

Hi Group



Broad Oak Commercial Services

Broad Oak Farm
Broad Oak Lane
Kingsley, S-O-T, ST10 2EL

Contact person:

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Project Name: Hopwood Hall College

09/04/2024

Your PV system from Broad Oak Commercial Services

Address of Installation

Hopwood Hall College
Middleton Campus
Rochdale Road
Middleton
Manchester



Project Overview



Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV System

Climate Data	Manchester, GBR (2001 - 2020)
Values source	Meteonorm 8.2(i)
PV Generator Output	497.64 kWp
PV Generator Surface	2,319.6 m ²
Number of PV Modules	858
Number of Inverters	13

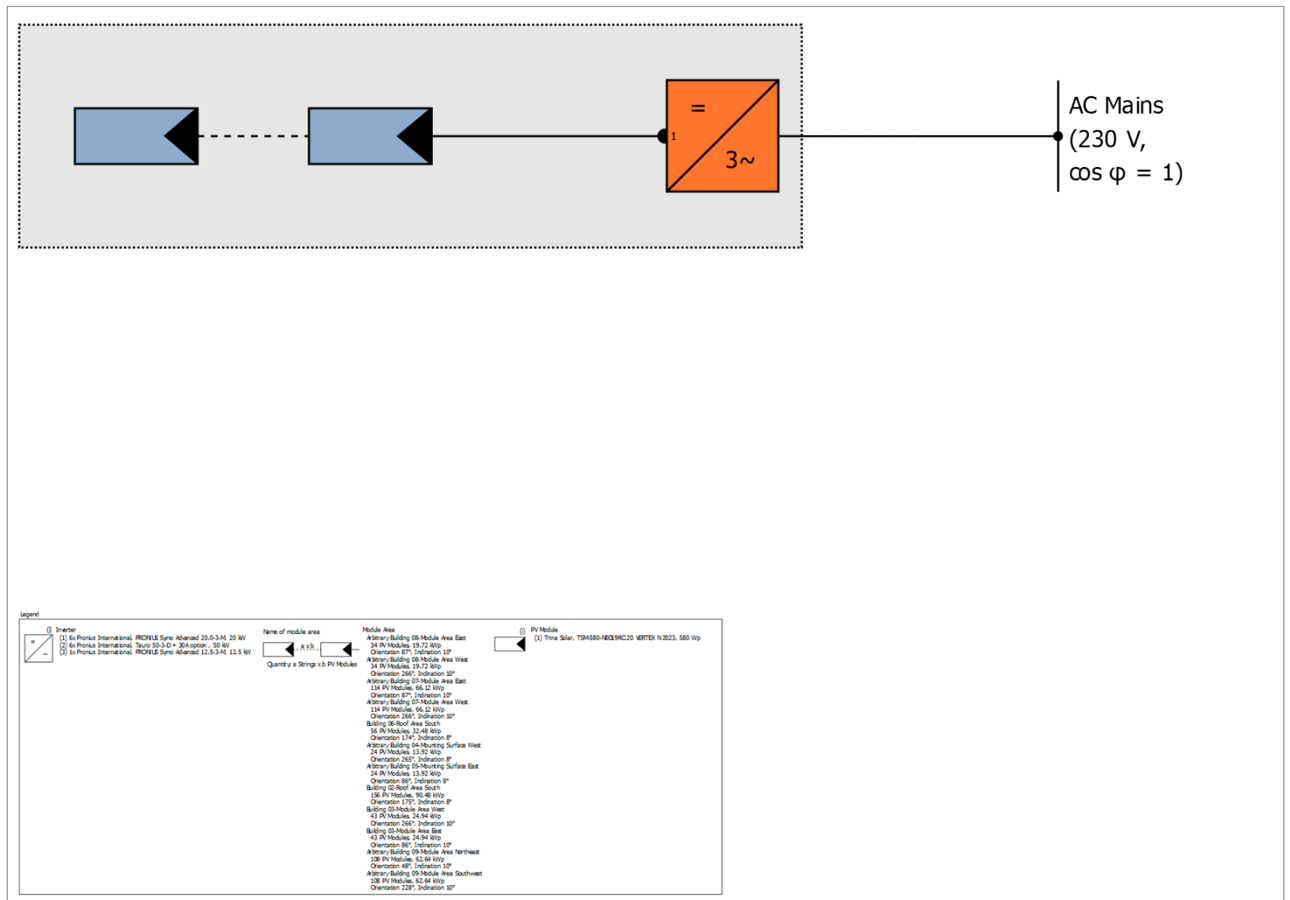


Figure: Schematic diagram

Production Forecast

Production Forecast

PV Generator Output	497.64 kWp
Spec. Annual Yield	911.77 kWh/kWp
Performance Ratio (PR)	92.49 %
Yield Reduction due to Shading	3.0 %
Grid Export	454,222 kWh/Year
Grid Export in the first year (incl. module degradation)	452,906 kWh/Year
Standby Consumption (Inverter)	495 kWh/Year
CO ₂ Emissions avoided	213,255 kg / year

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
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Climate Data

Location	Manchester, GBR (2001 - 2020)
Values source	Meteonorm 8.2(i)
Resolution of the data	1 h
Simulation models used:	
- Diffuse Irradiation onto Horizontal Plane	Hofmann
- Irradiance onto tilted surface	Hay & Davies

Module Areas

1. Module Area - Arbitrary Building 08-Module Area East

PV Generator, 1. Module Area - Arbitrary Building 08-Module Area East

Name	Arbitrary Building 08-Module Area East
PV Modules	34 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	10 °
Orientation	East 87 °
Installation Type	Mounted - Roof
PV Generator Surface	91.9 m²

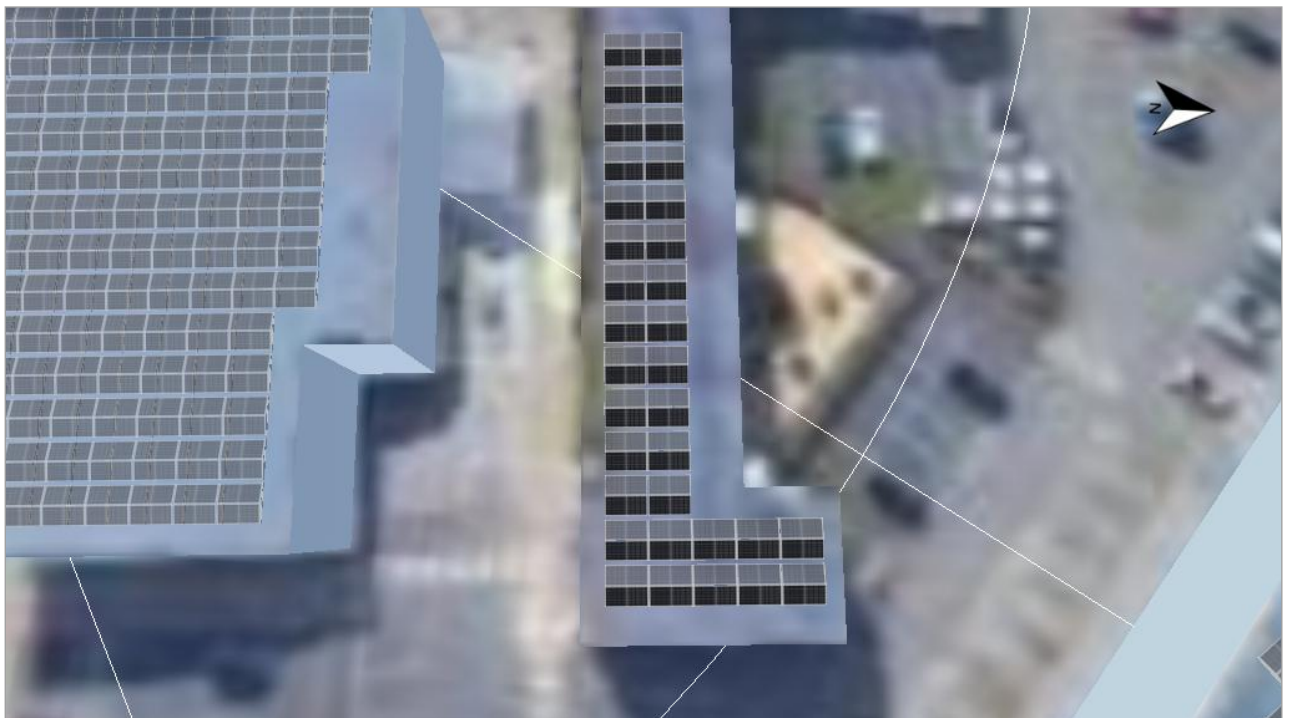


Figure: 1. Module Area - Arbitrary Building 08-Module Area East

2. Module Area - Arbitrary Building 08-Module Area West

PV Generator, 2. Module Area - Arbitrary Building 08-Module Area West

Name	Arbitrary Building 08-Module Area West
PV Modules	34 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	10 °
Orientation	West 266 °
Installation Type	Mounted - Roof
PV Generator Surface	91.9 m ²

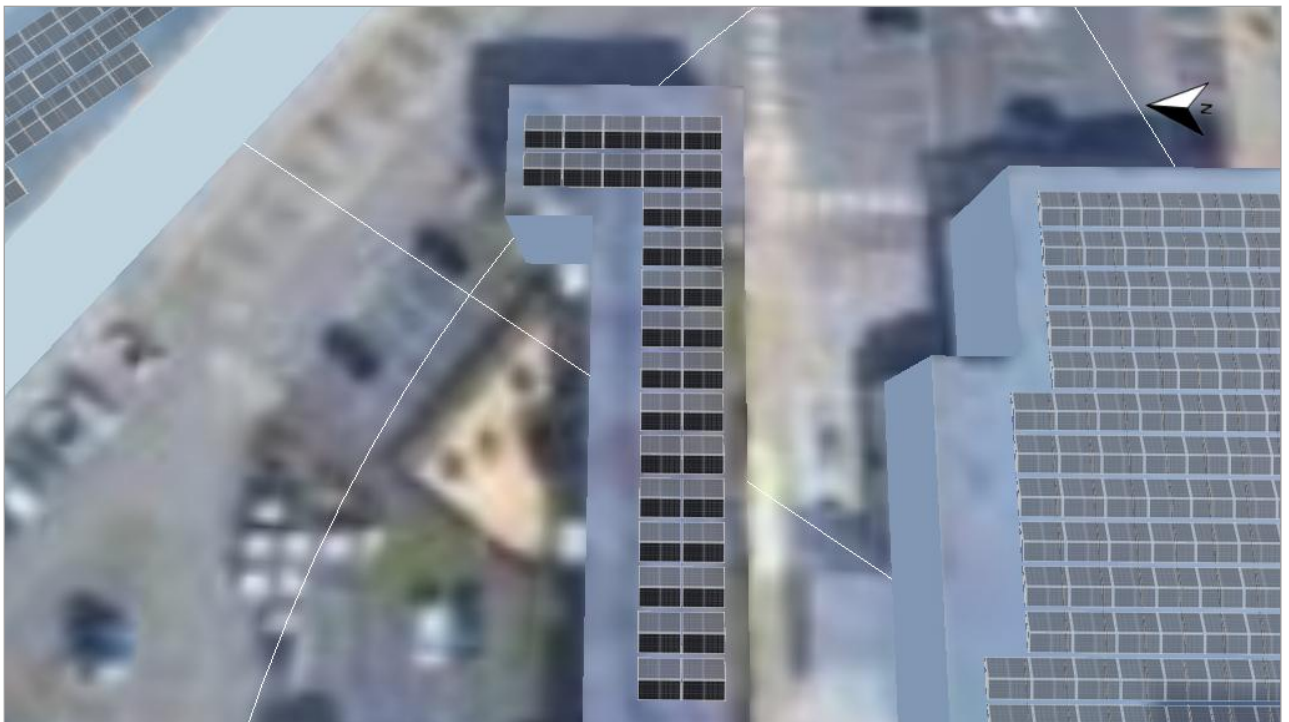


Figure: 2. Module Area - Arbitrary Building 08-Module Area West

3. Module Area - Arbitrary Building 07-Module Area East

PV Generator, 3. Module Area - Arbitrary Building 07-Module Area East

Name	Arbitrary Building 07-Module Area East
PV Modules	114 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	10 °
Orientation	East 87 °
Installation Type	Mounted - Roof
PV Generator Surface	308.2 m ²

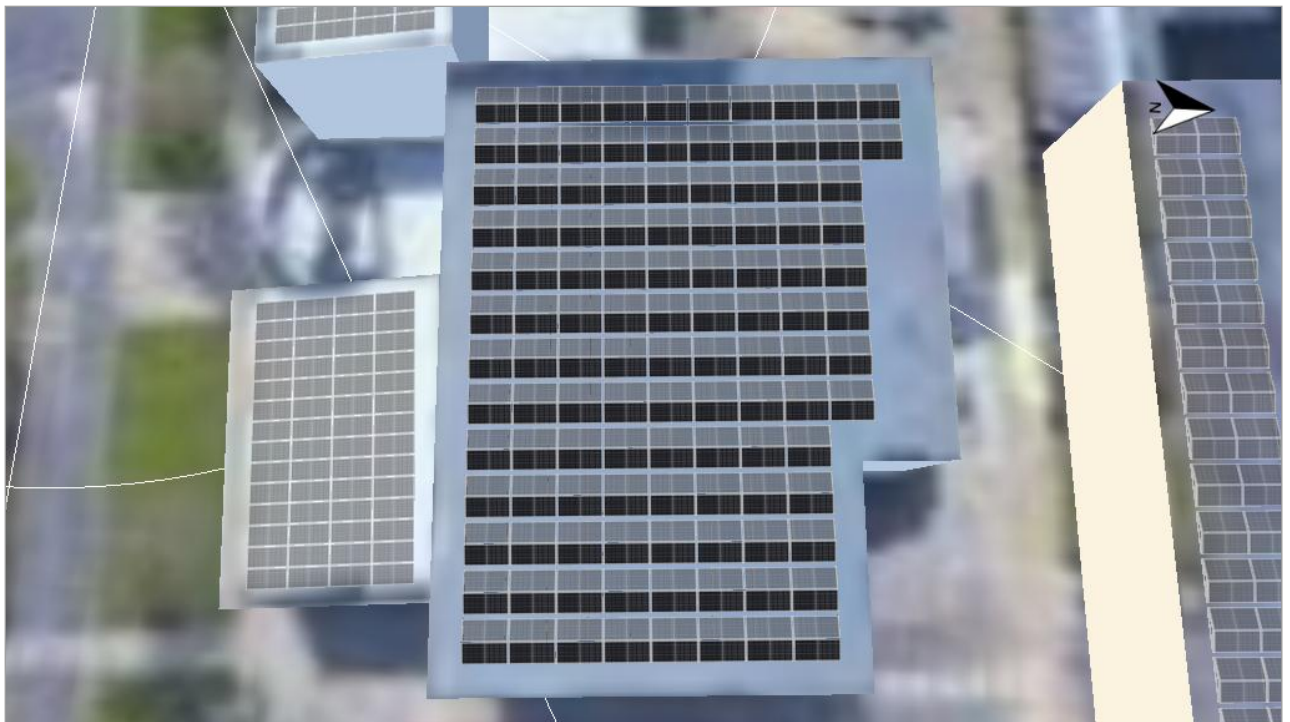


Figure: 3. Module Area - Arbitrary Building 07-Module Area East

4. Module Area - Arbitrary Building 07-Module Area West

PV Generator, 4. Module Area - Arbitrary Building 07-Module Area West

Name	Arbitrary Building 07-Module Area West
PV Modules	114 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	10 °
Orientation	West 266 °
Installation Type	Mounted - Roof
PV Generator Surface	308.2 m ²

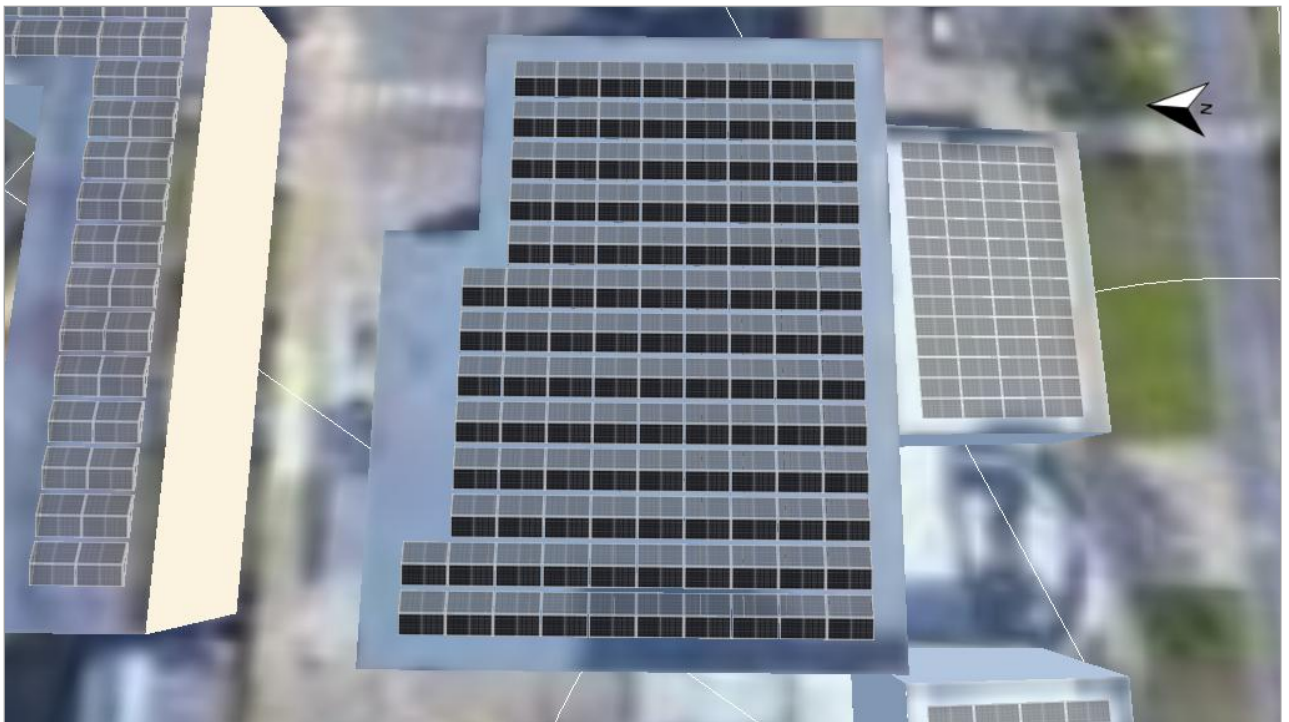


Figure: 4. Module Area - Arbitrary Building 07-Module Area West

5. Module Area - Building 06-Roof Area South

PV Generator, 5. Module Area - Building 06-Roof Area South

Name	Building 06-Roof Area South
PV Modules	56 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	8 °
Orientation	South 174 °
Installation Type	Mounted - Roof
PV Generator Surface	151.4 m ²

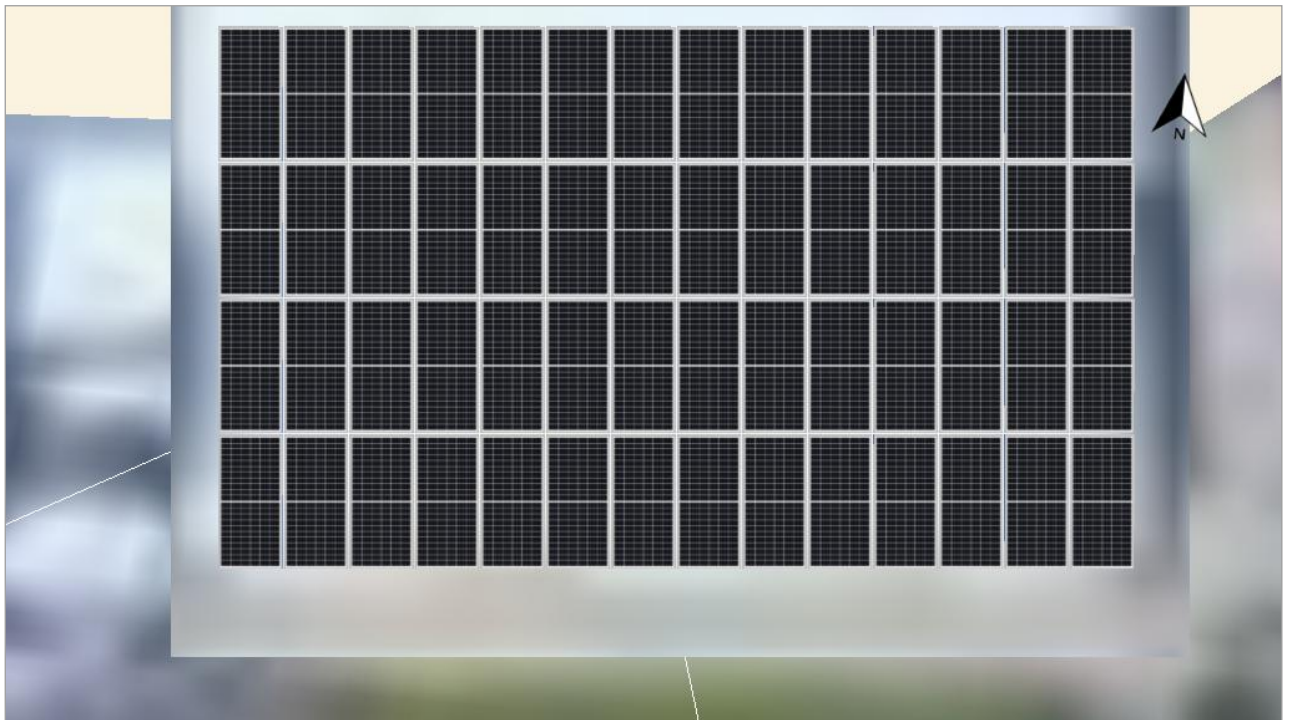


Figure: 5. Module Area - Building 06-Roof Area South

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

PV Generator, 6. Module Area - Arbitrary Building 04-Mounting Surface West

Name	Arbitrary Building 04-Mounting Surface West
PV Modules	24 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	8 °
Orientation	West 265 °
Installation Type	Mounted - Roof
PV Generator Surface	64.9 m ²

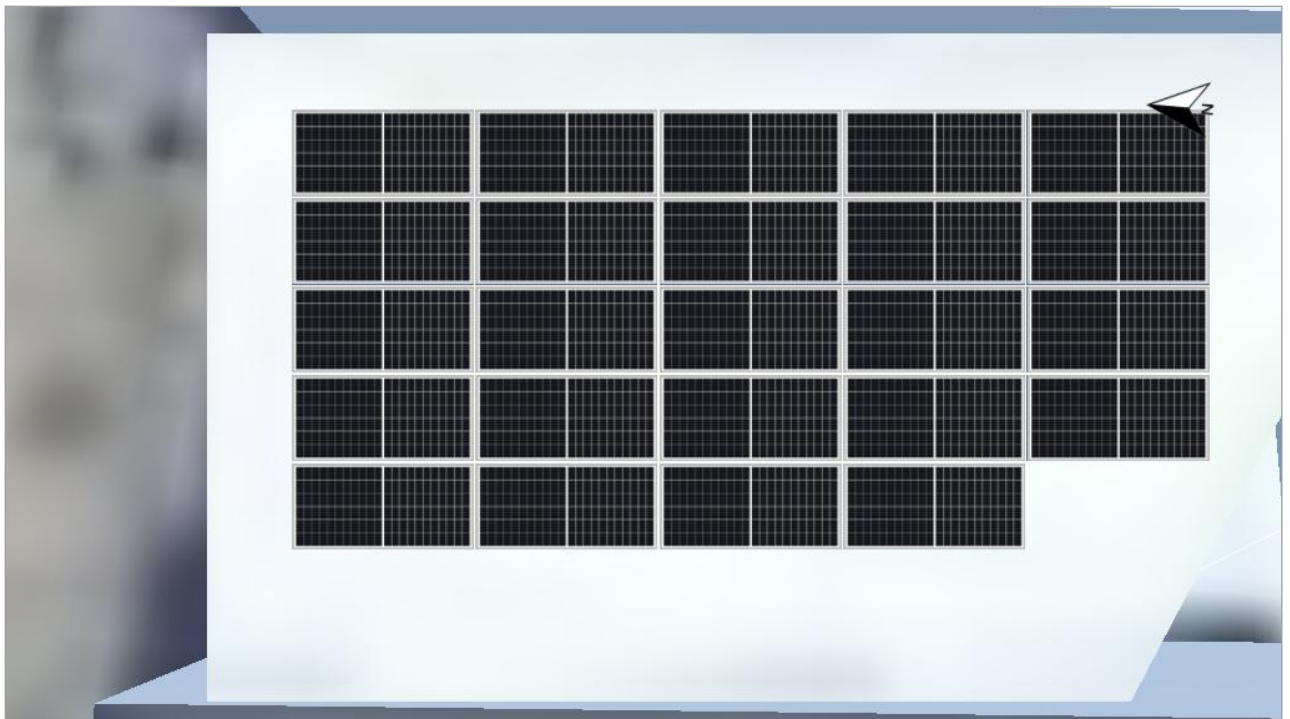


Figure: 6. Module Area - Arbitrary Building 04-Mounting Surface West

7. Module Area - Arbitrary Building 05-Mounting Surface East

PV Generator, 7. Module Area - Arbitrary Building 05-Mounting Surface East

Name	Arbitrary Building 05-Mounting Surface East
PV Modules	24 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	8 °
Orientation	East 86 °
Installation Type	Mounted - Roof
PV Generator Surface	64.9 m ²

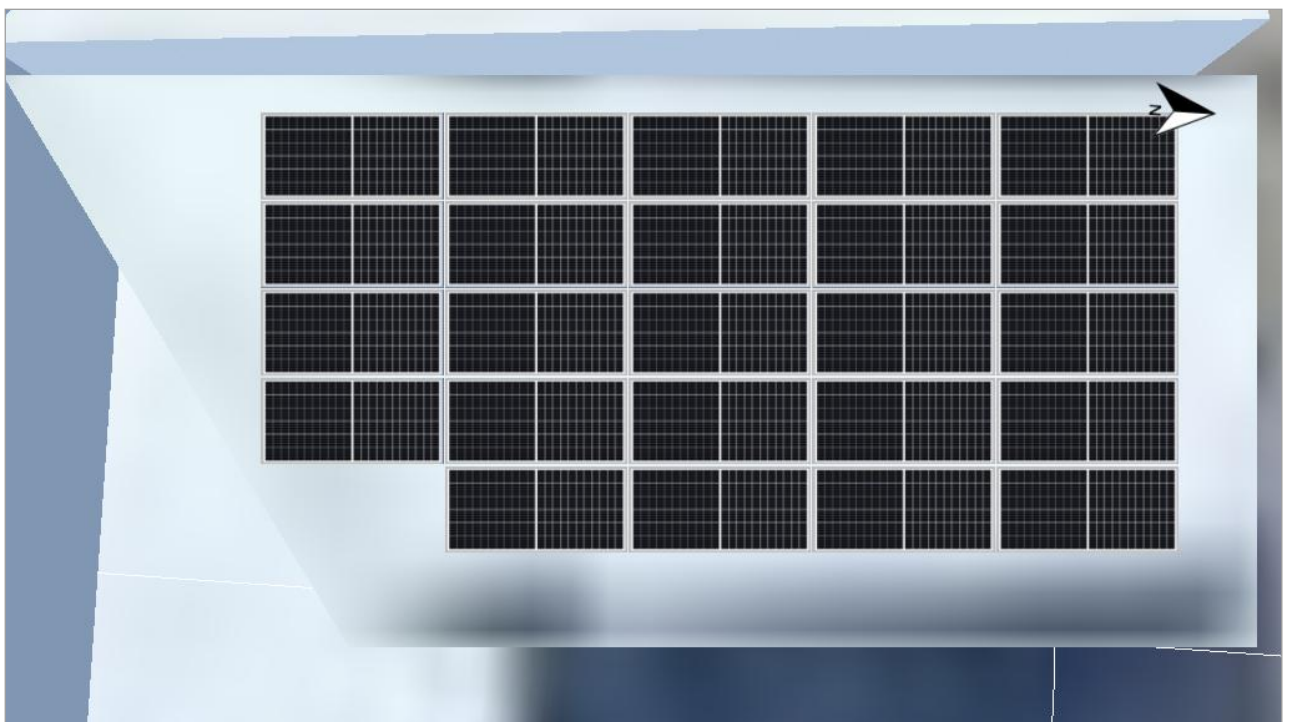


Figure: 7. Module Area - Arbitrary Building 05-Mounting Surface East

8. Module Area - Building 02-Roof Area South

PV Generator, 8. Module Area - Building 02-Roof Area South

Name	Building 02-Roof Area South
PV Modules	156 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	8 °
Orientation	South 175 °
Installation Type	Mounted - Roof
PV Generator Surface	421.7 m ²

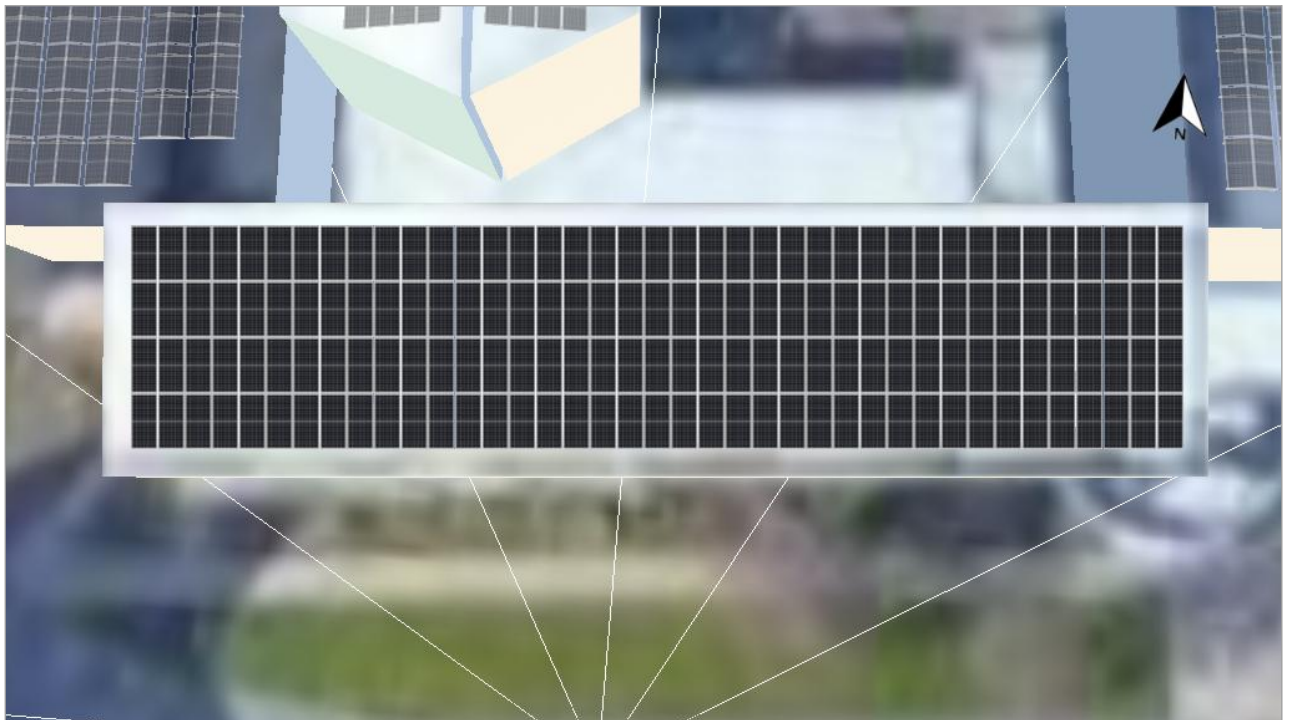


Figure: 8. Module Area - Building 02-Roof Area South

9. Module Area - Building 03-Module Area West

PV Generator, 9. Module Area - Building 03-Module Area West

Name	Building 03-Module Area West
PV Modules	43 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	10 °
Orientation	West 266 °
Installation Type	Mounted - Roof
PV Generator Surface	116.2 m ²

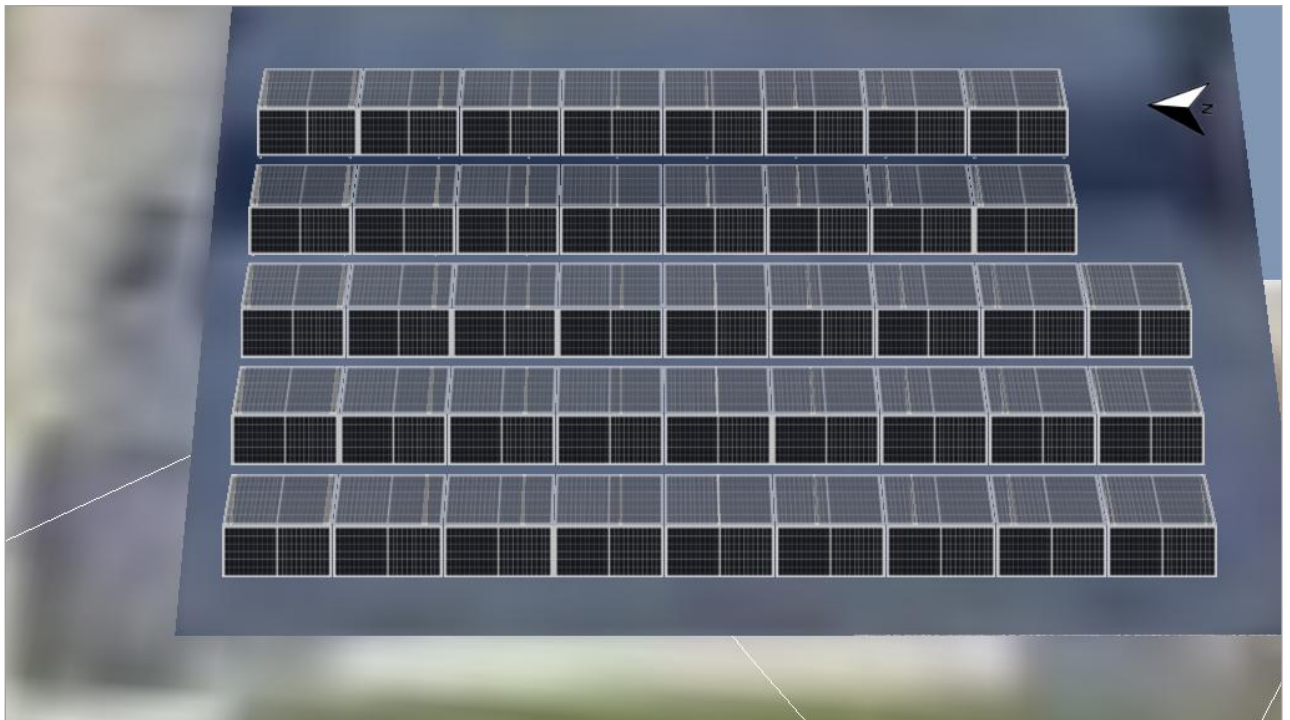


Figure: 9. Module Area - Building 03-Module Area West

10. Module Area - Building 03-Module Area East

PV Generator, 10. Module Area - Building 03-Module Area East

Name	Building 03-Module Area East
PV Modules	43 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	10 °
Orientation	East 86 °
Installation Type	Mounted - Roof
PV Generator Surface	116.2 m ²



Figure: 10. Module Area - Building 03-Module Area East

11. Module Area - Arbitrary Building 09-Module Area Northeast

PV Generator, 11. Module Area - Arbitrary Building 09-Module Area Northeast

Name	Arbitrary Building 09-Module Area Northeast
PV Modules	108 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	10 °
Orientation	Northeast 48 °
Installation Type	Mounted - Roof
PV Generator Surface	292.0 m ²

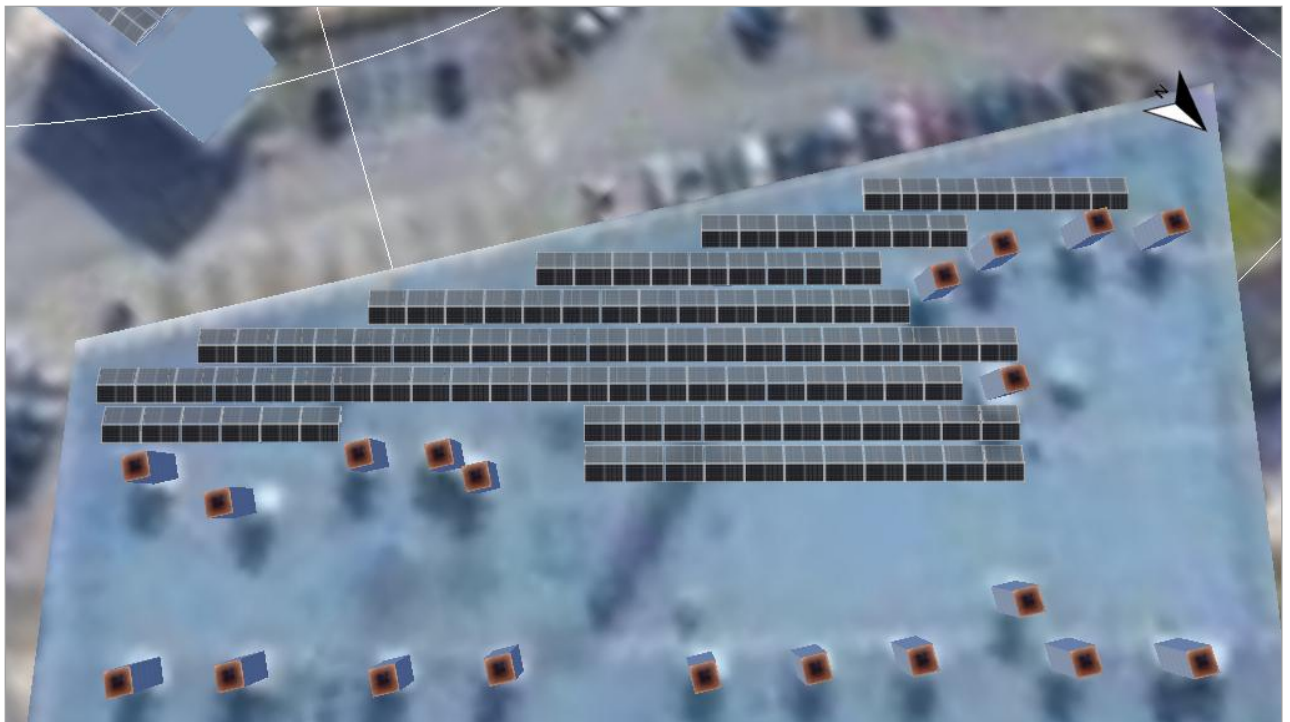


Figure: 11. Module Area - Arbitrary Building 09-Module Area Northeast

12. Module Area - Arbitrary Building 09-Module Area Southwest

PV Generator, 12. Module Area - Arbitrary Building 09-Module Area Southwest

Name	Arbitrary Building 09-Module Area Southwest
PV Modules	108 x TSM-580-NEG19RC.20 VERTEX N 2023 (v1)
Manufacturer	Trina Solar
Inclination	10 °
Orientation	Southwest 228 °
Installation Type	Mounted - Roof
PV Generator Surface	292.0 m ²



Figure: 12. Module Area - Arbitrary Building 09-Module Area Southwest

Horizon Line, 3D Design

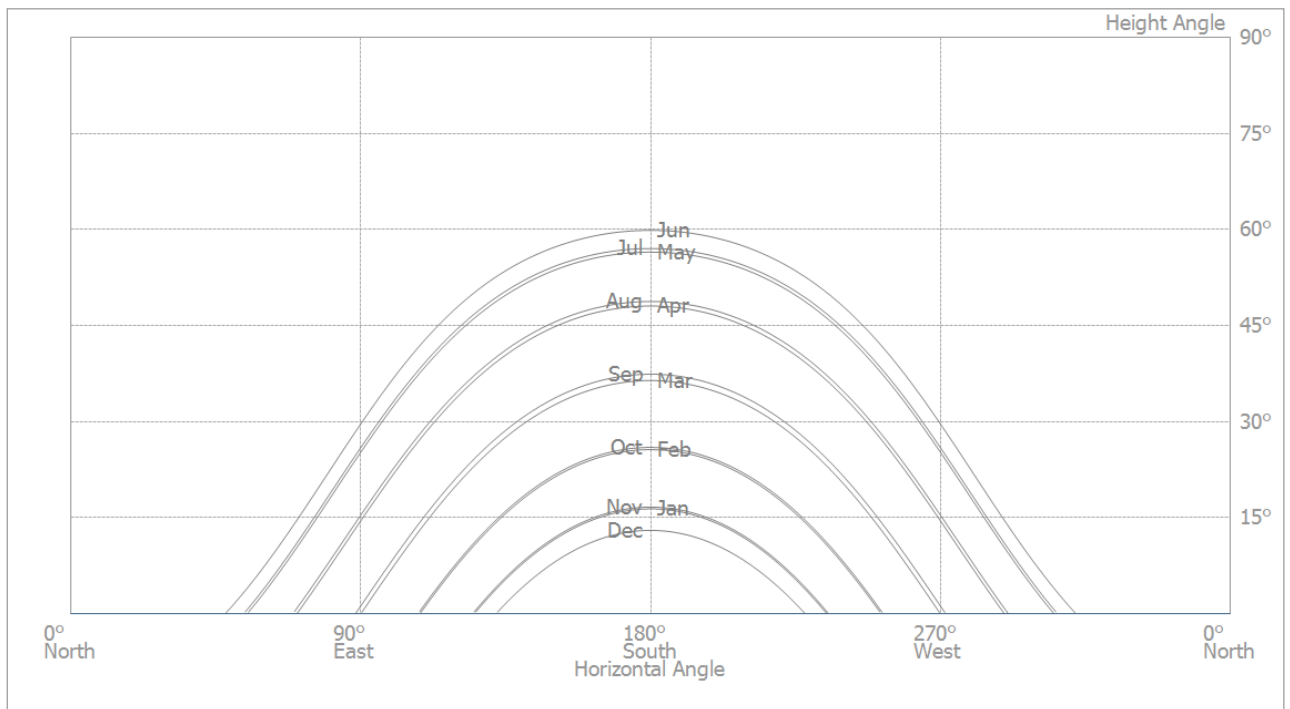


Figure: Horizon (3D Design)

Inverter configuration

Configuration 1

Module Areas		Arbitrary Building 08-Module Area East + Arbitrary Building 08-Module Area West
Inverter 1		
Model	FRONIUS Symo Advanced 20.0-3-M (v1)	
Manufacturer	Fronius International	
Quantity	1	
Sizing Factor	98.6 %	
Configuration	MPP 1: 1 x 17 MPP 2: 1 x 17	
Inverter 2		
Model	FRONIUS Symo Advanced 20.0-3-M (v1)	
Manufacturer	Fronius International	
Quantity	1	
Sizing Factor	98.6 %	
Configuration	MPP 1: 1 x 17 MPP 2: 1 x 17	

Configuration 2

Module Area	Arbitrary Building 07-Module Area East
Inverter 1	
Model	Tauro 50-3-D + 30A option (v1)
Manufacturer	Fronius International
Quantity	1
Sizing Factor	132.2 %
Configuration	MPP 1: 2 x 19
	MPP 2: 2 x 19
	MPP 3: 2 x 19

Configuration 3

Module Area	Arbitrary Building 07-Module Area West
Inverter 1	
Model	Tauro 50-3-D + 30A option (v1)
Manufacturer	Fronius International
Quantity	1
Sizing Factor	132.2 %
Configuration	MPP 1: 2 x 19
	MPP 2: 2 x 19
	MPP 3: 2 x 19

Configuration 4

Module Area	Building 06-Roof Area South
Inverter 1	
Model	FRONIUS Symo Advanced 20.0-3-M (v1)
Manufacturer	Fronius International
Quantity	1
Sizing Factor	104.4 %
Configuration	MPP 1: 1 x 18
	MPP 2: 1 x 18
Inverter 2	
Model	FRONIUS Symo Advanced 12.5-3-M (v1)
Manufacturer	Fronius International
Quantity	1
Sizing Factor	92.8 %
Configuration	MPP 1: 1 x 10
	MPP 2: 1 x 10

Configuration 5

Module Areas	Arbitrary Building 04-Mounting Surface West + Arbitrary Building 05-Mounting Surface East
Inverter 1	
Model	FRONIUS Symo Advanced 20.0-3-M (v1)
Manufacturer	Fronius International
Quantity	1
Sizing Factor	139.2 %
Configuration	MPP 1: 2 x 12
	MPP 2: 2 x 12

Configuration 6

Module Area	Building 02-Roof Area South
Inverter 1	
Model	Tauro 50-3-D + 30A option (v1)
Manufacturer	Fronius International
Quantity	2
Sizing Factor	90.5 %
Configuration	MPP 1: 2 x 17
	MPP 2: 2 x 17
	MPP 3: 1 x 10

Configuration 7

Module Area	Building 03-Module Area West
Inverter 1	
Model	FRONIUS Symo Advanced 20.0-3-M (v1)
Manufacturer	Fronius International
Quantity	1
Sizing Factor	124.7 %
Configuration	MPP 1: 2 x 15
	MPP 2: 1 x 13

Configuration 8

Module Area	Building 03-Module Area East
Inverter 1	
Model	FRONIUS Symo Advanced 20.0-3-M (v1)
Manufacturer	Fronius International
Quantity	1
Sizing Factor	124.7 %
Configuration	MPP 1: 2 x 15
	MPP 2: 1 x 13

Configuration 9

Module Area	Arbitrary Building 09-Module Area Northeast
Inverter 1	
Model	Tauro 50-3-D + 30A option (v1)
Manufacturer	Fronius International
Quantity	1
Sizing Factor	125.3 %
Configuration	MPP 1: 2 x 18
	MPP 2: 2 x 18
	MPP 3: 2 x 18

Configuration 10

Module Area	Arbitrary Building 09-Module Area Southwest
Inverter 1	
Model	Tauro 50-3-D + 30A option (v1)
Manufacturer	Fronius International
Quantity	1
Sizing Factor	125.3 %
Configuration	MPP 1: 2 x 18
	MPP 2: 2 x 18
	MPP 3: 2 x 18

AC Mains

AC Mains

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

Simulation Results

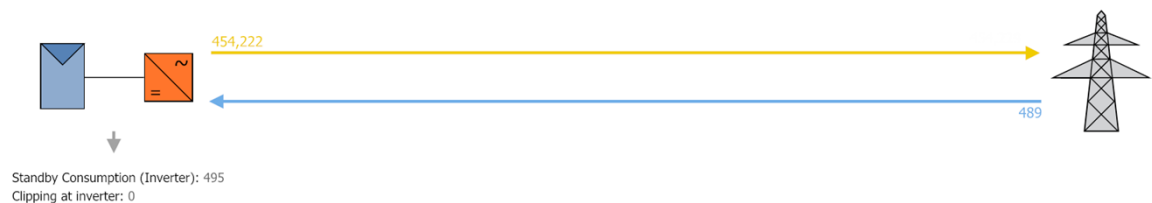
Results Total System

PV System

PV Generator Output	497.64 kWp
Spec. Annual Yield	911.77 kWh/kWp
Performance Ratio (PR)	92.49 %
Yield Reduction due to Shading	3.0 %
Grid Export	454,222 kWh/Year
Grid Export in the first year (incl. module degradation)	452,906 kWh/Year
Standby Consumption (Inverter)	495 kWh/Year
CO ₂ Emissions avoided	213,255 kg / year

Energy Flow Graph

Project: Hopwood Hall College



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

Figure: Energy flow

	(1) Inverter (1) 6x Fronius International, FRONIUS Symo Advanced 20.0-3-M, 20 kW (2) 6x Fronius International, Truo-S 50-3-D + 30A option, 50 kW (3) 1x Fronius International, FRONIUS Symo Advanced 12.5-3-W, 12.5 kW
Name of module area	
	Artillery Building 08-Module Area East 34 PV Modules, 19.72 kW p - Orientation 87°, Inclination 10° Artillery Building 08-Module Area West 34 PV Modules, 19.72 kW p - Orientation 266°, Inclination 10° Artillery Building 07-Module Area East 114 PV Modules, 66.12 kW p - Orientation 87°, Inclination 10° Artillery Building 07-Module Area West 114 PV Modules, 66.12 kW p - Orientation 87°, Inclination 10° Building 06-Roof Area South 56 PV Modules, 32.48 kW p - Orientation 174°, Inclination 8° Artillery Building 04-Mounting Surface West 24 PV Modules, 13.92 kW p - Orientation 265°, Inclination 8° Artillery Building 03-Mounting Surface East 24 PV Modules, 13.92 kW p - Orientation 89°, Inclination 8° Building 02-Roof Area South 156 PV Modules, 90.48 kW p - Orientation 175°, Inclination 8° Building 03-Module Area West 43 PV Modules, 24.94 kW p - Orientation 87°, Inclination 10° Building 03-Module Area East 43 PV Modules, 24.94 kW p - Orientation 86°, Inclination 10° Artillery Building 09-Module Area Northeast 108 PV Modules, 62.64 kW p - Orientation 48°, Inclination 10° Artillery Building 09-Module Area Southwest 108 PV Modules, 62.64 kW p - Orientation 228°, Inclination 10°
	PV Module (1) Time Solar TSM-960-N EG 19Kc20 VERTEXN, 2023, 580 W p

Company read Oak Commercial Services read Oak Farm read Oak Lane read Oak, ST10 2EL	Type of System 3D, Grid-connected PV system		System Output 497.64 kWp	Feed-in Phases 3-phase
	Created by N Hill	Approved by	Part Number	
	Title Hopwood Hall College	System Address Hopwood Hall College Middleton Campus Rochdale Road Middleton Manchester	Document Type Circuit Diagram	
			Date of Issue 09/04/2024	Sheet 1

Figure: Circuit Diagram

Overview plan

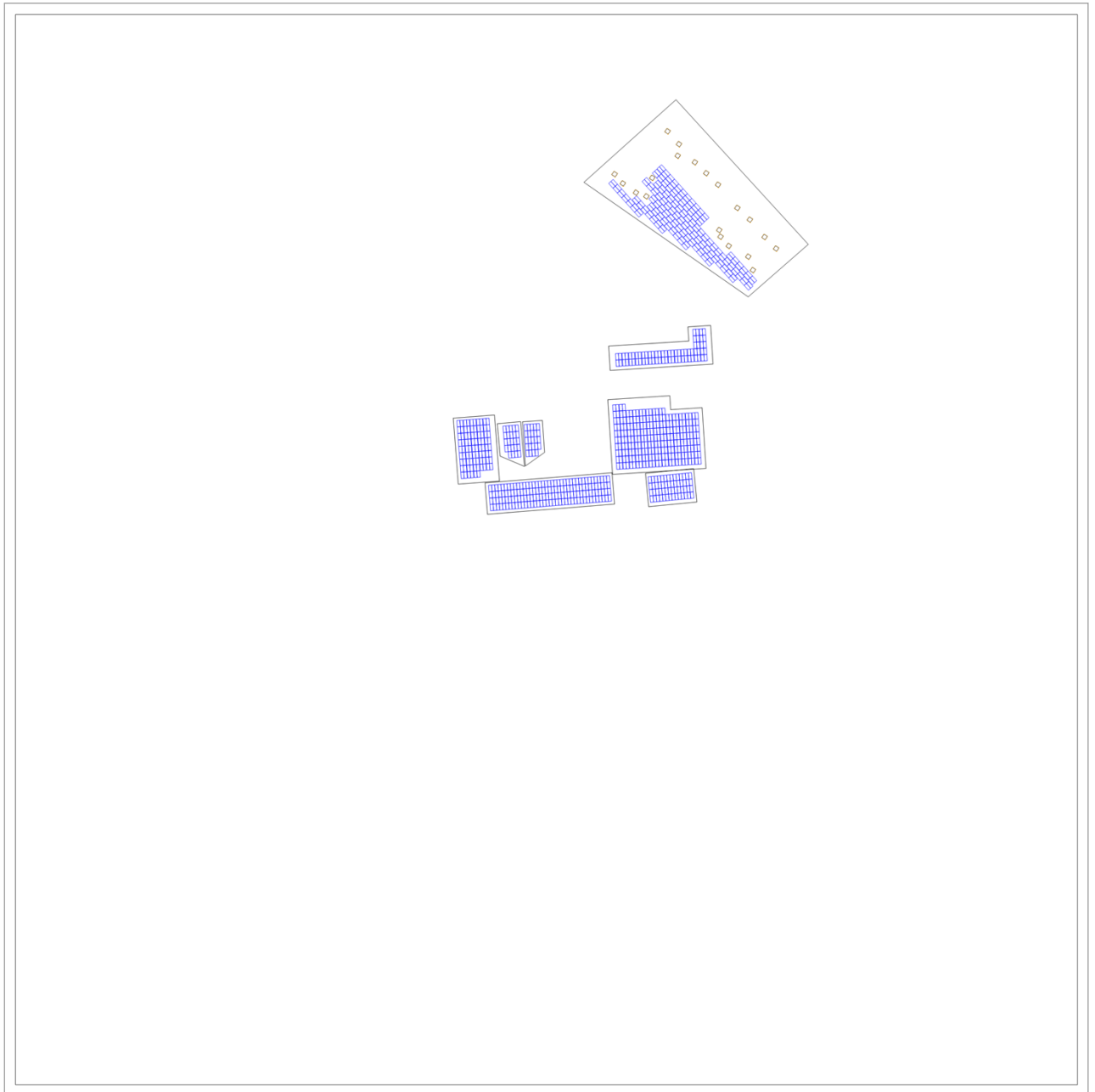


Figure: Overview plan

Dimensioning Plan

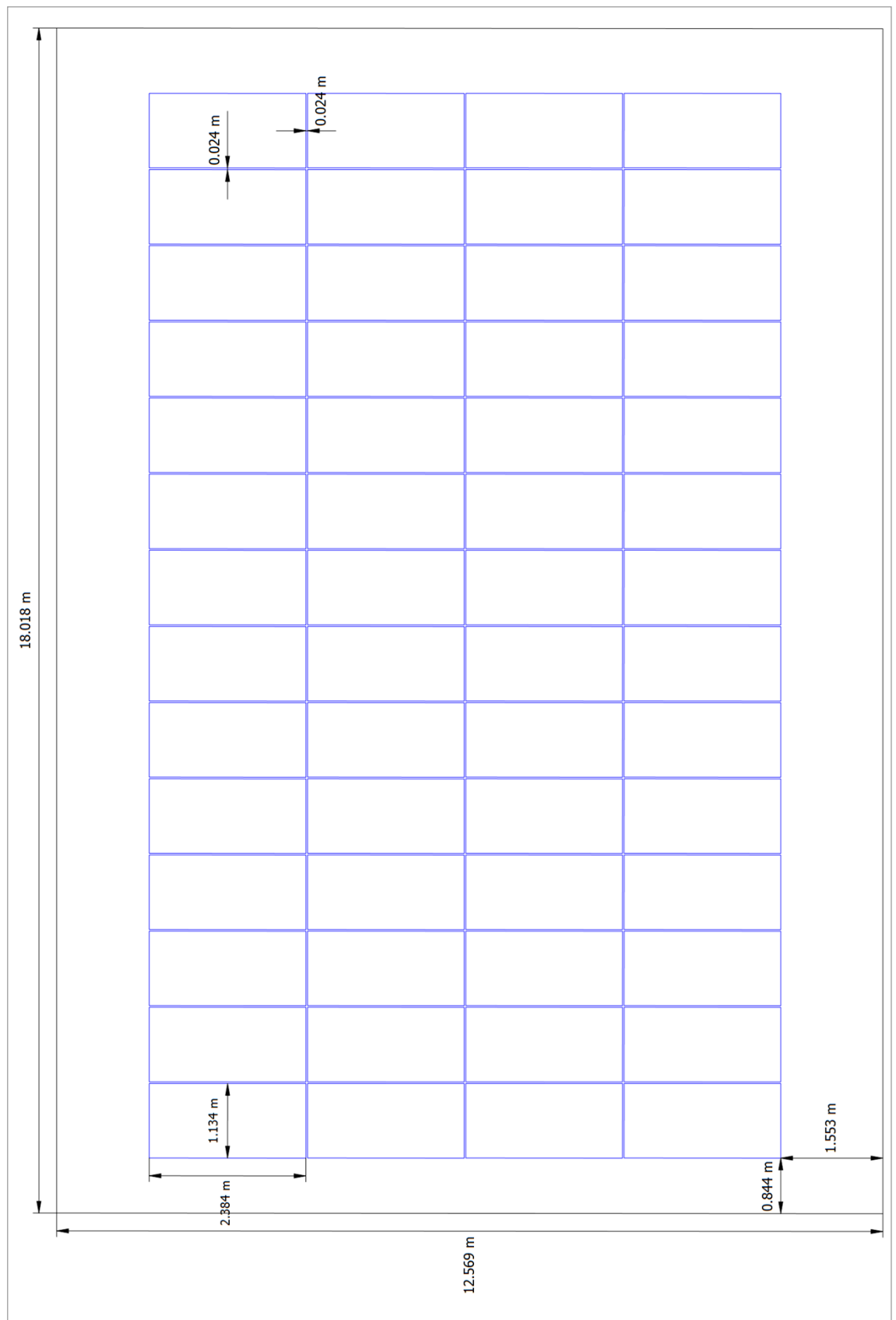


Figure: Building 06 - Roof Area South

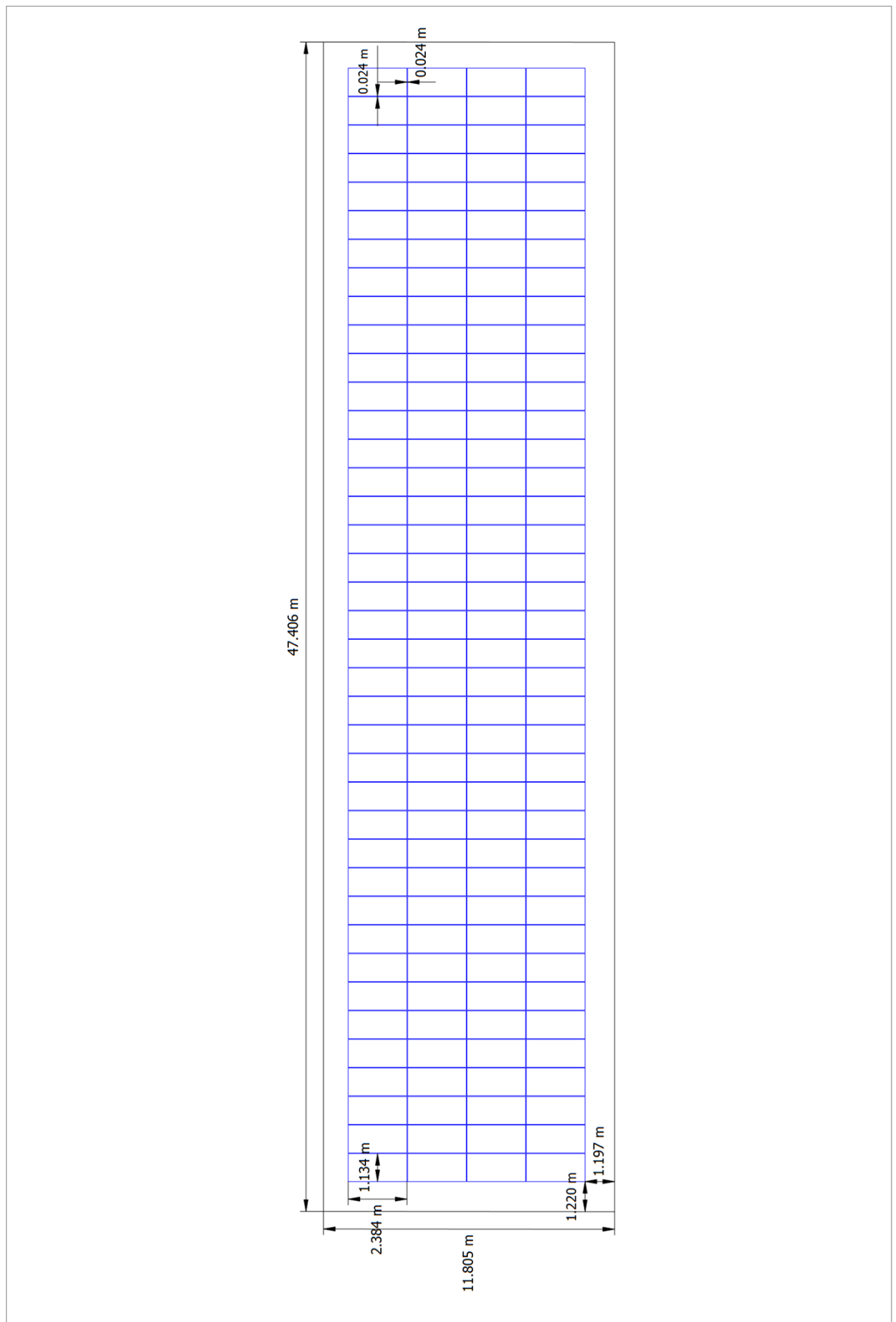


Figure: Building 02 - Roof Area South

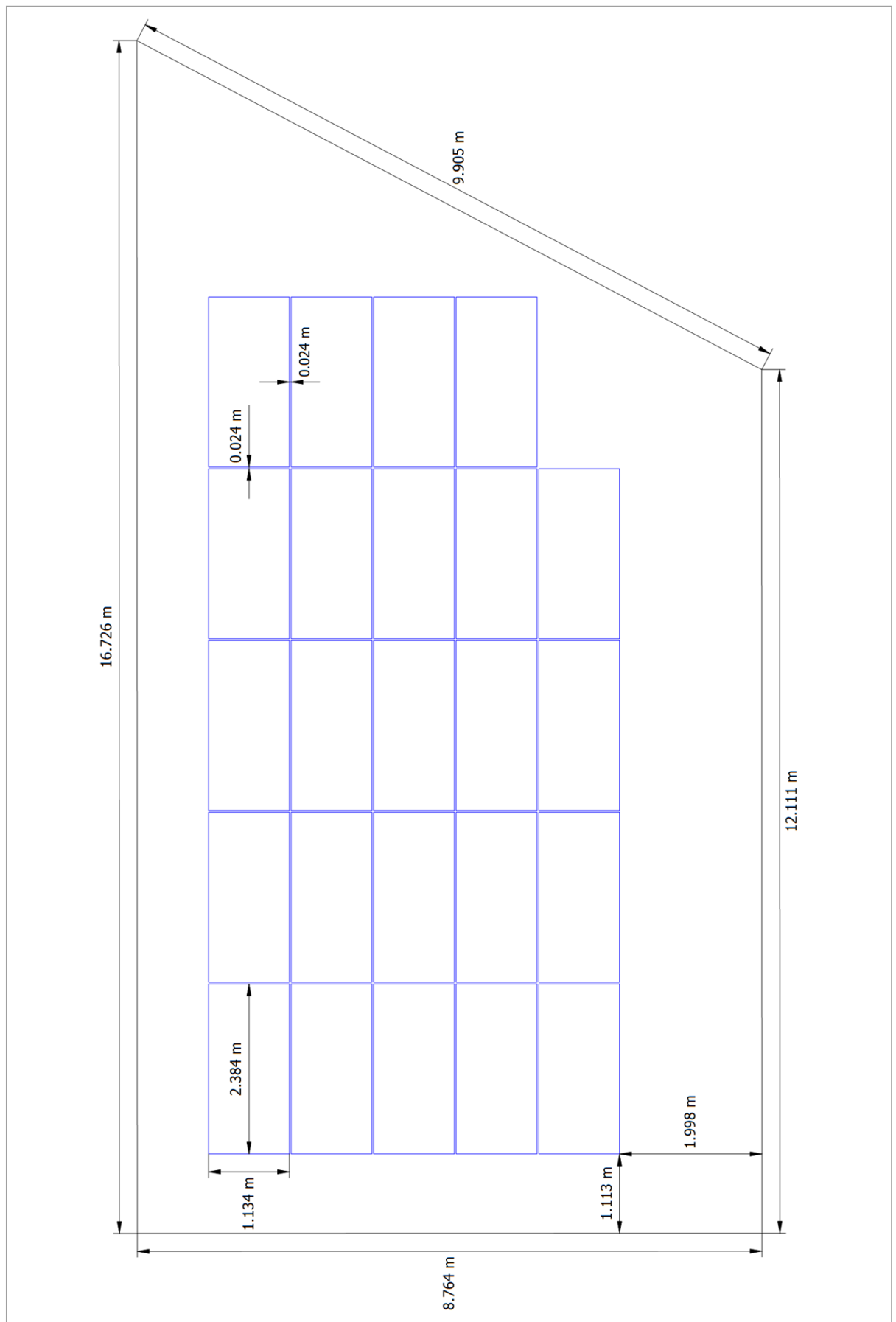


Figure: Arbitrary Building 04 - Mounting Surface West

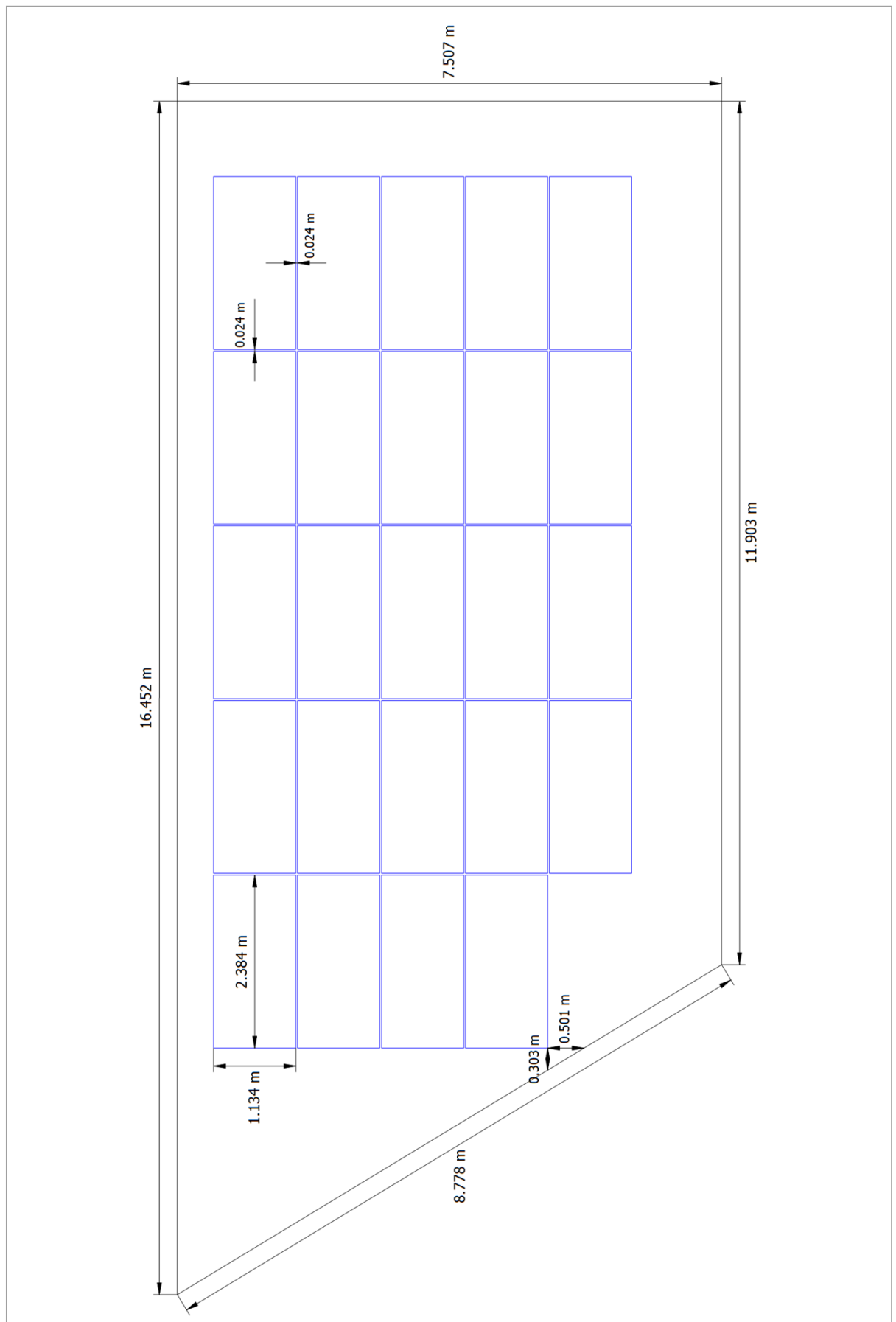


Figure: Arbitrary Building 05 - Mounting Surface East

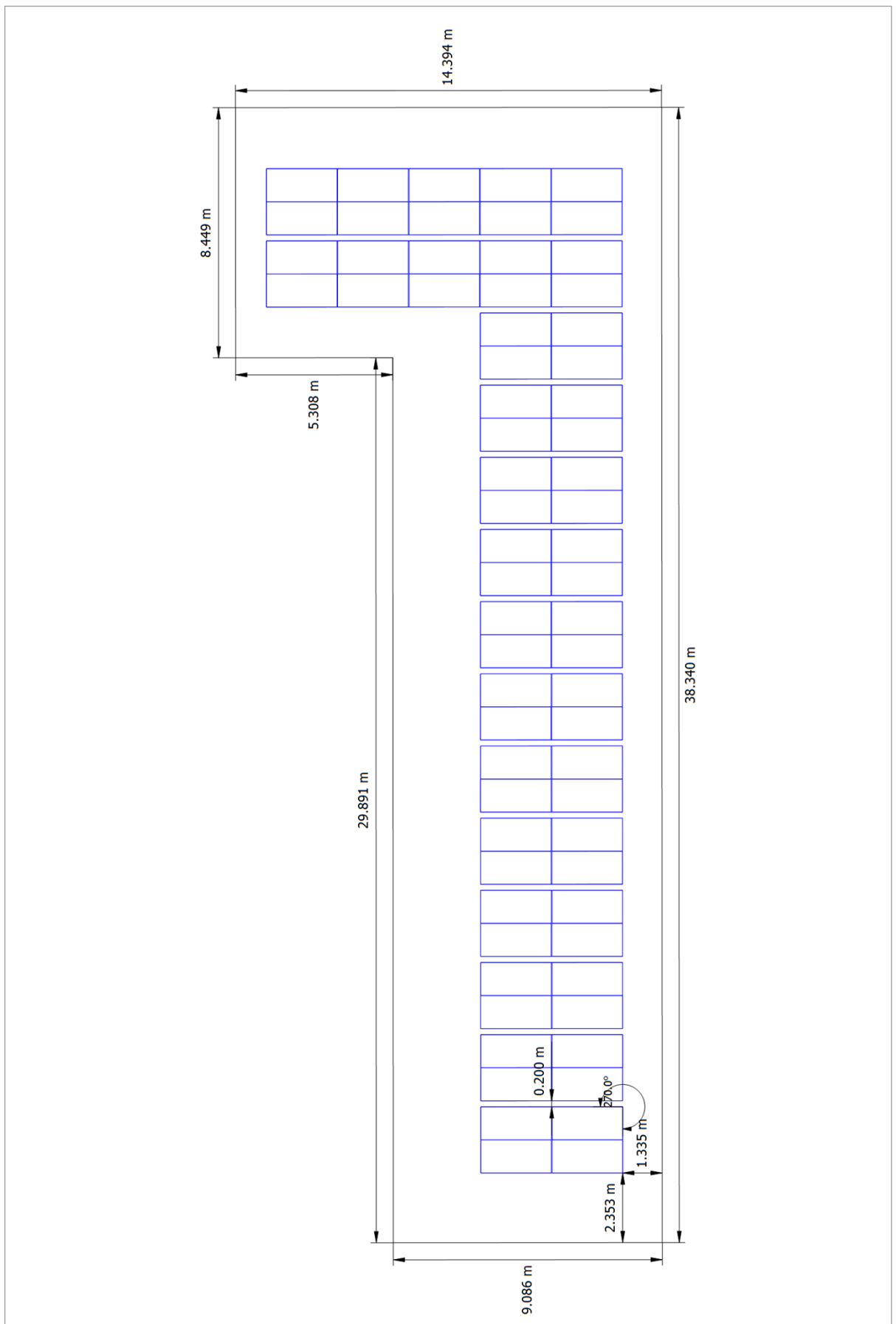


Figure: Arbitrary Building 08 - Mounting Surface South

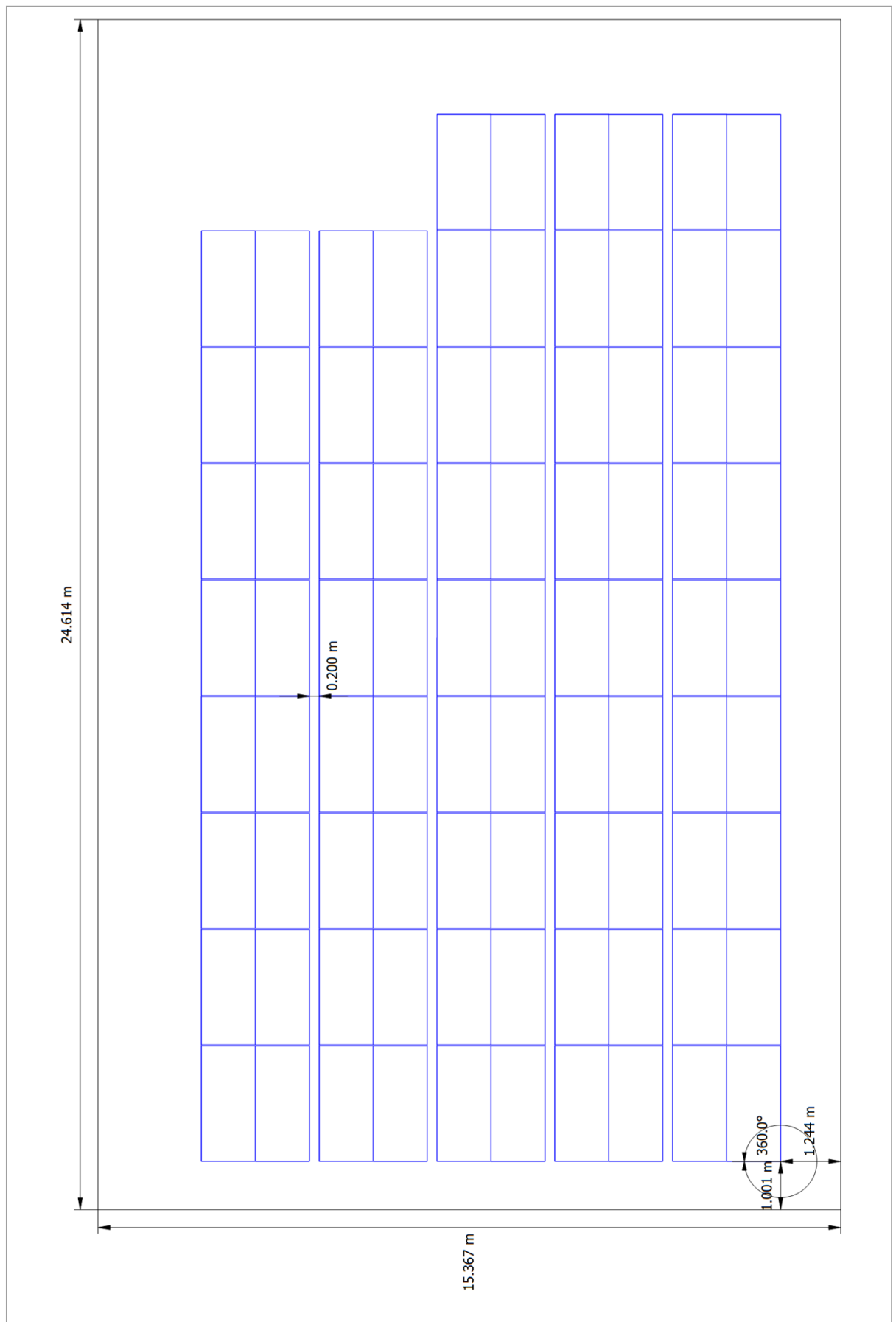
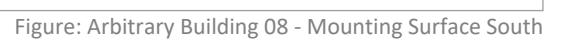
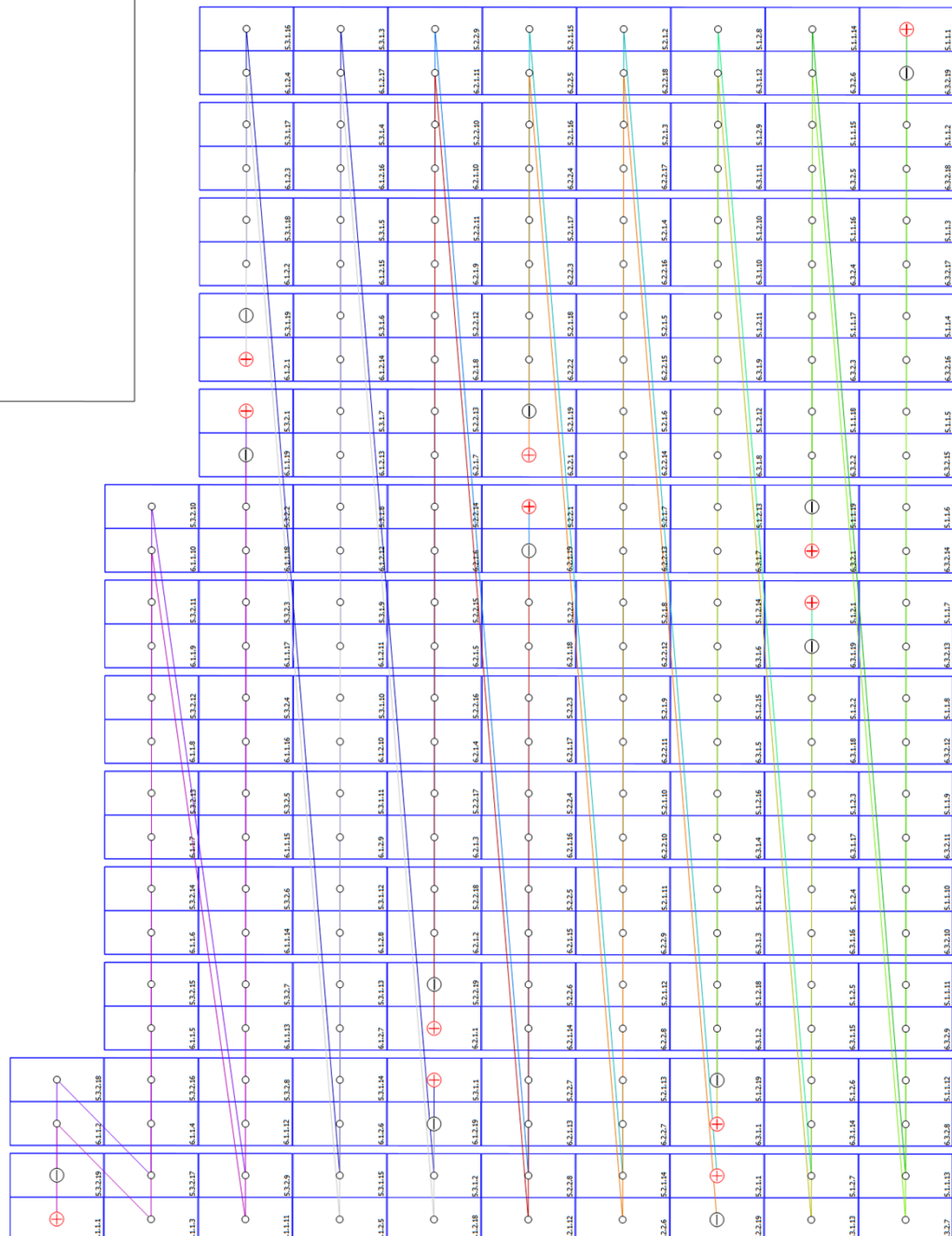


Figure: Building 03 - Roof Area West



Figure: Arbitrary Building 09 - Mounting Surface Southwest





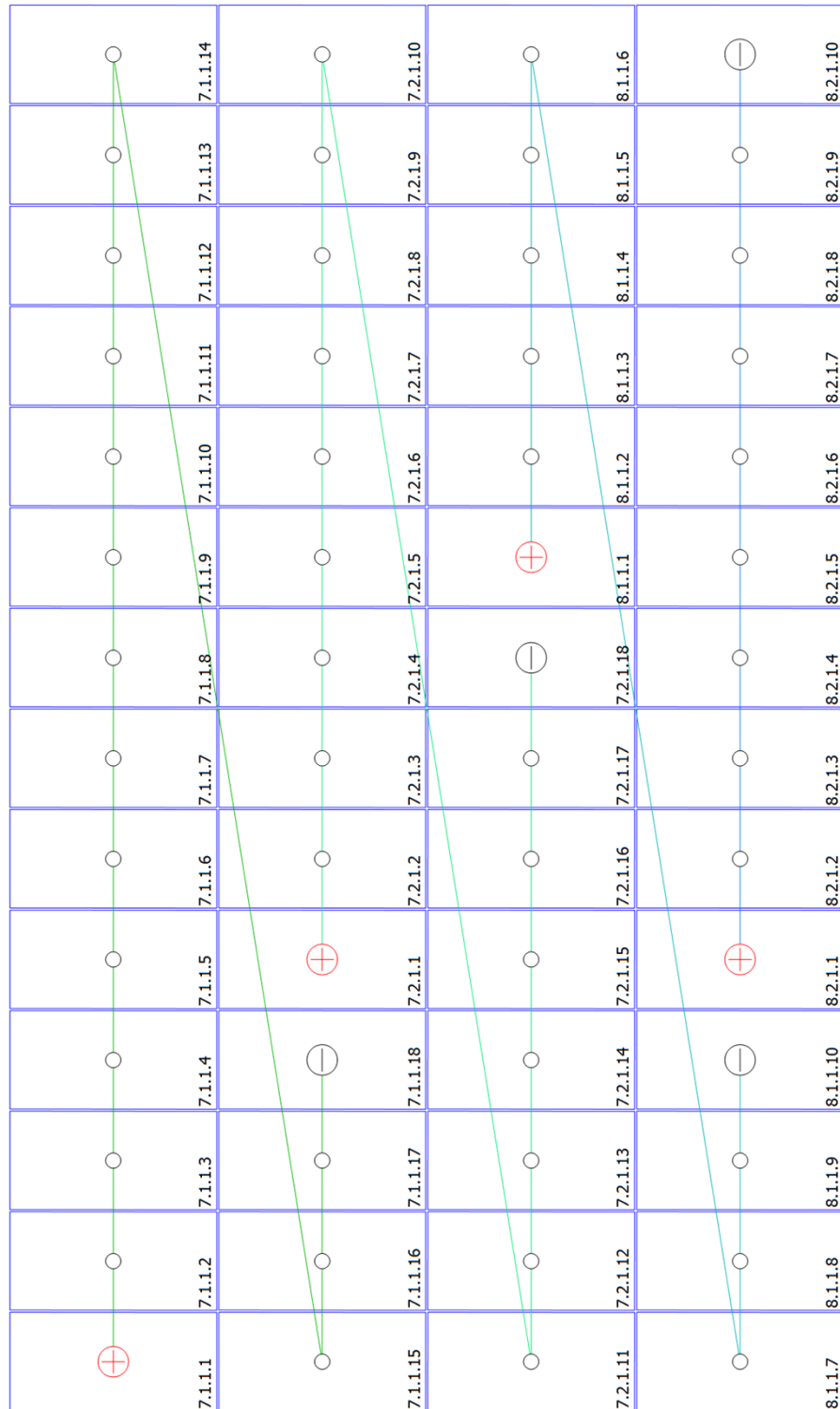


Figure: Building 06 - Roof Area South

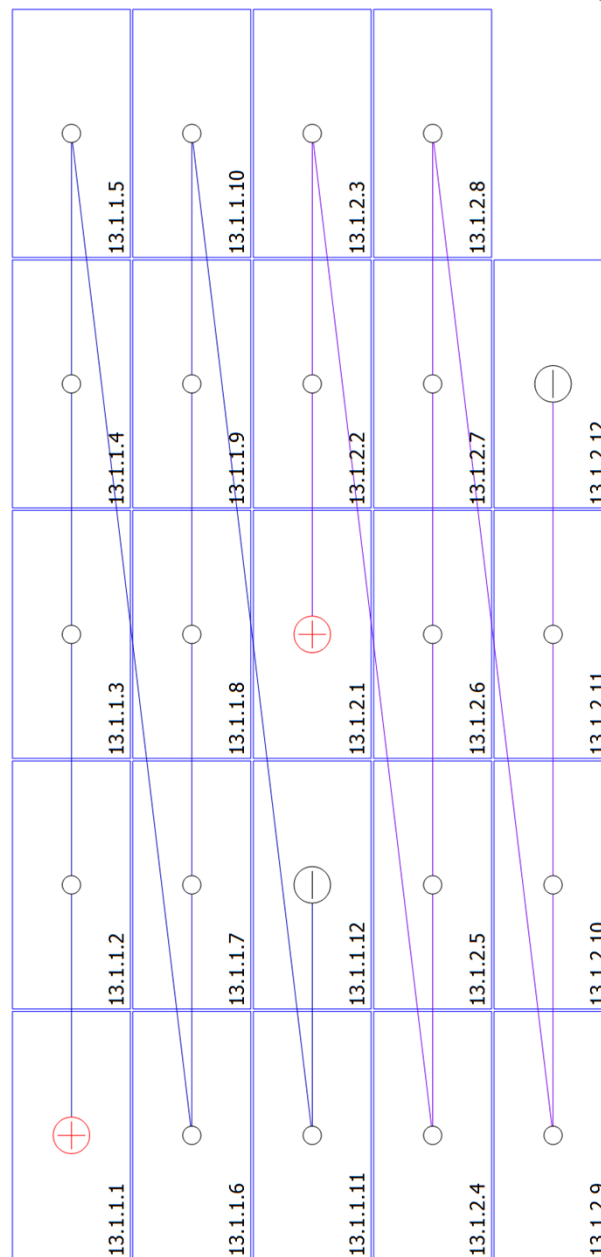


Figure: Arbitrary Building 04 - Mounting Surface West

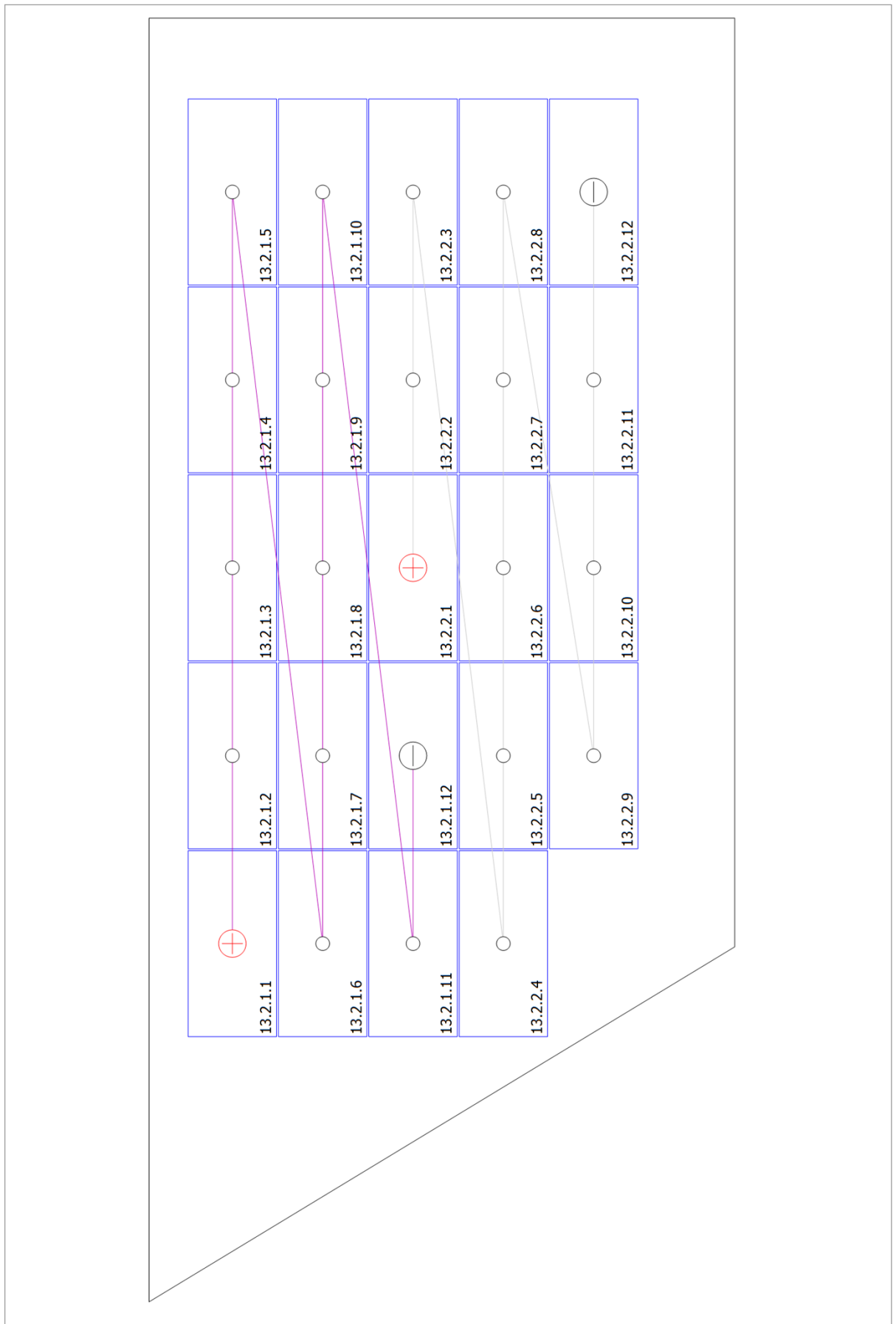


Figure: Arbitrary Building 05 - Mounting Surface East

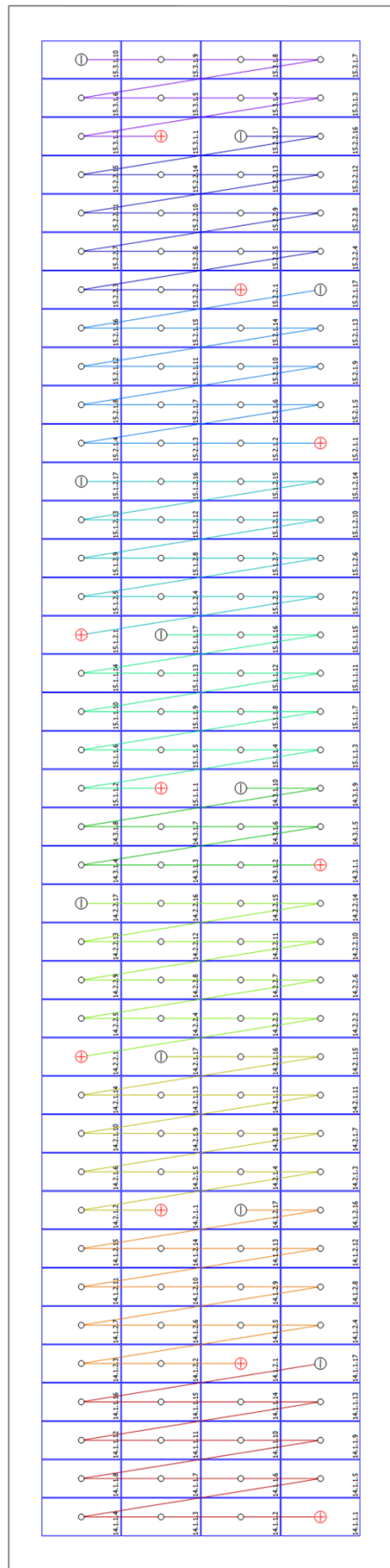


Figure: Building 02 - Roof Area South

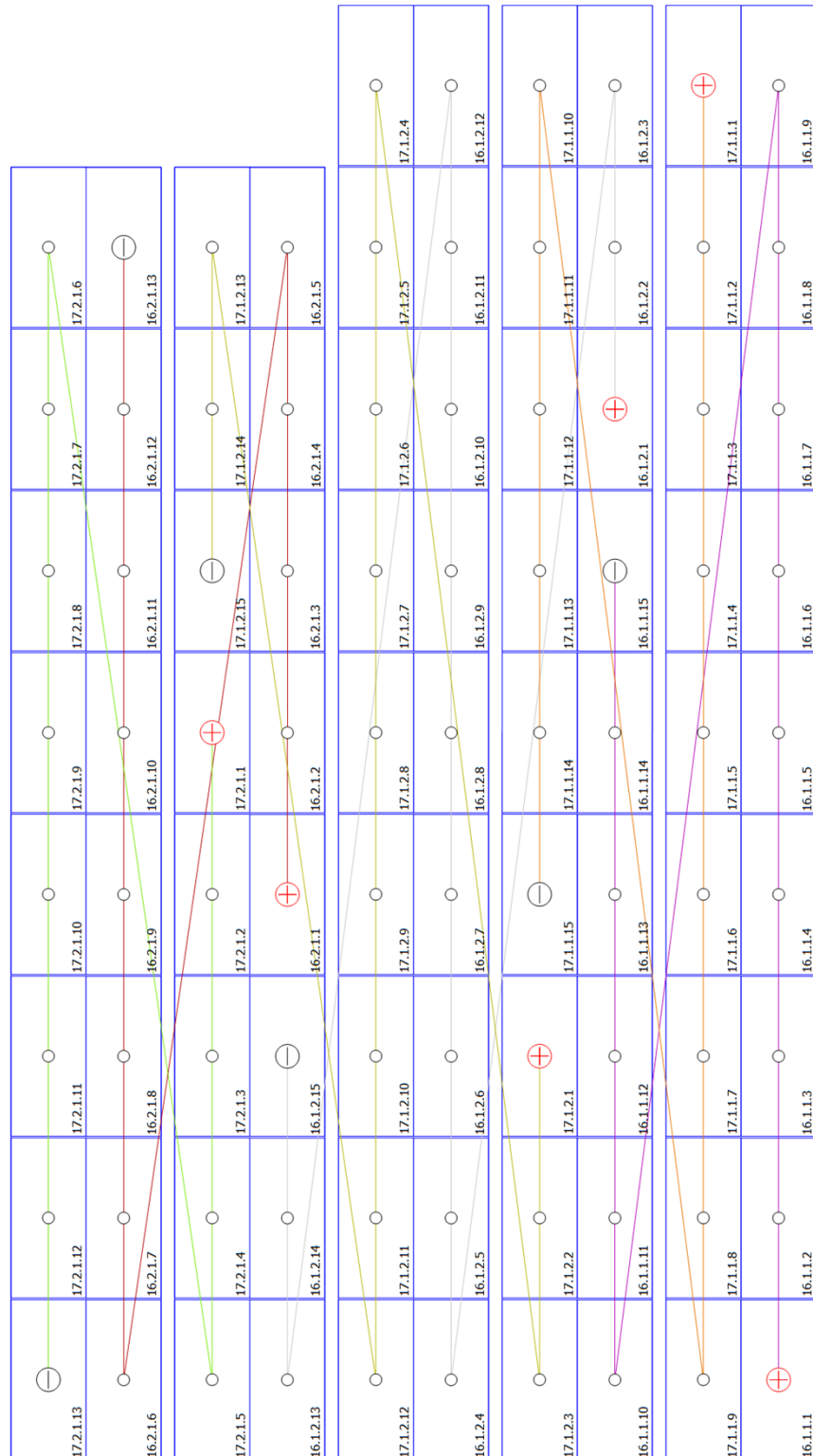


Figure: Building 03 - Roof Area West

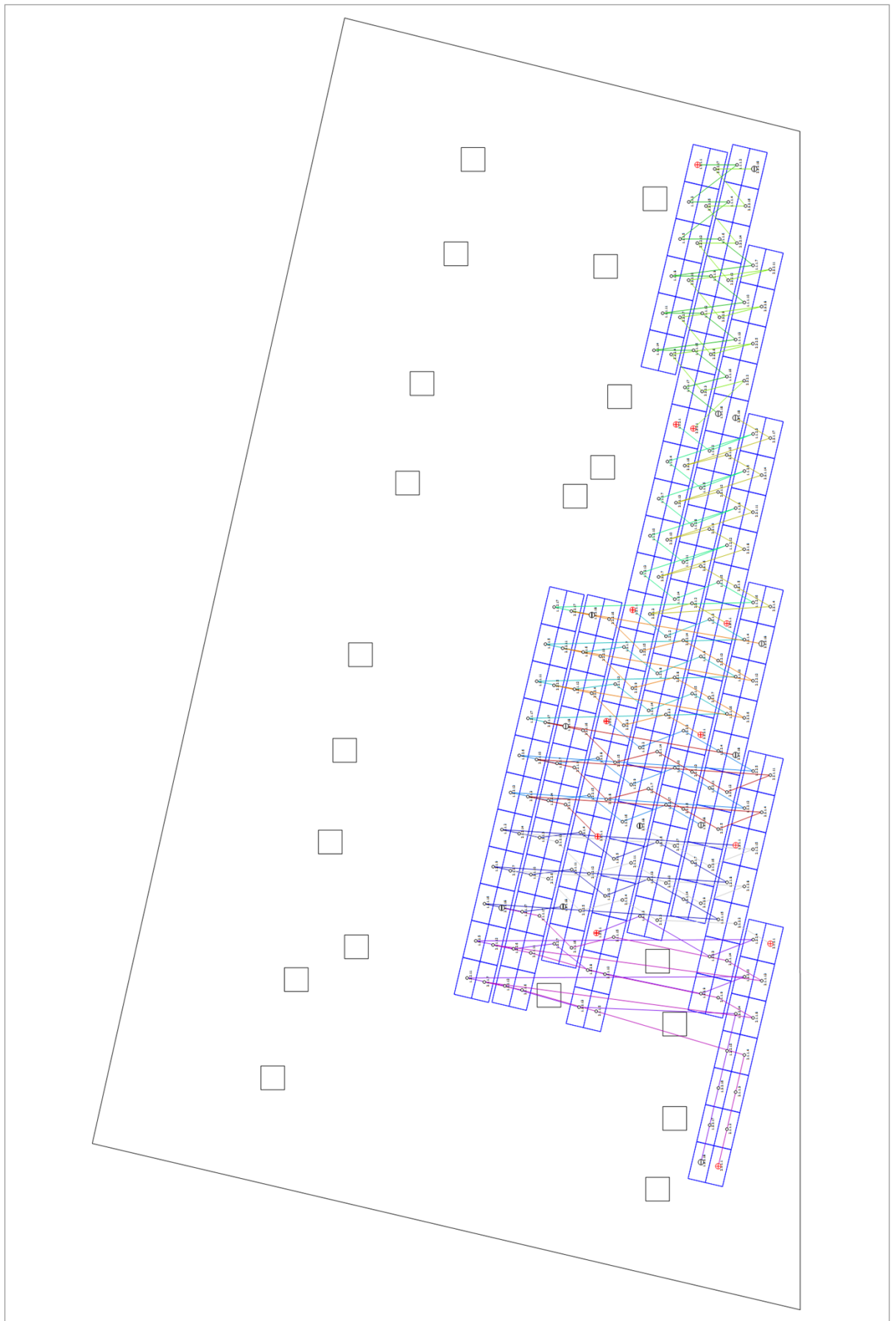


Figure: Arbitrary Building 09 - Mounting Surface Southwest

Parts list

Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		Trina Solar	TSM-580-NEG19RC.20 VERTEX N 2023	858	Piece
2	Inverter		Fronius International	FRONIUS Symo Advanced 20.0-3-M	6	Piece
3	Inverter		Fronius International	Tauro 50-3-D + 30A option	6	Piece
4	Inverter		Fronius International	FRONIUS Symo Advanced 12.5-3-M	1	Piece