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Great Places Housing Group
Ms Sarah McClelland
2a Derwent Avenue
West Didsbury
Manchester
M21 7QS

Customer No.: GREA01
Project Name: Solar Panels - HQ
Offer no.: 682

05/07/2019

Your PV system from GRIFF Services ltd

Address of Installation

2a Derwent Avenue
West Didsbury
Manchester
M21 7QS



Project Description:
Draft proposal for PV evaluation.

Project Overview



Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV System with Electrical Appliances

Climate Data	Manchester-Ringway, GBR (2000 - 2009)	
PV Generator Output	73.53	kWp
PV Generator Surface	421.9	m²
Number of PV Modules	258	
Number of Inverters	3	

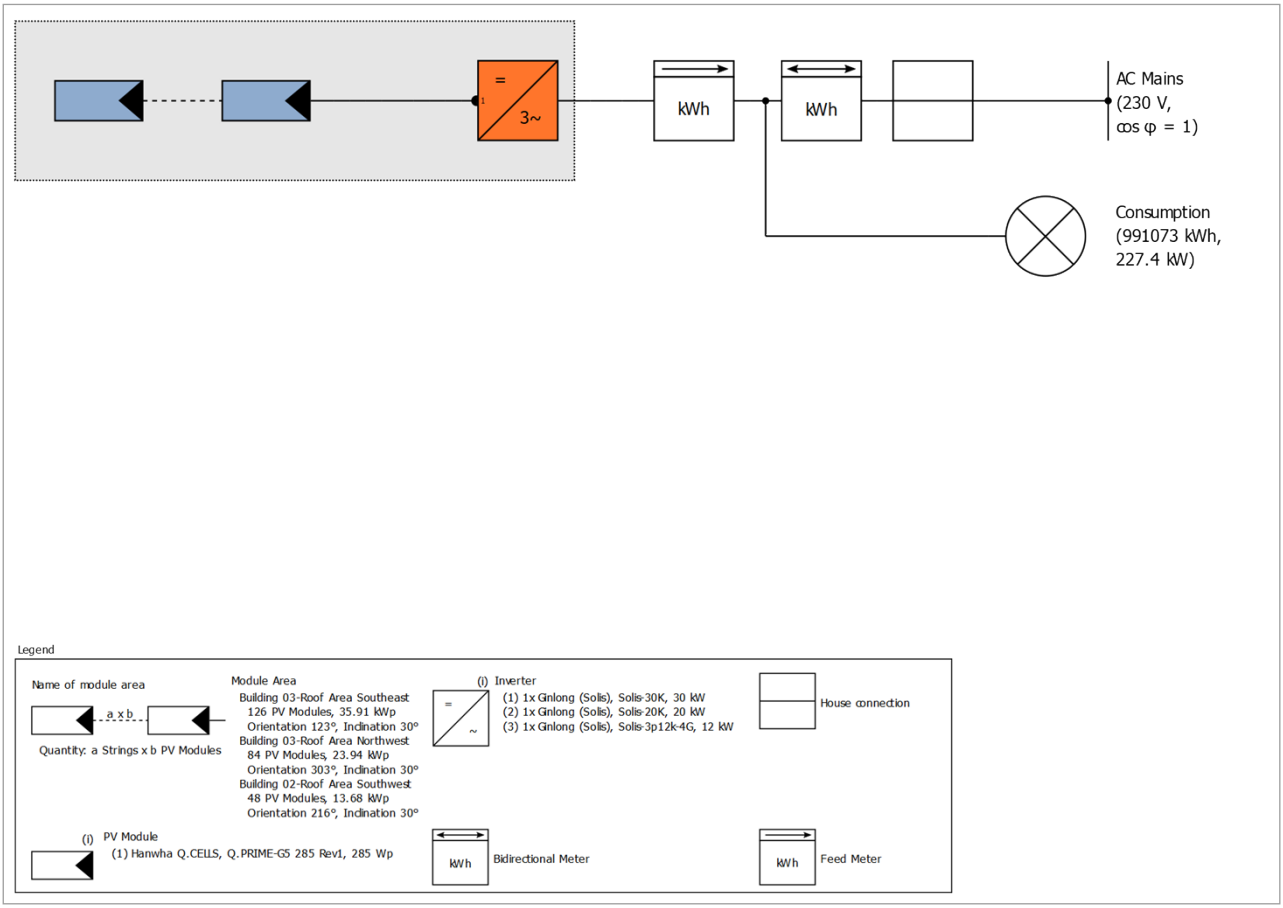


Figure: Schematic diagram

The yield

The yield

PV Generator Energy (AC grid)	56,743 kWh
Direct Own Use	47,378 kWh
Grid Feed-in	9,365 kWh
Down-regulation at Feed-in Point	0 kWh
Own Power Consumption	83.5 %
Solar Fraction	4.8 %
Spec. Annual Yield	771.70 kWh/kWp
Performance Ratio (PR)	87.9 %
Yield Reduction due to Shading	2.2 %/year
CO_2 Emissions avoided	34,046 kg / year

Financial Analysis

Your Gain

Total investment costs	1.00	£
Return on Assets	267.63	%
Amortization Period	0.0	Years
Electricity Production Costs	0	£/kWh
Energy Balance/Feed-in Concept	Net-Metering	

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
Start of Operation	06/12/2018

Climate Data

Location	Manchester-Ringway, GBR (2000 - 2009)
Resolution of the data	1 h
Simulation model used:	
- Diffuse Irradiation onto Horizontal Plane	Hofmann
- Irradiance onto tilted surface	Hay & Davies

Consumption

Total Consumption	991073 kWh
Load Profile 1	991073 kWh
Load Peak	227.4 kW

Module Areas

1. Module Area - Building 03-Roof Area Southeast

PV Generator, 1. Module Area - Building 03-Roof Area Southeast

Name	Building 03-Roof Area Southeast
PV Modules	126 x Q.PRIME-G5 285 Rev1
Manufacturer	Hanwha Q.CELLS
Inclination	30 °
Orientation	Southeast 123 °
Installation Type	Roof parallel
PV Generator Surface	206.0 m²



Figure: 1. Module Area - Building 03-Roof Area Southeast

2. Module Area - Building 03-Roof Area Northwest

PV Generator, 2. Module Area - Building 03-Roof Area Northwest

Name	Building 03-Roof Area Northwest
PV Modules	84 x Q.PRIME-G5 285 Rev1
Manufacturer	Hanwha Q.CELLS
Inclination	30 °
Orientation	Northwest 303 °
Installation Type	Roof parallel
PV Generator Surface	137.4 m²

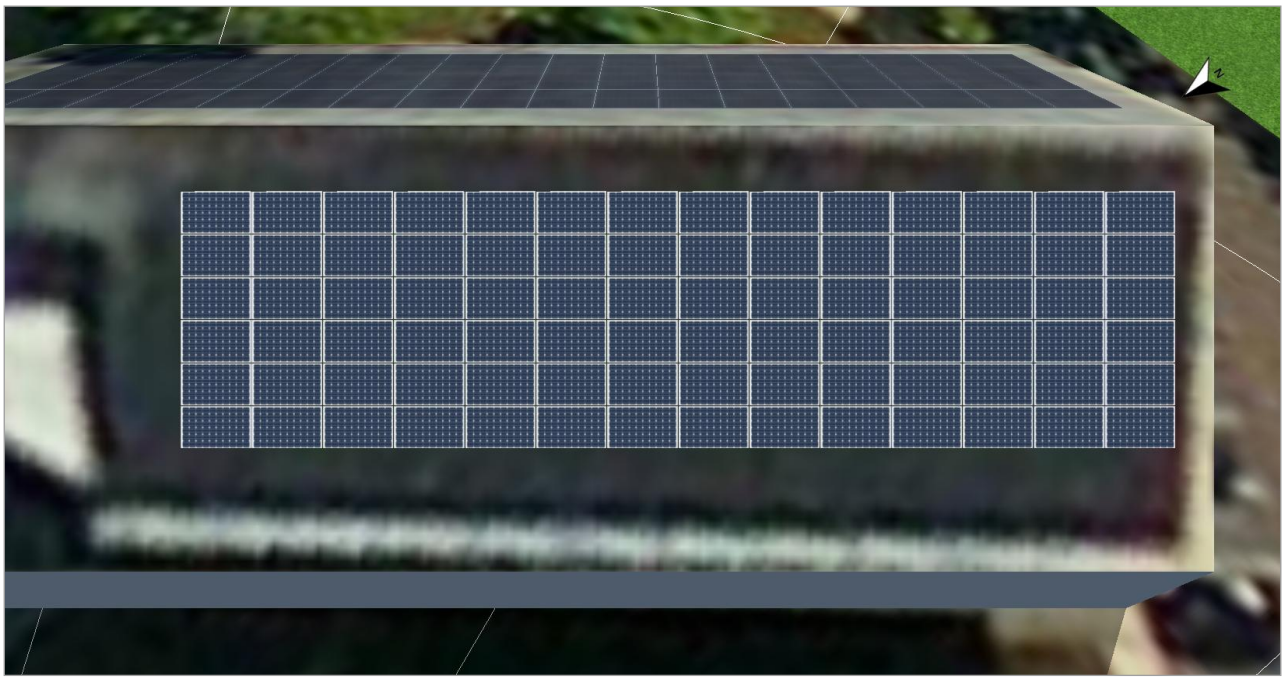


Figure: 2. Module Area - Building 03-Roof Area Northwest

3. Module Area - Building 02-Roof Area Southwest

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

Name	Building 02-Roof Area Southwest
PV Modules	48 x Q.PRIME-G5 285 Rev1
Manufacturer	Hanwha Q.CELLS
Inclination	30 °
Orientation	Southwest 216 °
Installation Type	Roof parallel
PV Generator Surface	78.5 m²



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

Horizon Line, 3D Design

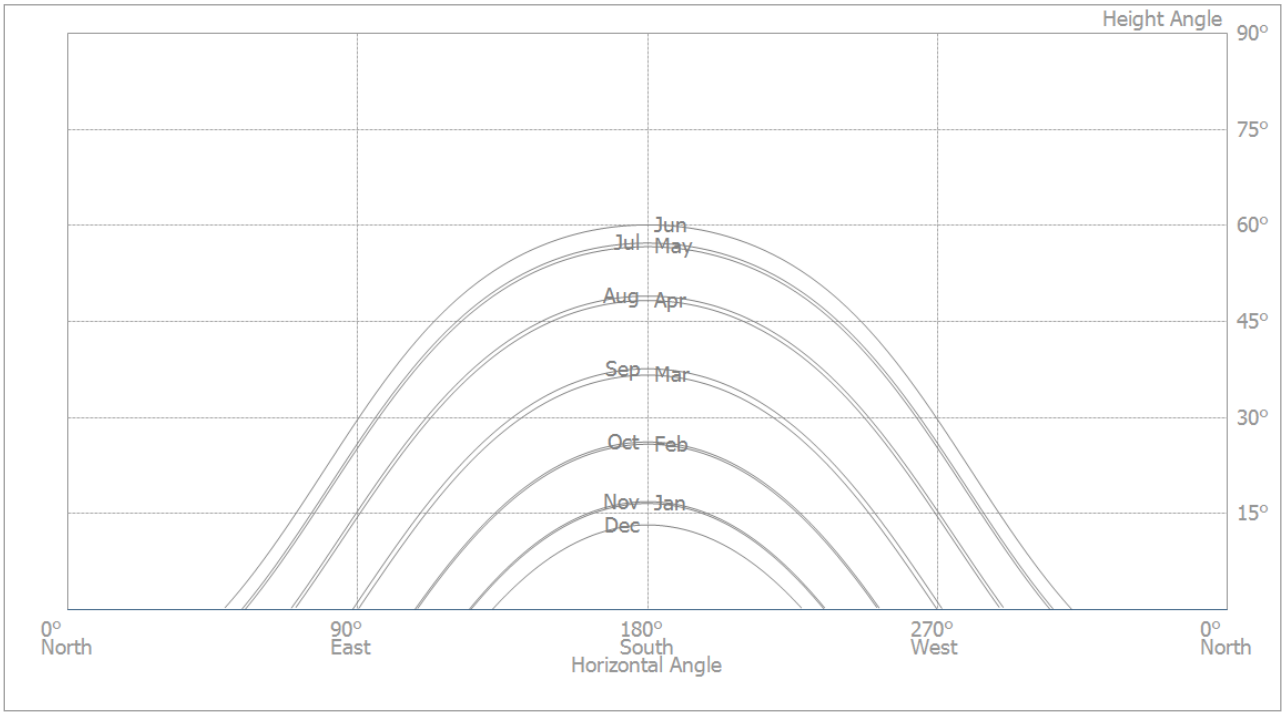


Figure: Horizon (3D Design)

Inverter configuration

Configuration 1

Module Area	Building 03-Roof Area Southeast
Inverter 1	
Manufacturer	Ginlong (Solis)
Model	Solis-30K
Quantity	1
Sizing Factor	119.7 %
Configuration	MPP 1: 2 x 18
	MPP 2: 2 x 18
	MPP 3: 2 x 18
	MPP 4: 1 x 18

Configuration 2

Module Area	Building 03-Roof Area Northwest
Inverter 1	
Manufacturer	Ginlong (Solis)
Model	Solis-20K
Quantity	1
Sizing Factor	119.7 %
Configuration	MPP 1: 2 x 14
	MPP 2: 2 x 14
	MPP 3: 1 x 14
	MPP 4: 1 x 14

Configuration 3

Module Area	Building 02-Roof Area Southwest
Inverter 1	
Manufacturer	Ginlong (Solis)
Model	Solis-3p12k-4G
Quantity	1
Sizing Factor	114 %
Configuration	MPP 1: 2 x 12
	MPP 2: 2 x 12

AC Mains

AC Mains

Number of Phases	3
Mains Voltage (1-phase)	230 V
Displacement Power Factor (cos phi)	+/- 1

Simulation Results

Results Total System

PV System

PV Generator Output	73.5	kWp
Spec. Annual Yield	771.70	kWh/kWp
Performance Ratio (PR)	87.9	%
Yield Reduction due to Shading	2.2	%/year
PV Generator Energy (AC grid)	56,743	kWh/year
Down-regulation at Feed-in Point	0	kWh/year
CO_2 Emissions avoided	34,046	kg / year

Appliances

Appliances	991,073	kWh/year
Standby Consumption (Inverter)	7	kWh/year
Total Consumption	991,080	kWh/year
Energy from Grid	934,337.4	kWh
Solar Fraction	5.7	%

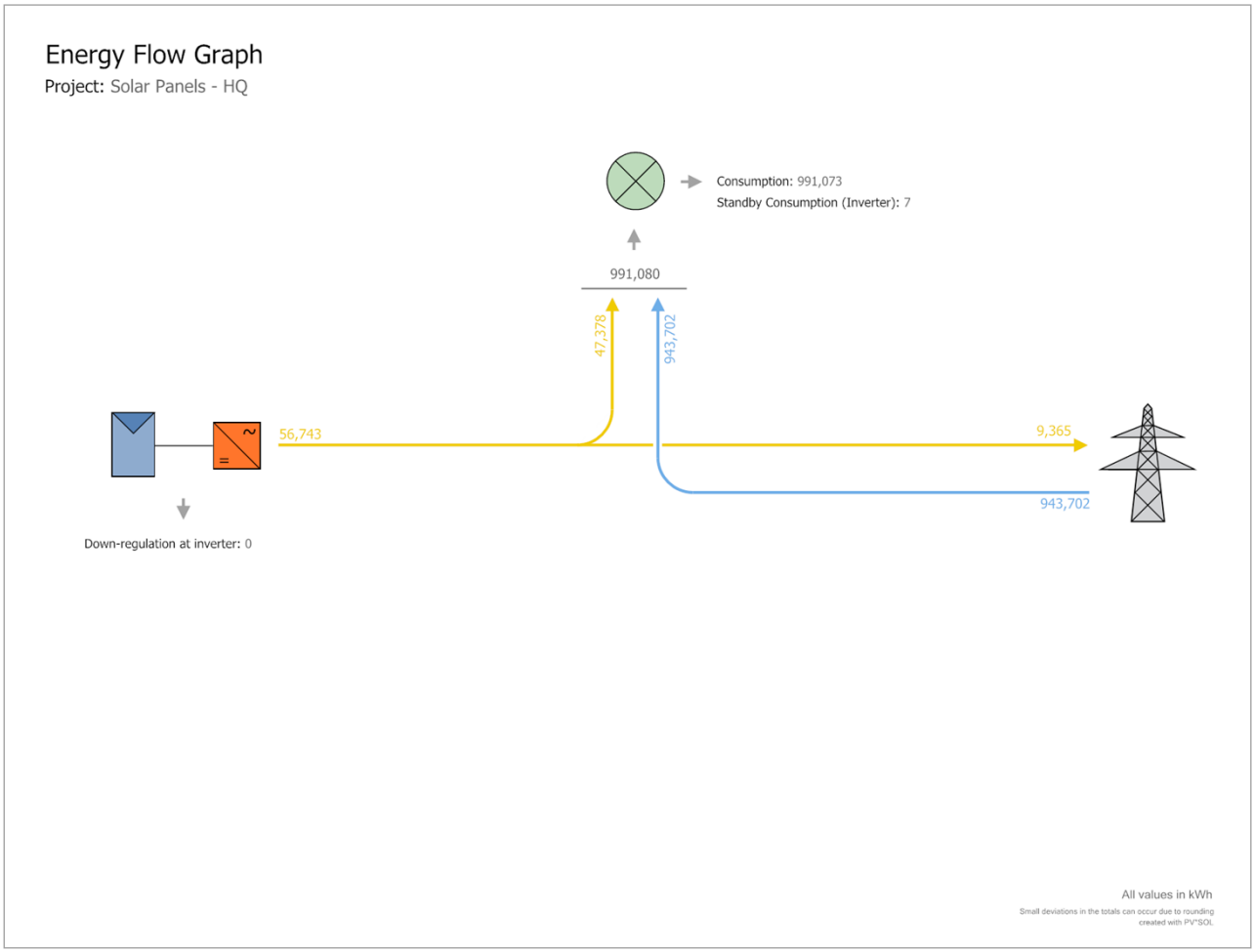


Figure: Energy Flow Graph

Financial Analysis

Overview

System Data

PV Generator Energy (AC grid)	56,743	kWh/year
PV Generator Output	73.5	kWp
Start of Operation of the System	06/12/2018	
Assessment Period	20	Years
Interest on Capital	1	%

Economic Parameters

Return on Assets	267.63	%
Accrued Cash Flow (Cash Balance)	222,962.51	£
Amortization Period	0.0	Years
Electricity Production Costs	0	£/kWh

Payment Overview

Specific Investment Costs	0.01	£/kWp
Investment Costs	1.00	£
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	£/year
First year savings	10,582.51	£/year
Net-Metering Example Tariff (Vattenfall)		
Energy Price	0.19	£/kWh
Compensation for Surplus	0.00	£/kWh
Inflation Rate for Energy Price	2	%/year

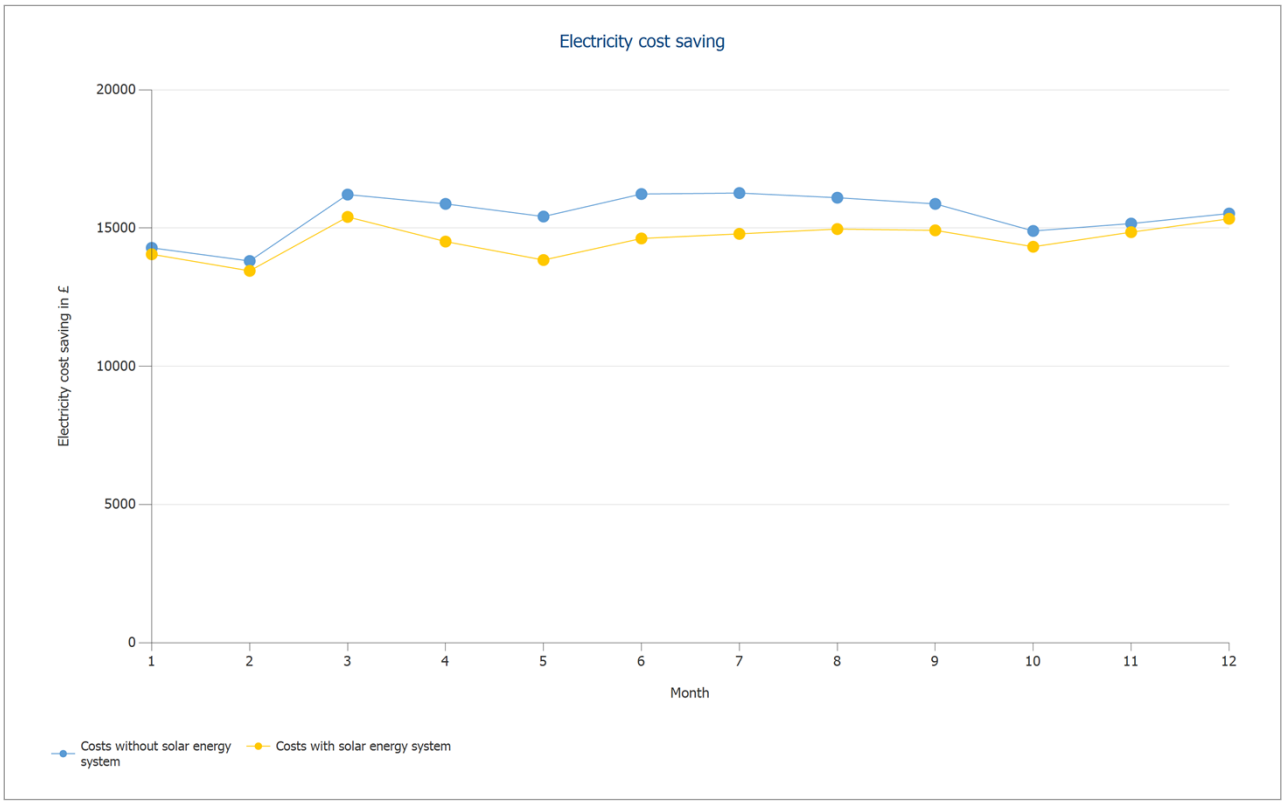


Figure: Electricity cost saving

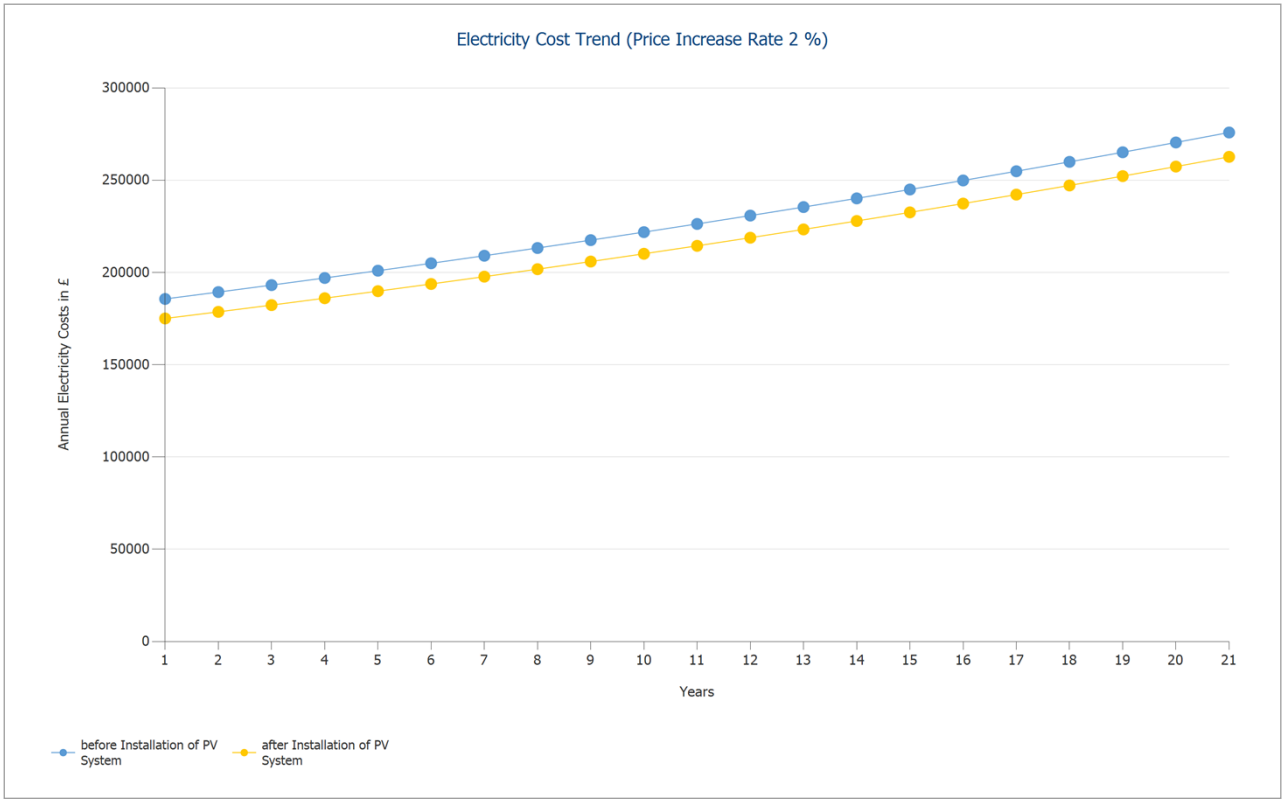


Figure: Electricity Cost Trend (Price Increase Rate 2 %)

Cash flow

Cashflow Table

	year 1	year 2	year 3	year 4	year 5
Investments	-£1.00	£0.00	£0.00	£0.00	£0.00
Electricity Savings	£10,440.72	£10,496.46	£10,514.54	£10,531.95	£10,548.67
Annual Cash Flow	**£10,439.72**	**£10,496.46**	**£10,514.54**	**£10,531.95**	**£10,548.67**
Accrued Cash Flow (Cash Balance)	£10,439.72	£20,936.18	£31,450.73	£41,982.68	£52,531.35

	year 6	year 7	year 8	year 9	year 10
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Electricity Savings	£10,564.70	£10,580.00	£10,594.57	£10,608.39	£10,621.46
Annual Cash Flow	**£10,564.70**	**£10,580.00**	**£10,594.57**	**£10,608.39**	**£10,621.46**
Accrued Cash Flow (Cash Balance)	£63,096.05	£73,676.04	£84,270.62	£94,879.01	£105,500.47

	year 11	year 12	year 13	year 14	year 15
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Electricity Savings	£10,633.73	£10,645.21	£10,655.87	£10,665.71	£10,674.69
Annual Cash Flow	**£10,633.73**	**£10,645.21**	**£10,655.87**	**£10,665.71**	**£10,674.69**
Accrued Cash Flow (Cash Balance)	£116,134.19	£126,779.40	£137,435.27	£148,100.98	£158,775.67

	year 16	year 17	year 18	year 19	year 20
Investments	£0.00	£0.00	£0.00	£0.00	£0.00
Electricity Savings	£10,682.80	£10,690.03	£10,696.35	£10,701.75	£10,706.21
Annual Cash Flow	**£10,682.80**	**£10,690.03**	**£10,696.35**	**£10,701.75**	**£10,706.21**
Accrued Cash Flow (Cash Balance)	£169,458.46	£180,148.49	£190,844.84	£201,546.59	£212,252.80

	year 21
Investments	£0.00
Electricity Savings	£10,709.71
Annual Cash Flow	**£10,709.71**
Accrued Cash Flow (Cash Balance)	£222,962.51

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

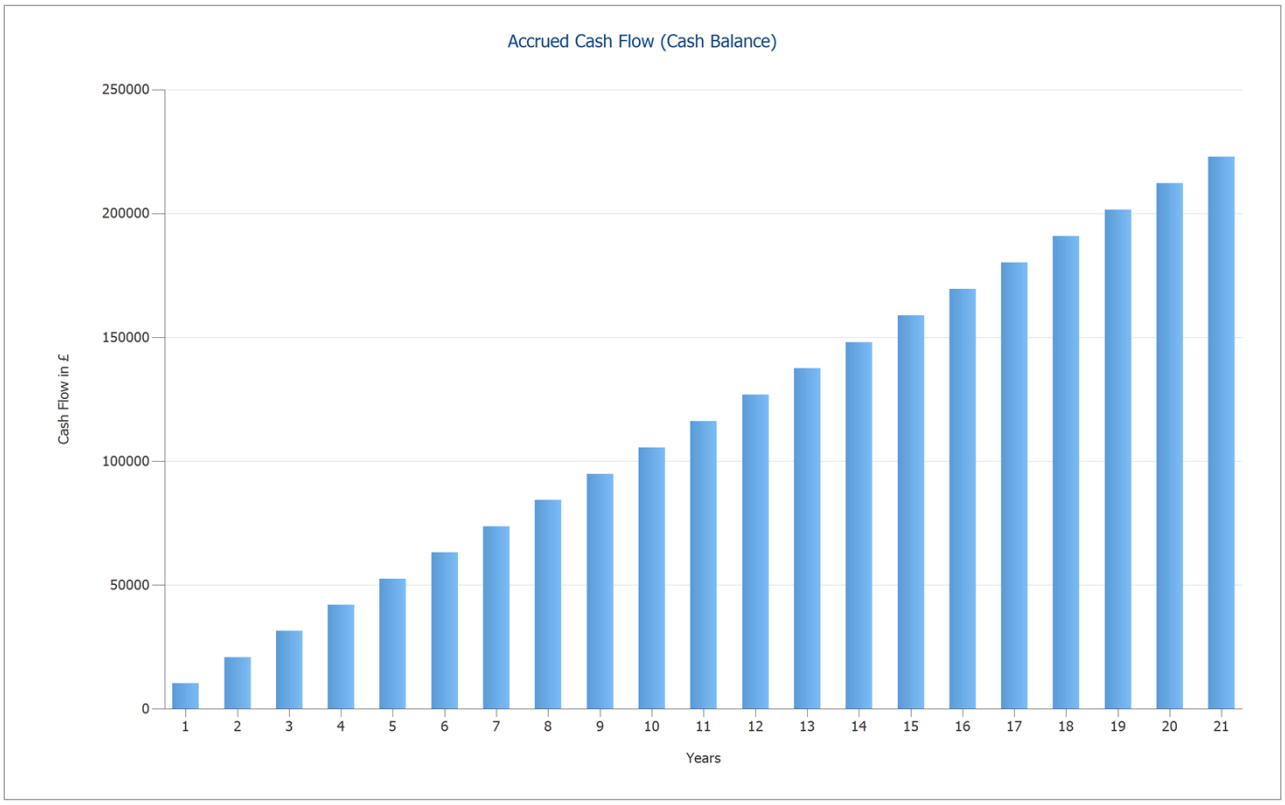


Figure: Accrued Cash Flow (Cash Balance)

Energy Supply Account

Energy Supply Account

Reference	Jan	Feb	Mar	Apr	May	Jun
Consumption	76251.02	73716.60	86543.16	84745.76	82301.16	86646.79
Energy production	1238.14	1906.02	4324.94	7298.55	8427.45	8616.06
Energy production (incl. Degradation of Module)	1237.31	1903.48	4316.29	7279.09	8399.36	8581.59
Balance	75013.71	71813.12	82226.87	77466.67	73901.80	78065.20
Savings	1237.31	1903.48	4316.29	7279.09	8399.36	8581.59
Value in kWh						
Costs without solar energy system	14281.82	13807.12	16209.53	15872.88	15415.01	16228.94
Costs with solar energy system	14050.07	13450.60	15401.09	14509.51	13841.81	14621.61
Cost savings	231.75	356.52	808.44	1363.37	1573.20	1607.33
Value in £						

Reference	Jul	Aug	Sep	Oct	Nov	Dec
Consumption	86840.20	85937.72	84745.76	79516.18	80943.71	82884.93
Energy production	7923.19	6085.60	5142.96	3071.46	1674.41	1026.82
Energy production (incl. Degradation of Module)	7886.22	6053.15	5112.10	3050.98	1662.13	1018.61
Balance	78953.98	79884.57	79633.66	76465.19	79281.58	81866.33
Savings	7886.22	6053.15	5112.10	3050.98	1662.13	1018.61
Value in kWh						
Costs without solar energy system	16265.17	16096.14	15872.88	14893.38	15160.76	15524.35
Costs with solar energy system	14788.08	14962.38	14915.38	14321.93	14849.44	15333.56
Cost savings	1477.09	1133.75	957.50	571.45	311.32	190.79
Value in £						

Reference	Total
Consumption	991073.00
Energy production	56735.59
Energy production (incl. Degradation of Module)	56500.30
Balance	934572.70
Savings	56500.30
Value in kWh	
Costs without solar energy system	185627.97
Costs with solar energy system	175045.47
Cost savings	10582.51
Value in £	

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

Plans

Circuit Diagram

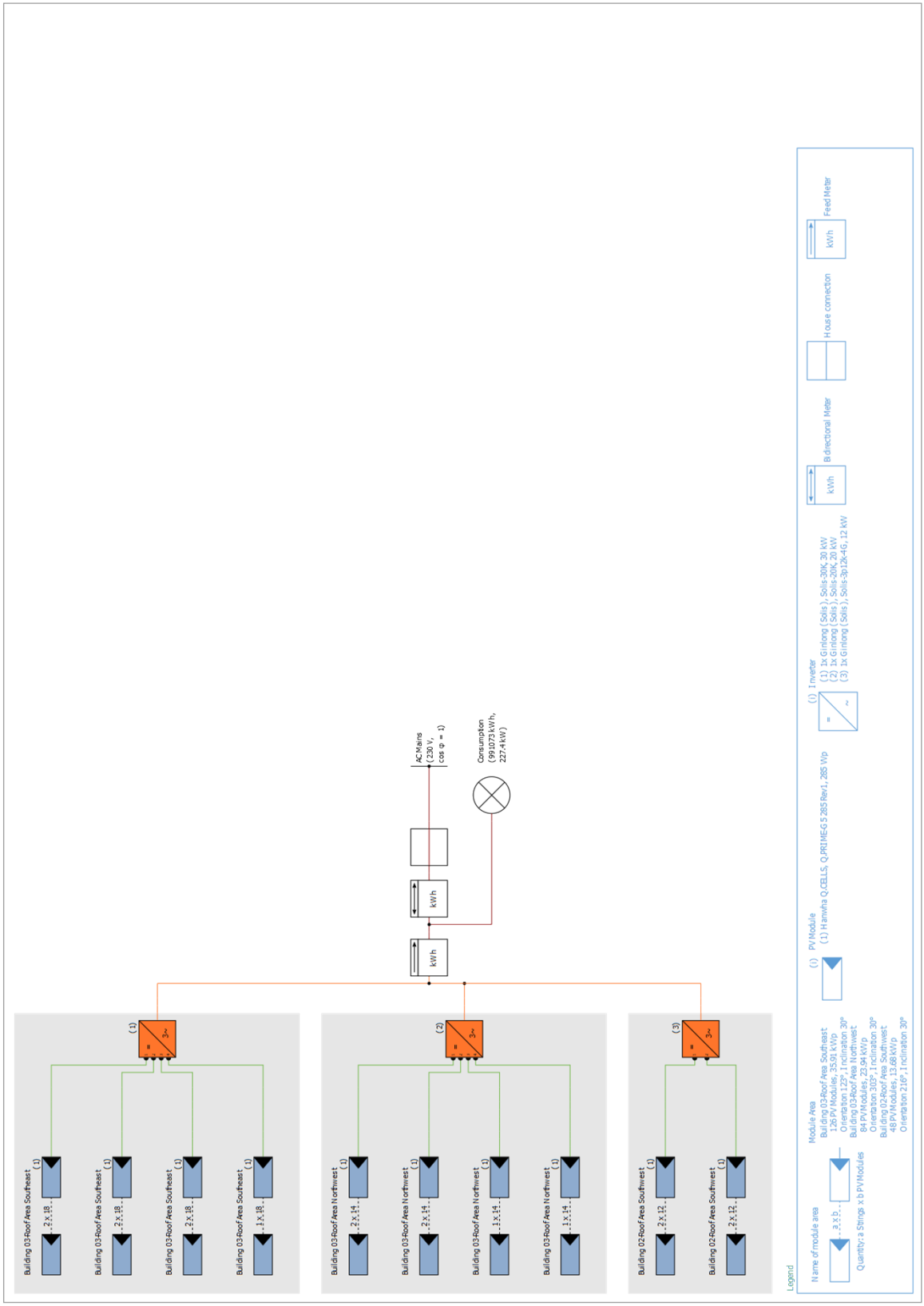


Figure: Circuit Diagram

Dimensioning Plan

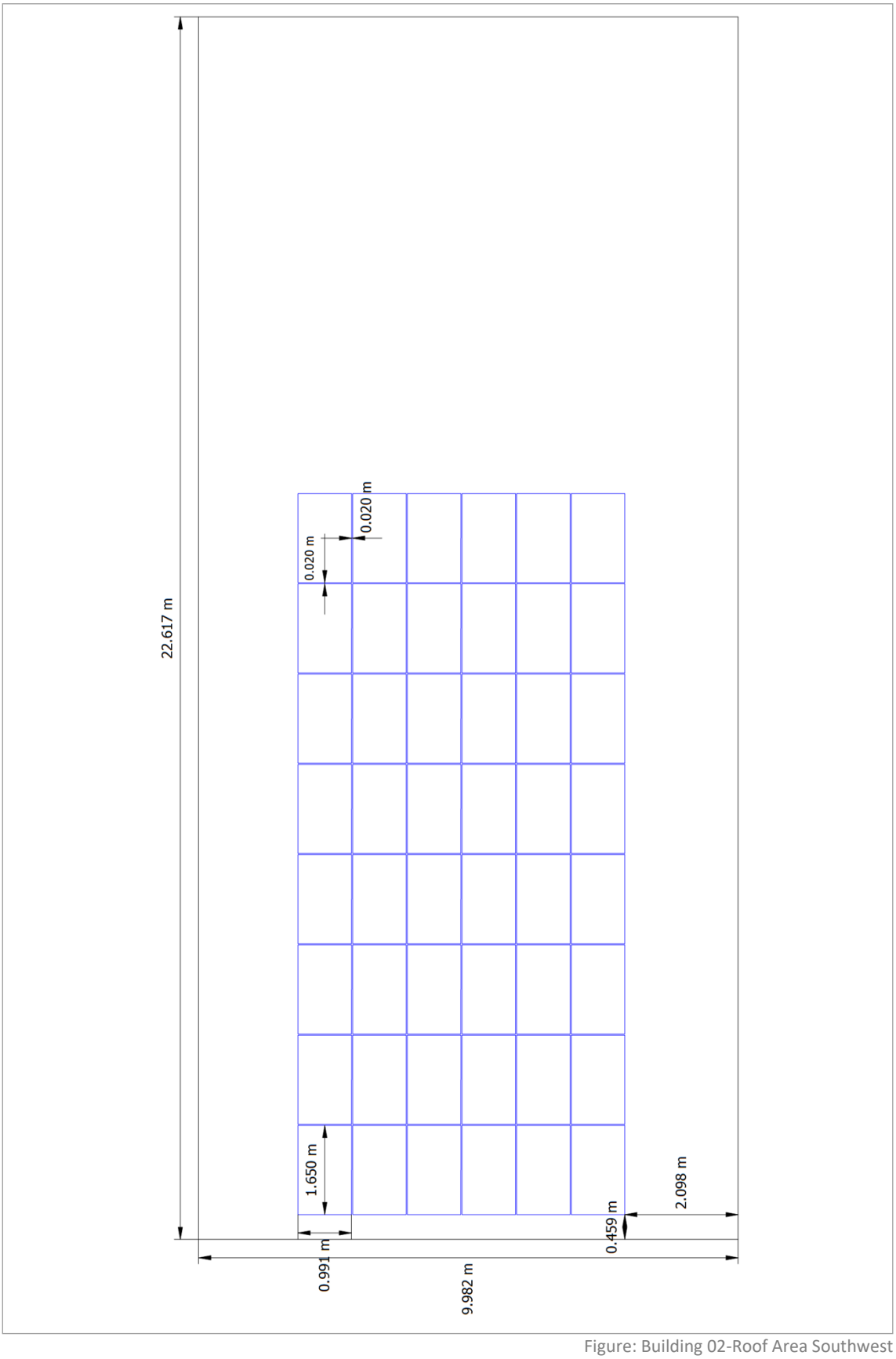


Figure: Building 02-Roof Area Southwest

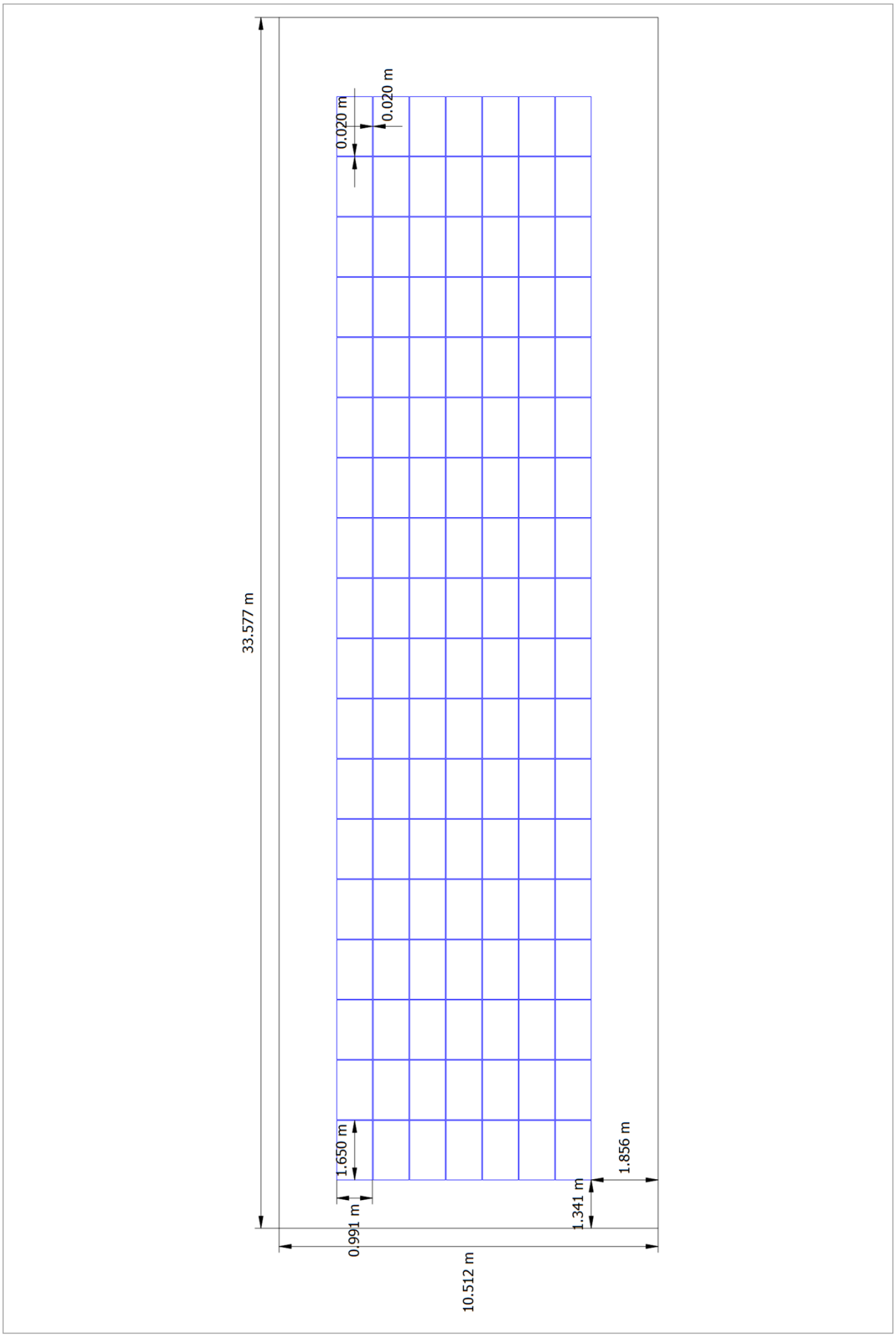


Figure: Building 03-Roof Area Southeast

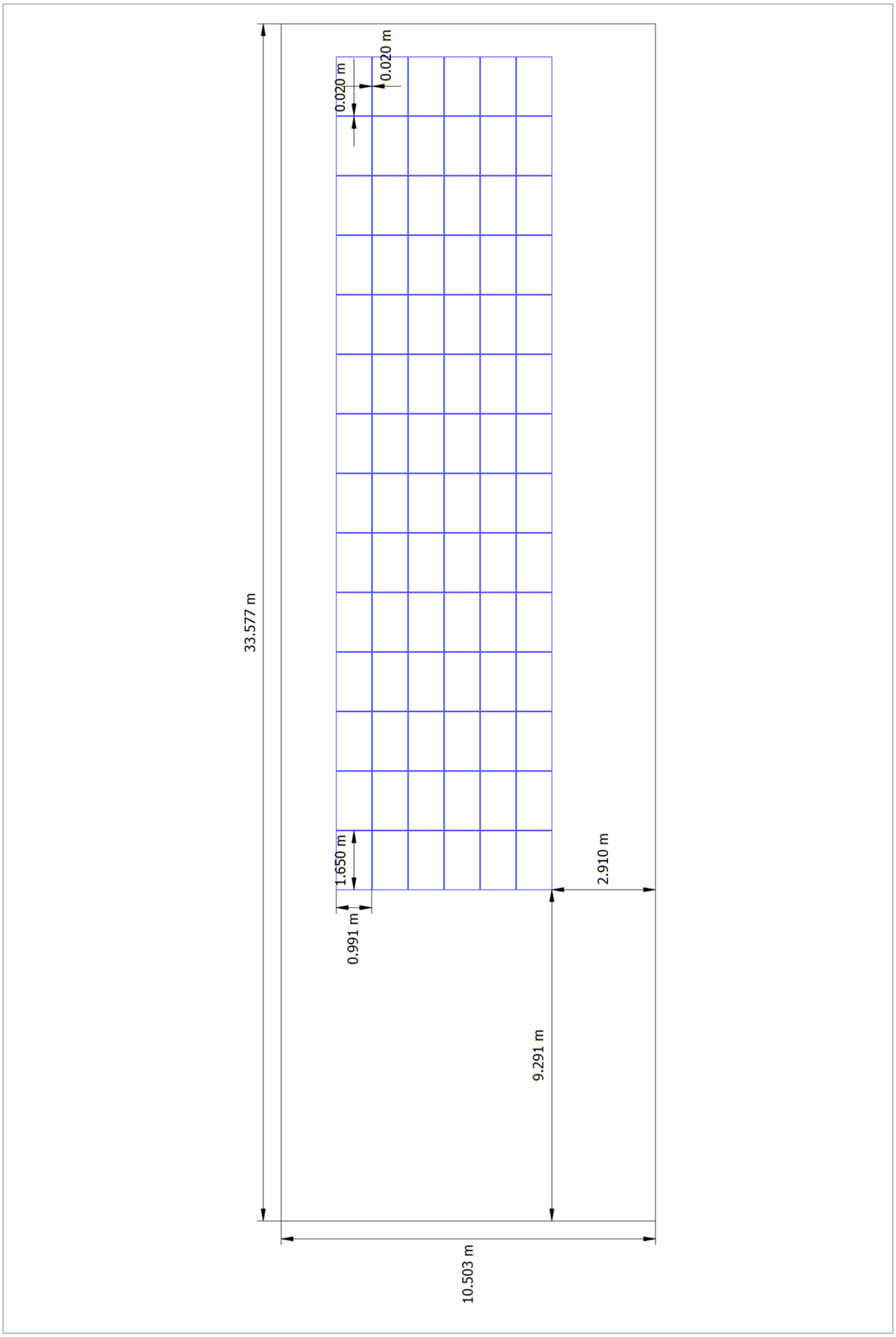


Figure: Building 03-Roof Area Northwest

String Plan

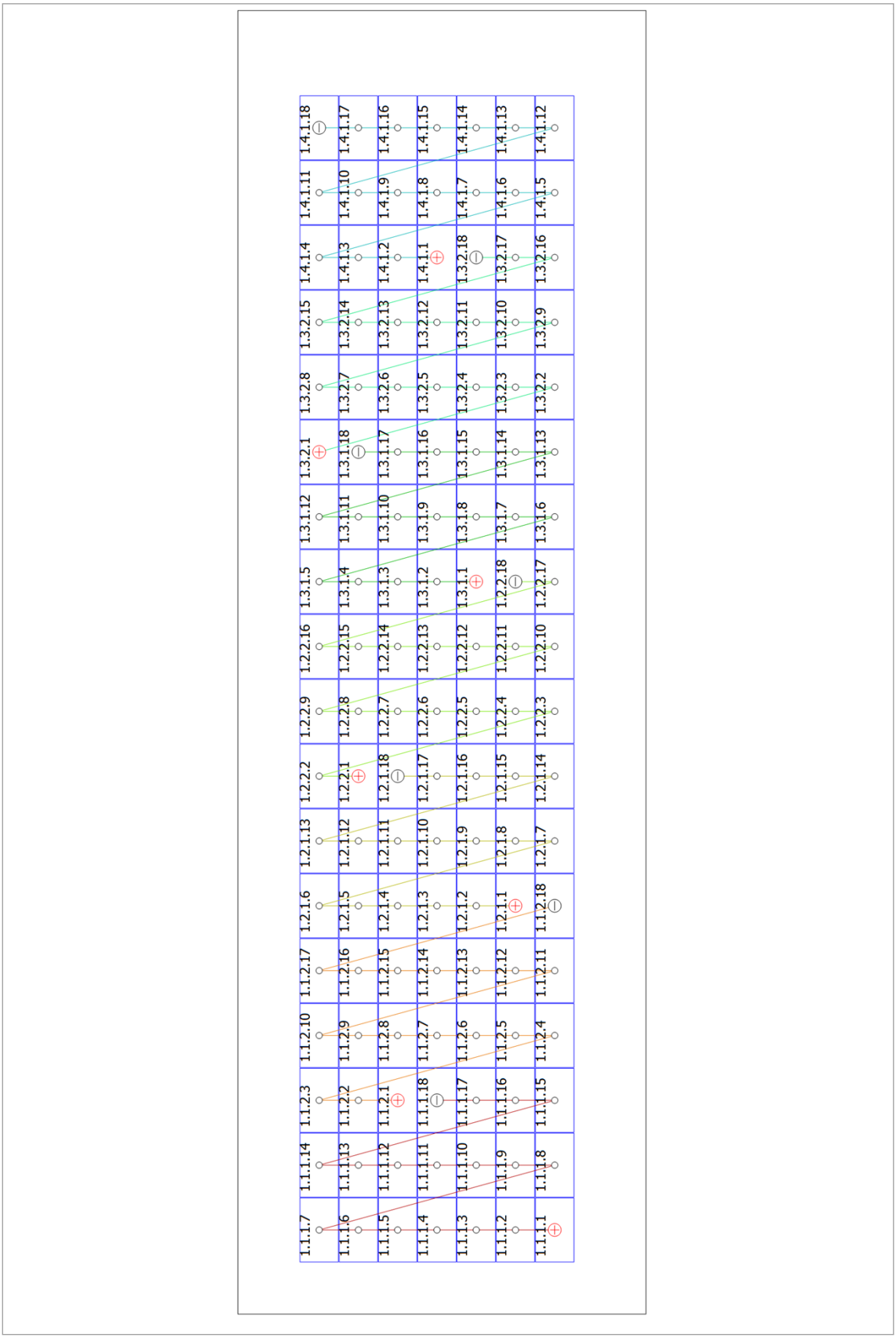


Figure: Building 03-Roof Area Southeast

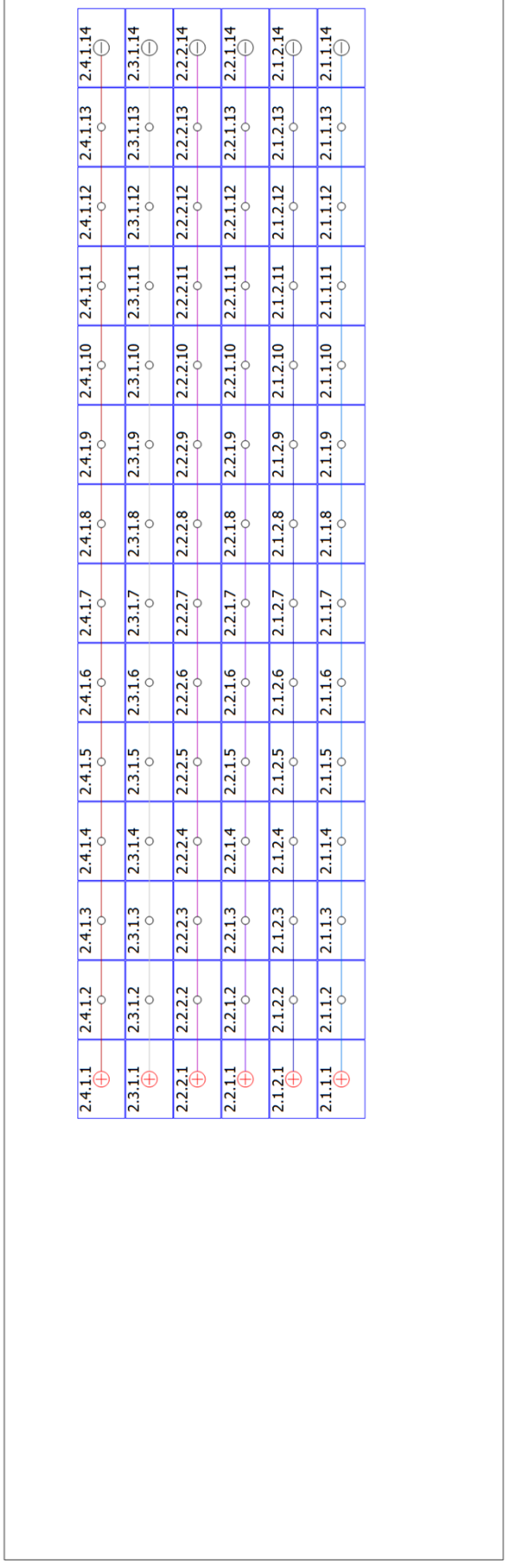


Figure: Building 03-Roof Area Northwest

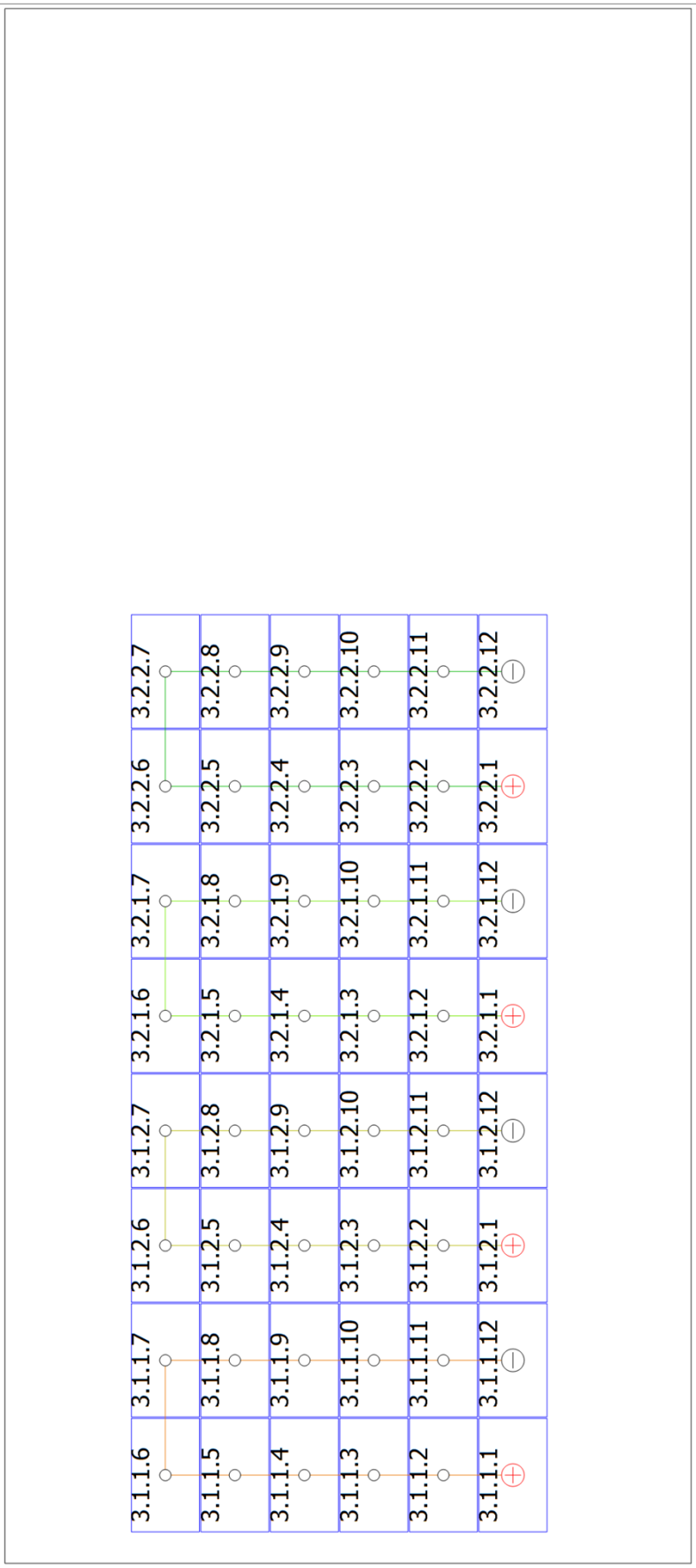


Figure: Building 02-Roof Area Southwest