Green Leaf Engineering
The Arrow, Team Valley Trading Estate
Fifth Avenue Business Park
Gateshead, NE11 0NG

Contact person:
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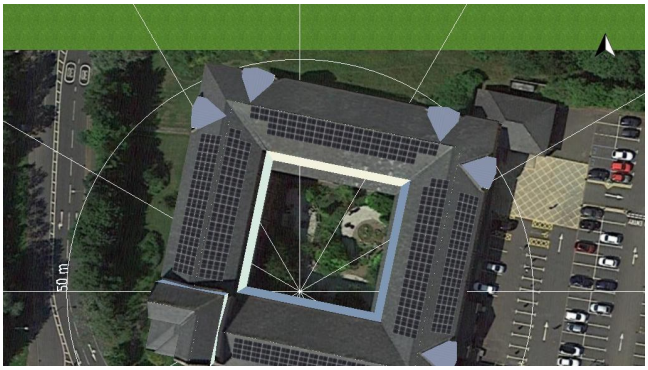
Project Name: Boldon House

13/02/2024

Your PV system from Green Leaf Engineering

Address of Installation

Wheatlands Way, Pity Me, Durham DH1 5FA



Project Description:
Photovoltaic Roof System

Project Overview

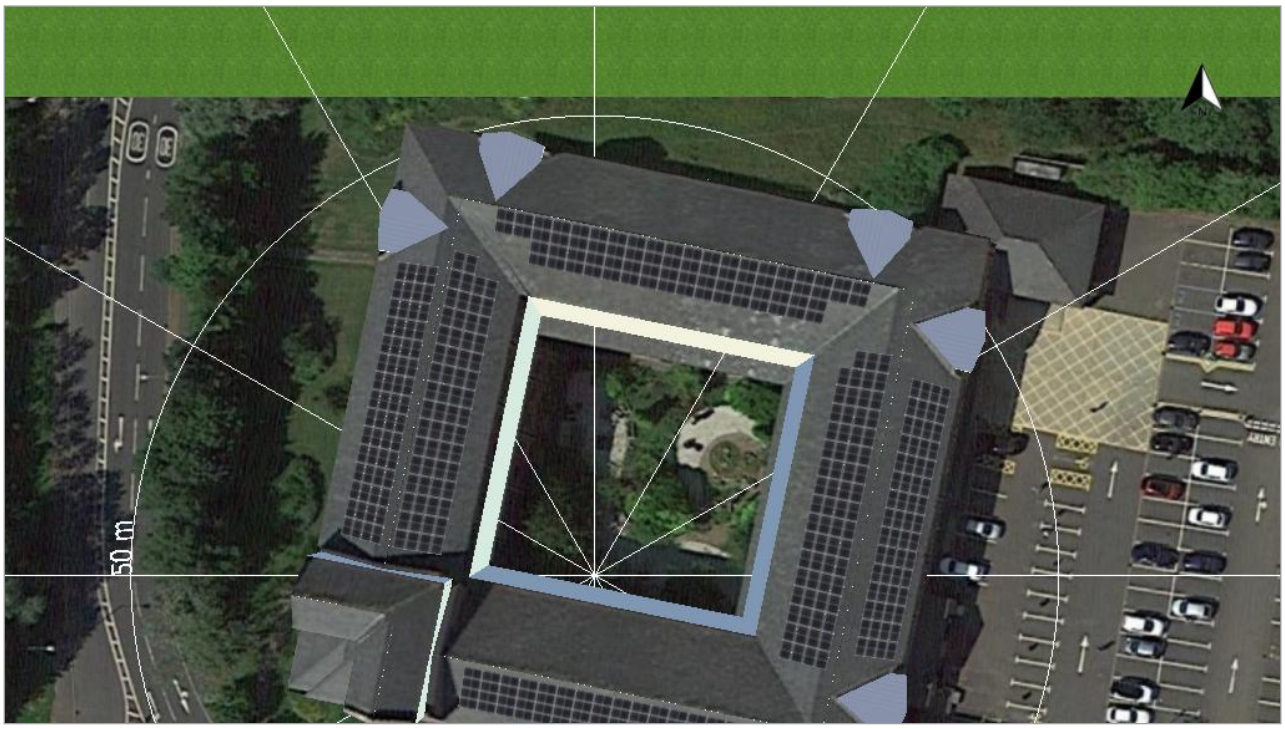


Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV System with Electrical Appliances

Climate Data	Durham, GBR (1996 - 2015)	
Values source	Meteonorm 8.1(i)	
PV Generator Output	168.52	kWp
PV Generator Surface	765.3	m²
Number of PV Modules	383	
Number of Inverters	4	

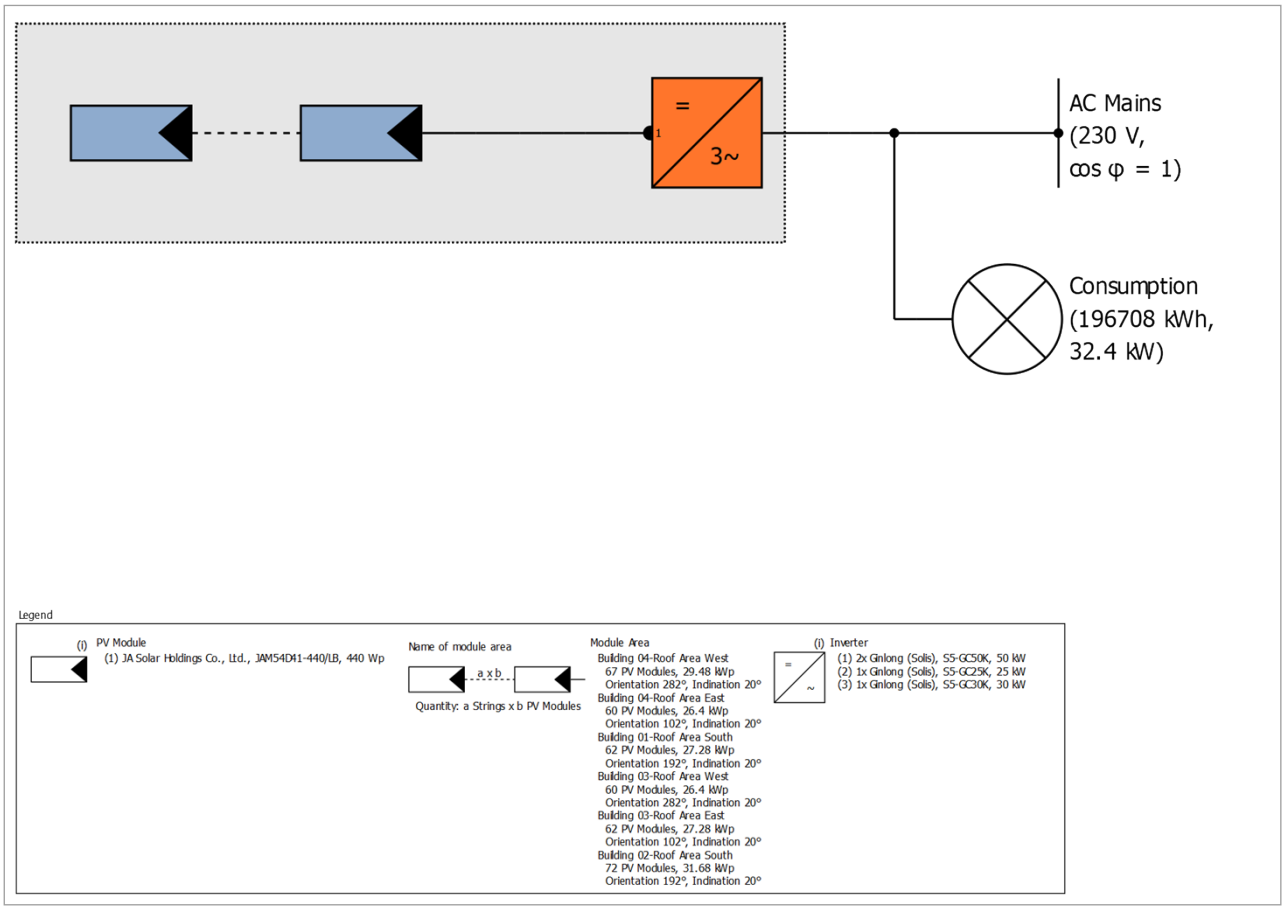


Figure: Schematic diagram

Production Forecast

Production Forecast

PV Generator Output	168.52	kWp
Spec. Annual Yield	942.44	kWh/kWp
Performance Ratio (PR)	92.77	%
Yield Reduction due to Shading	2.4	%
PV Generator Energy (AC grid)	158,879	kWh/Year
Own Consumption	87,448	kWh/Year
Clipping at Feed-in Point	0	kWh/Year
Grid Export	71,431	kWh/Year
Own Power Consumption	55.0	%
CO_2 Emissions avoided	74,645	kg / year
Level of Self-sufficiency	44.4	%

Financial Analysis

Your Gain

Total investment costs	0.00	£
Internal Rate of Return (IRR)	268.25	%
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

Climate Data

Location	Durham, 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	196708 kWh
Office building 16000 m²	196708 kWh
Load Peak	32.4 kW

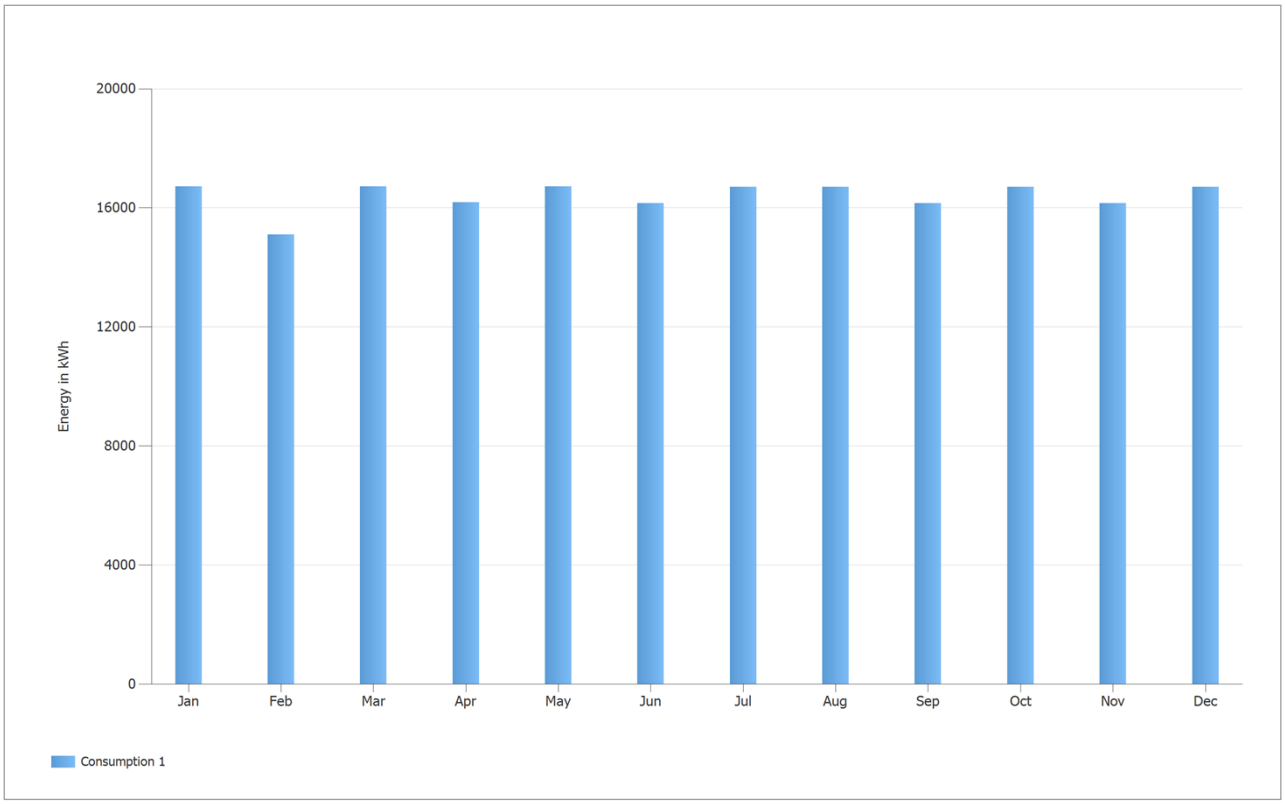


Figure: Consumption

Module Areas

1. Module Area - Building 04-Roof Area West

PV Generator, 1. Module Area - Building 04-Roof Area West

Name	Building 04-Roof Area West
PV Modules	67 x JAM54D41-440/LB (v1)
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	20 °
Orientation	West 282 °
Installation Type	Roof parallel
PV Generator Surface	133.9 m²

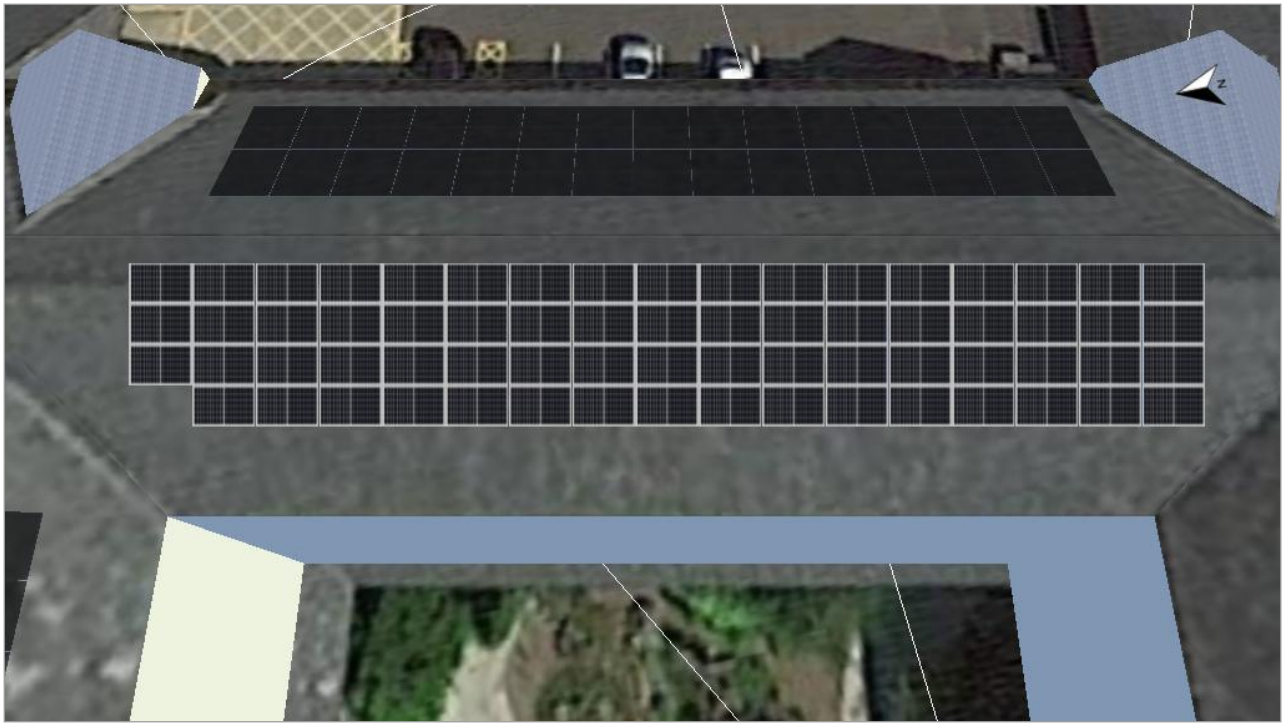


Figure: 1. Module Area - Building 04-Roof Area West

2. Module Area - Building 04-Roof Area East

PV Generator, 2. Module Area - Building 04-Roof Area East

Name	Building 04-Roof Area East
PV Modules	60 x JAM54D41-440/LB (v1)
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	20 °
Orientation	East 102 °
Installation Type	Roof parallel
PV Generator Surface	119.9 m²

Figure: 2. Module Area - Building 04-Roof Area East

3. Module Area - Building 01-Roof Area South

PV Generator, 3. Module Area - Building 01-Roof Area South

Name	Building 01-Roof Area South
PV Modules	62 x JAM54D41-440/LB (v1)
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	20 °
Orientation	South 192 °
Installation Type	Roof parallel
PV Generator Surface	123.9 m²

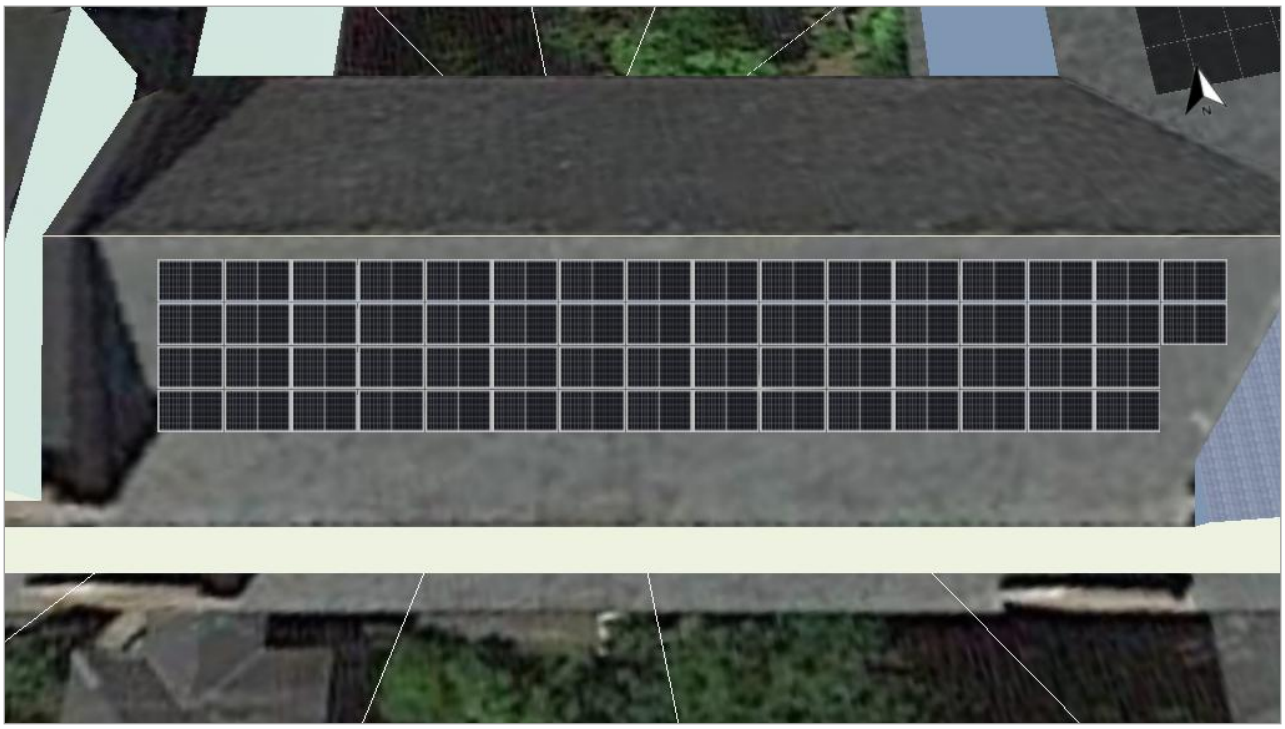


Figure: 3. Module Area - Building 01-Roof Area South

4. Module Area - Building 03-Roof Area West

PV Generator, 4. Module Area - Building 03-Roof Area West

Name	Building 03-Roof Area West
PV Modules	60 x JAM54D41-440/LB (v1)
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	20 °
Orientation	West 282 °
Installation Type	Roof parallel
PV Generator Surface	119.9 m²

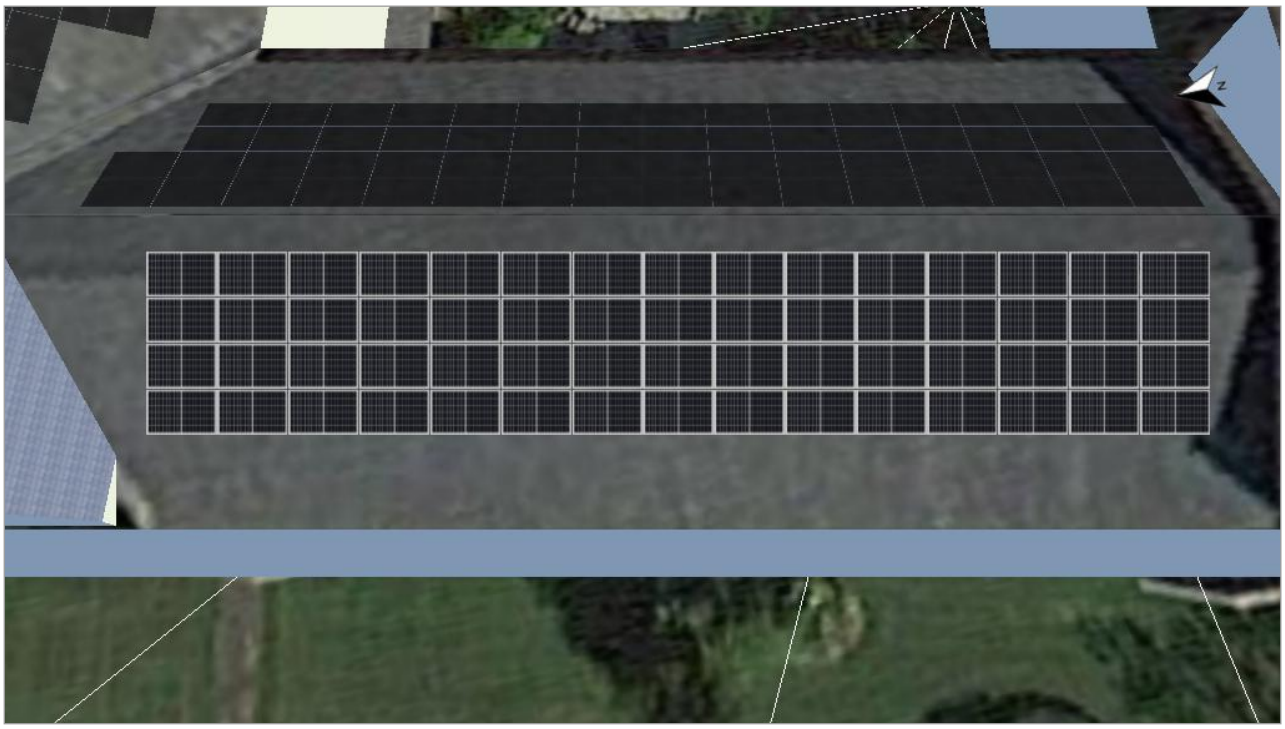


Figure: 4. Module Area - Building 03-Roof Area West

5. Module Area - Building 03-Roof Area East

PV Generator, 5. Module Area - Building 03-Roof Area East

Name	Building 03-Roof Area East
PV Modules	62 x JAM54D41-440/LB (v1)
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	20 °
Orientation	East 102 °
Installation Type	Roof parallel
PV Generator Surface	123.9 m²

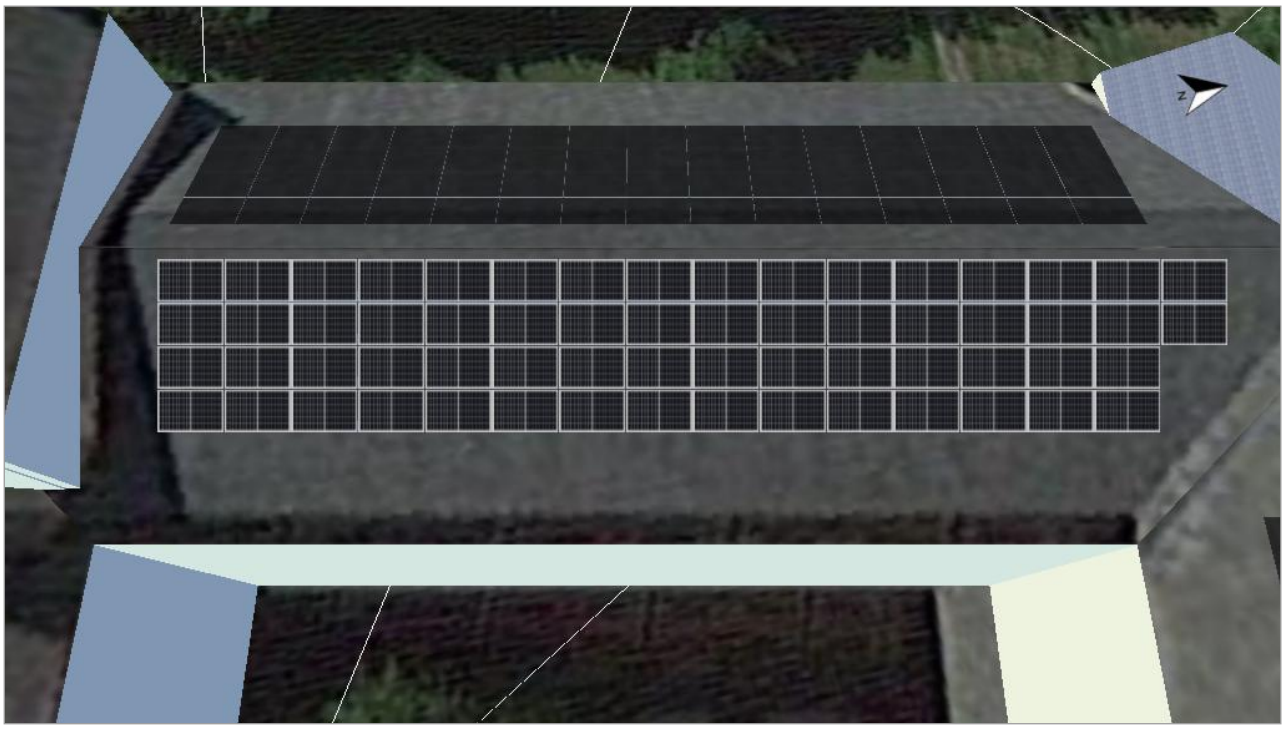


Figure: 5. Module Area - Building 03-Roof Area East

6. Module Area - Building 02-Roof Area South

PV Generator, 6. Module Area - Building 02-Roof Area South

Name	Building 02-Roof Area South
PV Modules	72 x JAM54D41-440/LB (v1)
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	20 °
Orientation	South 192 °
Installation Type	Roof parallel
PV Generator Surface	143.9 m²

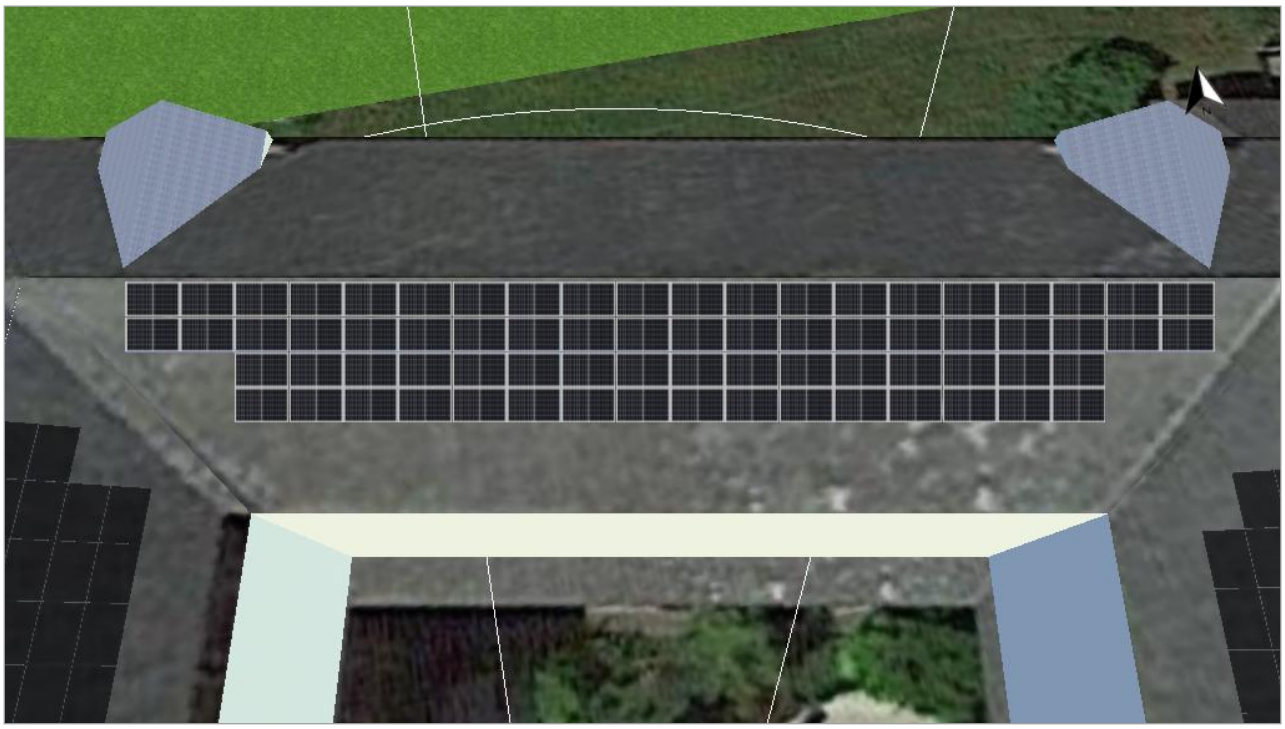


Figure: 6. Module Area - Building 02-Roof Area South

Horizon Line, 3D Design

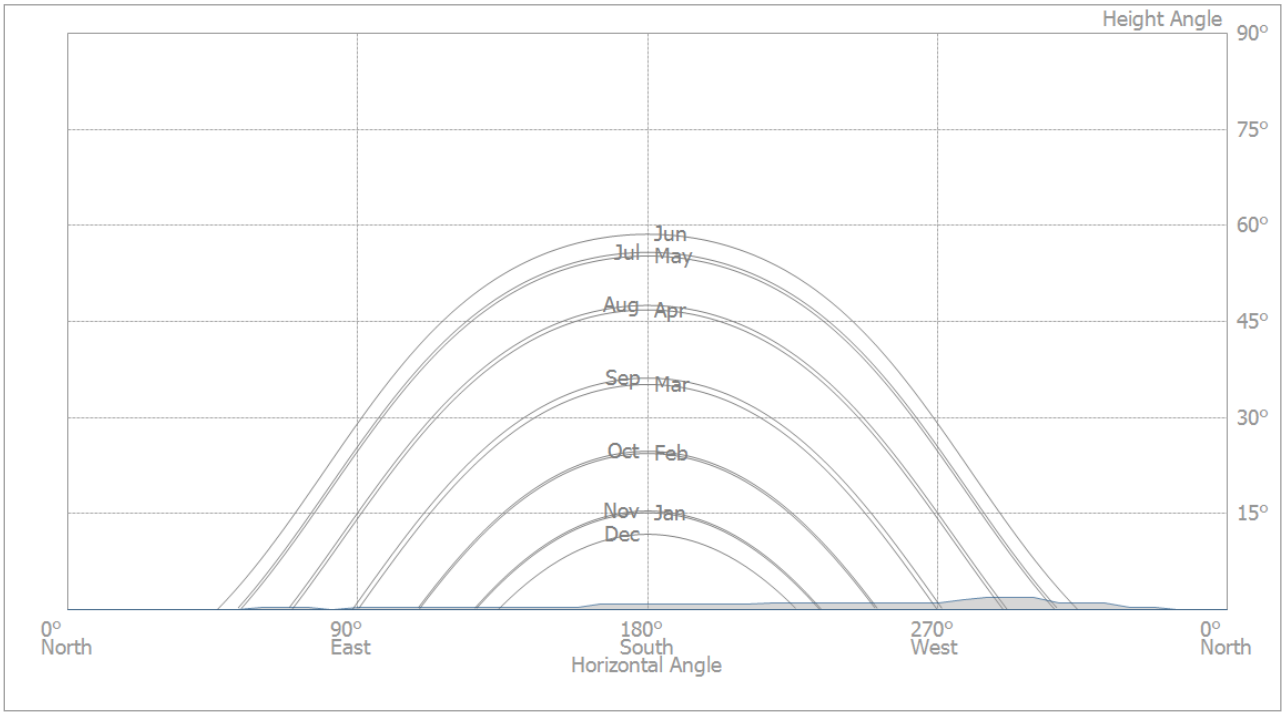


Figure: Horizon (3D Design)

Inverter configuration

Configuration 1

Module Areas	Building 04-Roof Area West + Building 04-Roof Area East
Inverter 1	
Model	S5-GC50K (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	111.8 %
Configuration	MPP 1: 1 x 19
	MPP 2: 1 x 16
	MPP 3: 2 x 16
	MPP 4: 2 x 20
	MPP 5: 1 x 20

Configuration 2

Module Area	Building 01-Roof Area South
Inverter 1	
Model	S5-GC25K (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	109.1 %
Configuration	MPP 1: 2 x 16
	MPP 2: 1 x 16
	MPP 3: 1 x 14

Configuration 3

Module Areas	Building 03-Roof Area West + Building 03-Roof Area East
Inverter 1	
Model	S5-GC50K (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	107.4 %
Configuration	MPP 1: 2 x 20
	MPP 2: 1 x 20
	MPP 3: 2 x 16
	MPP 4: 1 x 16
	MPP 5: 1 x 14

Configuration 4

Module Area	Building 02-Roof Area South
Inverter 1	
Model	S5-GC30K (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	105.6 %
Configuration	MPP 1: 2 x 20
	MPP 2: 1 x 20
	MPP 3: 1 x 12

AC Mains

AC Mains

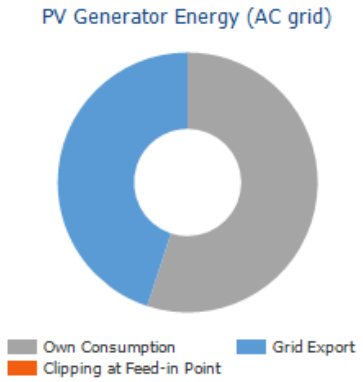
Number of Phases	3
Mains voltage between phase and neutral	230 V
Displacement Power Factor (cos phi)	+/- 1

Simulation Results

Results Total System

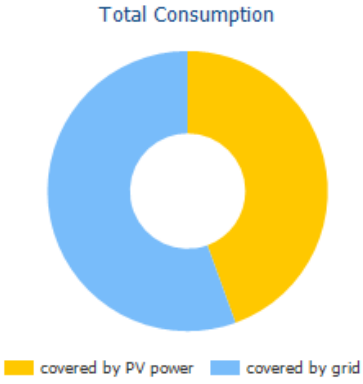
PV System

PV Generator Output	168.52	kWp
Spec. Annual Yield	942.44	kWh/kWp
Performance Ratio (PR)	92.77	%
Yield Reduction due to Shading	2.4	%
PV Generator Energy (AC grid)	158,879	kWh/Year
Own Consumption	87,448	kWh/Year
Clipping at Feed-in Point	0	kWh/Year
Grid Export	71,431	kWh/Year
Own Power Consumption	55.0	%
CO_2 Emissions avoided	74,645	kg / year



Appliances

Appliances	196,708	kWh/Year
Standby Consumption (Inverter)	59	kWh/Year
Total Consumption	196,767	kWh/Year
covered by PV power	87,448	kWh/Year
covered by grid	109,319	kWh/Year
Solar Fraction	44.4	%



Level of Self-sufficiency

Total Consumption	196,767	kWh/Year
covered by grid	109,319	kWh/Year
Level of Self-sufficiency	44.4	%

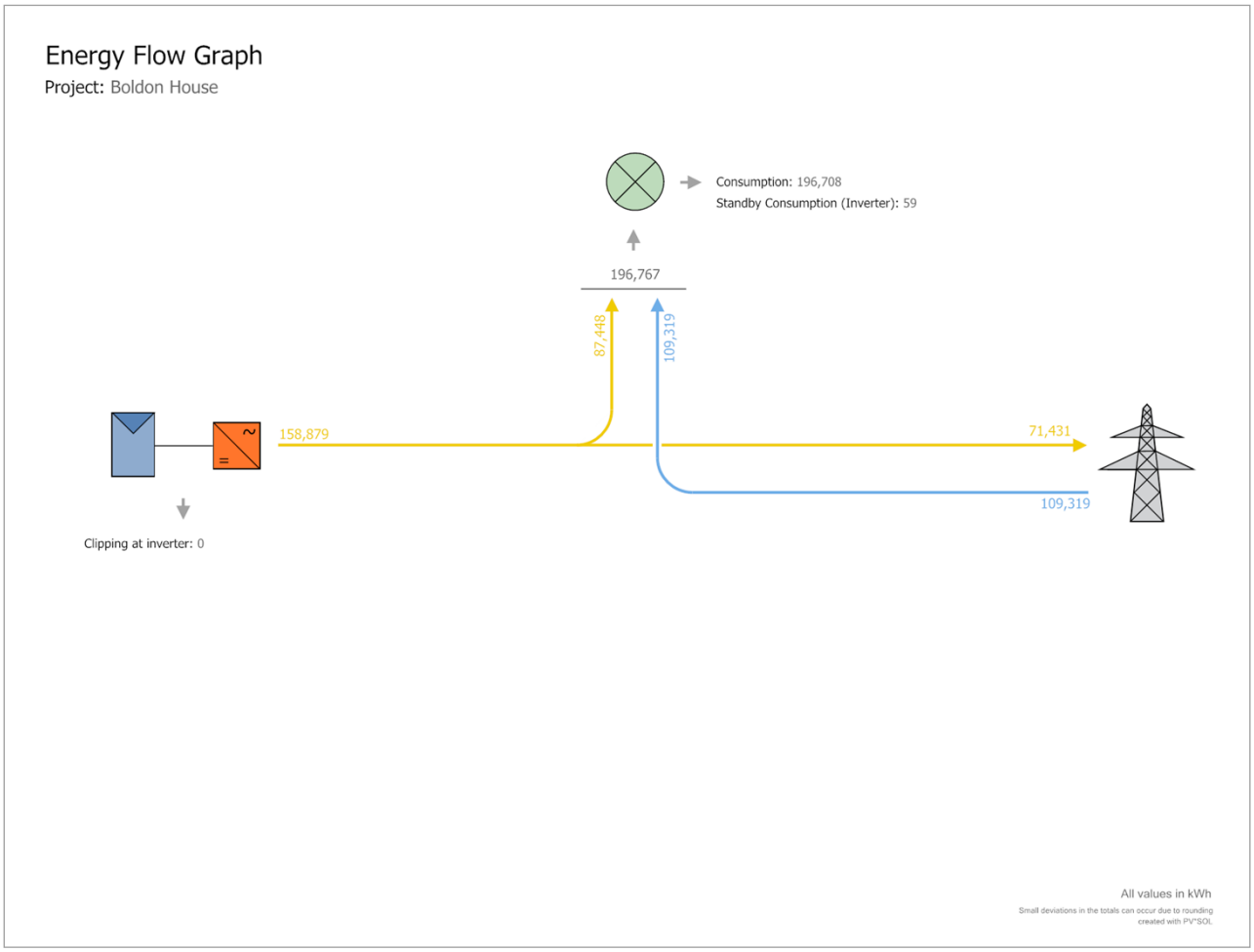


Figure: Energy flow

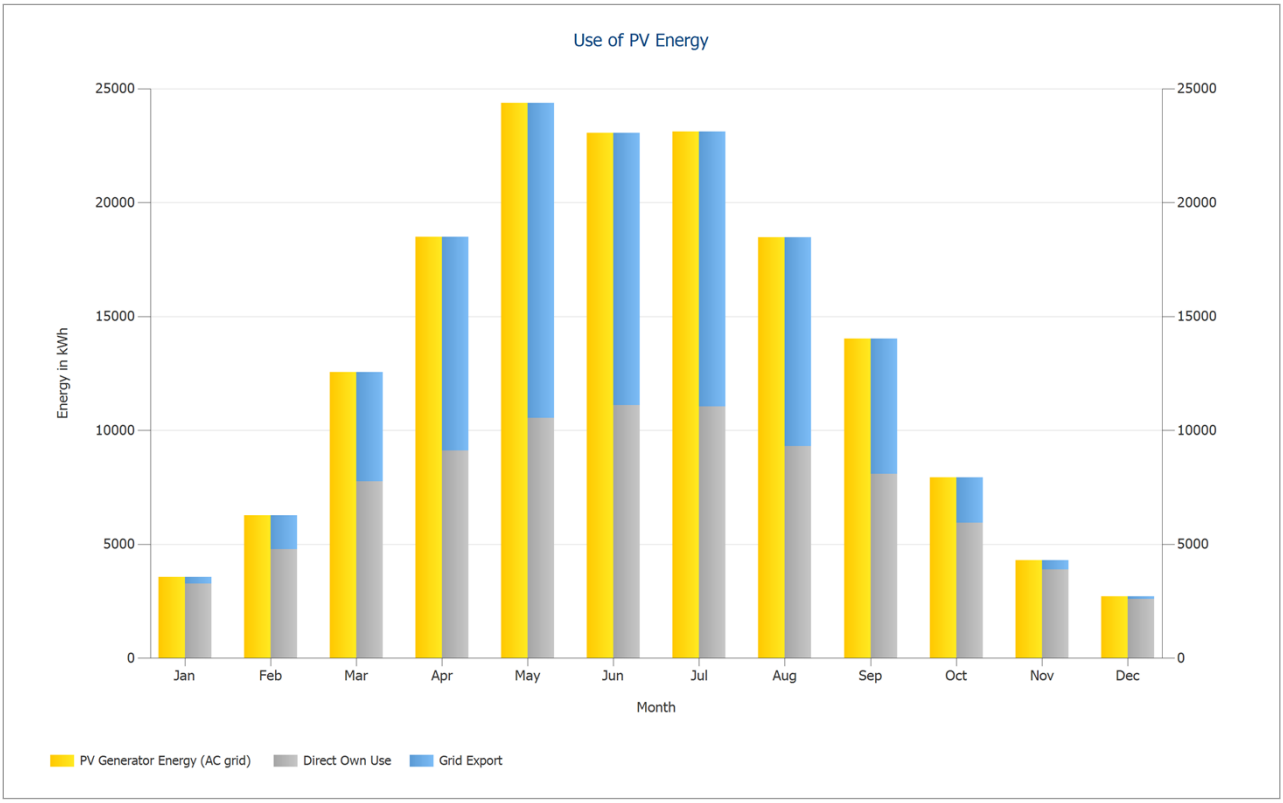


Figure: Use of PV Energy

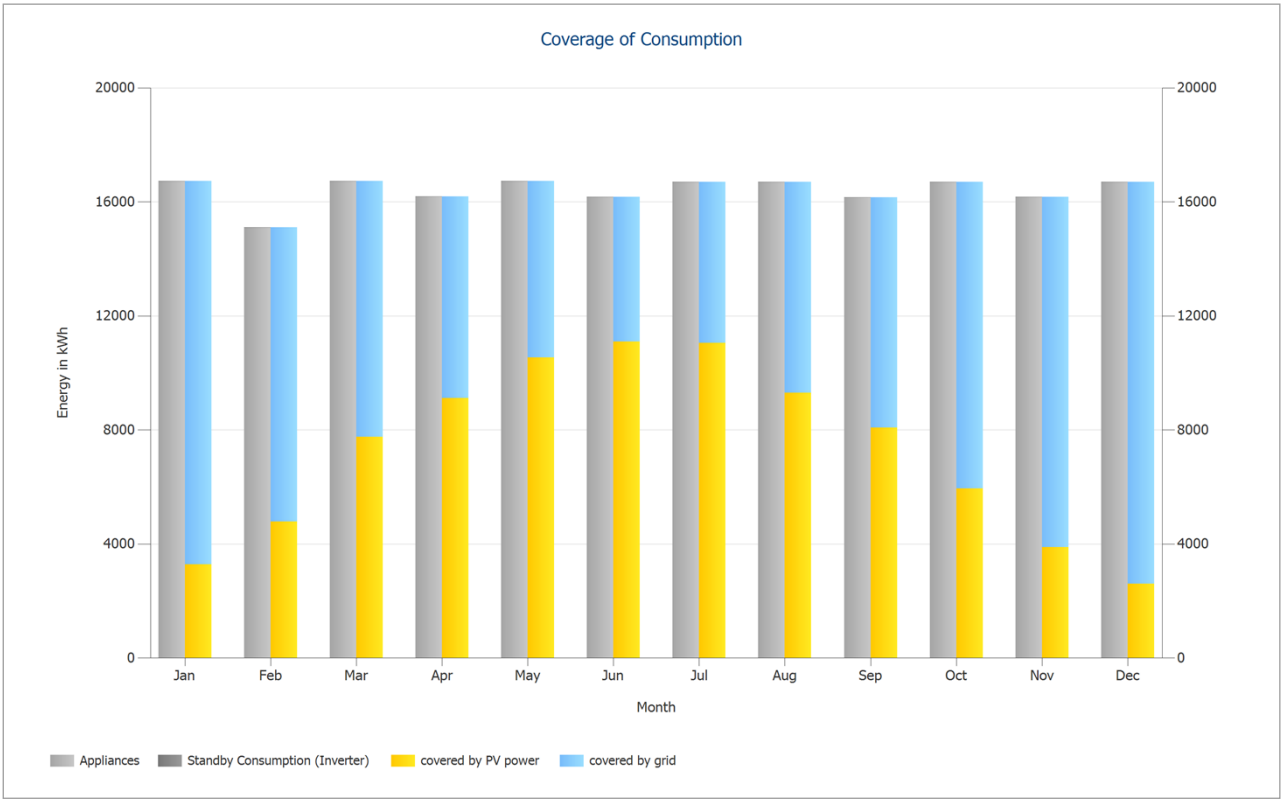


Figure: Coverage of Consumption

Financial Analysis

Overview

System Data

Grid Export in the first year (incl. module degradation)	71,431	kWh/Year
PV Generator Output	168.5	kWp
Start of Operation of the System	23/05/2023	
Assessment Period	25	Years
Interest on Capital	1	%

Economic Parameters

Internal Rate of Return (IRR)	268.25	%
Accrued Cash Flow (Cash Balance)	1,776,705.16	£
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	15,714.73	£/Year
First year savings	34,955.53	£/Year
GLE Tariff (Example)		
Energy Price	0.4	£/kWh
Inflation Rate for Energy Price	5	%/Year
Remuneration of Electricity sold to Third Party		
Price of Electricity sold to Third Party	0.22	£/kWh
Remuneration of Electricity sold to Third Party	15,714.73	£/Year

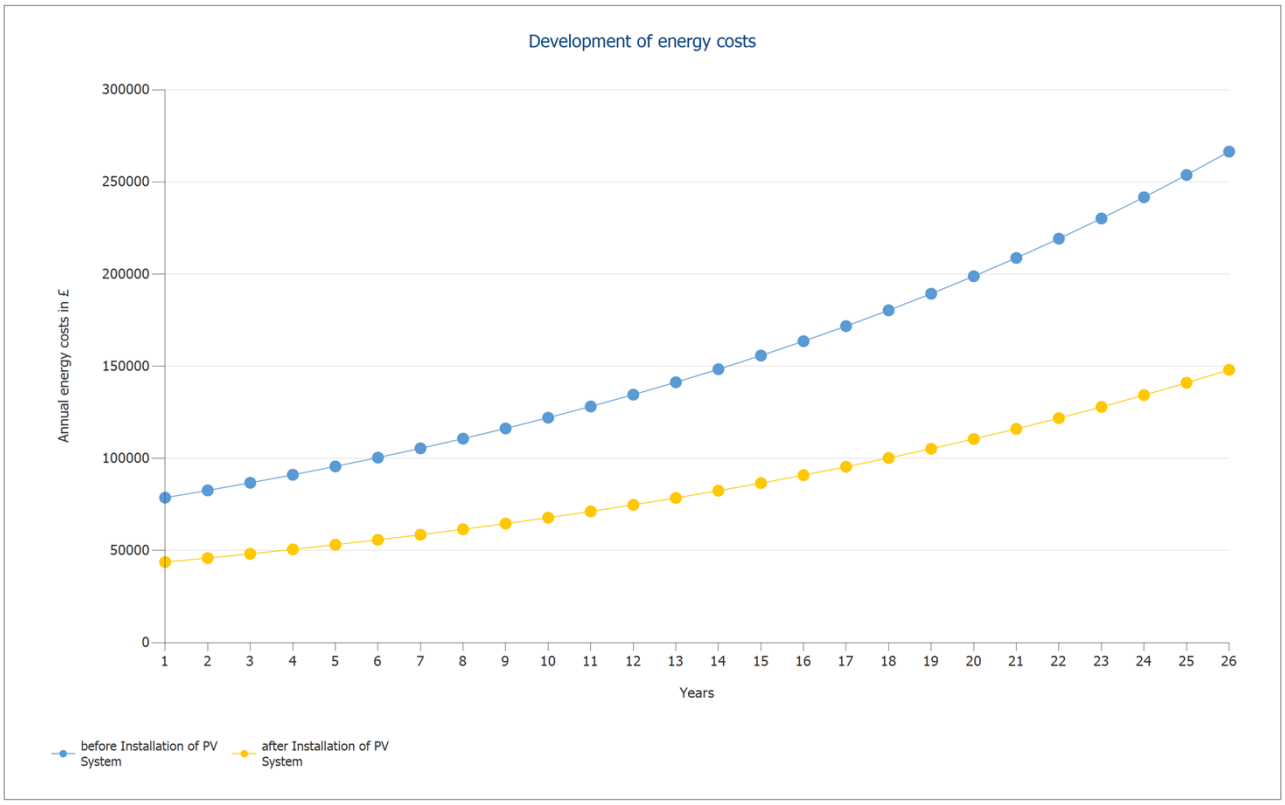


Figure: Development of energy costs

Cash flow

Cash flow

	Year 1	Year 2	Year 3	Year 4	Year 5
Feed-in / Export Tariff	£13,420.34	£15,405.09	£15,252.56	£15,101.55	£14,952.03
Electricity Savings	£33,688.31	£35,980.10	£37,405.06	£38,886.45	£40,426.50
Annual Cash Flow	**£47,108.65**	**£51,385.19**	**£52,657.62**	**£53,987.99**	**£55,378.52**
Accrued Cash Flow (Cash Balance)	£47,108.65	£98,493.84	£151,151.46	£205,139.45	£260,517.98

Cash flow

	Year 6	Year 7	Year 8	Year 9	Year 10
Feed-in / Export Tariff	£14,803.99	£14,657.41	£14,512.29	£14,368.60	£14,226.34
Electricity Savings	£42,027.57	£43,692.02	£45,422.38	£47,221.28	£49,091.44
Annual Cash Flow	**£56,831.55**	**£58,349.44**	**£59,934.66**	**£61,589.88**	**£63,317.78**
Accrued Cash Flow (Cash Balance)	£317,349.53	£375,698.97	£435,633.63	£497,223.52	£560,541.29

Cash flow

	Year 11	Year 12	Year 13	Year 14	Year 15
Feed-in / Export Tariff	£14,085.48	£13,946.02	£13,807.94	£13,671.23	£13,535.87
Electricity Savings	£51,035.67	£53,056.87	£55,158.13	£57,342.62	£59,613.63
Annual Cash Flow	**£65,121.16**	**£67,002.89**	**£68,966.07**	**£71,013.85**	**£73,149.50**
Accrued Cash Flow (Cash Balance)	£625,662.45	£692,665.34	£761,631.41	£832,645.26	£905,794.76

Cash flow

	Year 16	Year 17	Year 18	Year 19	Year 20
Feed-in / Export Tariff	£13,401.85	£13,269.16	£13,137.79	£13,007.71	£12,878.92
Electricity Savings	£61,974.54	£64,429.00	£66,980.62	£69,633.32	£72,391.08
Annual Cash Flow	**£75,376.40**	**£77,698.16**	**£80,118.41**	**£82,641.03**	**£85,270.00**
Accrued Cash Flow (Cash Balance)	£981,171.16	£1,058,869.32	£1,138,987.73	£1,221,628.76	£1,306,898.76

Cash flow

	Year 21	Year 22	Year 23	Year 24	Year 25
Feed-in / Export Tariff	£12,751.41	£12,625.15	£12,500.15	£12,376.39	£12,253.85
Electricity Savings	£75,258.07	£78,238.59	£81,337.14	£84,558.41	£87,907.25
Annual Cash Flow	**£88,009.47**	**£90,863.74**	**£93,837.29**	**£96,934.80**	**£100,161.10**
Accrued Cash Flow (Cash Balance)	£1,394,908.23	£1,485,771.97	£1,579,609.26	£1,676,544.06	£1,776,705.16

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

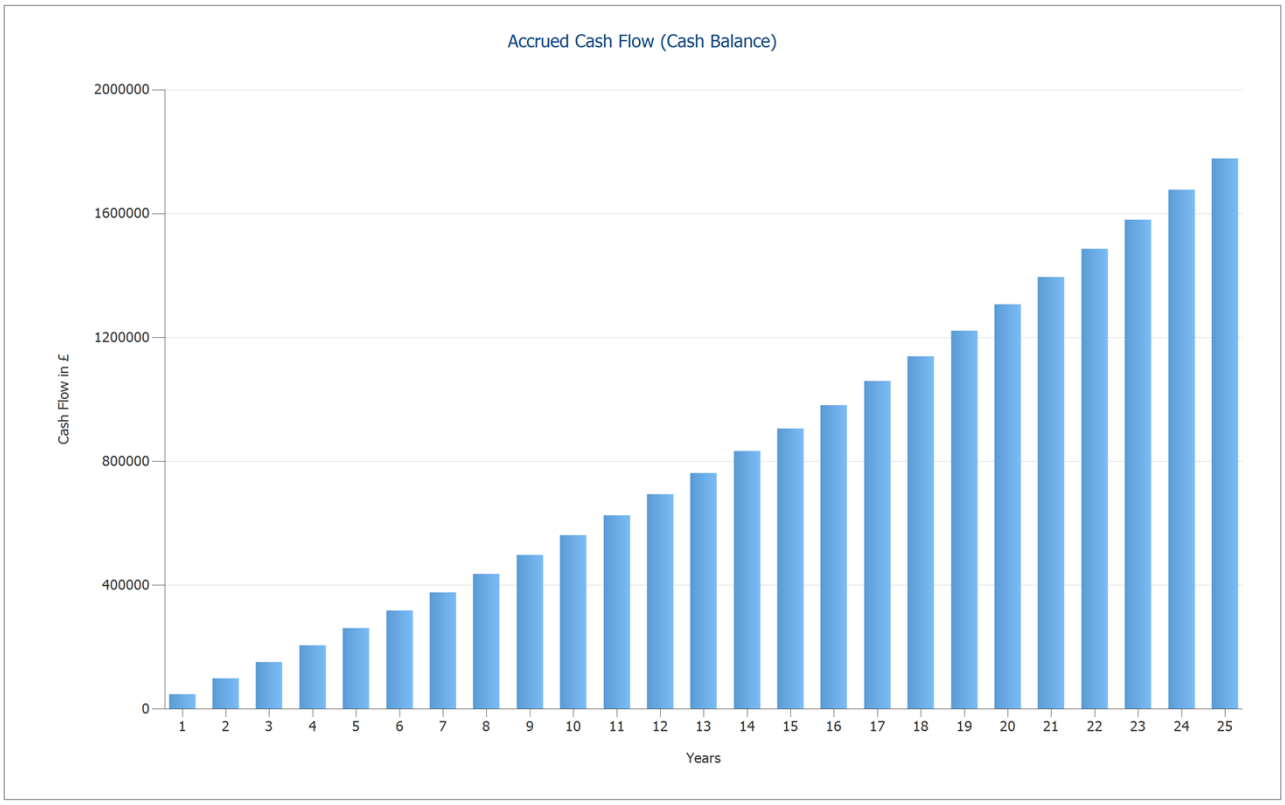


Figure: Accrued Cash Flow (Cash Balance)

Plans and parts list

Circuit Diagram

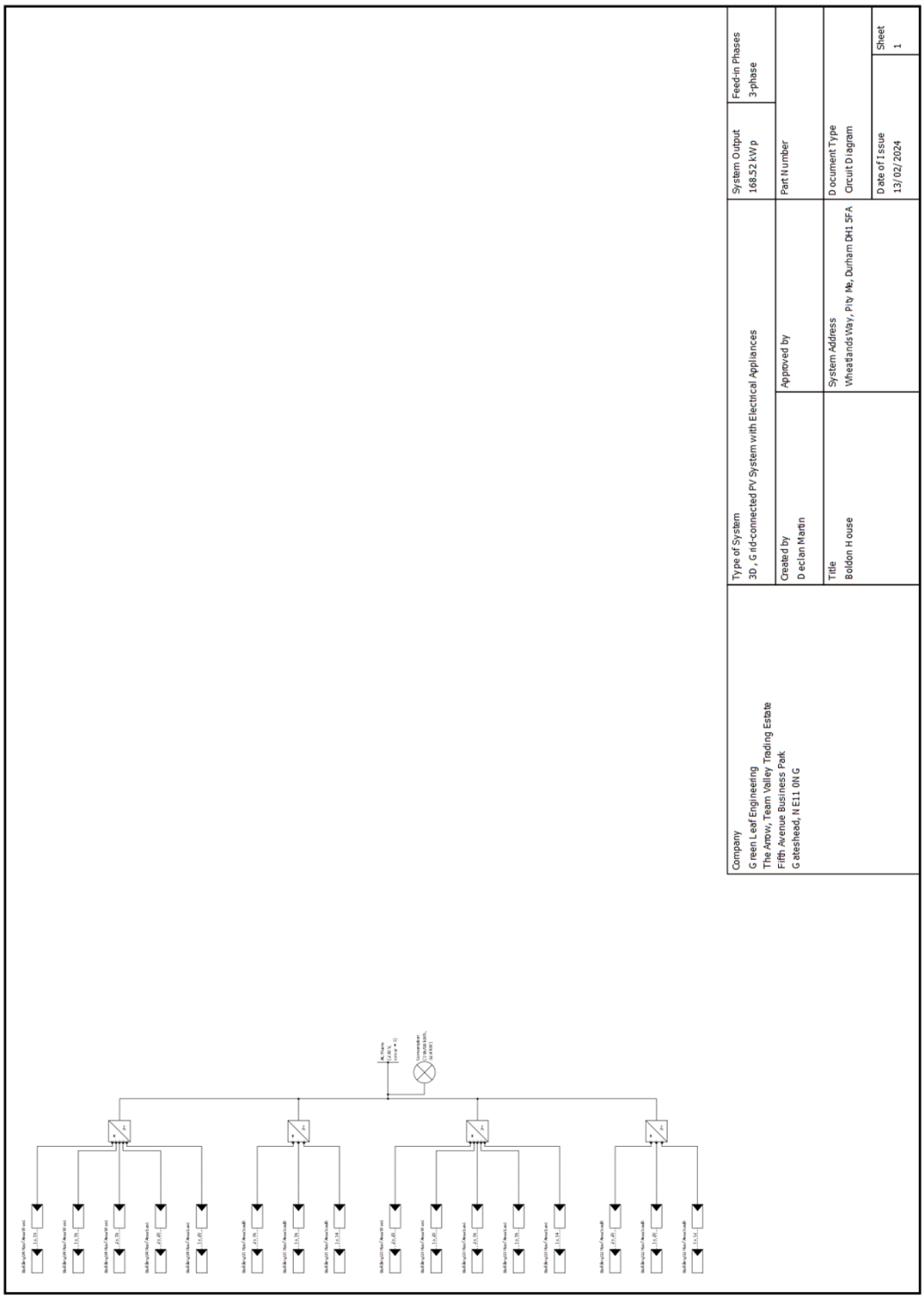


Figure: Circuit Diagram

Overview plan

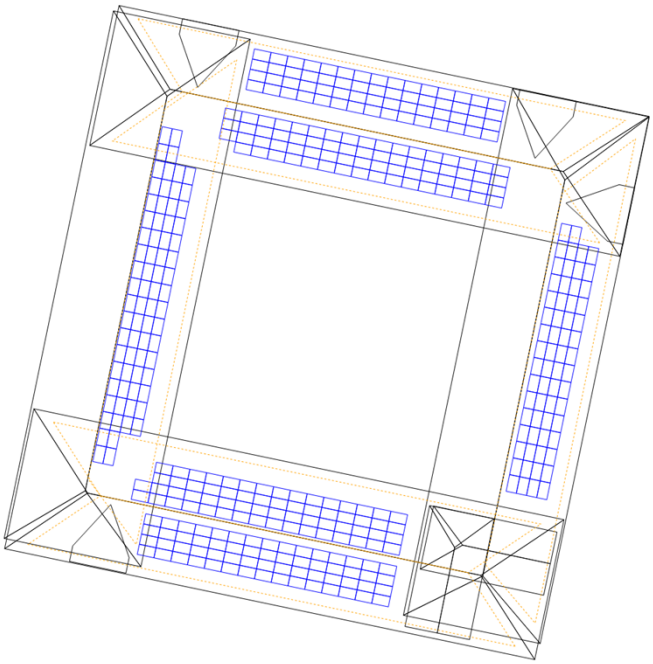


Figure: Overview plan

Dimensioning Plan

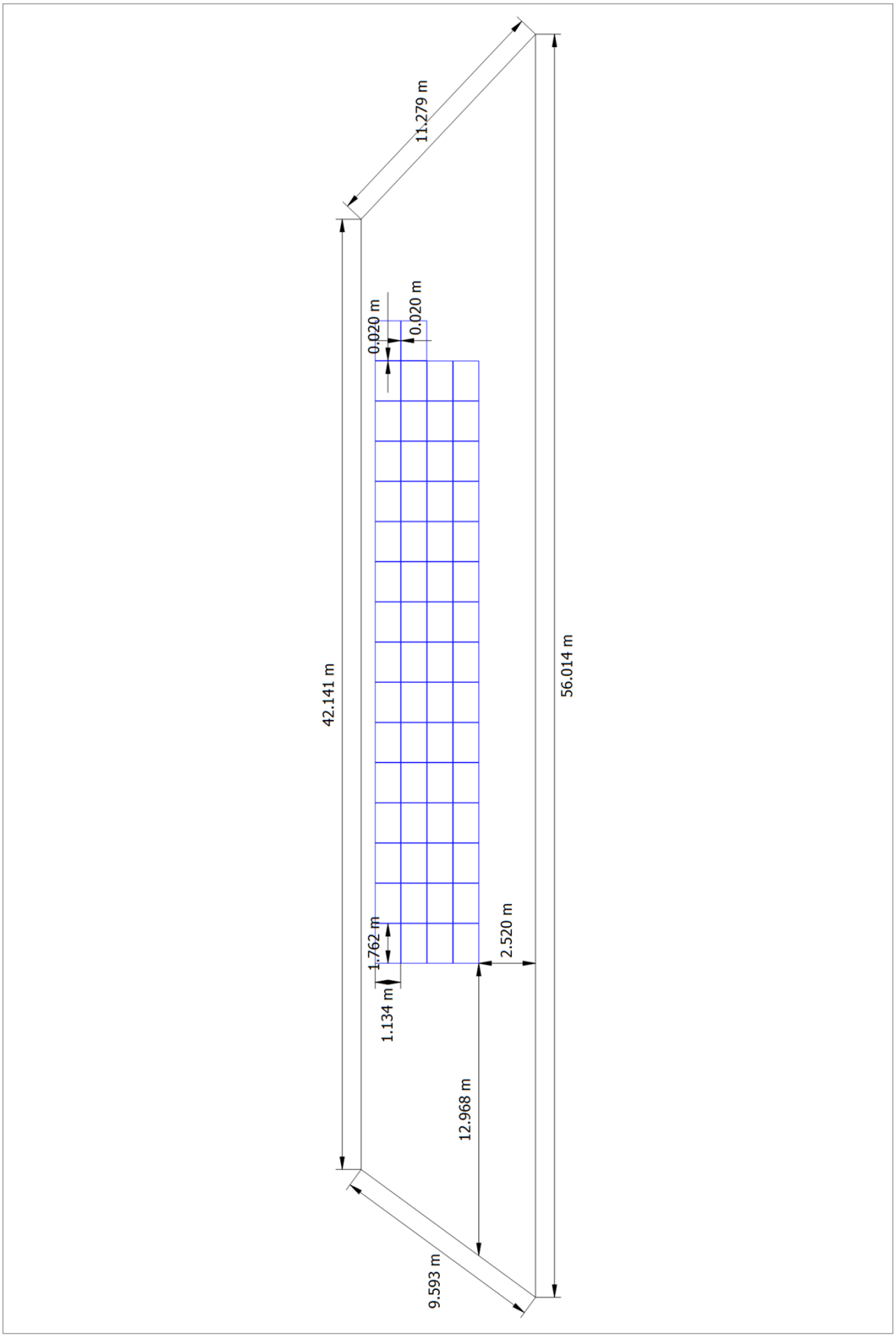


Figure: Building 01 - Roof Area South

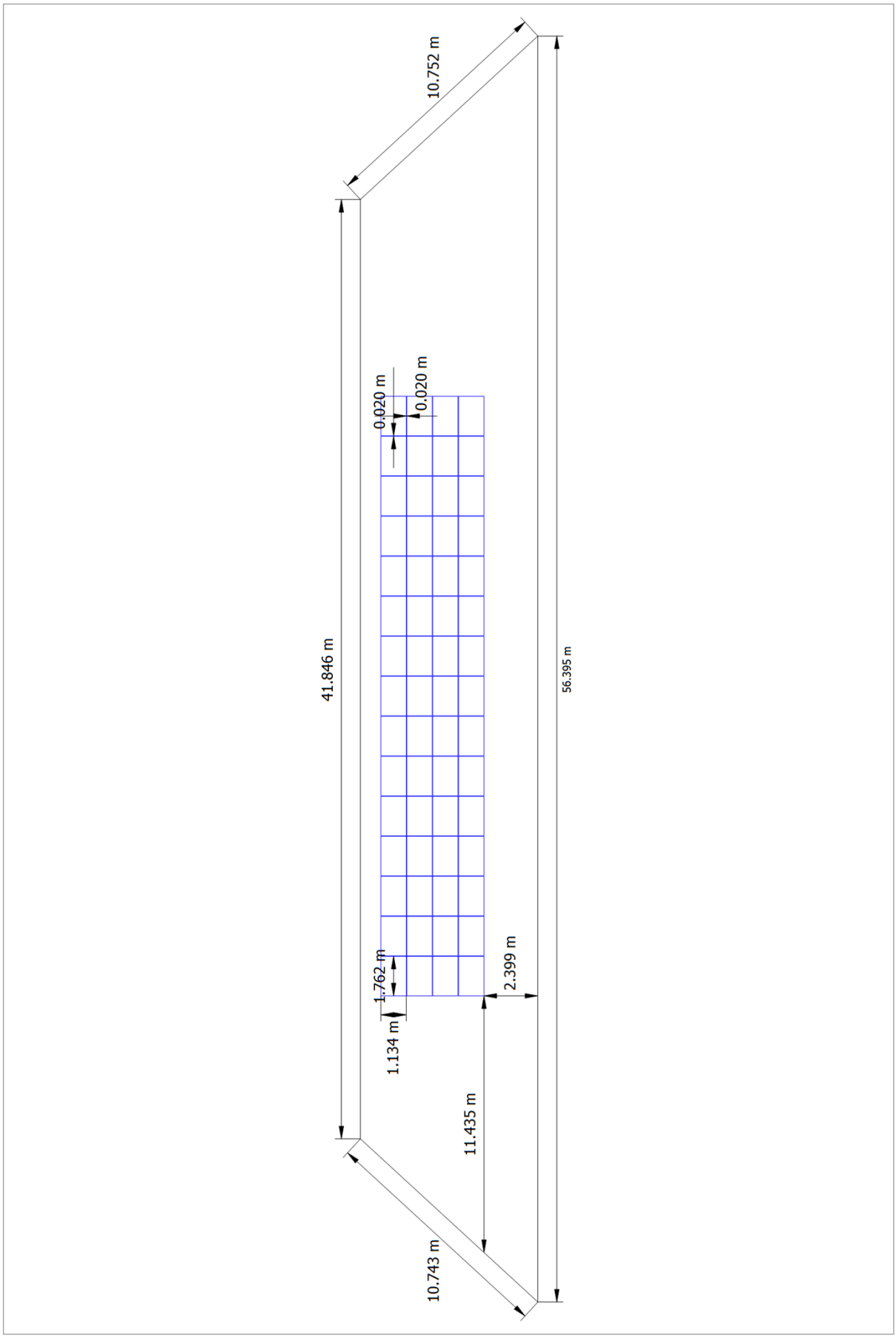


Figure: Building 03 - Roof Area West

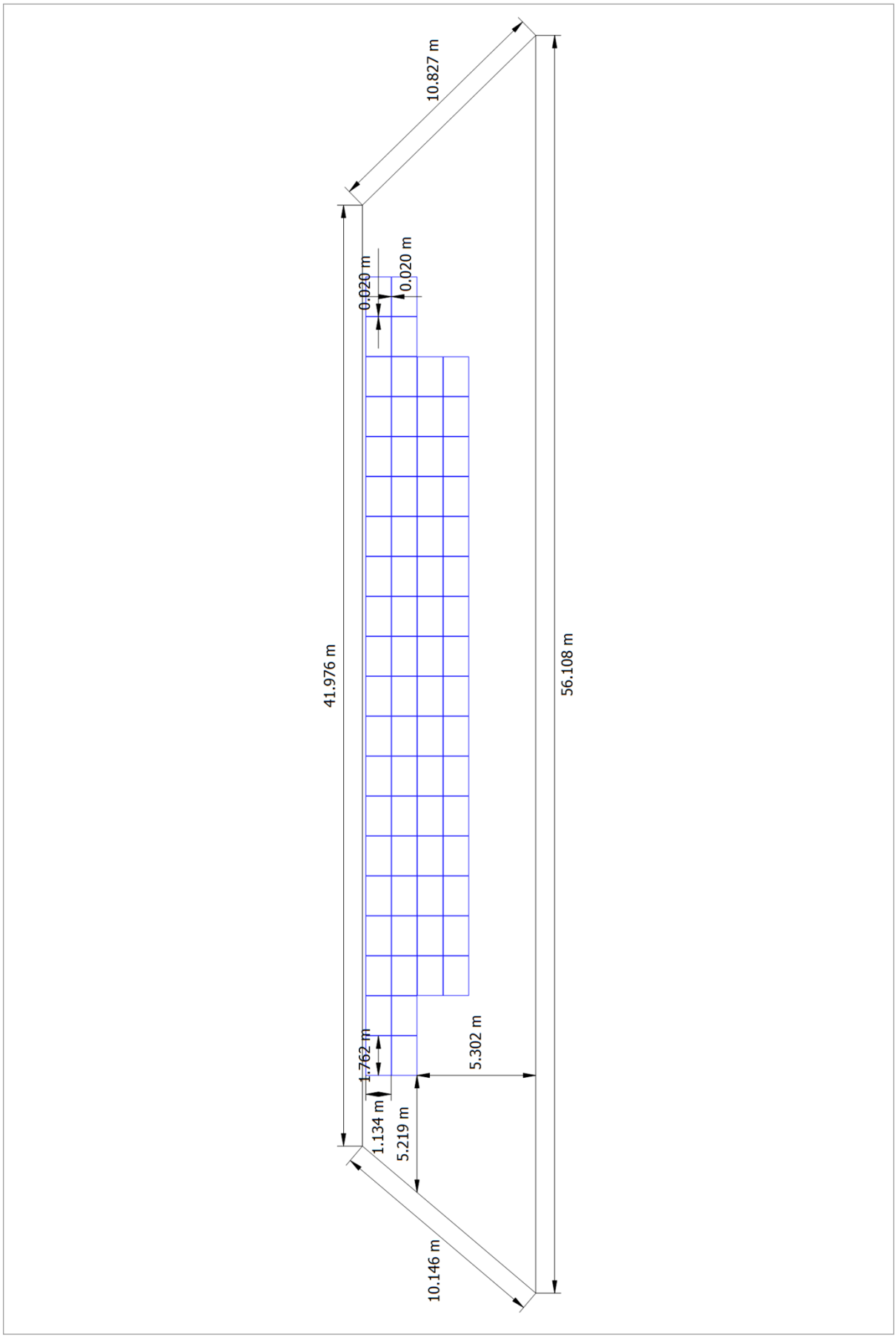


Figure: Building 02 - Roof Area South

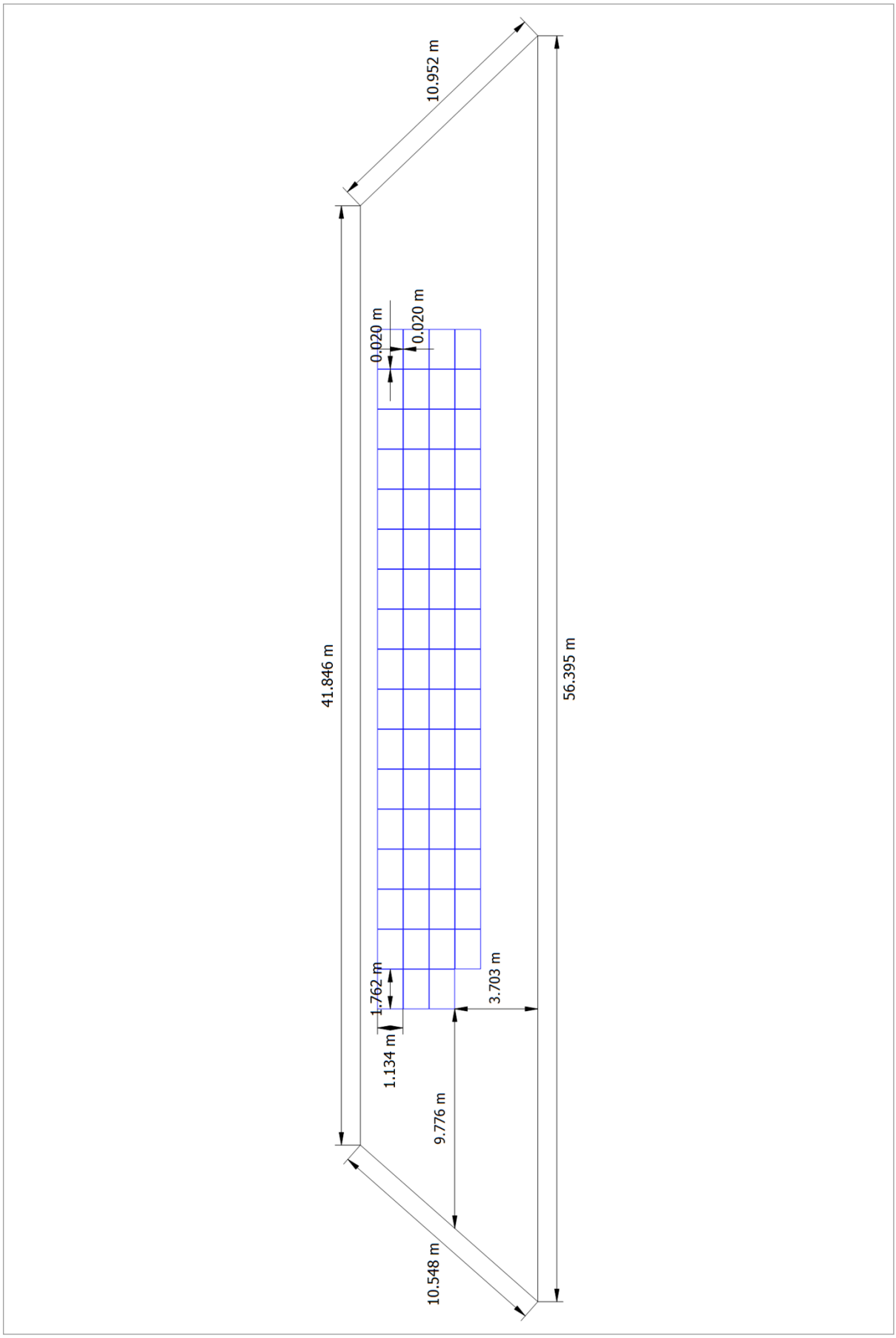


Figure: Building 04 - Roof Area West

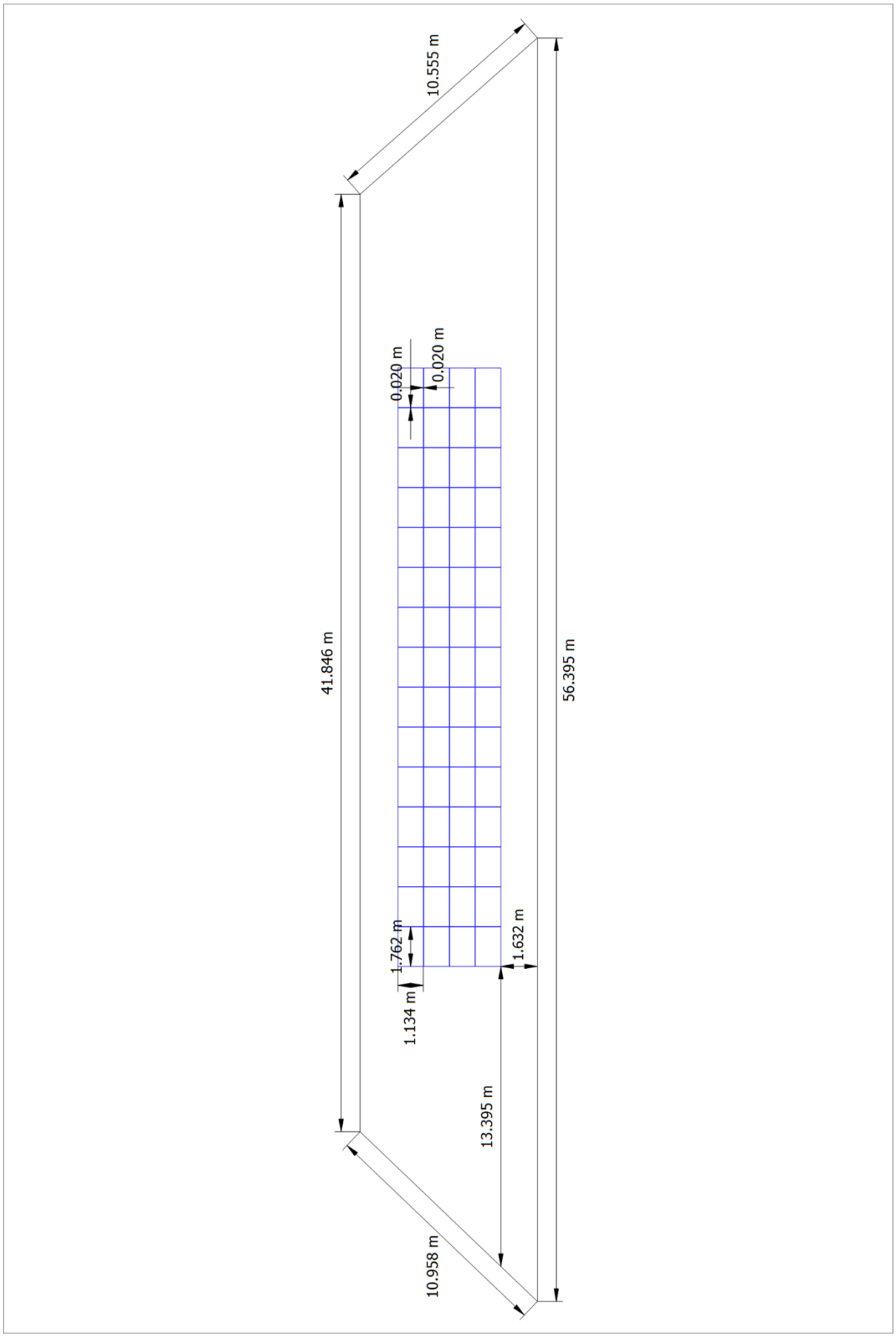


Figure: Building 04 - Roof Area East

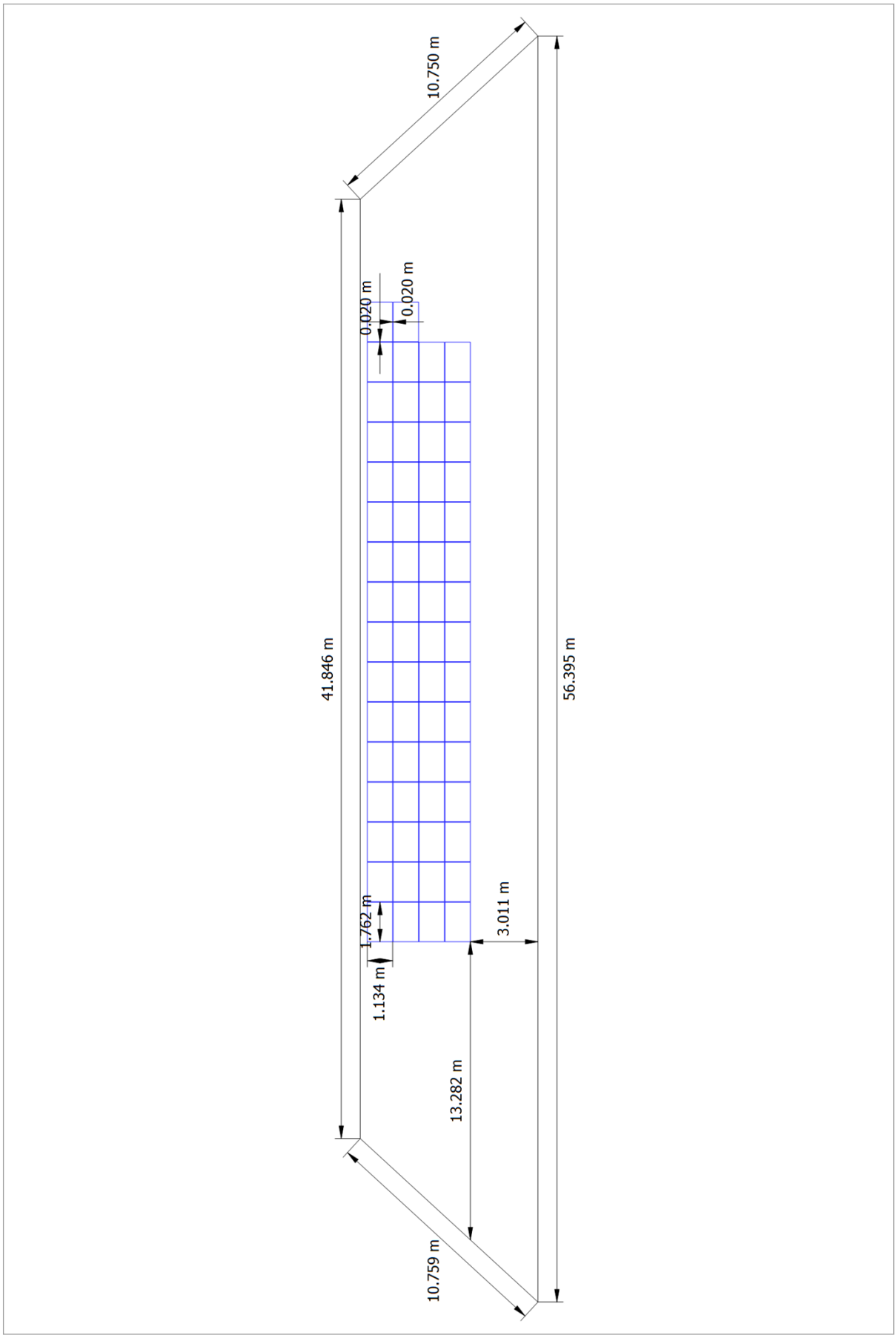


Figure: Building 03 - Roof Area East

String Plan

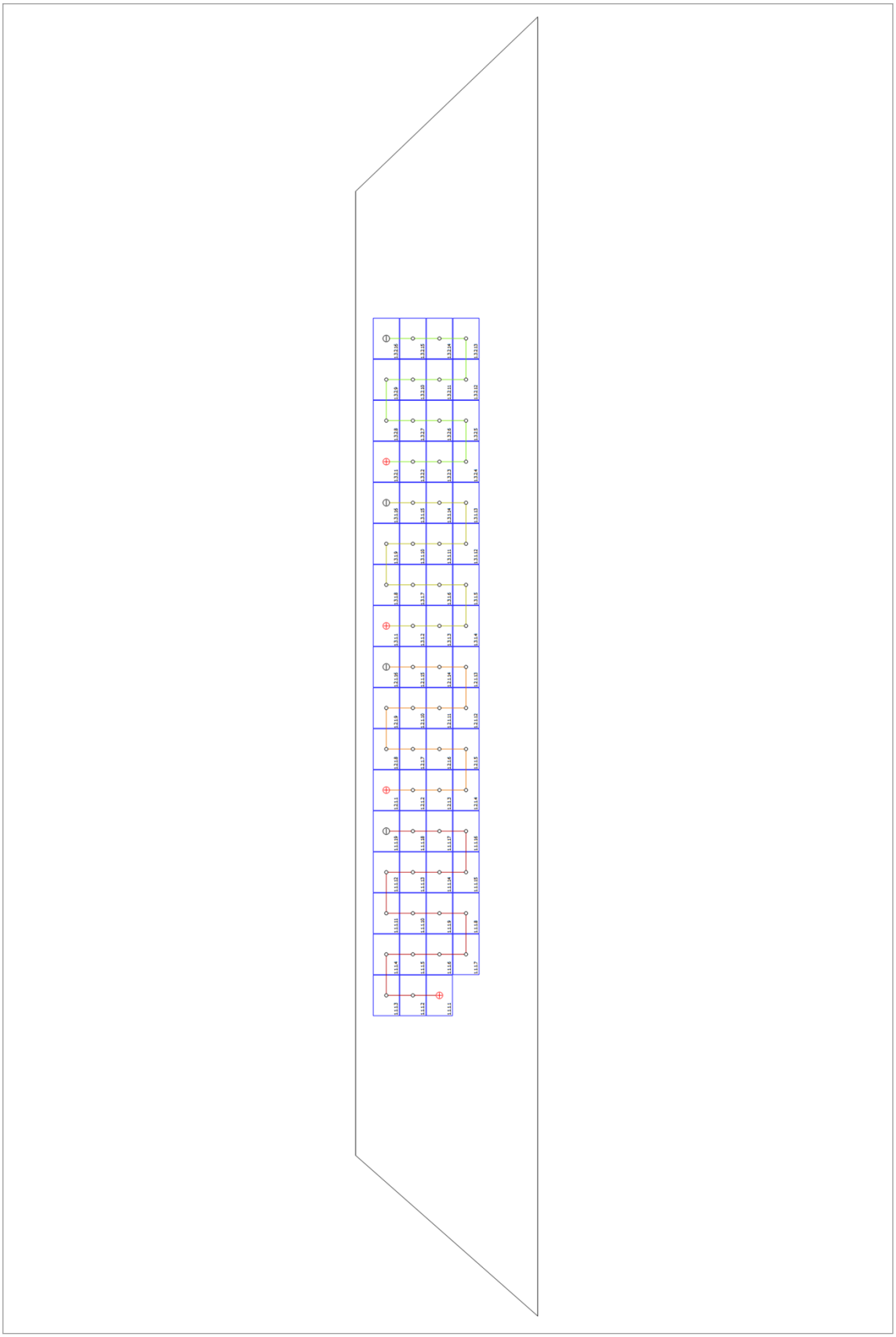


Figure: Building 04 - Roof Area West

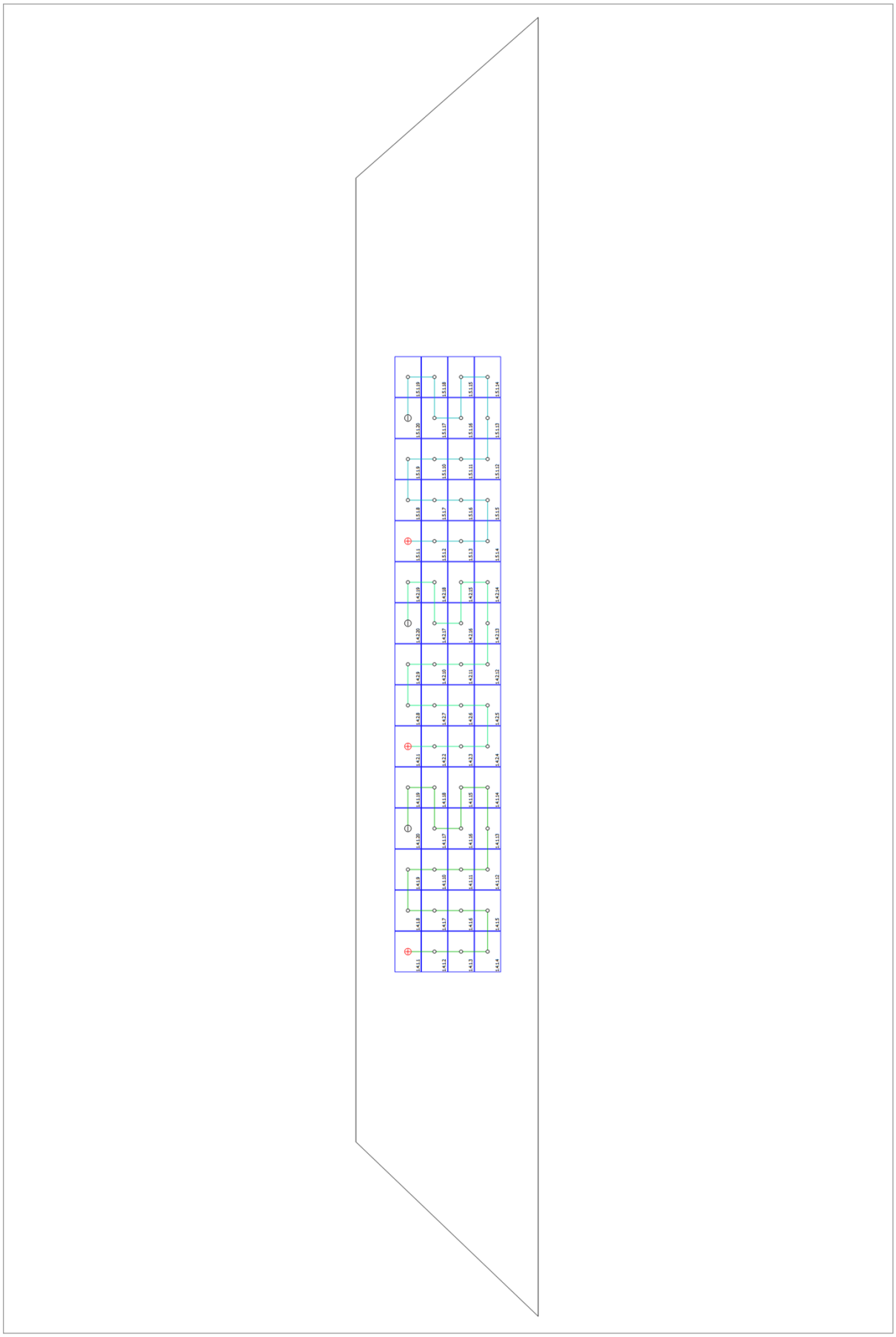


Figure: Building 04 - Roof Area East

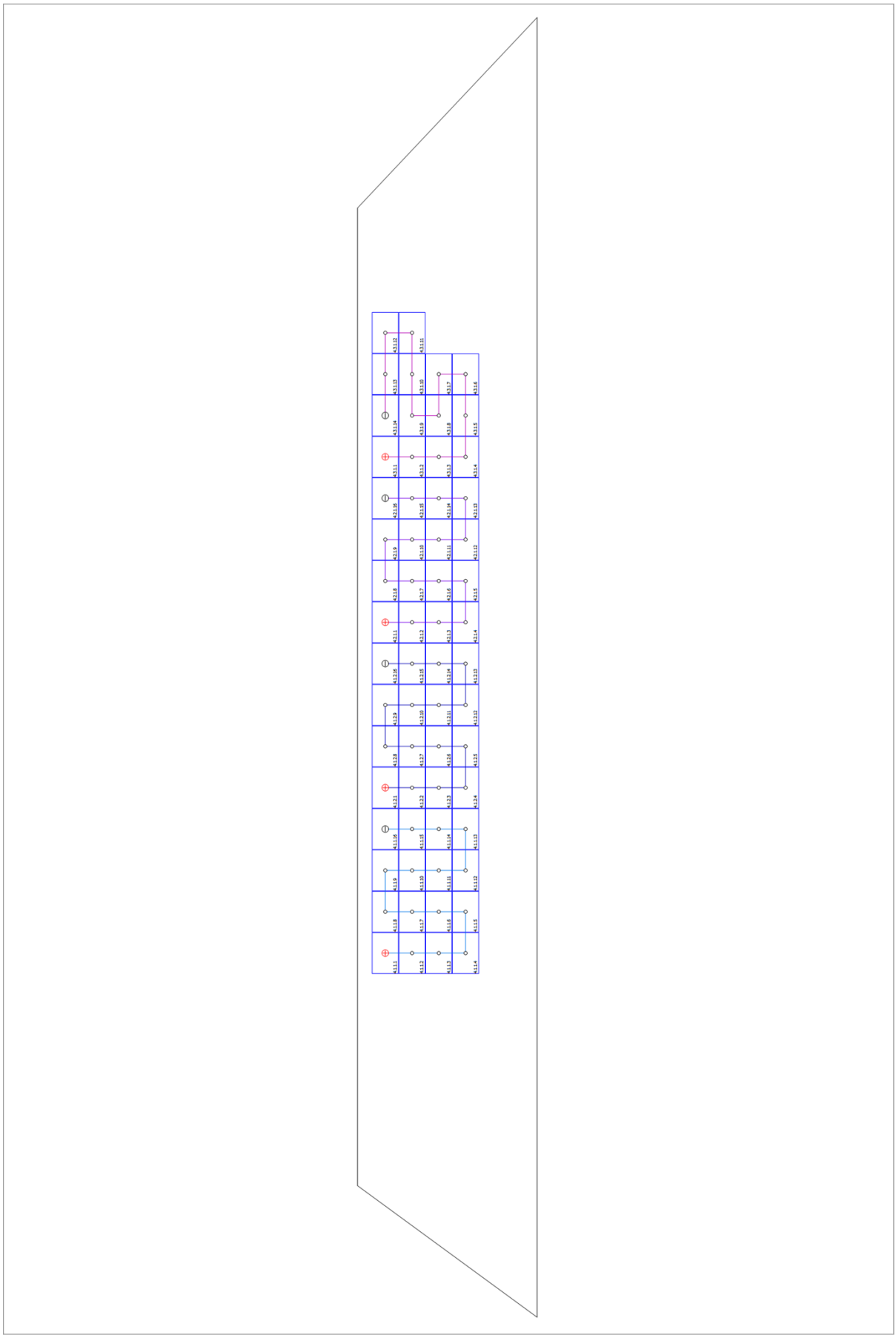


Figure: Building 01 - Roof Area South

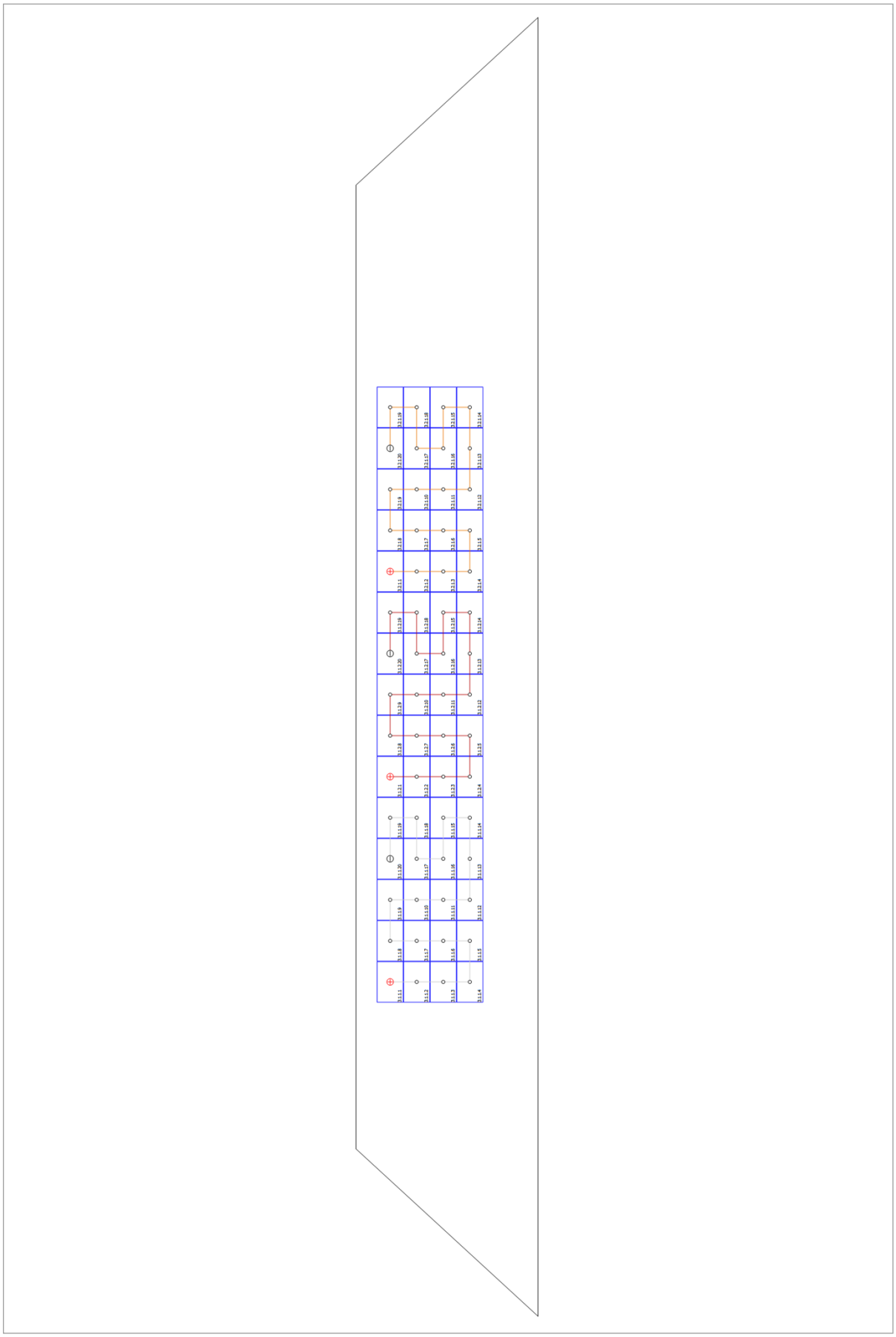


Figure: Building 03 - Roof Area West

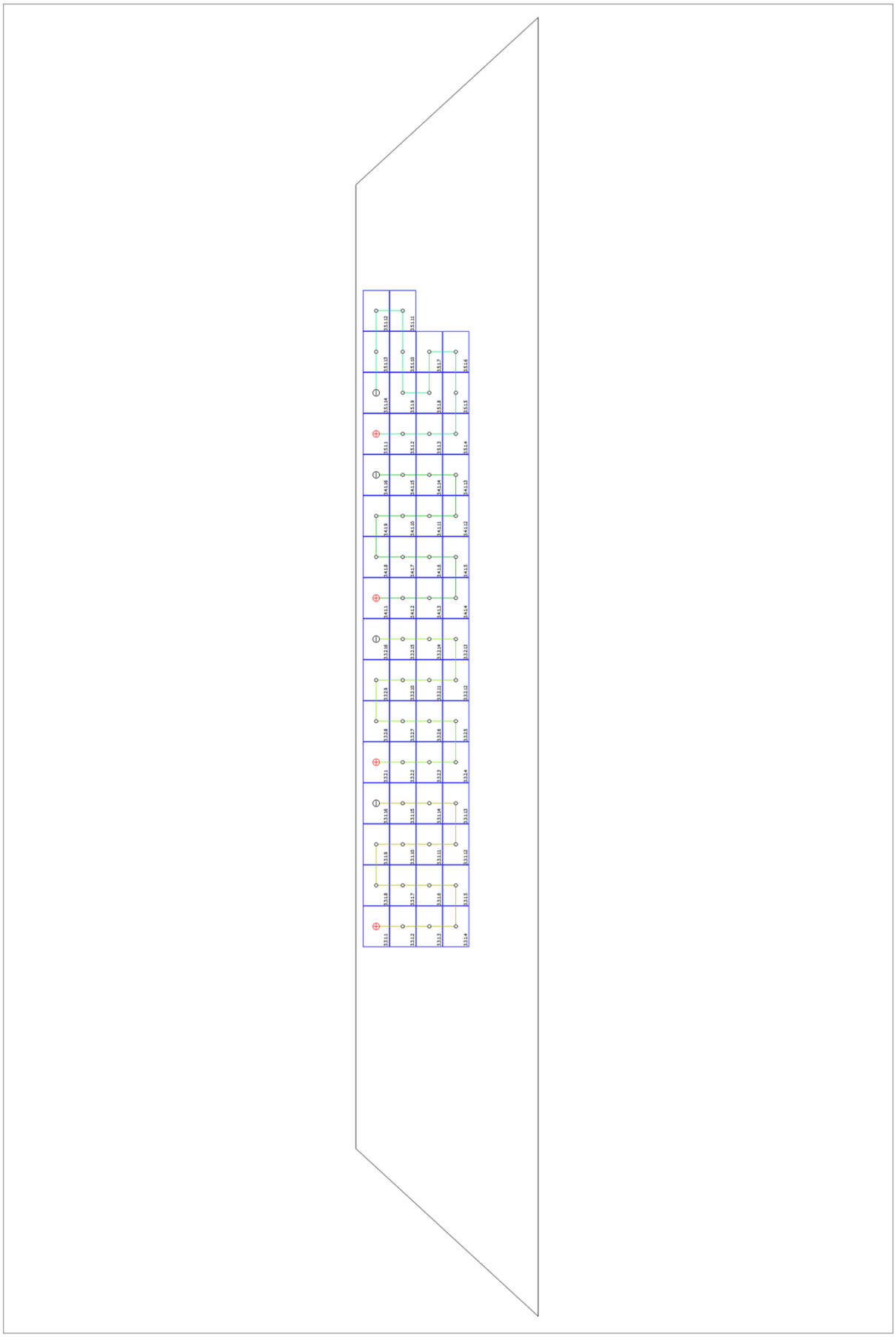


Figure: Building 03 - Roof Area East

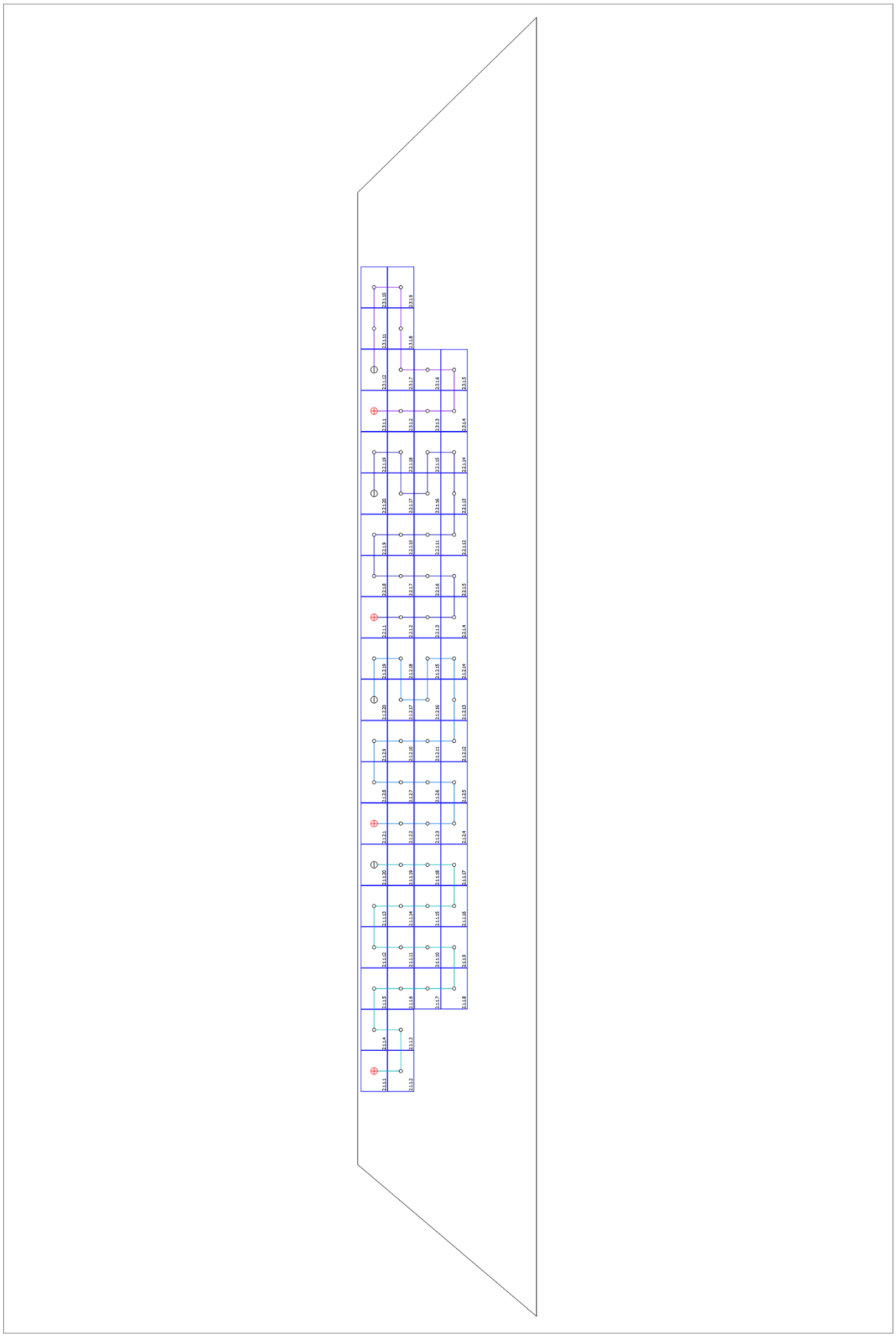


Figure: Building 02 - Roof Area South

Parts list

Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		JA Solar Holdings Co., Ltd.	JAM54D41-440/LB	383	Piece
2	Inverter		Ginlong (Solis)	S5-GC50K	2	Piece
3	Inverter		Ginlong (Solis)	S5-GC25K	1	Piece
4	Inverter		Ginlong (Solis)	S5-GC30K	1	Piece