ltd

Address of Installation

89-91, Holcombe Old Road
Holcombe, BL8 4NF



Project Overview



Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV System with Electrical Appliances and Battery Systems

Climate Data	Bury, GBR (1996 - 2015)
Values source	Meteonorm 8.1(i)
PV Generator Output	4.98 kWp
PV Generator Surface	23.5 m ²
Number of PV Modules	12
Number of Inverters	1
No. of battery systems	1

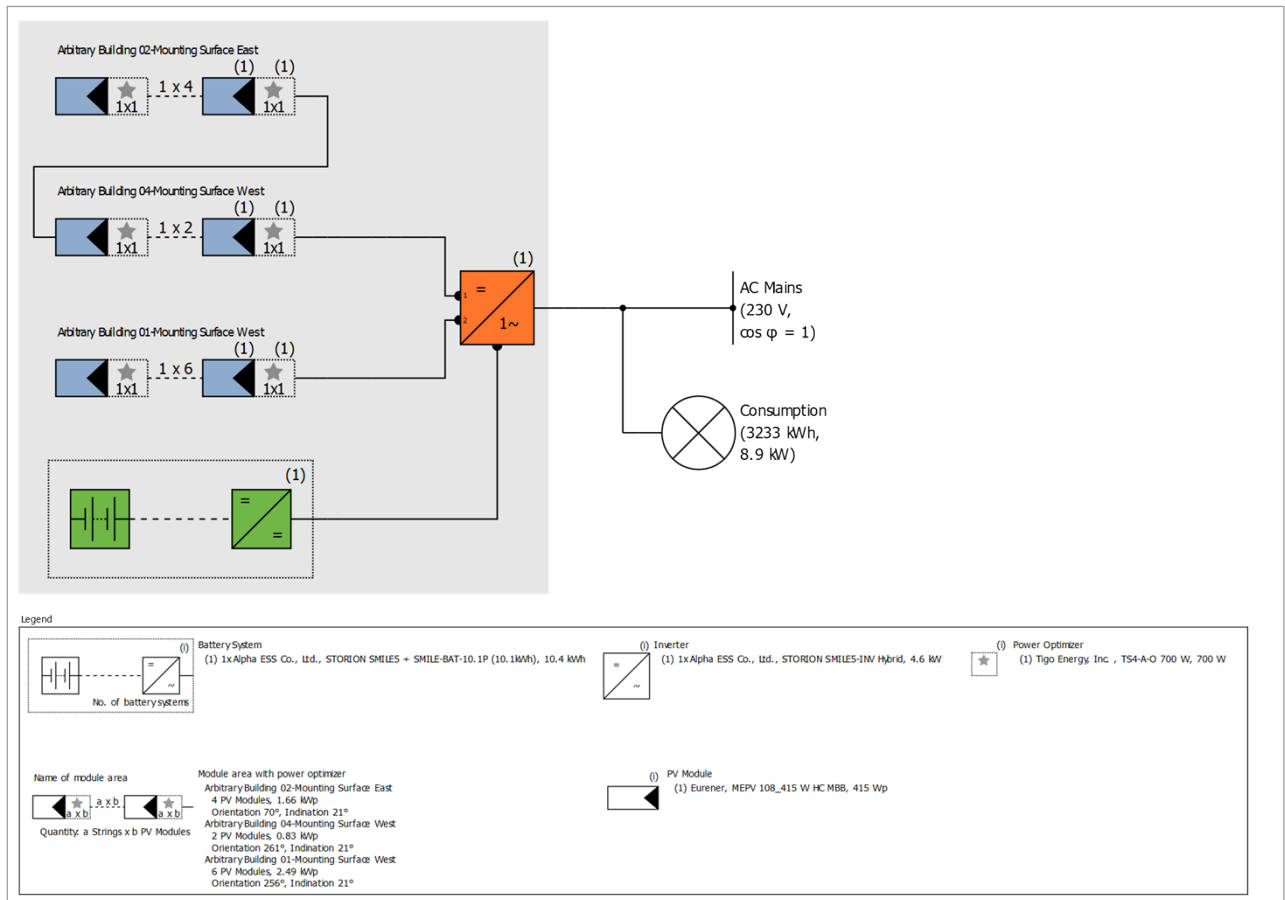


Figure: Schematic diagram

Production Forecast

Production Forecast

PV Generator Output	4.98 kWp
Spec. Annual Yield	722.26 kWh/kWp
Performance Ratio (PR)	77.68 %
Yield Reduction due to Shading	8.8 %
PV Generator Energy (AC grid) with battery	3,374 kWh/Year
Direct Own Use	2,020 kWh/Year
Down-regulation at Feed-in Point	0 kWh/Year
Grid Export	1,354 kWh/Year
Own Power Consumption	59.8 %
CO ₂ Emissions avoided	729 kg / year
Level of Self-sufficiency	62.4 %

Financial Analysis

Your Gain

Total investment costs	0.00 £
Internal Rate of Return (IRR)	268.42 %
Amortization Period	0.0 Years
Electricity Production Costs	0 £/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 and Battery Systems
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Climate Data

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

Consumption

Total Consumption	3233 kWh
2-person household	3233 kWh
Load Peak	8.9 kW

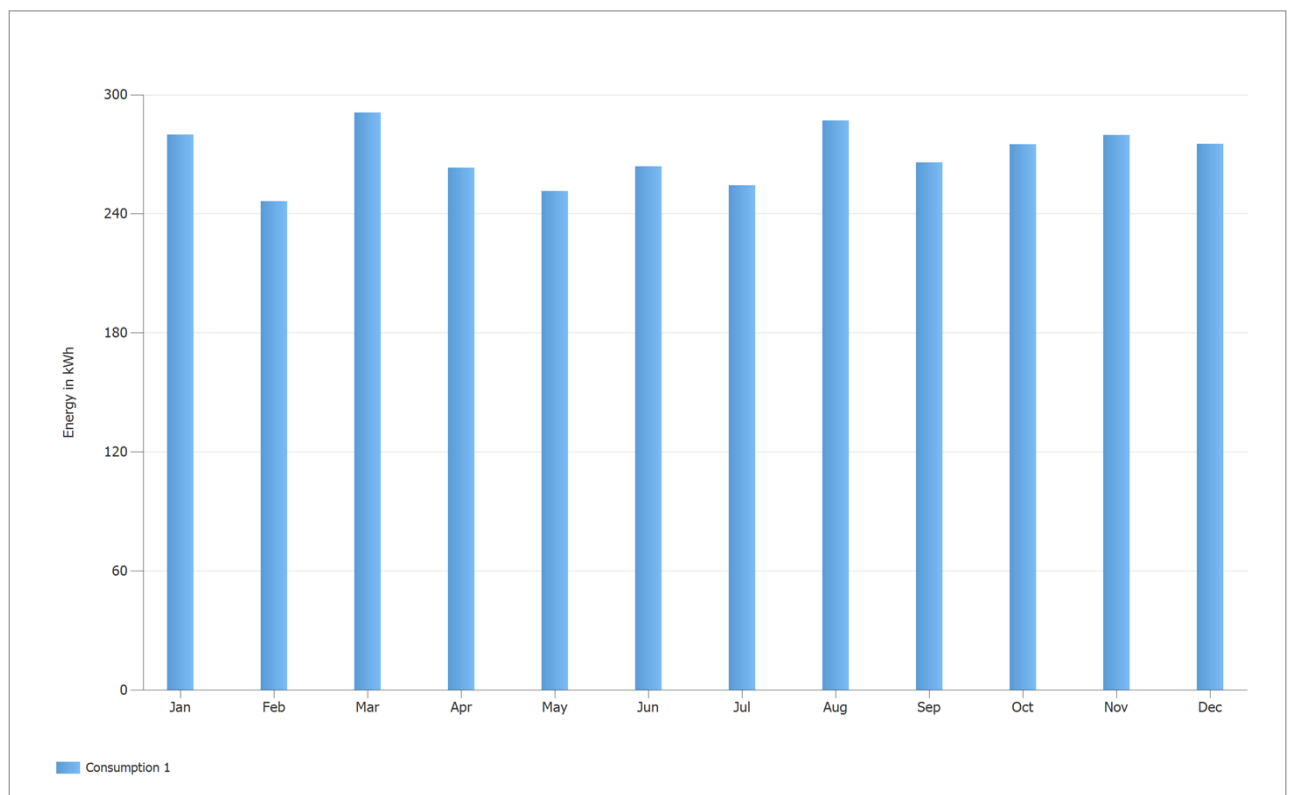


Figure: Consumption

Module Areas

1. Module Area - Arbitrary Building 02-Mounting Surface East

PV Generator, 1. Module Area - Arbitrary Building 02-Mounting Surface East

Name	Arbitrary Building 02-Mounting Surface East
PV Modules	4 x MEPV 108_415 W HC MBB (v1)
Manufacturer	Eurener
Inclination	21 °
Orientation	East 70 °
Installation Type	Mounted - Roof
PV Generator Surface	7.8 m ²

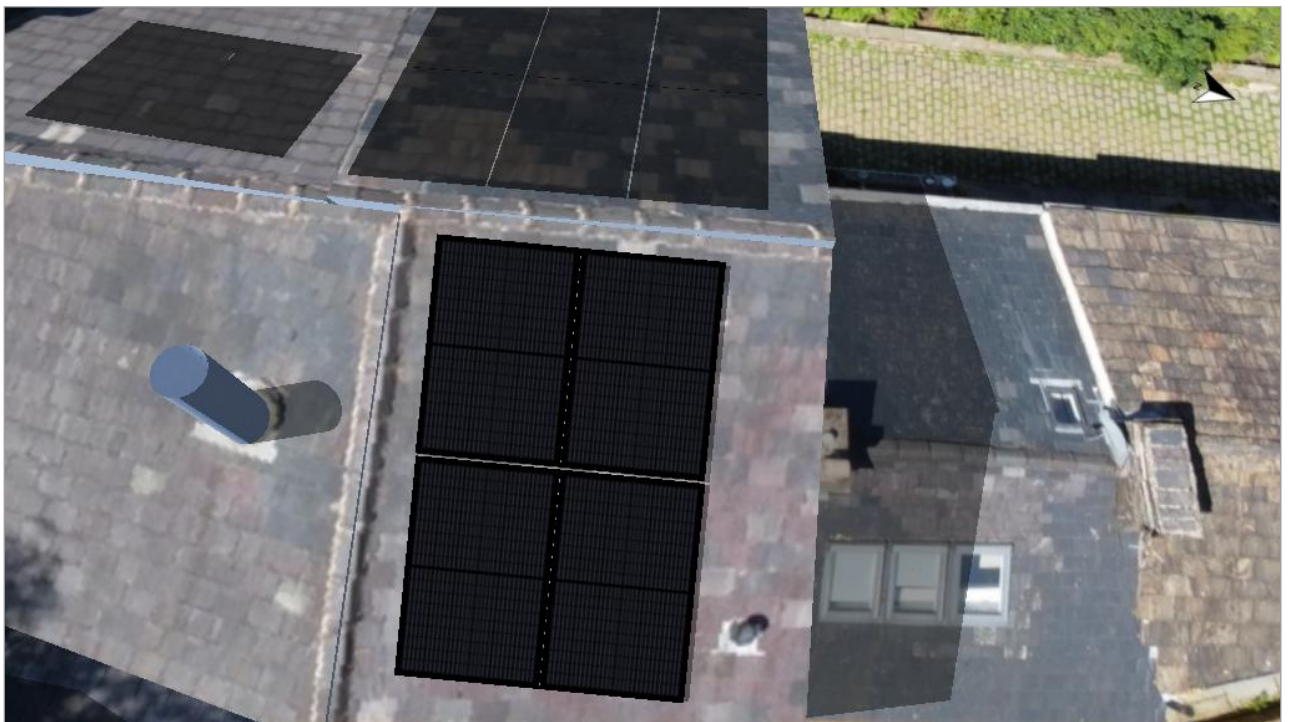


Figure: 1. Module Area - Arbitrary Building 02-Mounting Surface East

2. Module Area - Arbitrary Building 04-Mounting Surface West

PV Generator, 2. Module Area - Arbitrary Building 04-Mounting Surface West

Name	Arbitrary Building 04-Mounting Surface West
PV Modules	2 x MEPV 108_415 W HC MBB (v1)
Manufacturer	Eurener
Inclination	21 °
Orientation	West 261 °
Installation Type	Roof parallel
PV Generator Surface	3.9 m²



Figure: 2. Module Area - Arbitrary Building 04-Mounting Surface West

3. Module Area - Arbitrary Building 01-Mounting Surface West

PV Generator, 3. Module Area - Arbitrary Building 01-Mounting Surface West

Name	Arbitrary Building 01-Mounting Surface West
PV Modules	6 x MEPV 108_415 W HC MBB (v1)
Manufacturer	Eurener
Inclination	21 °
Orientation	West 256 °
Installation Type	Roof parallel
PV Generator Surface	11.7 m ²

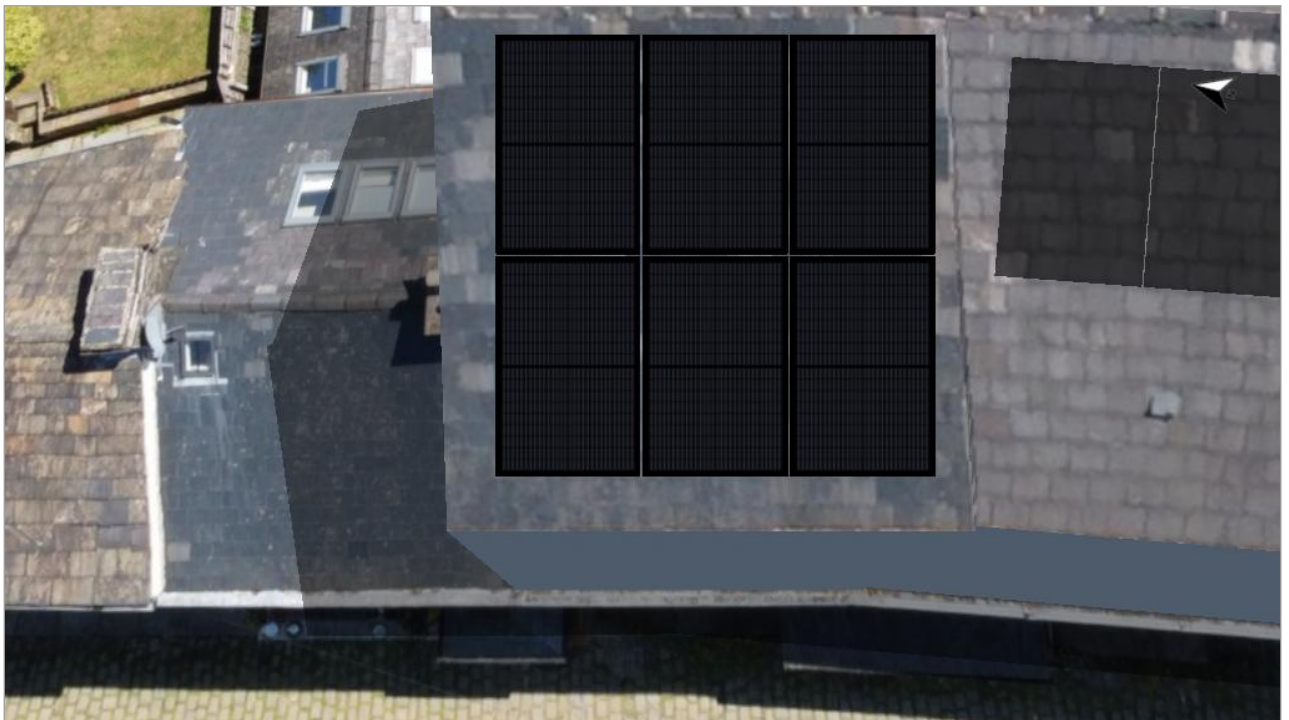


Figure: 3. Module Area - Arbitrary Building 01-Mounting Surface West

Horizon Line, 3D Design

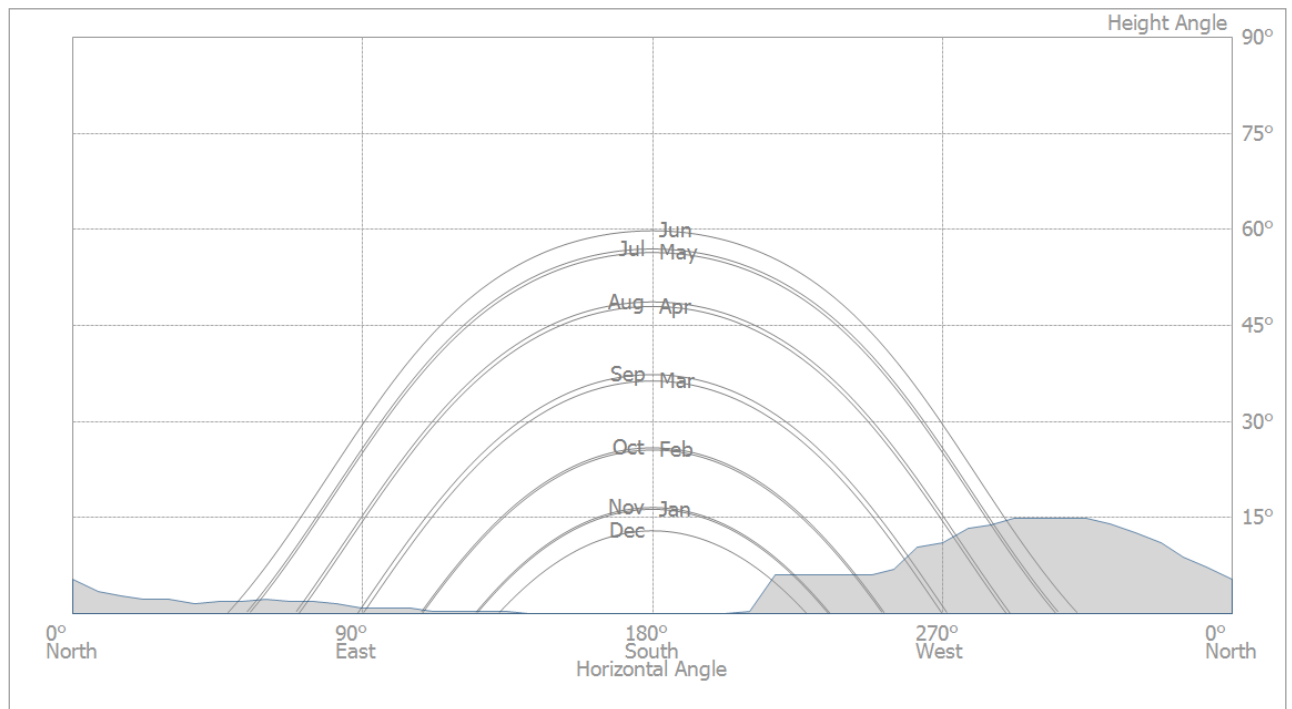


Figure: Horizon (3D Design)

Inverter configuration

Configuration 1

Module Areas	Arbitrary Building 02-Mounting Surface East + Arbitrary Building 04-Mounting Surface West + Arbitrary Building 01-Mounting Surface West
Inverter 1	
Model	STORION SMILE5-INV Hybrid (v4)
Manufacturer	Alpha ESS Co., Ltd.
Quantity	1
Sizing Factor	108.3 %
Configuration	MPP 1: 1 x 4 ☆ [1 x 1] + 1 x 2 ☆ [1 x 1] MPP 2: 1 x 6 ☆ [1 x 1]
Power Optimizer	12x Tigo Energy, Inc. , TS4-A-O 700 W (v2)

AC Mains

AC Mains

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

Battery Systems

Battery System

Model	STORION SMILE5 + SMILE-BAT-10.1P (10.1kWh) (v4)
Manufacturer	Alpha ESS Co., Ltd.
Quantity	1
Battery Inverter	
Type of Coupling	DC intermediate circuit coupling
Nominal output	4.8 kW
Battery	
Manufacturer	Alpha ESS Co., Ltd.
Model	Alpha ESS SMILE-BAT-5.8P 5.8 kWh / 48V / LiFePo (v1)
Quantity	2
Battery Energy	10.4 kWh
Battery Type	Lithium iron phosphate

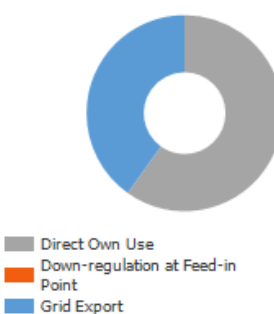
Simulation Results

Results Total System

PV System

PV Generator Output	4.98 kWp
Spec. Annual Yield	722.26 kWh/kWp
Performance Ratio (PR)	77.68 %
Yield Reduction due to Shading	8.8 %
PV Generator Energy (AC grid) with battery	3,374 kWh/Year
Direct Own Use	2,020 kWh/Year
Down-regulation at Feed-in Point	0 kWh/Year
Grid Export	1,354 kWh/Year
Own Power Consumption	59.8 %
CO ₂ Emissions avoided	729 kg / year

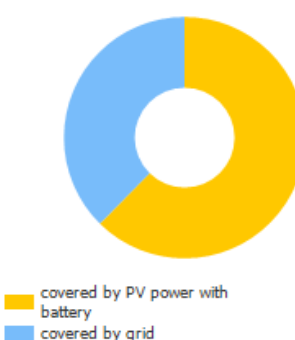
PV Generator Energy (AC grid) with battery



Appliances

Appliances	3,233 kWh/Year
Standby Consumption (Inverter)	5 kWh/Year
Total Consumption	3,238 kWh/Year
covered by PV power with battery	2,020 kWh/Year
covered by grid	1,218 kWh/Year
Solar Fraction	62.4 %

Total Consumption



Battery System

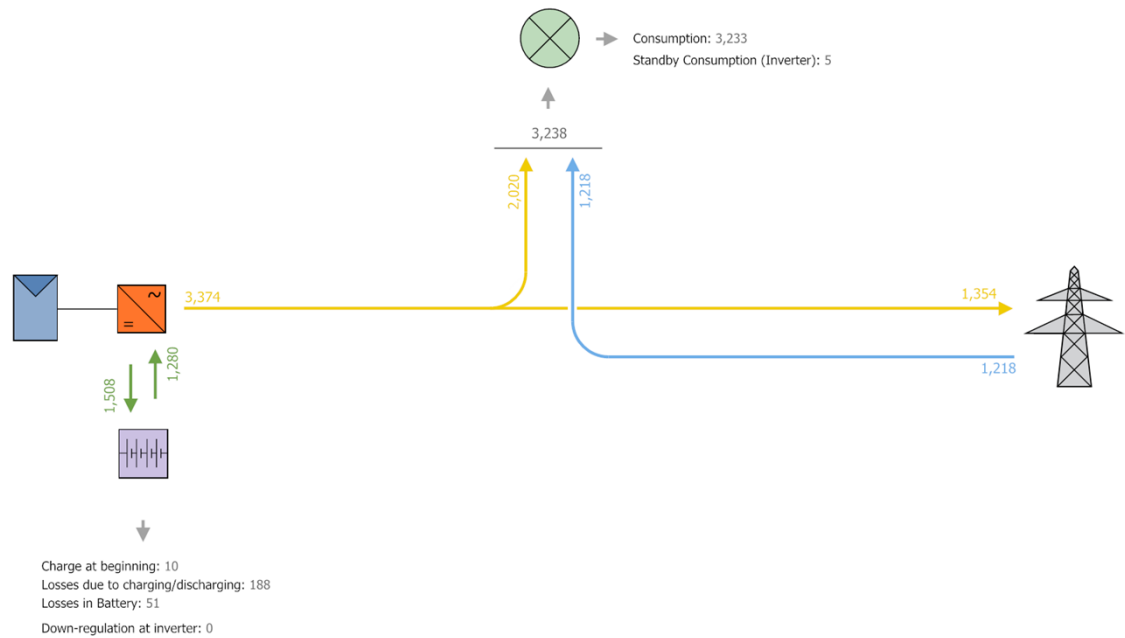
Charge at beginning	10 kWh
Battery Charge (PV System)	1,508 kWh/Year
Battery Energy for the Covering of Consumption	1,280 kWh/Year
Losses due to charging/discharging	188 kWh/Year
Losses in Battery	51 kWh/Year
Cycle Load	1.7 %
Service Life	>20 Years

Level of Self-sufficiency

Total Consumption	3,238 kWh/Year
covered by grid	1,218 kWh/Year
Level of Self-sufficiency	62.4 %

Energy Flow Graph

Project: YHB-030



All values in kWh
Small deviations in the totals can occur due to rounding
created with PV*SOL

Figure: Energy flow

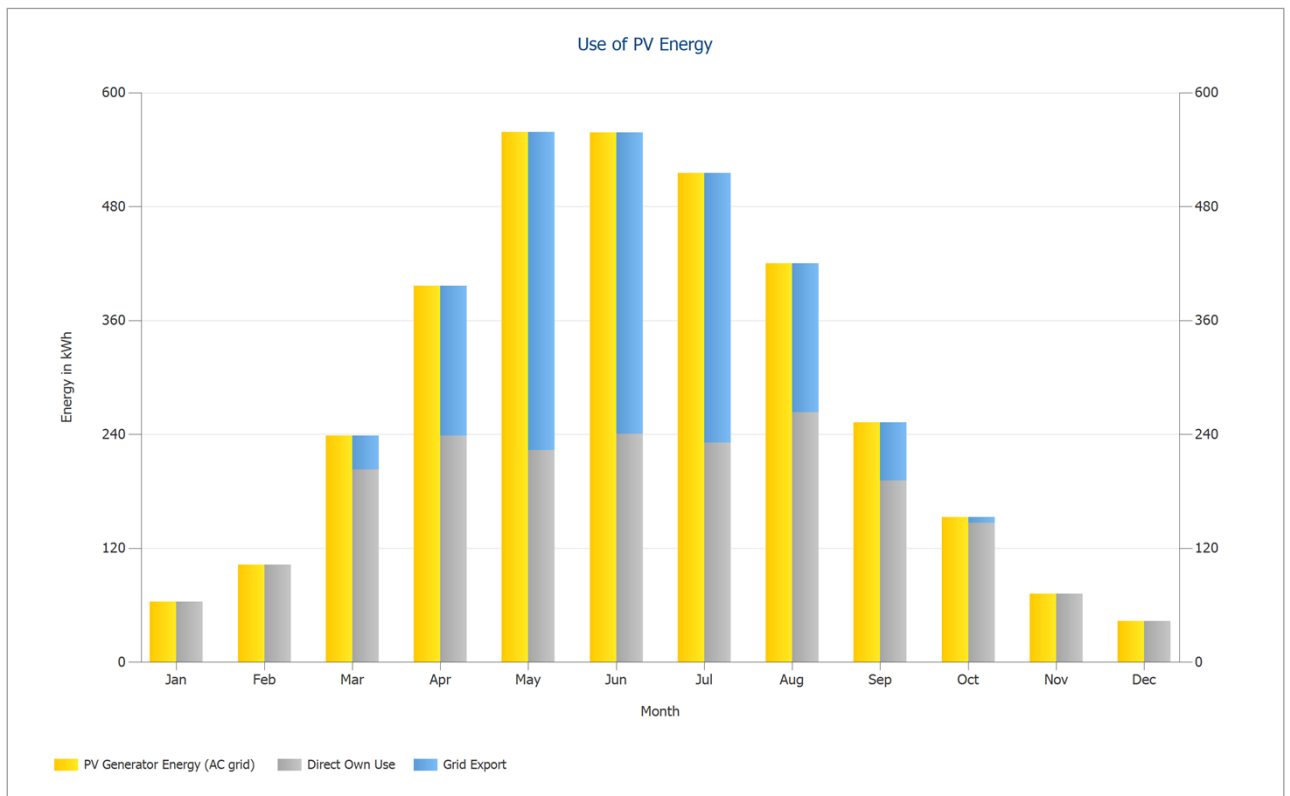


Figure: Use of PV Energy

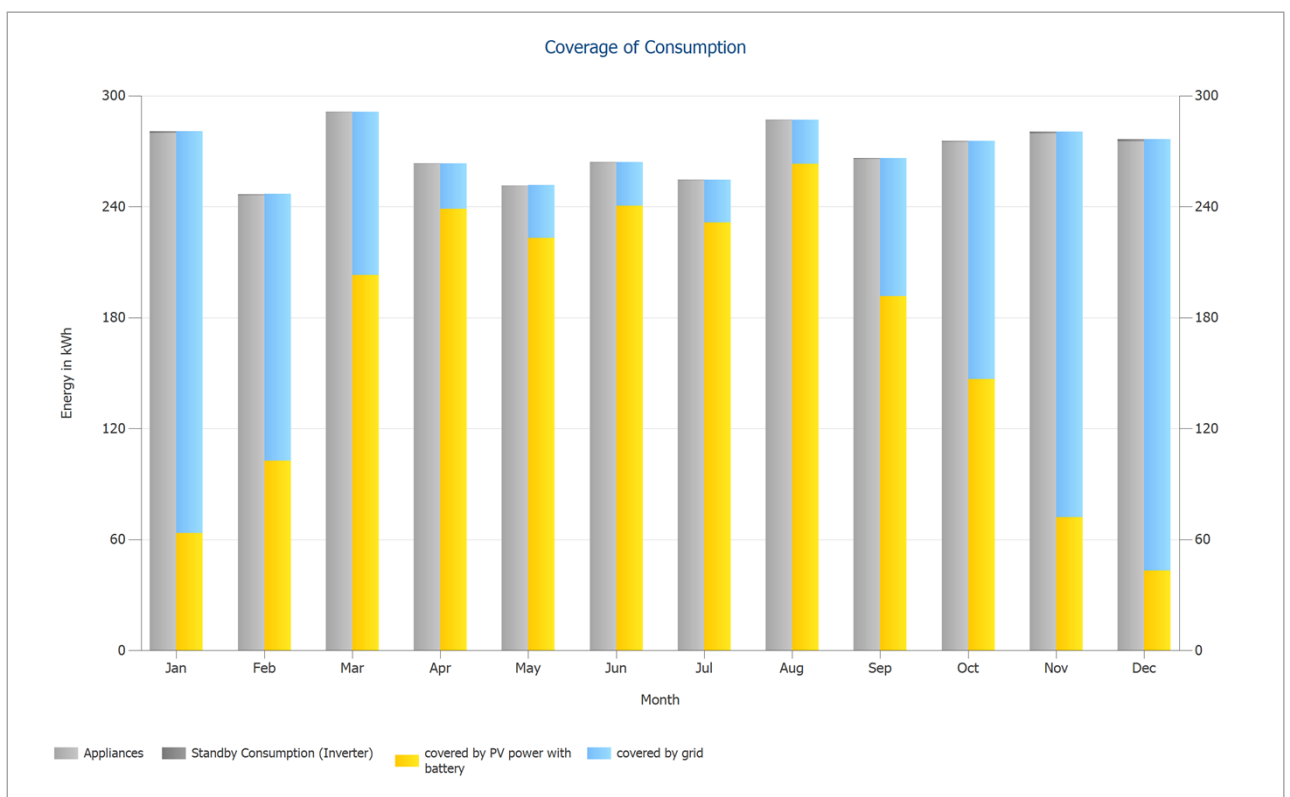


Figure: Coverage of Consumption

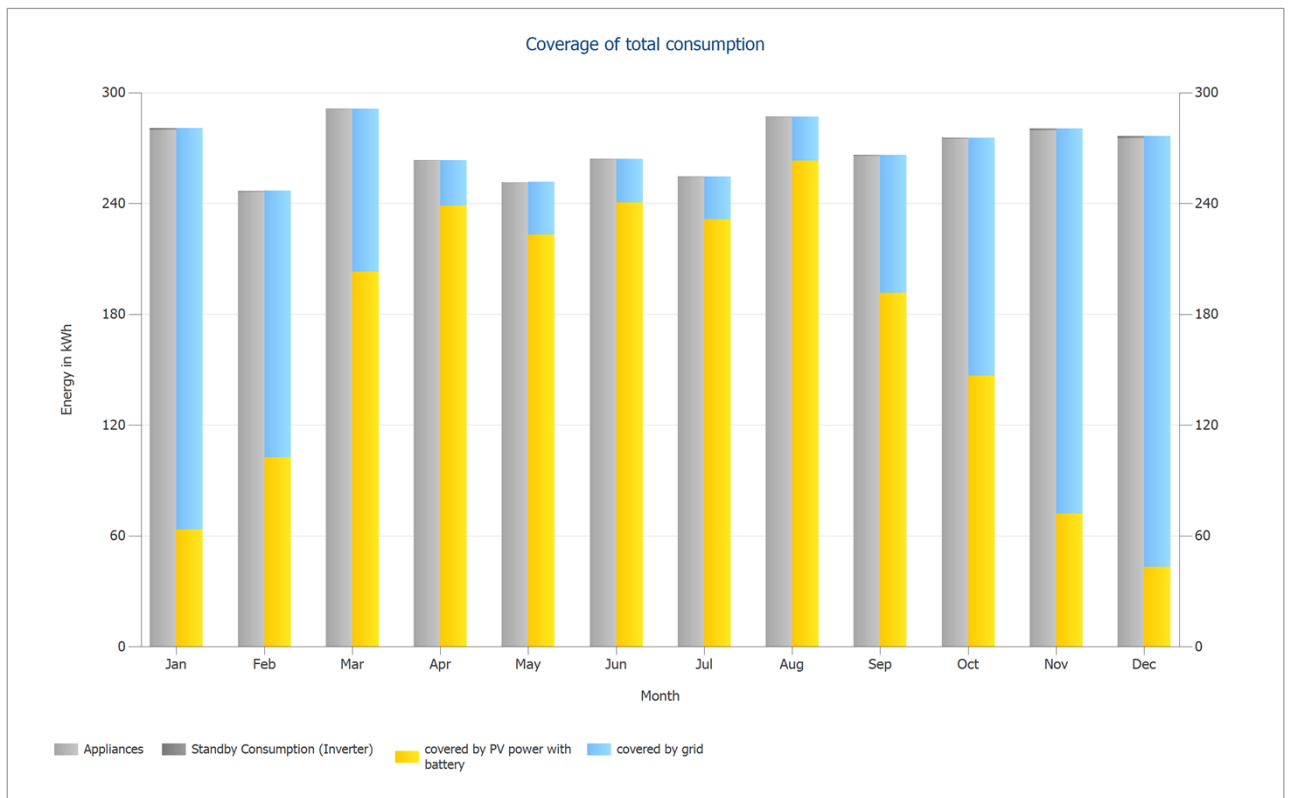


Figure: Coverage of total consumption

Financial Analysis

Overview

System Data

Grid Export in the first year (incl. module degradation)	1,354 kWh/Year
PV Generator Output	5 kWp
Start of Operation of the System	23/06/2023
Assessment Period	25 Years
Interest on Capital	0 %

Economic Parameters

Internal Rate of Return (IRR)	268.42 %
Accrued Cash Flow (Cash Balance)	44,162.43 £
Amortization Period	0.0 Years
Electricity Production Costs	0 £/kWh

Payment Overview

Specific Investment Costs	0.00 £/kWp
Investment Costs	0.00 £
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	74.46 £/Year
First year savings	679.13 £/Year

SEG - Octopus Energy - Outgoing Fixed - SEG eligible

Validity	01/01/2020 - 31/12/2039
Specific feed-in / export Remuneration	0.055 £/kWh
Feed-in / Export Tariff	74.4583 £/Year

YHB-030 (Example)

Energy Price	0.337 £/kWh
Inflation Rate for Energy Price	7 %/Year

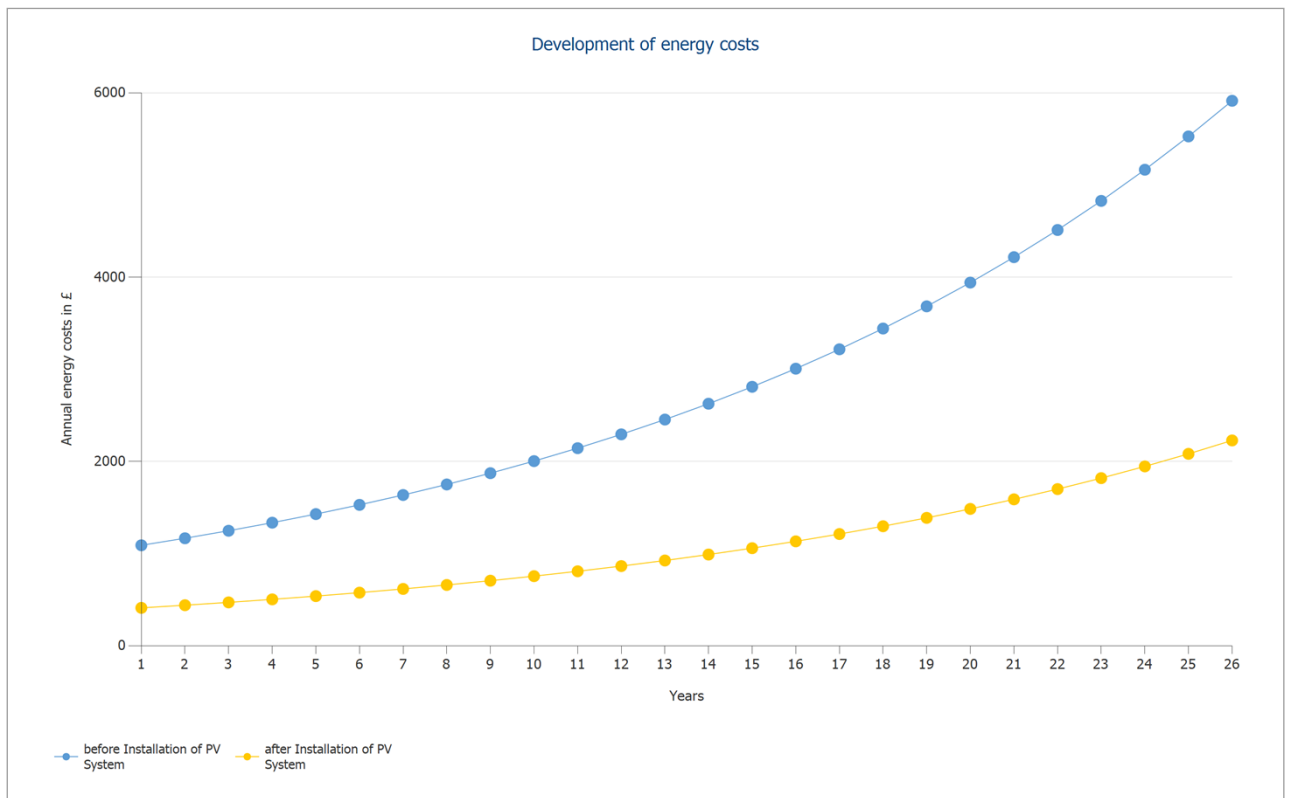


Figure: Development of energy costs

Cash flow

Cash flow

	Year 1	Year 2	Year 3	Year 4	Year 5
Feed-in / Export Tariff	£61.65	£74.46	£74.46	£74.46	£74.46
Electricity Savings	£663.63	£726.66	£777.53	£831.96	£890.19
Annual Cash Flow	£725.28	£801.12	£851.99	£906.42	£964.65
Accrued Cash Flow (Cash Balance)	£725.28	£1,526.40	£2,378.39	£3,284.80	£4,249.46

Cash flow

	Year 6	Year 7	Year 8	Year 9	Year 10
Feed-in / Export Tariff	£74.46	£74.46	£74.46	£74.46	£74.46
Electricity Savings	£952.51	£1,019.18	£1,090.53	£1,166.86	£1,248.54
Annual Cash Flow	£1,026.97	£1,093.64	£1,164.98	£1,241.32	£1,323.00
Accrued Cash Flow (Cash Balance)	£5,276.42	£6,370.07	£7,535.05	£8,776.37	£10,099.37

Cash flow

	Year 11	Year 12	Year 13	Year 14	Year 15
Feed-in / Export Tariff	£74.46	£74.46	£74.46	£74.46	£74.46
Electricity Savings	£1,335.94	£1,429.46	£1,529.52	£1,636.59	£1,751.15
Annual Cash Flow	£1,410.40	£1,503.92	£1,603.98	£1,711.04	£1,825.61
Accrued Cash Flow (Cash Balance)	£11,509.77	£13,013.69	£14,617.67	£16,328.71	£18,154.32

Cash flow

	Year 16	Year 17	Year 18	Year 19	Year 20
Feed-in / Export Tariff	£74.46	£45.40	£0.00	£0.00	£0.00
Electricity Savings	£1,873.73	£2,004.89	£2,145.23	£2,295.40	£2,456.07
Annual Cash Flow	£1,948.19	£2,050.28	£2,145.23	£2,295.40	£2,456.07
Accrued Cash Flow (Cash Balance)	£20,102.50	£22,152.79	£24,298.02	£26,593.42	£29,049.49

Cash flow

	Year 21	Year 22	Year 23	Year 24	Year 25
Feed-in / Export Tariff	£0.00	£0.00	£0.00	£0.00	£0.00
Electricity Savings	£2,628.00	£2,811.96	£3,008.80	£3,219.41	£3,444.77
Annual Cash Flow	£2,628.00	£2,811.96	£3,008.80	£3,219.41	£3,444.77
Accrued Cash Flow (Cash Balance)	£31,677.49	£34,489.45	£37,498.25	£40,717.66	£44,162.43

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

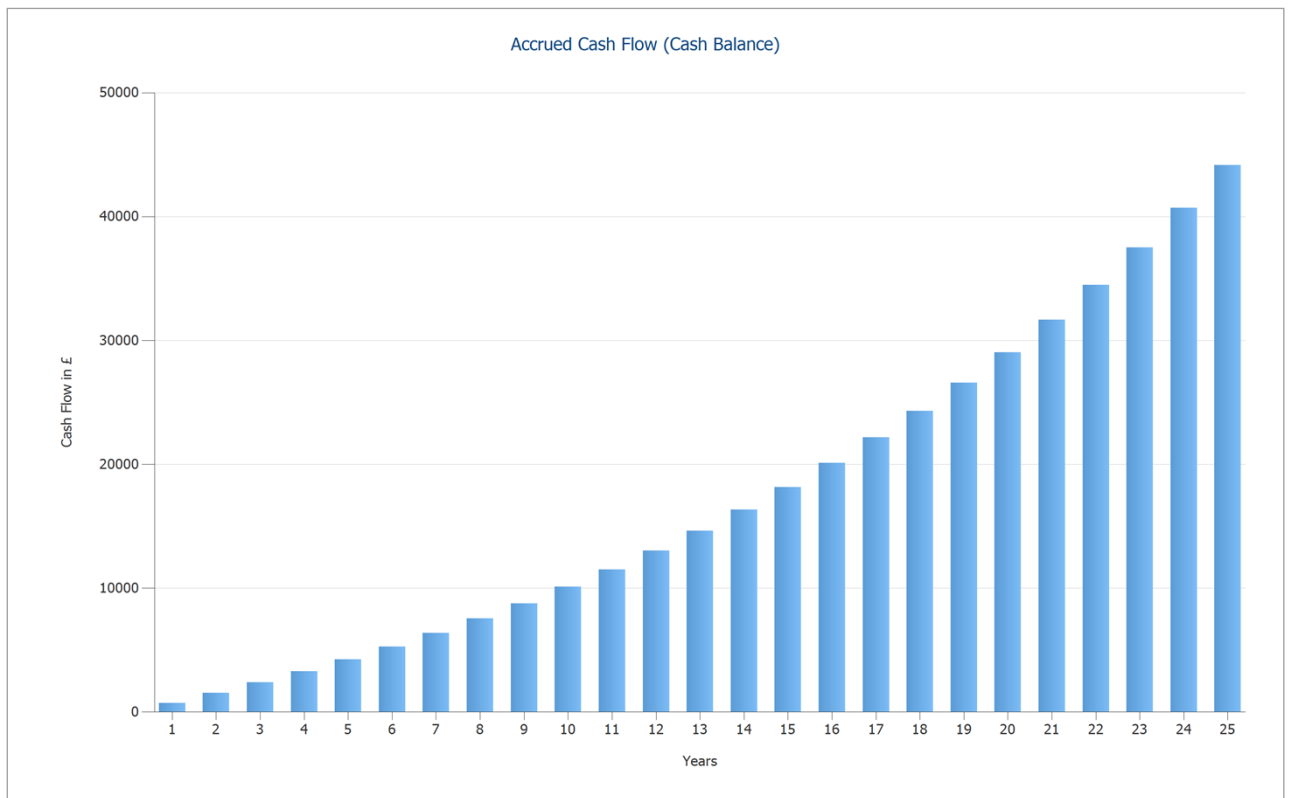


Figure: Accrued Cash Flow (Cash Balance)

Plans and parts list

Circuit Diagram

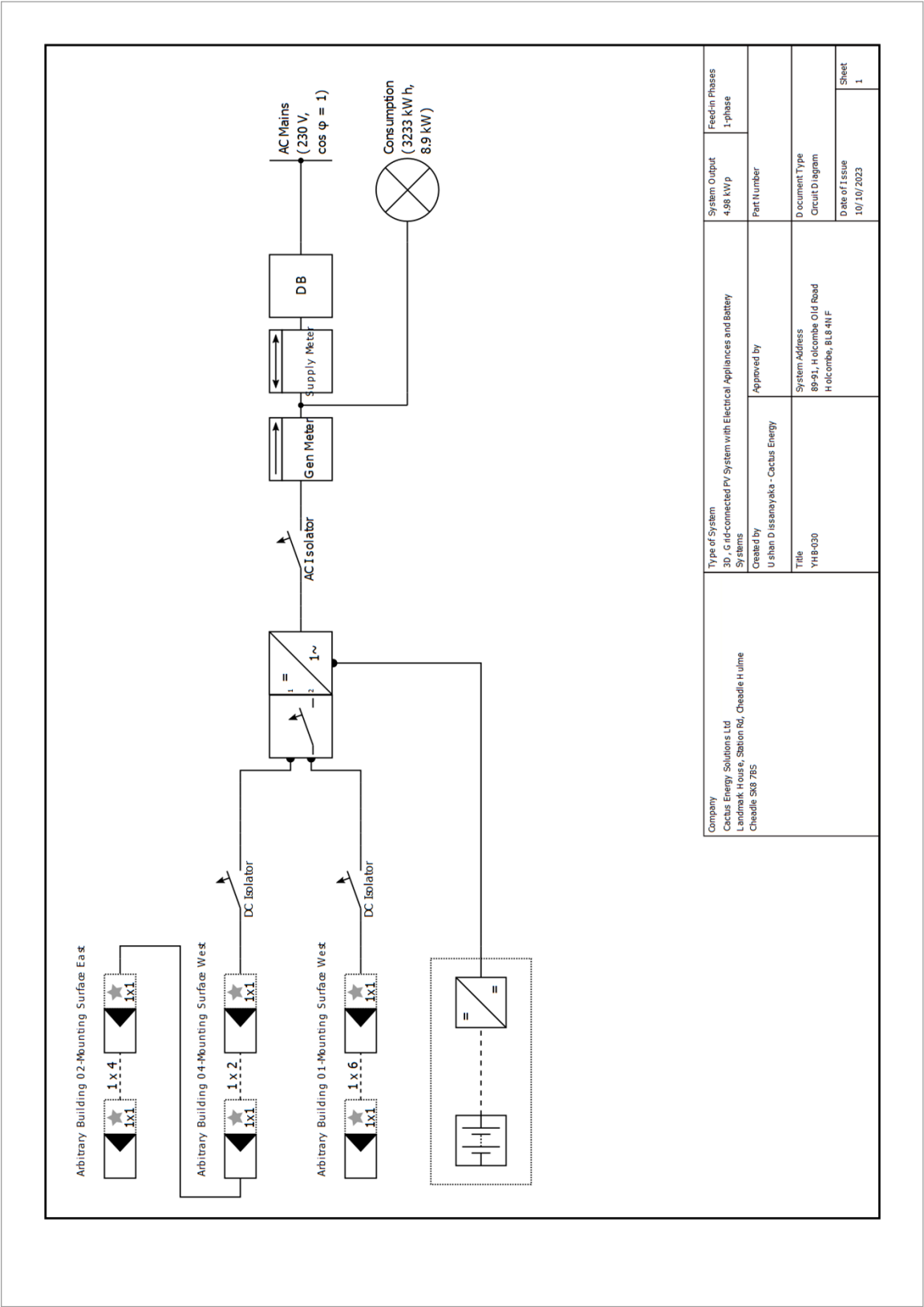


Figure: Circuit Diagram

Overview plan

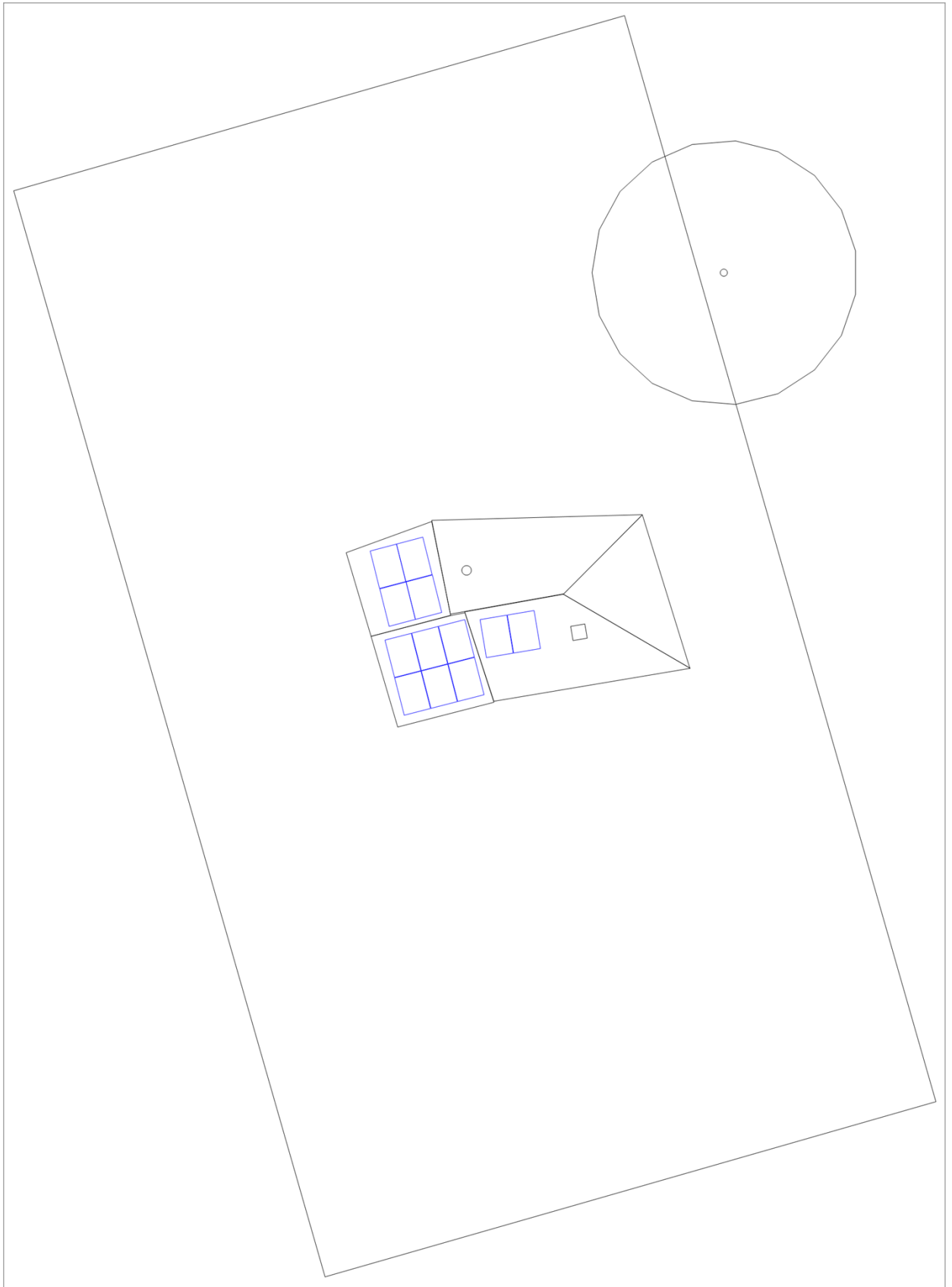


Figure: Overview plan

Dimensioning Plan

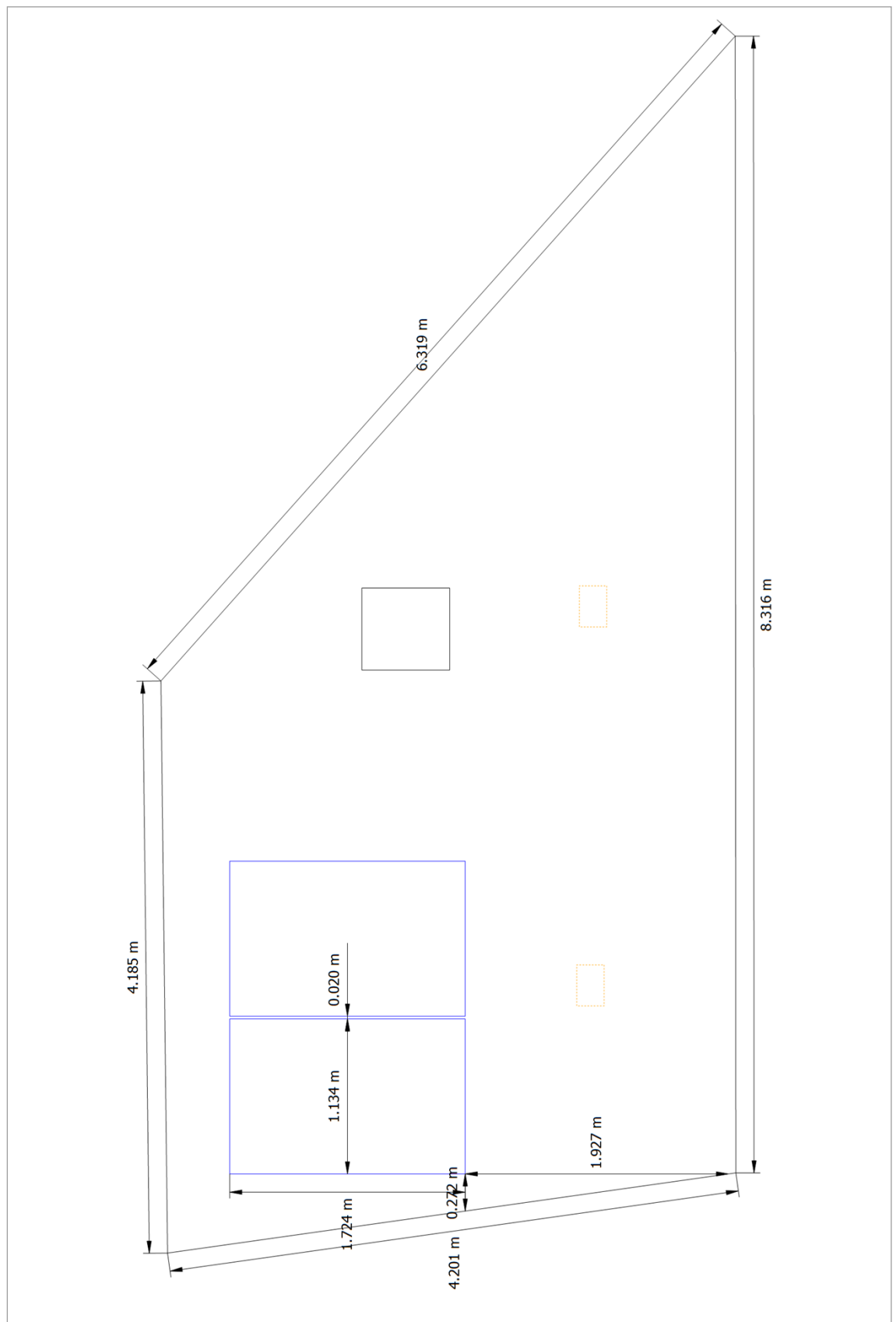


Figure: Arbitrary Building 04 - Mounting Surface West

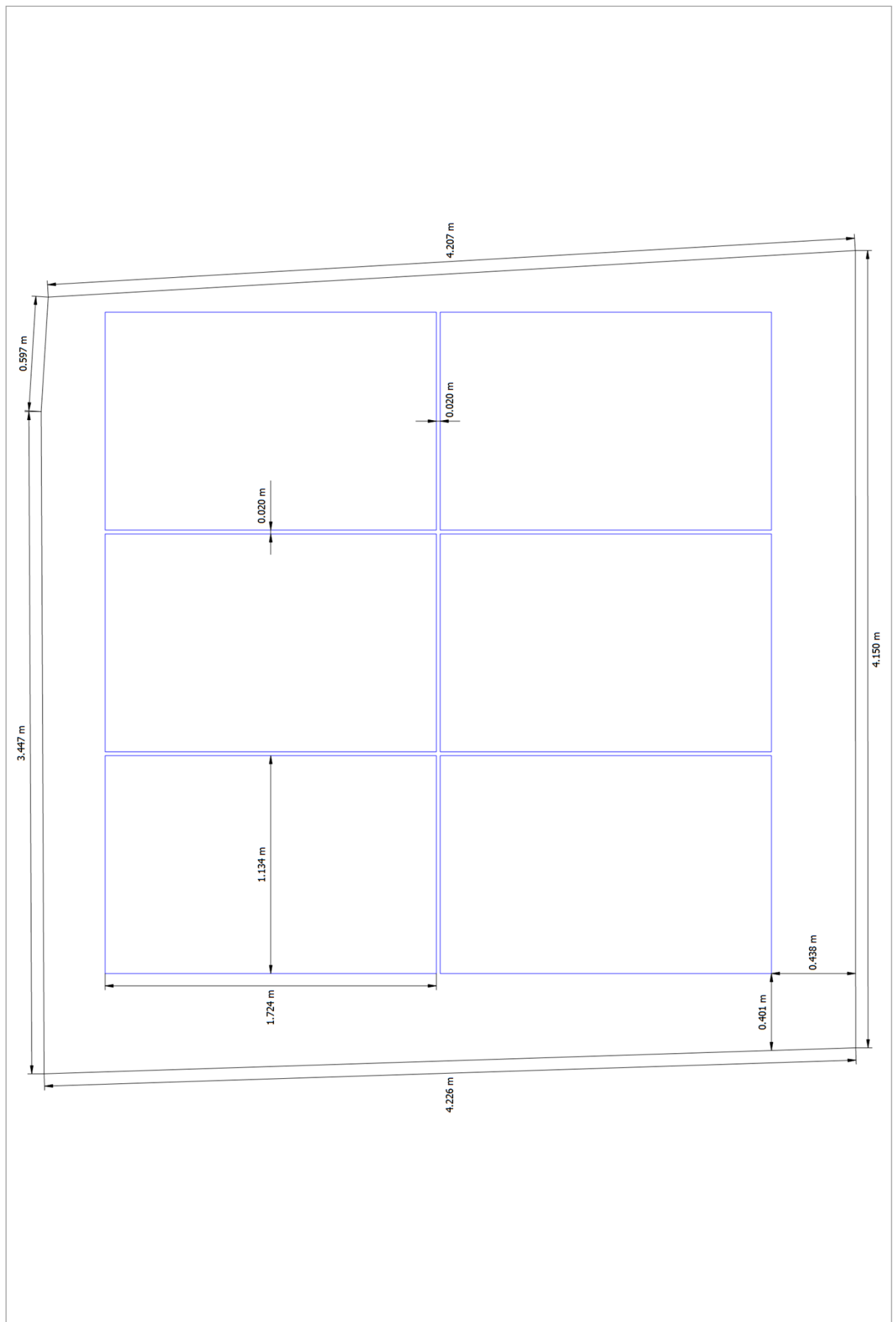


Figure: Arbitrary Building 01 - Mounting Surface West

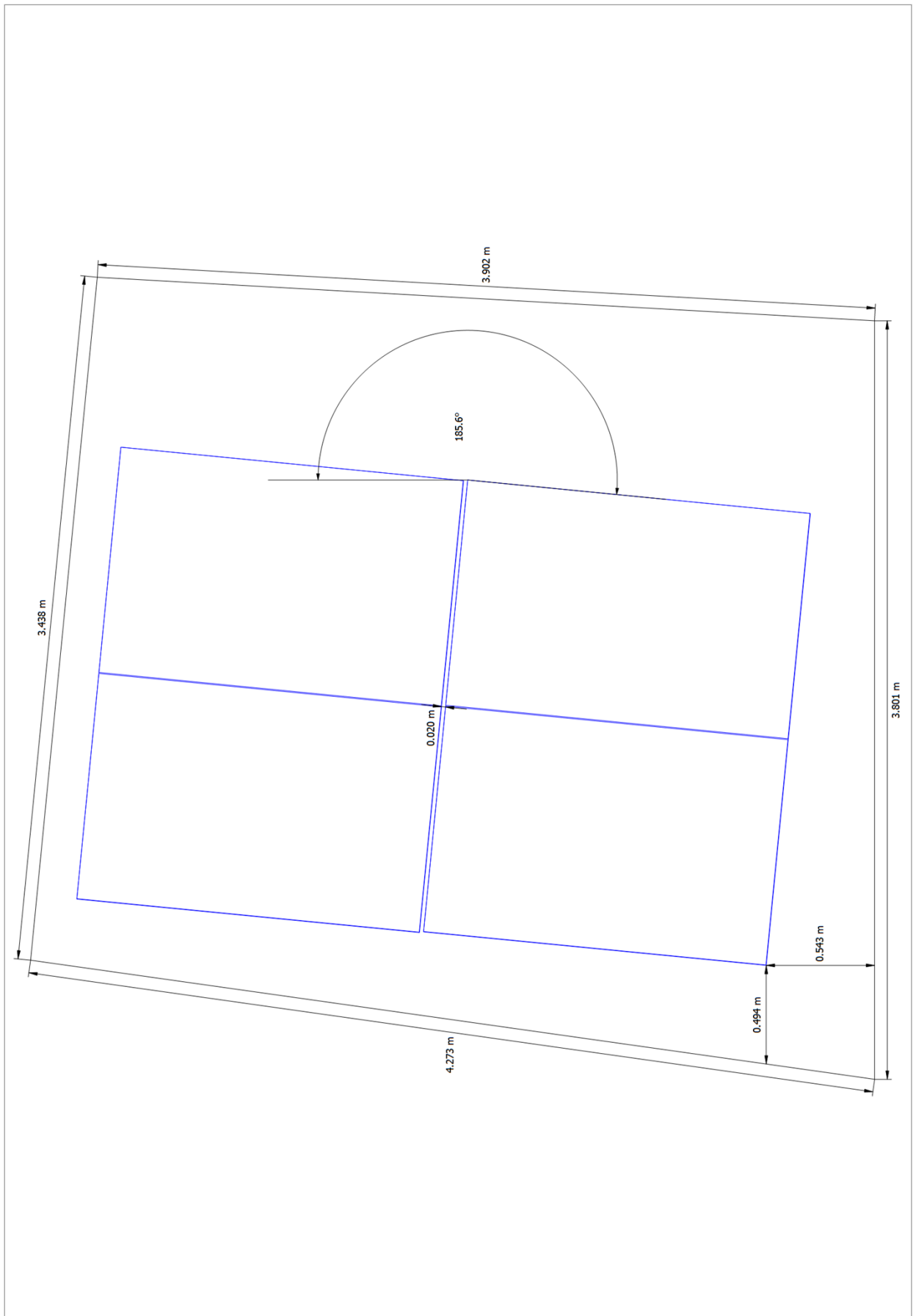


Figure: Arbitrary Building 02 - Mounting Surface East

String Plan

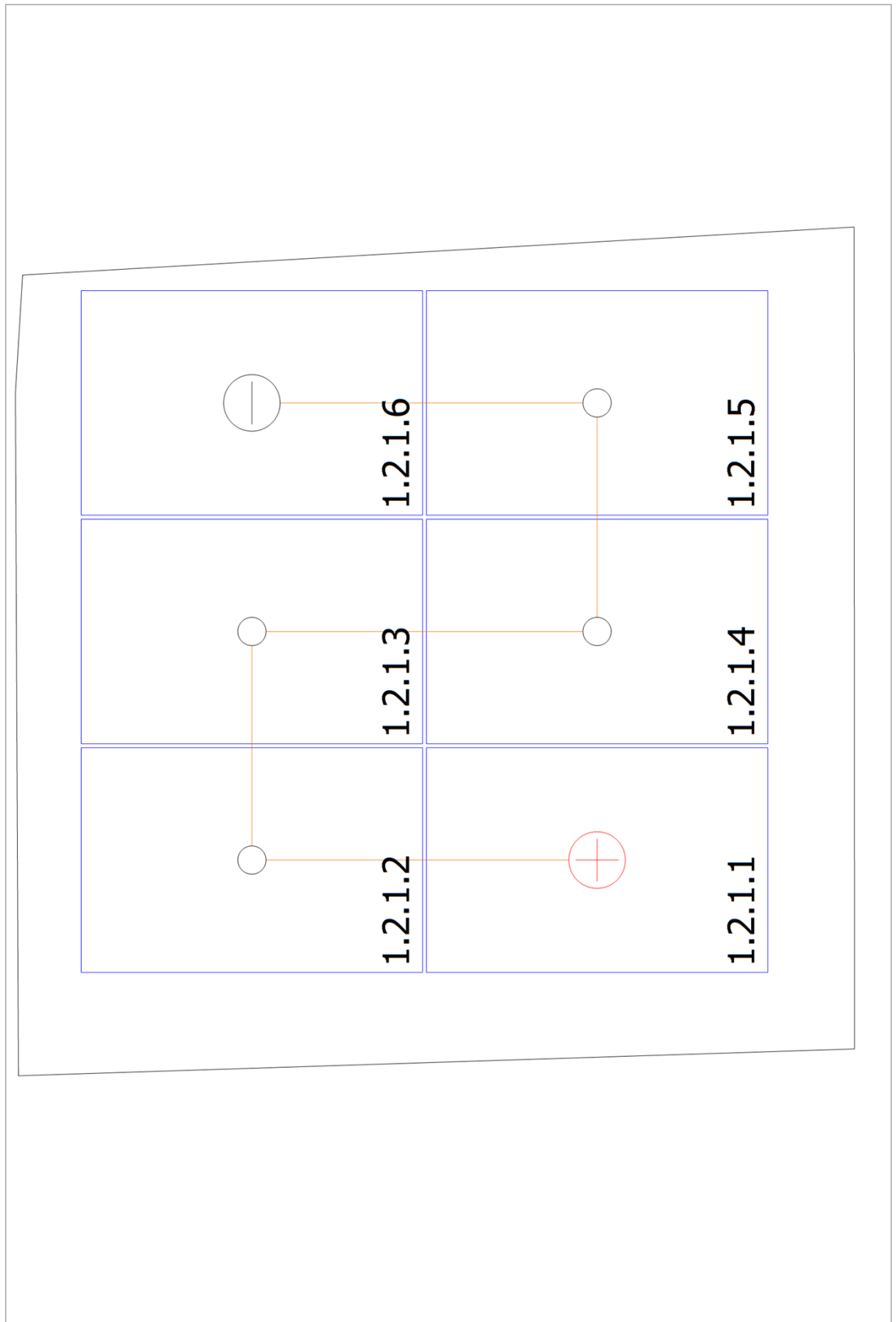


Figure: Arbitrary Building 01 - Mounting Surface West

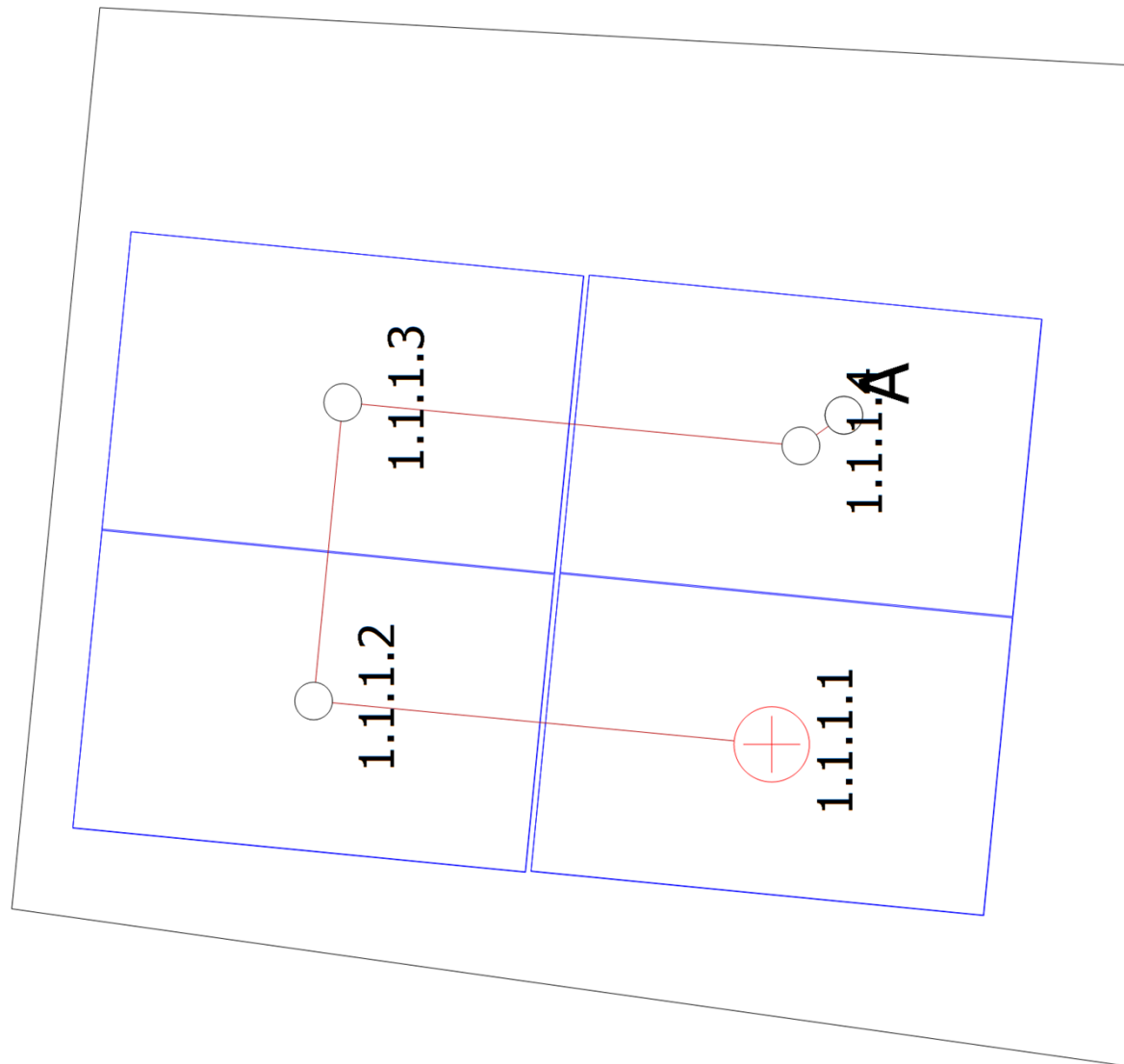


Figure: Arbitrary Building 02 - Mounting Surface East

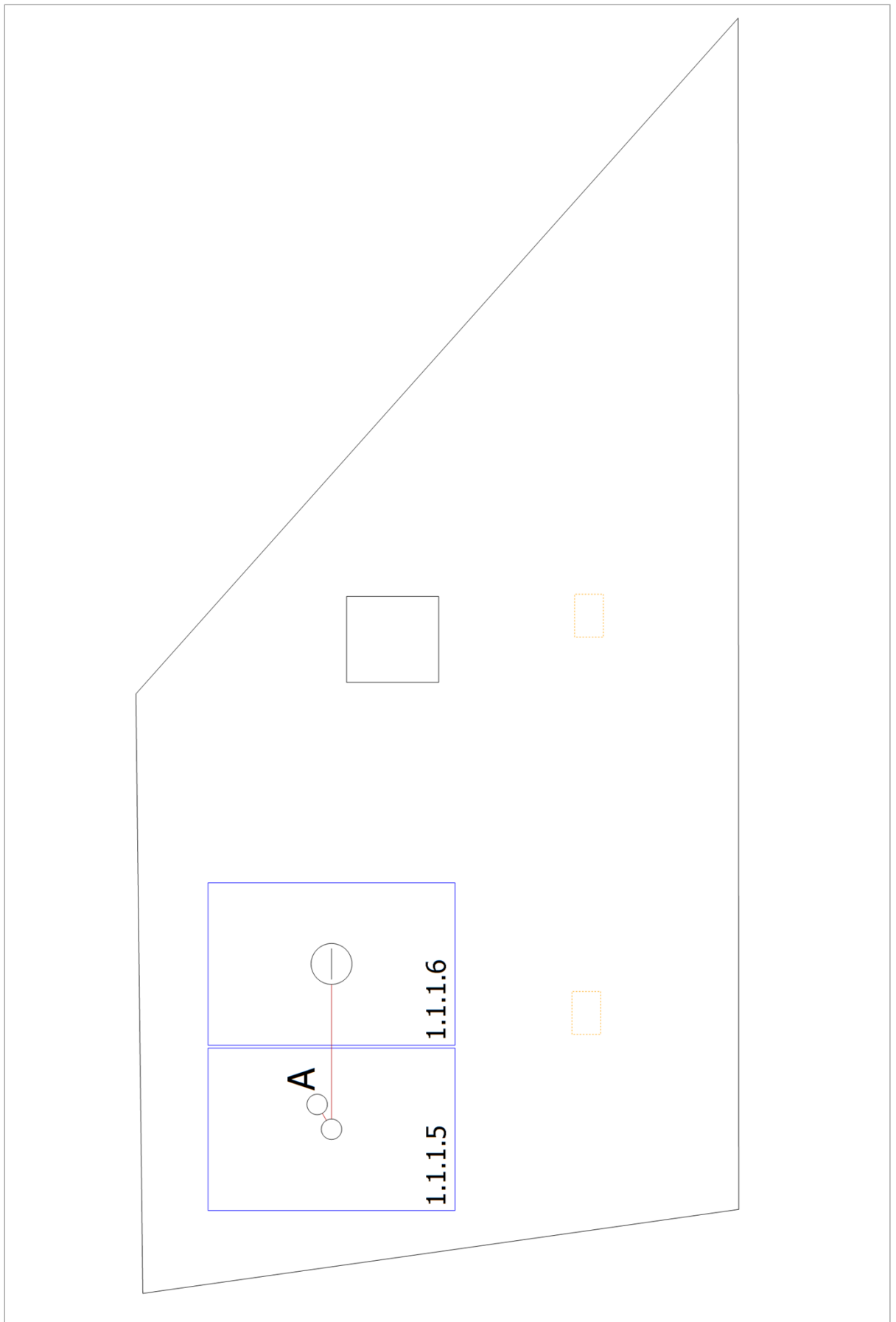


Figure: Arbitrary Building 04 - Mounting Surface West

Parts list

Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		Eurener	MEPV 108_415 W HC MBB	12	Piece
2	Inverter		Alpha ESS Co., Ltd.	STORION SMILE5-INV Hybrid	1	Piece
3	Power Optimizer		Tigo Energy, Inc.	TS4-A-O 700 W	12	Piece
4	Battery System		Alpha ESS Co., Ltd.	STORION SMILE5 + SMILE-BAT-10.1P (10.1kWh)	1	Piece
5	Components			Energy flow sensor Gen Meter	1	Piece
6	Components			Energy flow sensor Supply Meter	1	Piece
7	Components			Circuit Breaker AC Isolator	1	Piece
8	Components			Circuit Breaker DC Isolator	2	Piece
9	Flashing Kit		DEKS	Dektite® Multi Cable - Aluminium base (MCS Recommended)	1	Piece
10	Smoke Alarm		AICO	EI146E SMOKE ALARM (MCS Requirement)	1	Piece
11	Bird Protection			Bird Protection / Netting (MCS Requirement)	40	m
12	MCS			MCS Certificate & Number for SEG payments	2	Certificate
13	Warning Labels			Battery & PV Array Labellings (MCS Requirement)	2	Sheets
14	HIES			HIES is a consumer protection organisation covering the installation of renewable energy and home energy efficiency products	2	Years

Screenshots, 3D Design Environment



Figure: Screenshot01