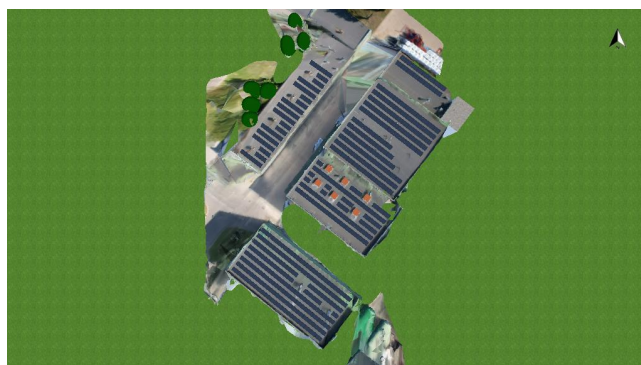


8/4/2023

Your PV system

Address of Installation

Miškininkų g. 7, Vaišvydava
Samylų sen., Kauno r. sav.



Project Overview

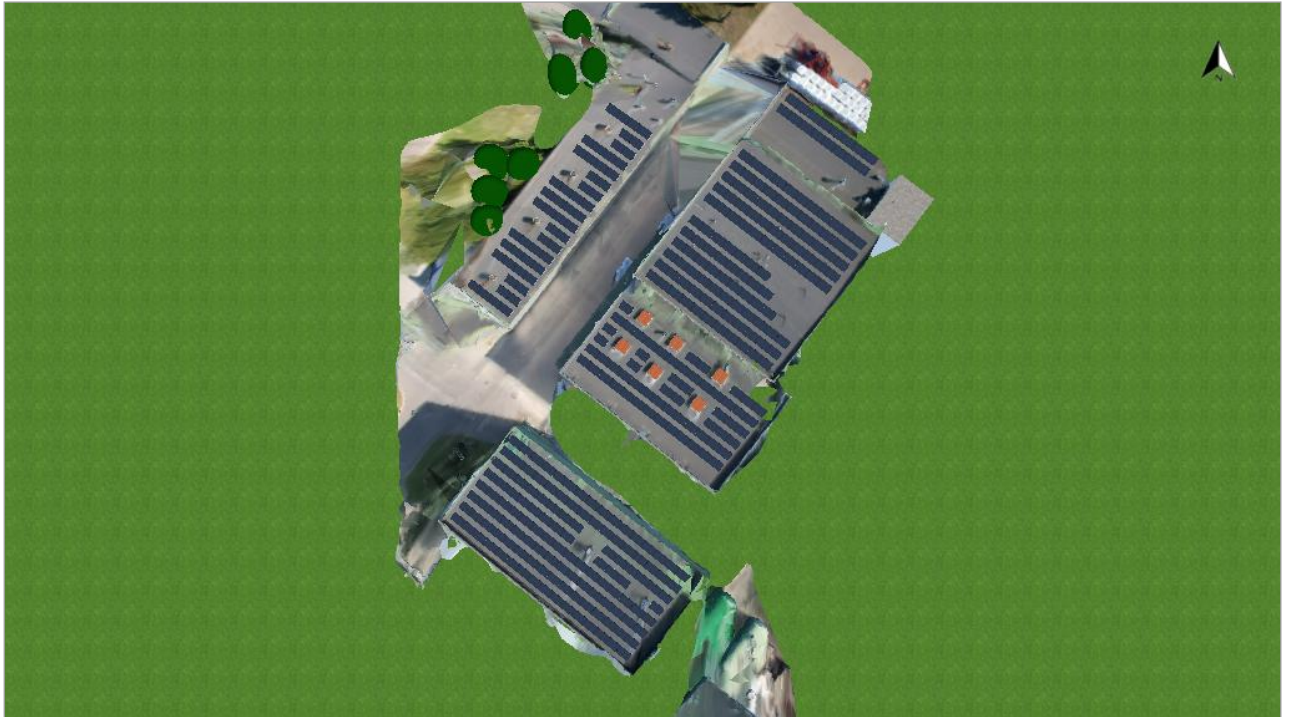


Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV System

Climate Data	Kaunas, LTU (1996 - 2015)
Values source	Meteonorm 8.1
PV Generator Output	151.48 kWp
PV Generator Surface	712.8 m ²
Number of PV Modules	365
Number of Inverters	4

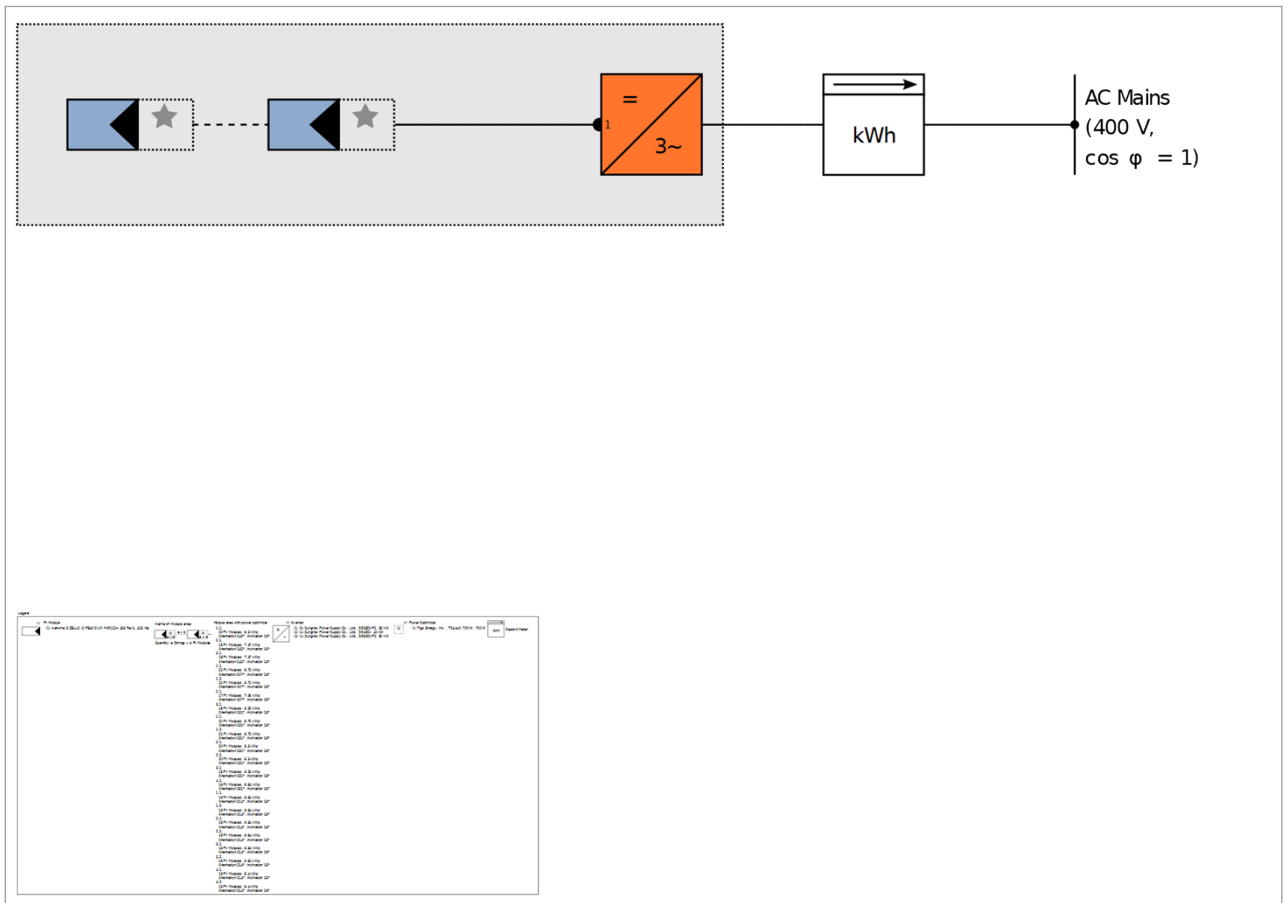


Figure: Schematic diagram

Production Forecast

Production Forecast

PV Generator Output	151.48 kWp
Spec. Annual Yield	939.18 kWh/kWp
Performance Ratio (PR)	86.10 %
Yield Reduction due to Shading	8.1 %
Grid Export	142,374 kWh/Year
Grid Export in the first year (incl. module degradation)	142,374 kWh/Year
Standby Consumption (Inverter)	112 kWh/Year
CO ₂ Emissions avoided	66,863 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
----------------	------------------------------

Climate Data

Location	Kaunas, LTU (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

Module Areas

1. Module Area - 1.1.

PV Generator, 1. Module Area - 1.1.

Name	1.1.
PV Modules	20 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	16 °
Orientation	Southwest 242 °
Installation Type	Mounted - Roof
PV Generator Surface	39.1 m ²

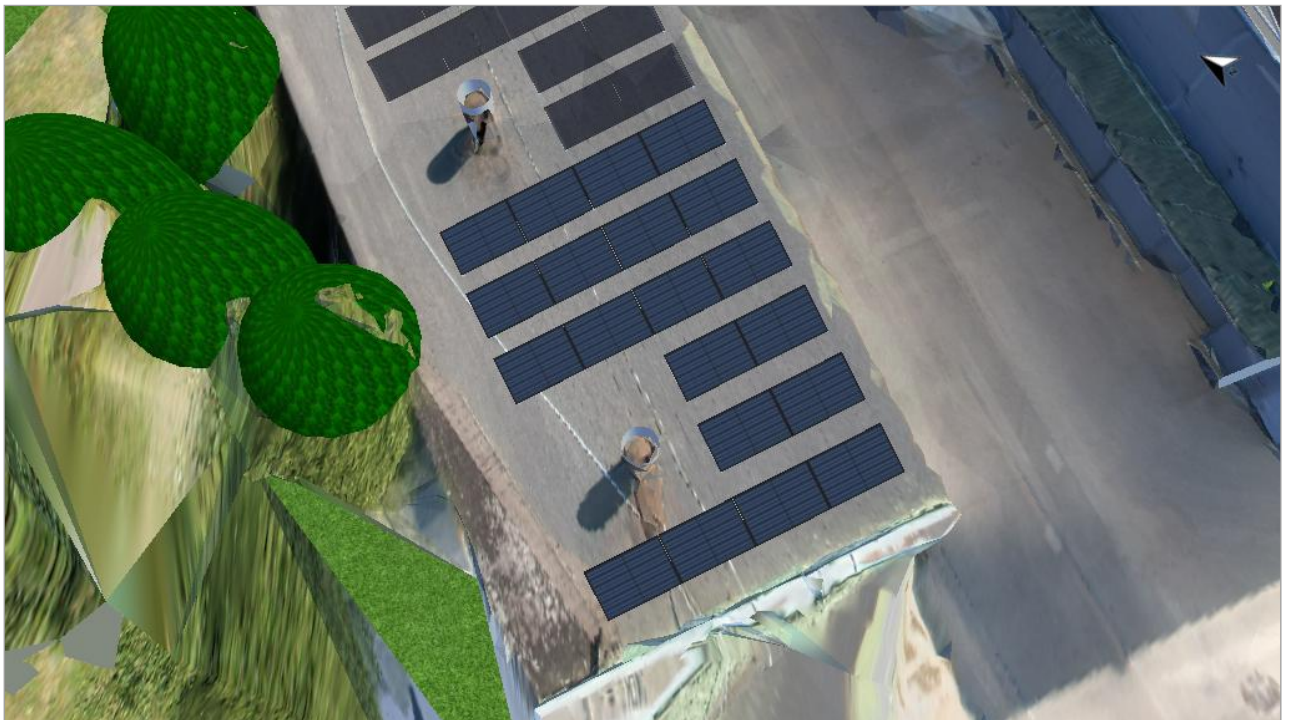


Figure: 1. Module Area - 1.1.

2. Module Area - 2.1.

PV Generator, 2. Module Area - 2.1.

Name	2.1.
PV Modules	18 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	16 °
Orientation	Southwest 242 °
Installation Type	Mounted - Roof
PV Generator Surface	35.1 m ²

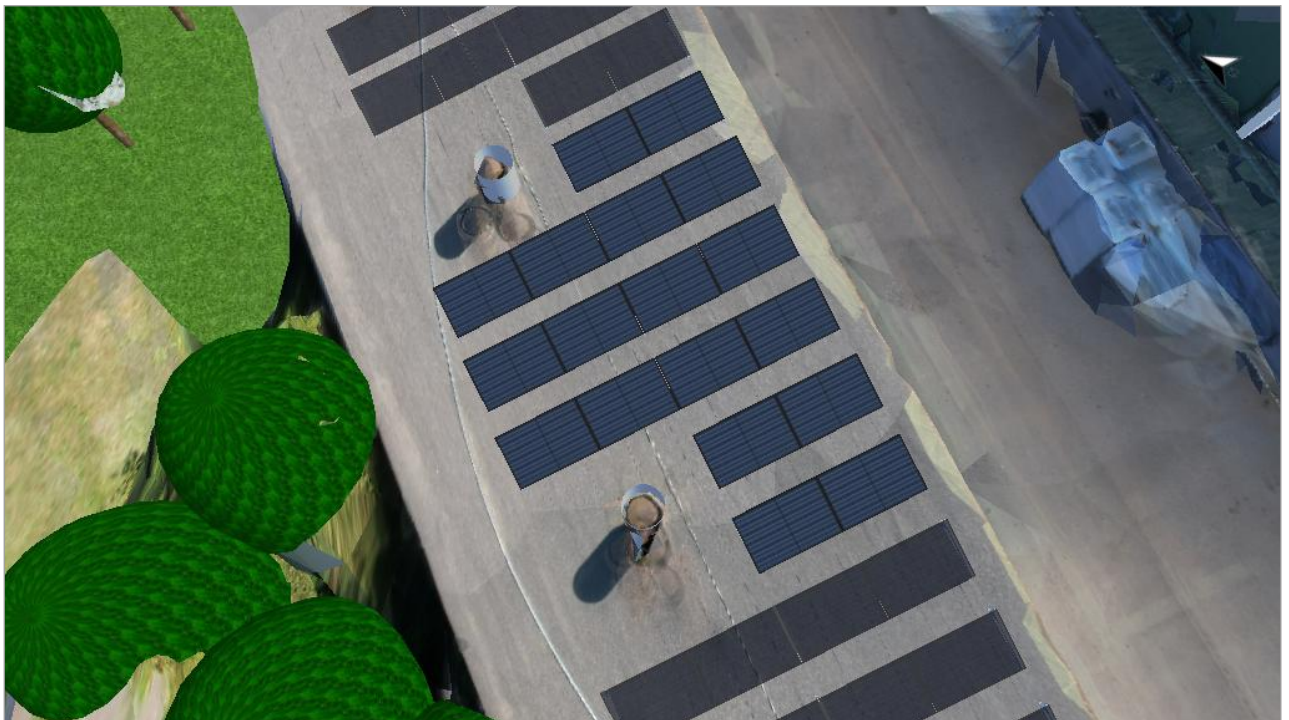


Figure: 2. Module Area - 2.1.

3. Module Area - 3.1.

PV Generator, 3. Module Area - 3.1.

Name	3.1.
PV Modules	18 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	16 °
Orientation	Southwest 242 °
Installation Type	Mounted - Roof
PV Generator Surface	35.1 m ²



Figure: 3. Module Area - 3.1.

4. Module Area - 1.1.

PV Generator, 4. Module Area - 1.1.

Name	1.1.
PV Modules	21 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 207 °
Installation Type	Mounted - Roof
PV Generator Surface	41.0 m ²

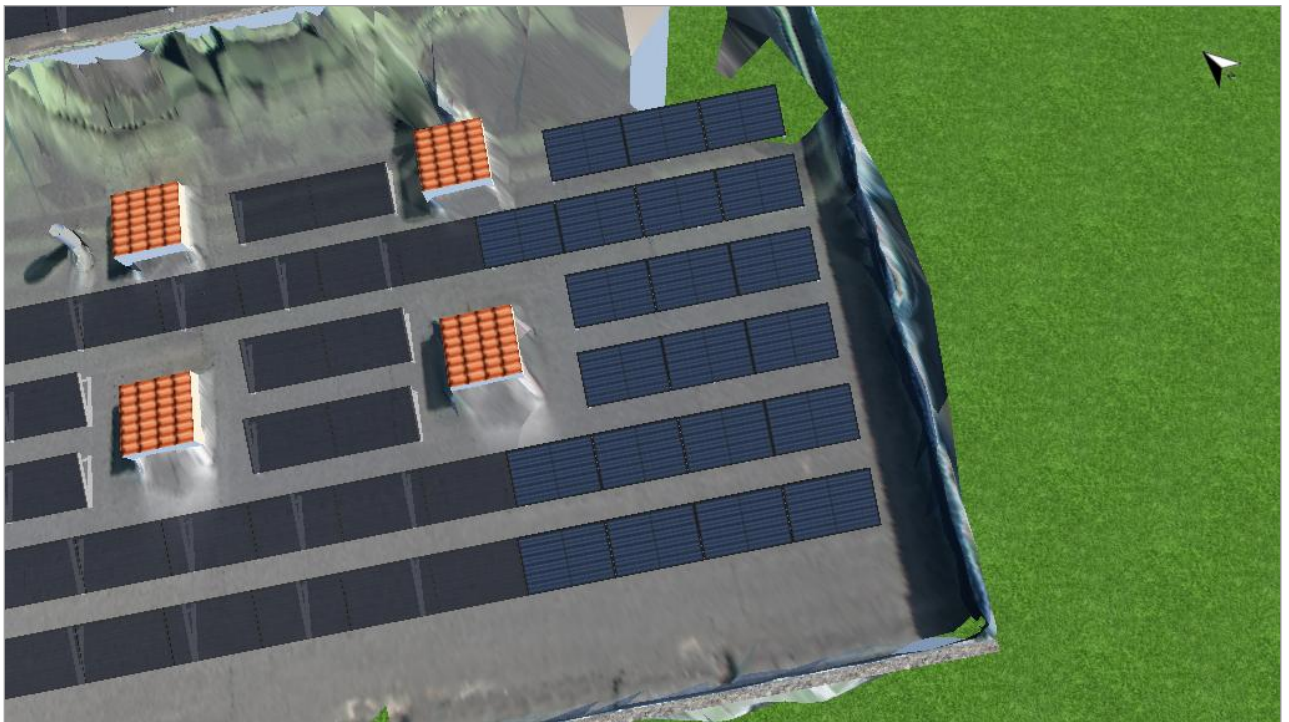


Figure: 4. Module Area - 1.1.

5. Module Area - 1.2.

PV Generator, 5. Module Area - 1.2.

Name	1.2.
PV Modules	21 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 207 °
Installation Type	Mounted - Roof
PV Generator Surface	41.0 m ²



Figure: 5. Module Area - 1.2.

6. Module Area - 2.1.

PV Generator, 6. Module Area - 2.1.

Name	2.1.
PV Modules	17 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 207 °
Installation Type	Mounted - Roof
PV Generator Surface	33.2 m ²

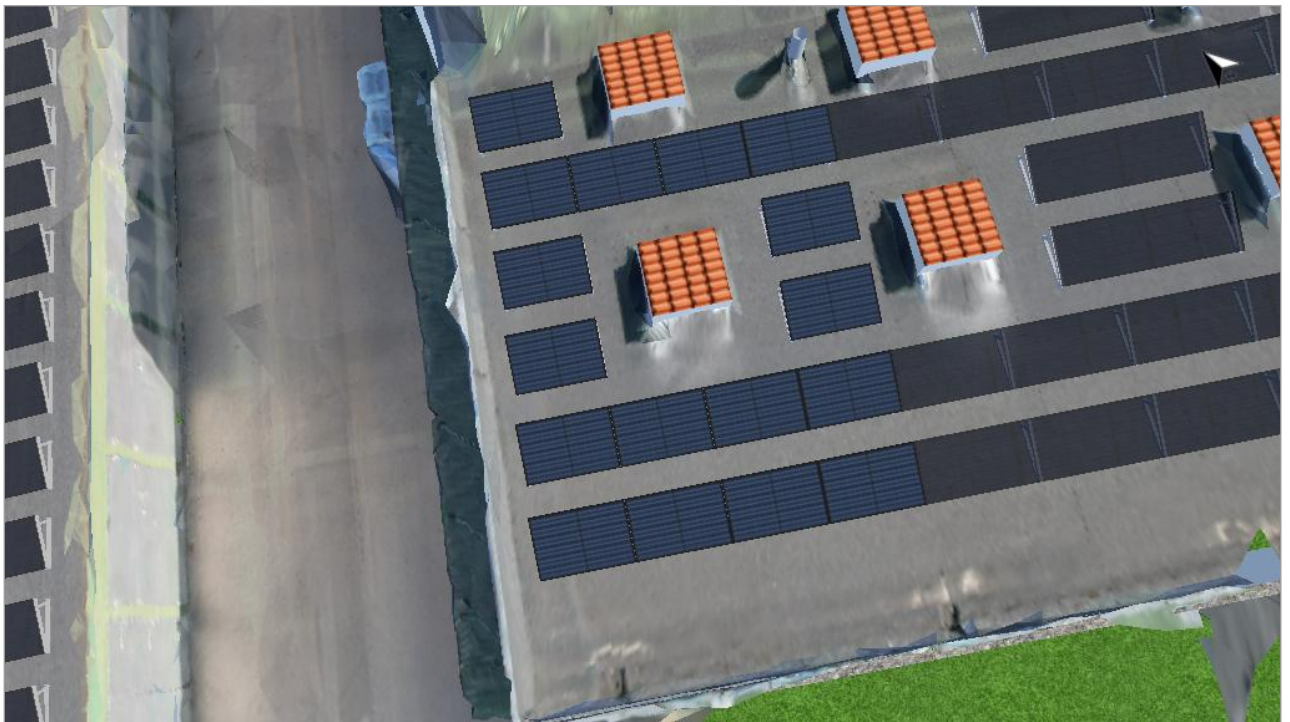


Figure: 6. Module Area - 2.1.

7. Module Area - 3.1.

PV Generator, 7. Module Area - 3.1.

Name		3.1.
PV Modules	15 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)	
Manufacturer		Hanwha Q.CELLS
Inclination		15 °
Orientation		Southwest 231 °
Installation Type		Mounted - Roof
PV Generator Surface		29.3 m ²

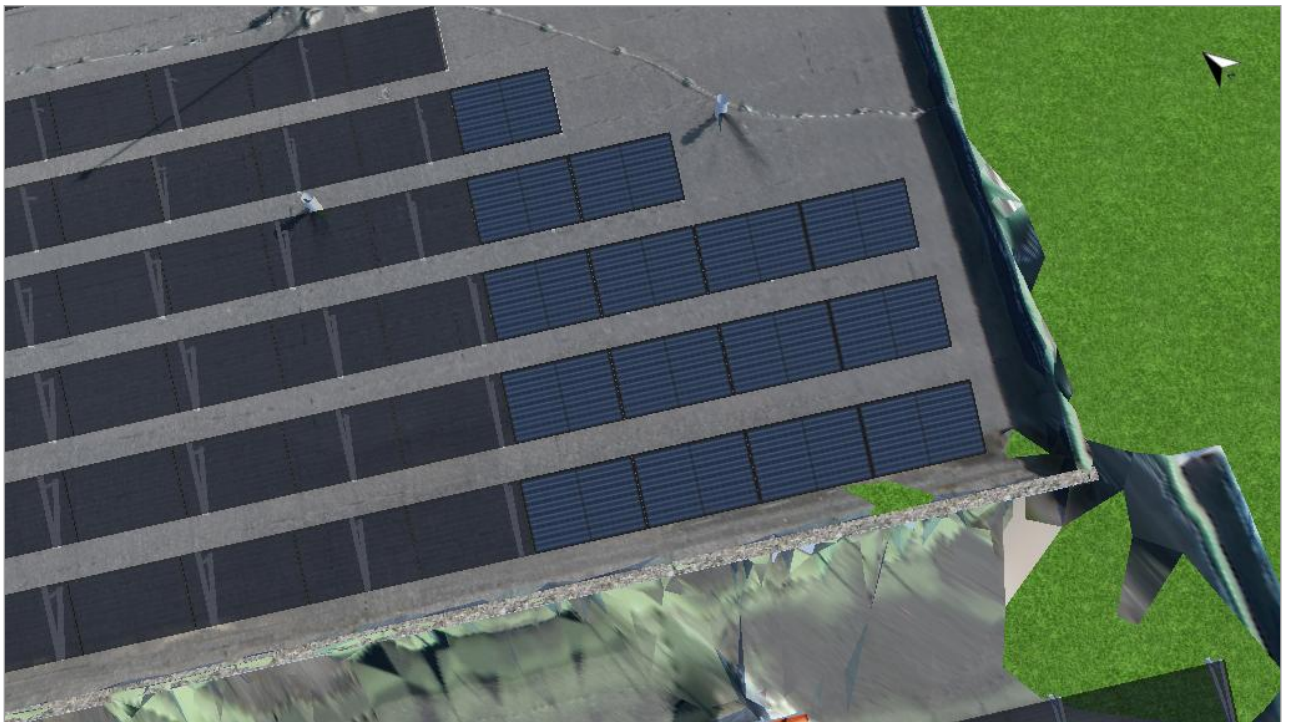


Figure: 7. Module Area - 3.1.

8. Module Area - 1.1.

PV Generator, 8. Module Area - 1.1.

Name		1.1.
PV Modules	21 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)	
Manufacturer		Hanwha Q.CELLS
Inclination		15 °
Orientation		Southwest 231 °
Installation Type		Mounted - Roof
PV Generator Surface		41.0 m ²

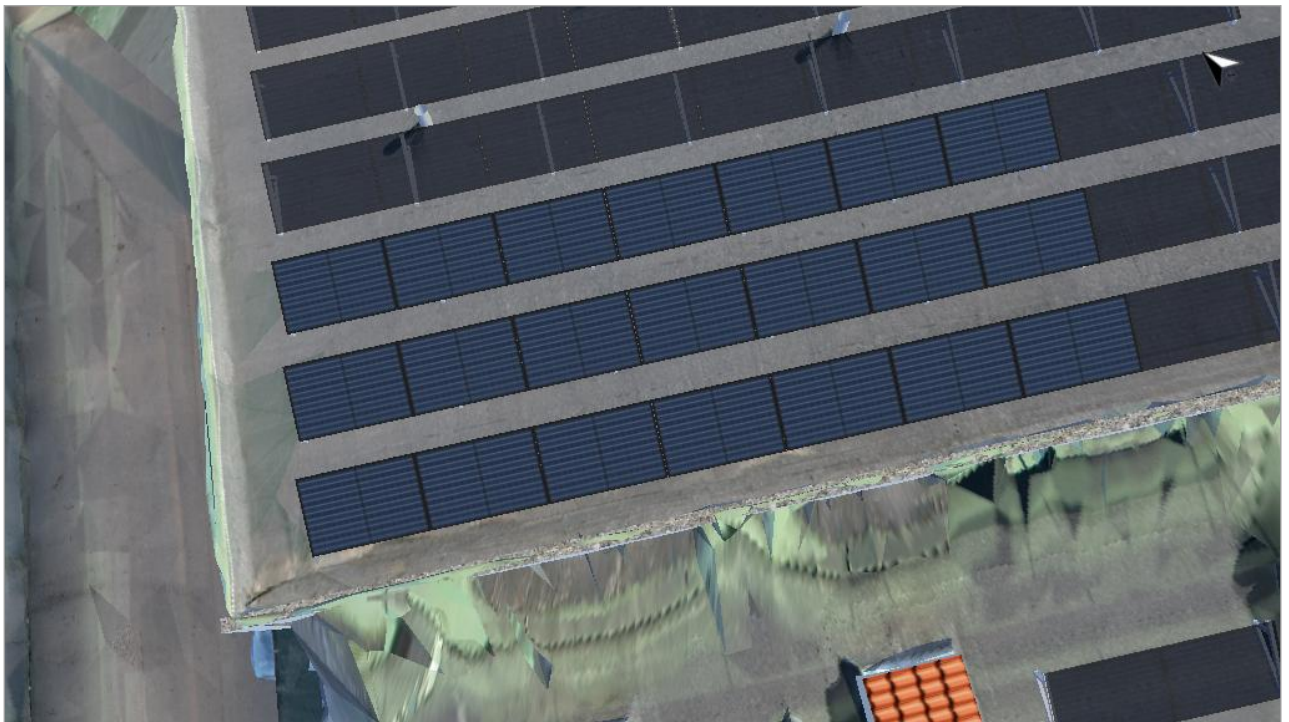


Figure: 8. Module Area - 1.1.

9. Module Area - 1.2.

PV Generator, 9. Module Area - 1.2.

Name	1.2.
PV Modules	21 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 231 °
Installation Type	Mounted - Roof
PV Generator Surface	41.0 m ²

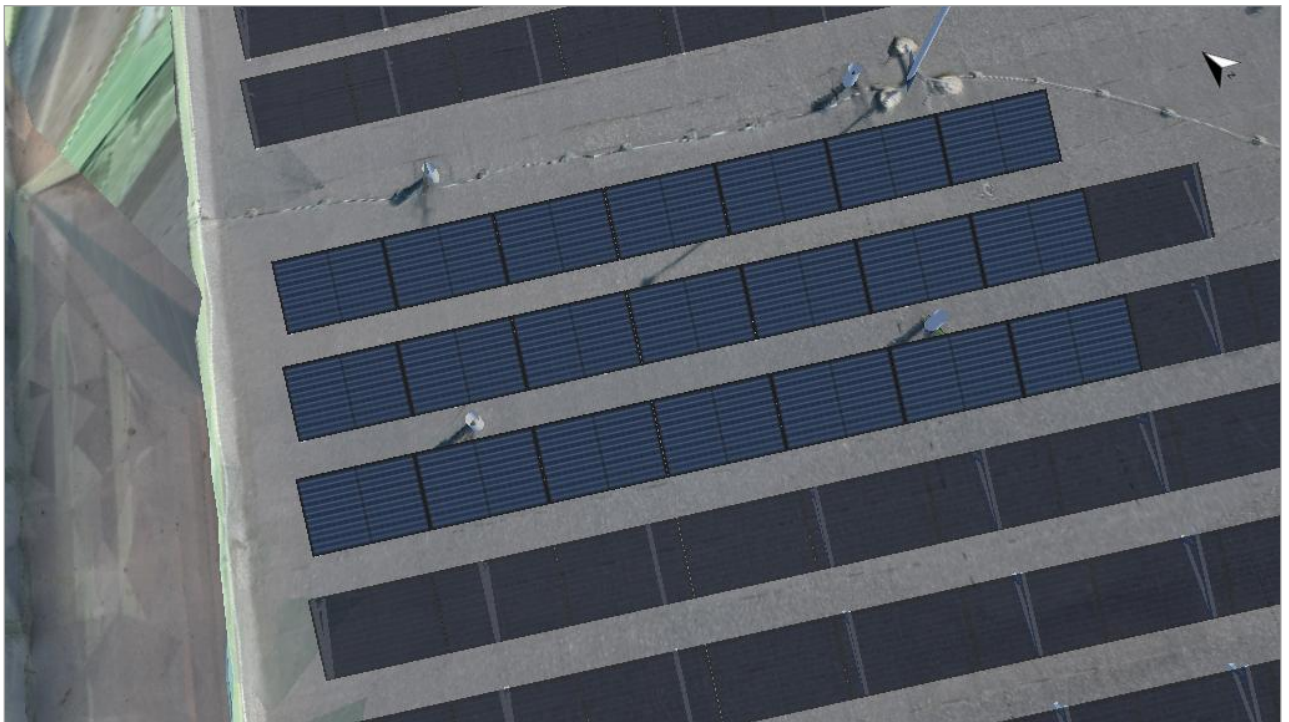


Figure: 9. Module Area - 1.2.

10. Module Area - 2.1.

PV Generator, 10. Module Area - 2.1.

Name	2.1.
PV Modules	20 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 231 °
Installation Type	Mounted - Roof
PV Generator Surface	39.1 m ²

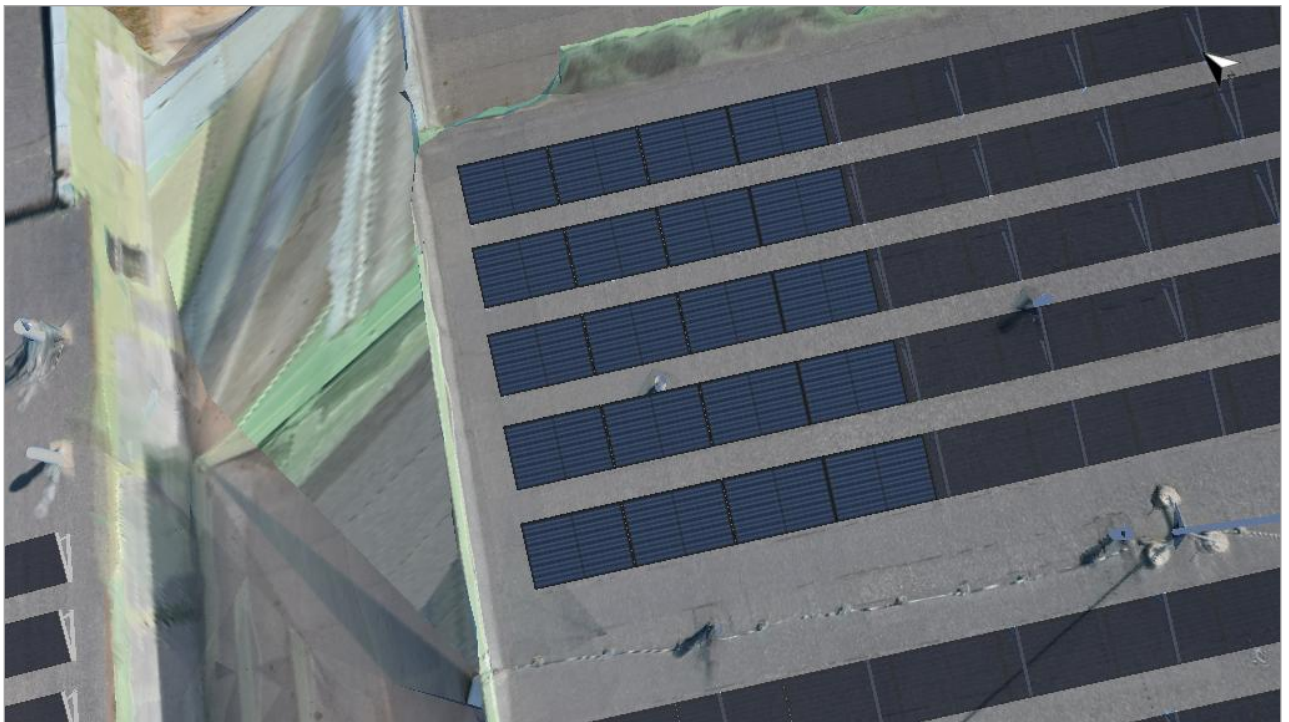


Figure: 10. Module Area - 2.1.

11. Module Area - 2.2.

PV Generator, 11. Module Area - 2.2.

Name	2.2.
PV Modules	20 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 231 °
Installation Type	Mounted - Roof
PV Generator Surface	39.1 m ²

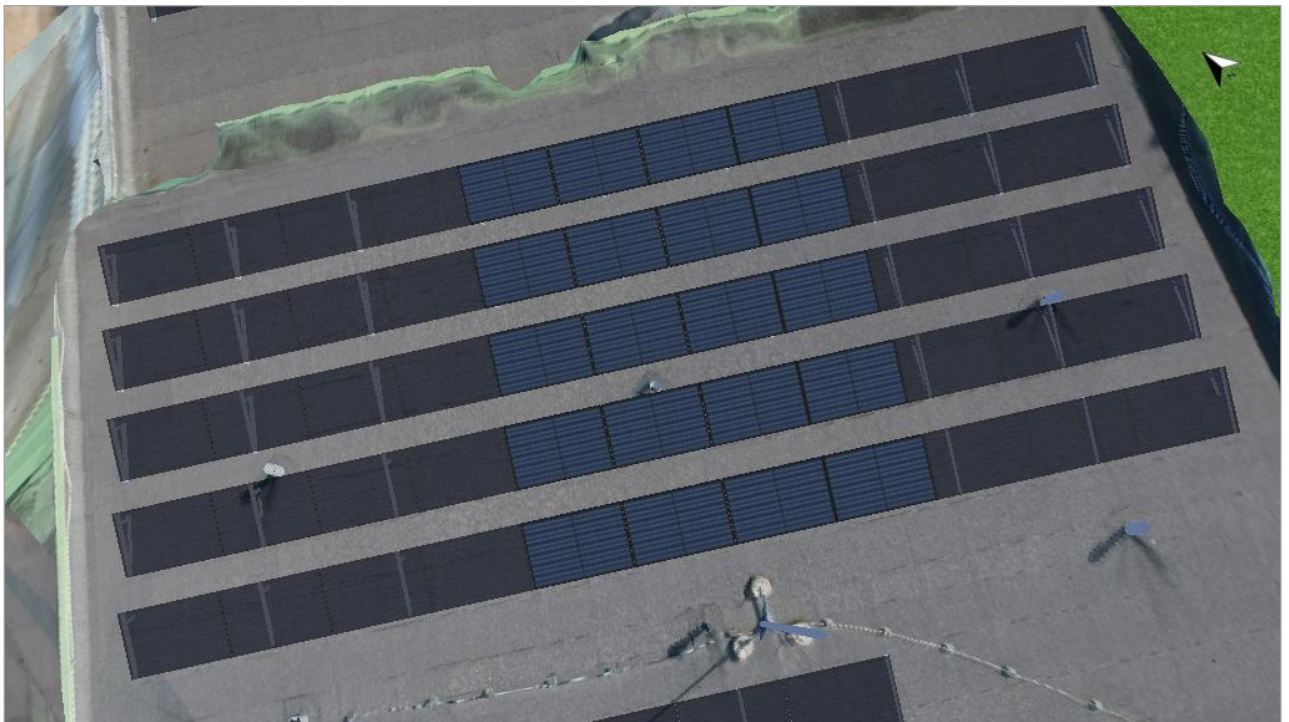


Figure: 11. Module Area - 2.2.

12. Module Area - 3.1.

PV Generator, 12. Module Area - 3.1.

Name	3.1.
PV Modules	15 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 231 °
Installation Type	Mounted - Roof
PV Generator Surface	29.3 m ²

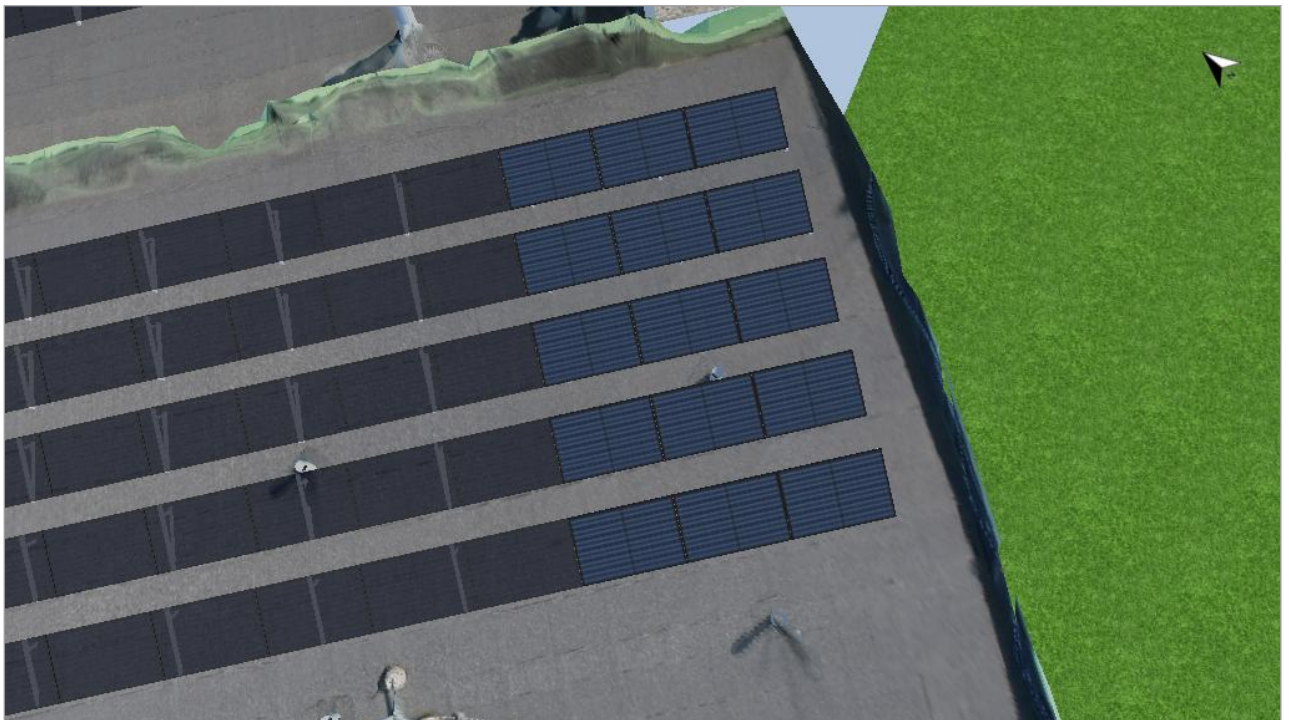


Figure: 12. Module Area - 3.1.

13. Module Area - 4.1.

PV Generator, 13. Module Area - 4.1.

Name	4.1.
PV Modules	16 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	West 251 °
Installation Type	Mounted - Roof
PV Generator Surface	31.2 m ²

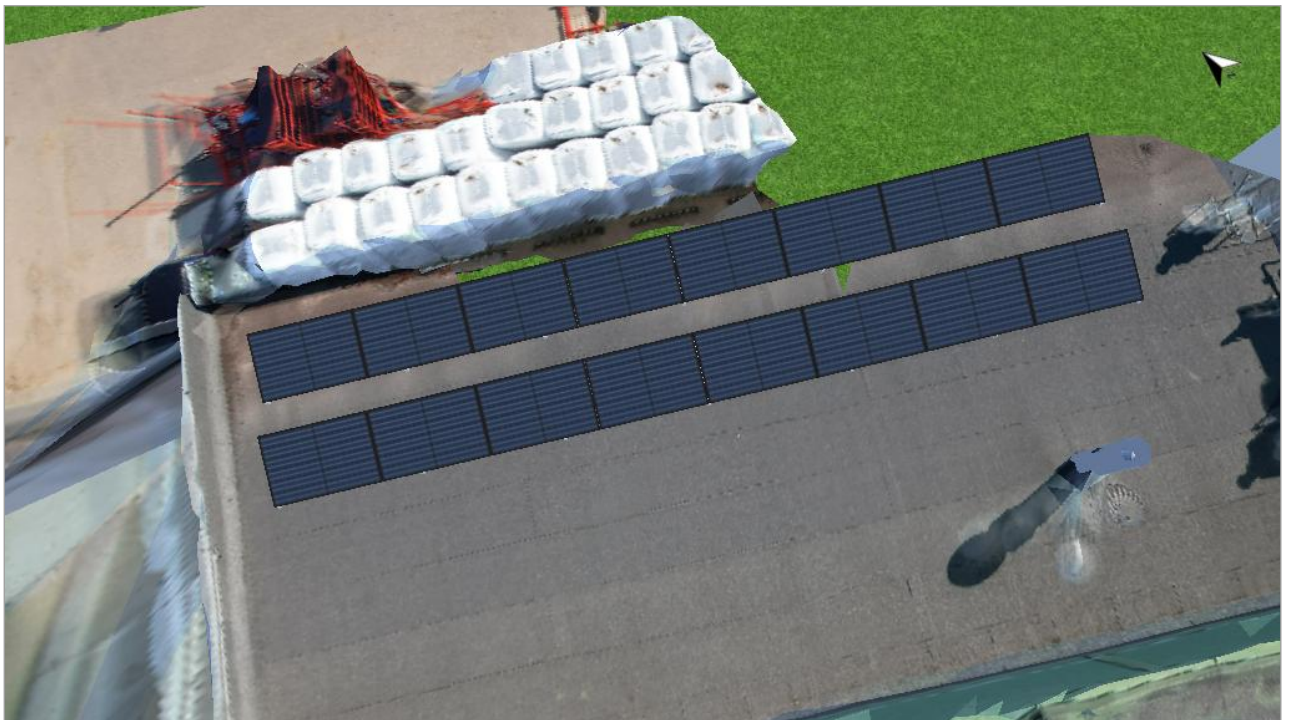


Figure: 13. Module Area - 4.1.

14. Module Area - 1.1.

PV Generator, 14. Module Area - 1.1.

Name	1.1.
PV Modules	16 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 214 °
Installation Type	Mounted - Roof
PV Generator Surface	31.2 m ²

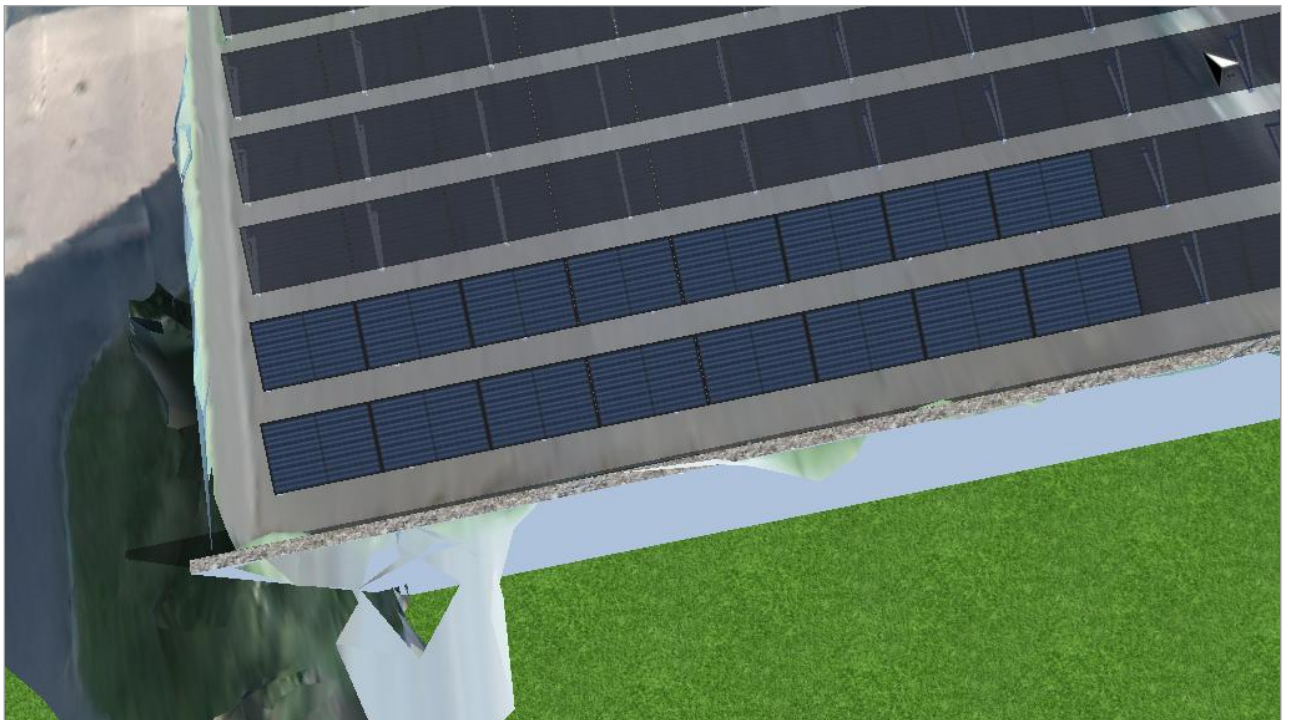


Figure: 14. Module Area - 1.1.

15. Module Area - 1.2.

PV Generator, 15. Module Area - 1.2.

Name	1.2.
PV Modules	16 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 214 °
Installation Type	Mounted - Roof
PV Generator Surface	31.2 m ²

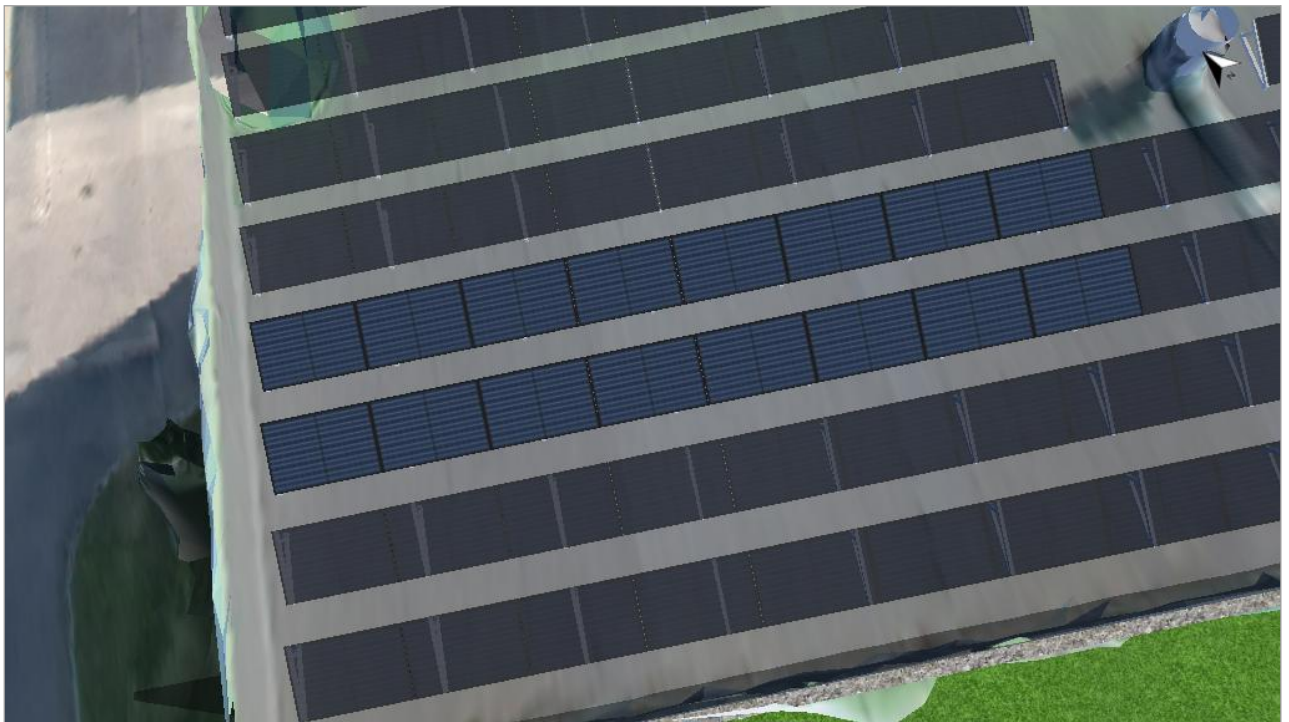


Figure: 15. Module Area - 1.2.

16. Module Area - 2.1.

PV Generator, 16. Module Area - 2.1.

Name	2.1.
PV Modules	16 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 214 °
Installation Type	Mounted - Roof
PV Generator Surface	31.2 m ²

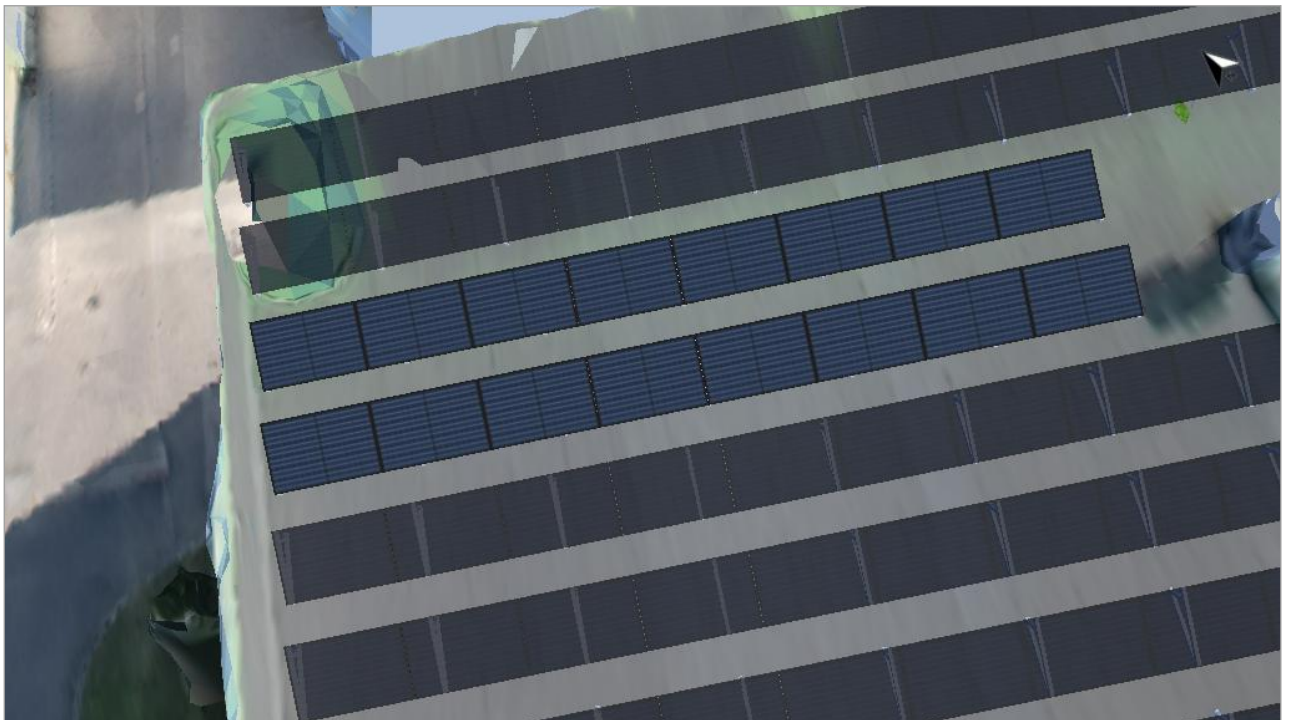


Figure: 16. Module Area - 2.1.

17. Module Area - 2.2.

PV Generator, 17. Module Area - 2.2.

Name	2.2.
PV Modules	16 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 214 °
Installation Type	Mounted - Roof
PV Generator Surface	31.2 m ²

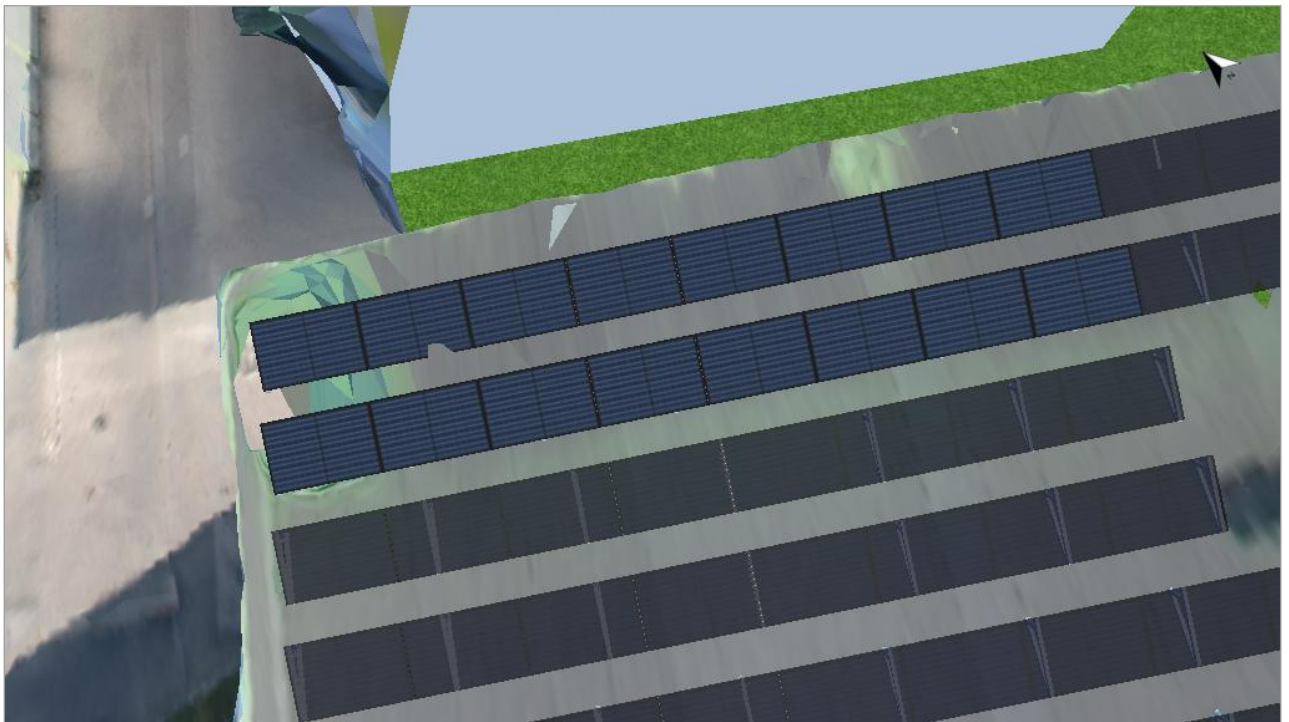


Figure: 17. Module Area - 2.2.

18. Module Area - 3.1.

PV Generator, 18. Module Area - 3.1.

Name	3.1.
PV Modules	16 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 214 °
Installation Type	Mounted - Roof
PV Generator Surface	31.2 m ²

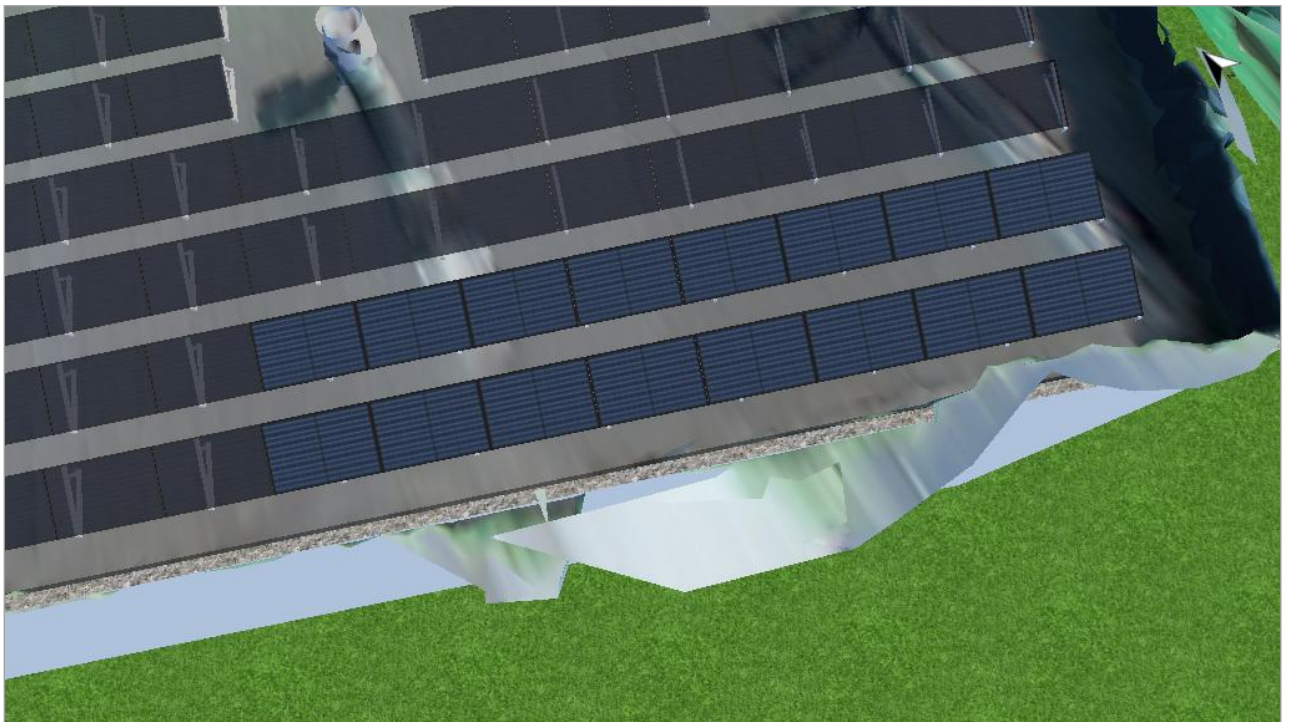


Figure: 18. Module Area - 3.1.

19. Module Area - 3.2.

PV Generator, 19. Module Area - 3.2.

Name	3.2.
PV Modules	16 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 214 °
Installation Type	Mounted - Roof
PV Generator Surface	31.2 m ²

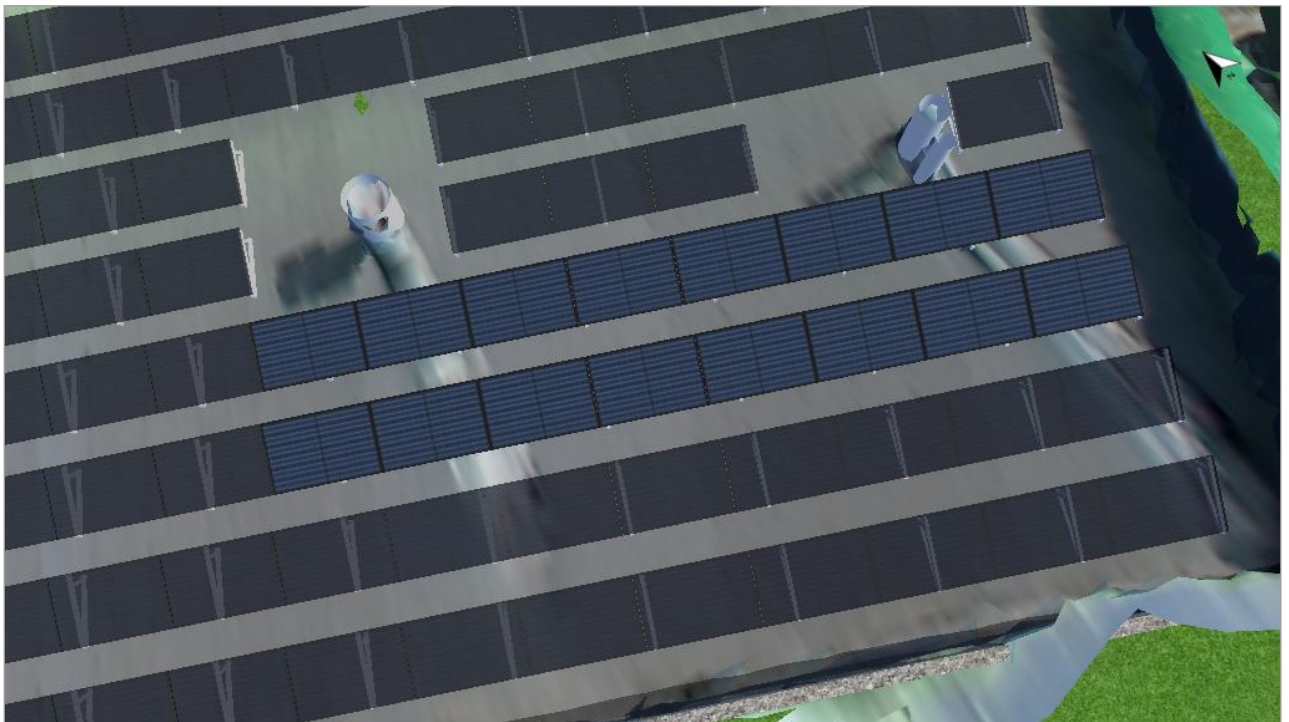


Figure: 19. Module Area - 3.2.

20. Module Area - 4.1.

PV Generator, 20. Module Area - 4.1.

Name	4.1.
PV Modules	13 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 214 °
Installation Type	Mounted - Roof
PV Generator Surface	25.4 m ²

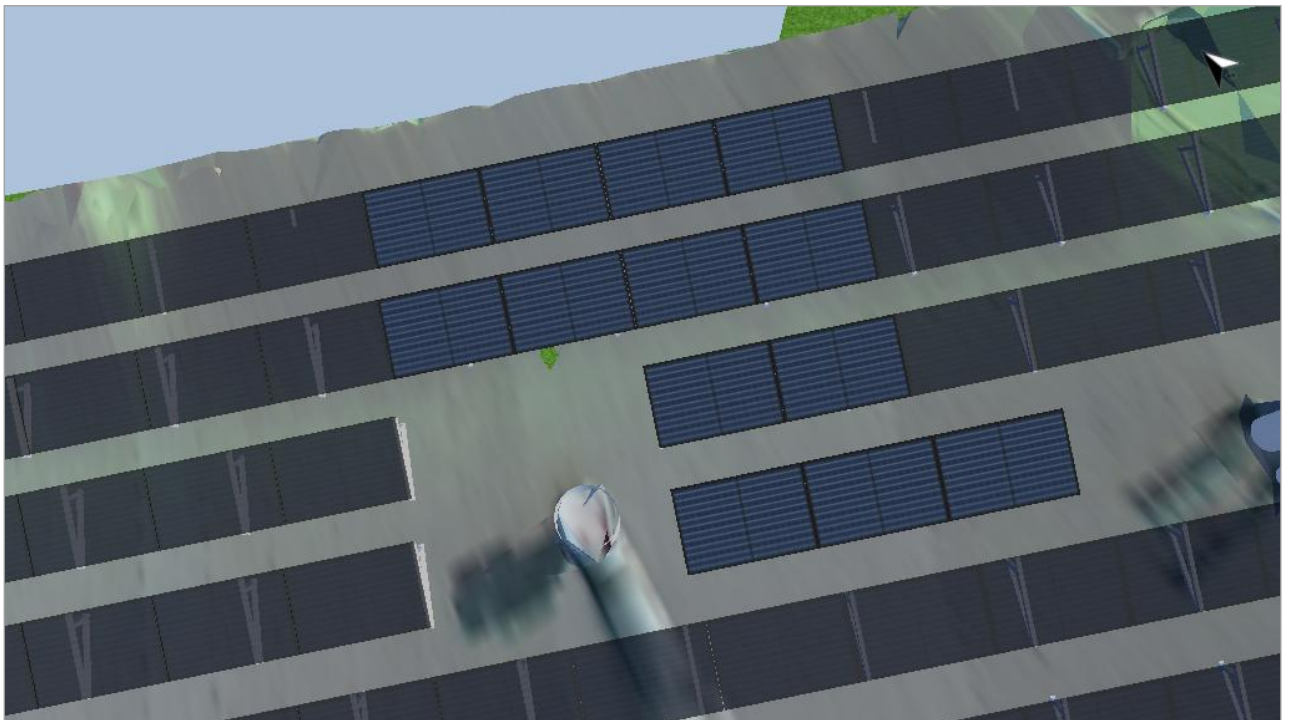


Figure: 20. Module Area - 4.1.

21. Module Area - 4.2.

PV Generator, 21. Module Area - 4.2.

Name	4.2.
PV Modules	13 x Q.PEAK DUO M-G11S+ 415 Rev1 (v1)
Manufacturer	Hanwha Q.CELLS
Inclination	15 °
Orientation	Southwest 214 °
Installation Type	Mounted - Roof
PV Generator Surface	25.4 m ²

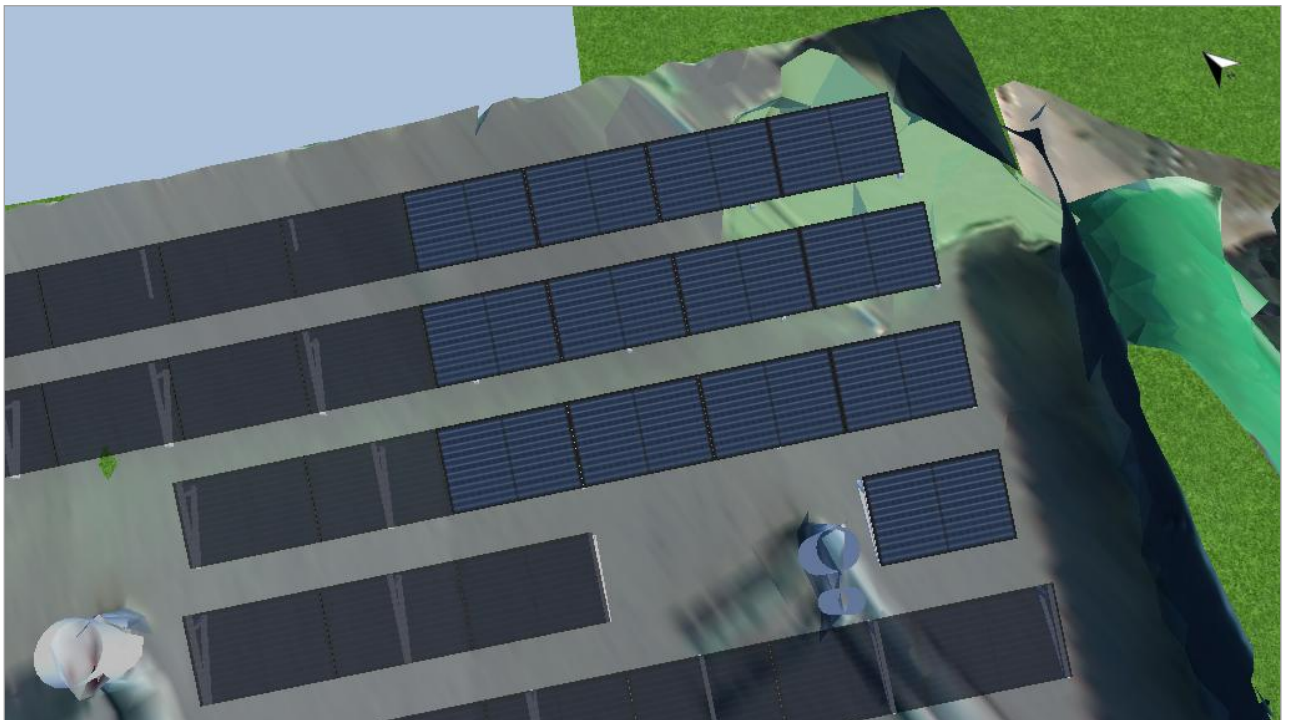


Figure: 21. Module Area - 4.2.

Horizon Line, 3D Design

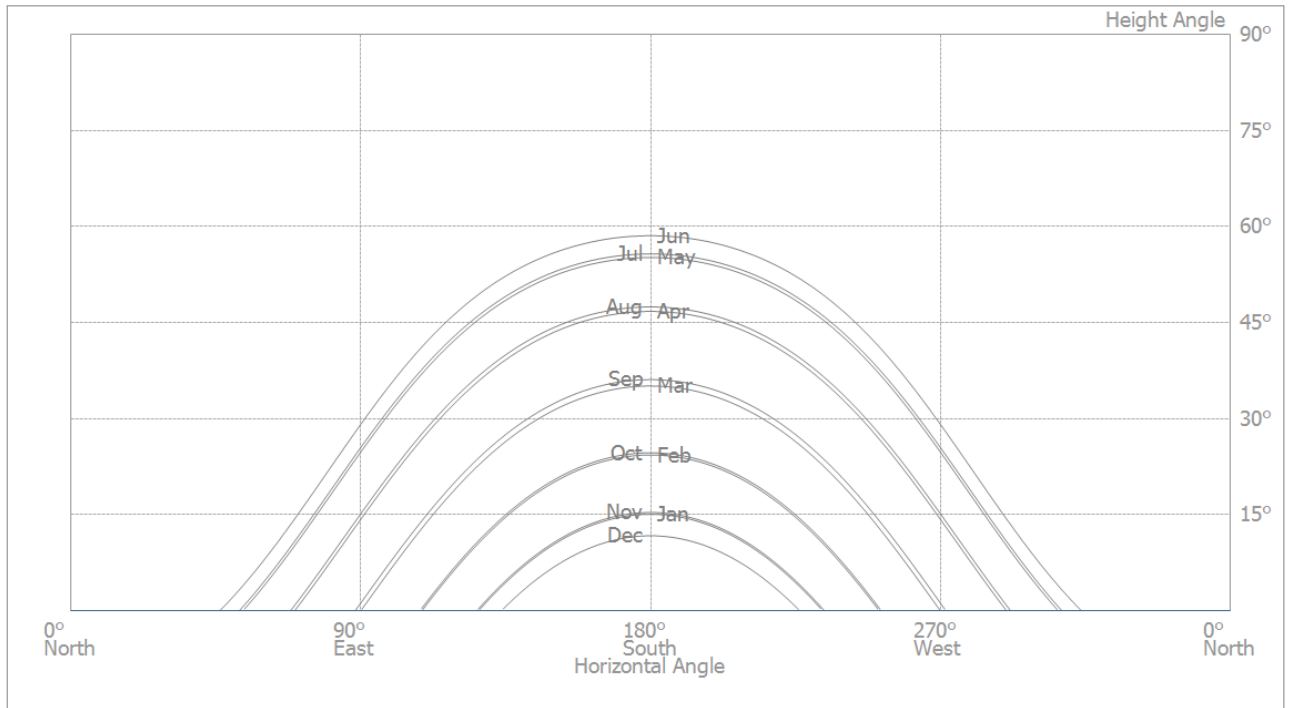


Figure: Horizon (3D Design)

Inverter configuration

Configuration 1

Module Areas	1.1. + 2.1. + 3.1.
Inverter 1	
Model	SG33CX-P2 (v1)
Manufacturer	Sungrow Power Supply Co., Ltd.
Quantity	1
Sizing Factor	70.4 %
Configuration	MPP 1: 1 x 20 MPP 2: 1 x 18 MPP 3: 1 x 18

Configuration 2

Module Areas	1.1. + 1.2. + 2.1. + 3.1.
Inverter 1	
Model	SG33CX-P2 (v1)
Manufacturer	Sungrow Power Supply Co., Ltd.
Quantity	1
Sizing Factor	93.1 %
Configuration	MPP 1: 1 x 21 1 x 21 MPP 2: 1 x 17 MPP 3: 1 x 15

Configuration 3

Module Areas	1.1. + 1.2. + 2.1. + 2.2. + 3.1. + 4.1.
Inverter 1	
Model	SG40CX (v3)
Manufacturer	Sungrow Power Supply Co., Ltd.
Quantity	1
Sizing Factor	117.2 %
Configuration	MPP 1: 1 x 21 1 x 21 MPP 2: 1 x 20 1 x 1 + 1 x 2☆ [1 x 1] + 1 x 17 MPP 3: 1 x 15 MPP 4: 1 x 16
Power Optimizer	2x Tigo Energy, Inc. , TS4-A-O 700 W (v2)

Configuration 4

Module Areas	1.1. + 1.2. + 2.1. + 2.2. + 3.1. + 3.2. + 4.1. + 4.2.
Inverter 1	
Model	SG50CX-P2 (v1)
Manufacturer	Sungrow Power Supply Co., Ltd.
Quantity	1
Sizing Factor	101.3 %
Configuration	MPP 1: 1 x 8 + 1 x 8☆ [1 x 1] 1 x 16 MPP 2: 1 x 16 1 x 16 MPP 3: 1 x 8 + 1 x 8☆ [1 x 1] 1 x 16 MPP 4: 1 x 13 1 x 13
Power Optimizer	16x Tigo Energy, Inc. , TS4-A-O 700 W (v2)

AC Mains

AC Mains

Number of Phases	3
Mains voltage between phase and neutral	400 V
Displacement Power Factor (cos phi)	+/- 1

Simulation Results

Results Total System

PV System

PV Generator Output	151.48 kWp
Spec. Annual Yield	939.18 kWh/kWp
Performance Ratio (PR)	86.10 %
Yield Reduction due to Shading	8.1 %
Grid Export	142,374 kWh/Year
Grid Export in the first year (incl. module degradation)	142,374 kWh/Year
Standby Consumption (Inverter)	112 kWh/Year
CO ₂ Emissions avoided	66,863 kg / year

Energy Flow Graph

Project: 2 objektas



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

Figure: Energy flow

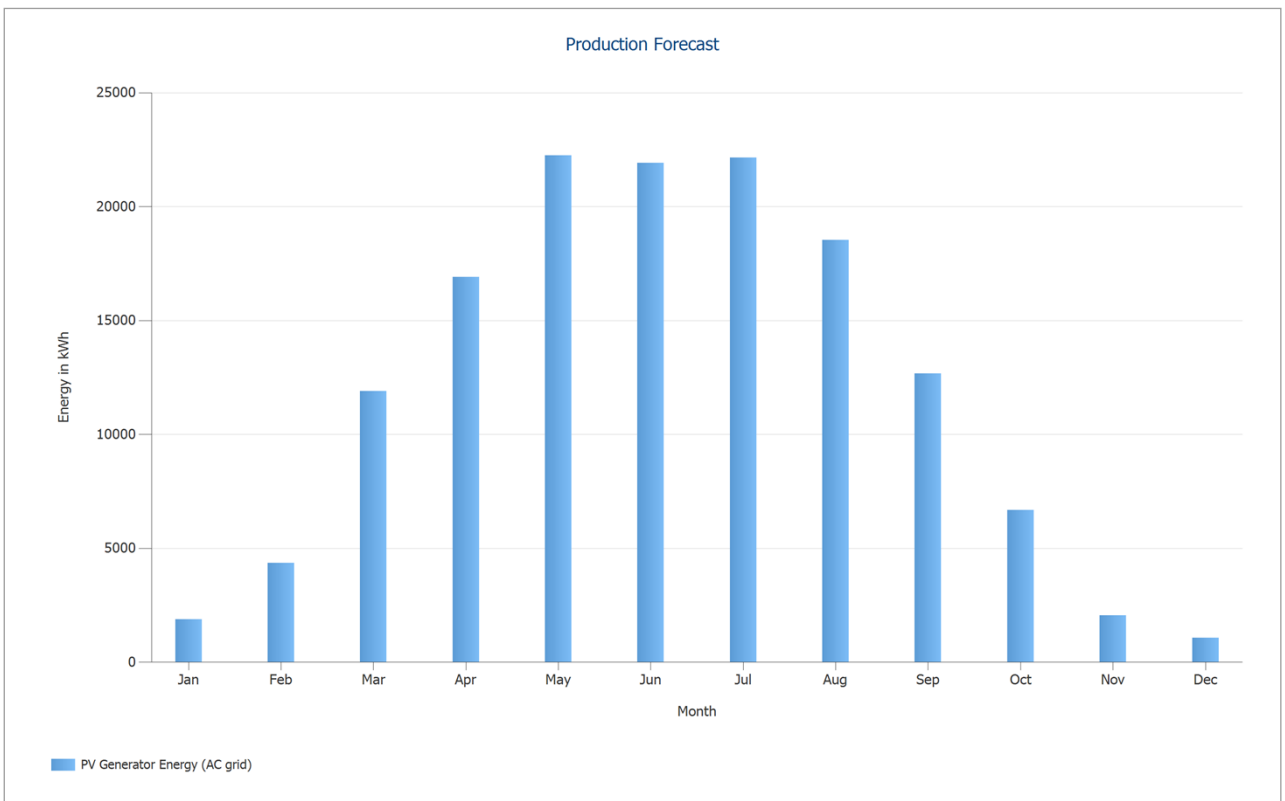


Figure: Production Forecast

PV System Energy Balance

PV System Energy Balance

Global radiation - horizontal	1,035.41 kWh/m²	
Deviation from standard spectrum	-10.35 kWh/m ²	-1.00 %
Ground Reflection (Albedo)	3.57 kWh/m ²	0.35 %
Orientation and inclination of the module surface	72.50 kWh/m ²	7.05 %
Module-independent shading	-10.64 kWh/m ²	-0.97 %
Reflection on the Module Interface	0.00 kWh/m ²	0.00 %
Global Radiation at the Module	1,090.47 kWh/m²	
	1,090.47 kWh/m ²	
	x 712.753 m ²	
	= 777,237.03 kWh	
Global PV Radiation	777,237.03 kWh	
Soiling	0.00 kWh	0.00 %
STC Conversion (Rated Efficiency of Module 21.26 %)	-612,002.69 kWh	-78.74 %
Rated PV Energy	165,234.33 kWh	
Module-specific Partial Shading	-7,827.33 kWh	-4.74 %
Low-light performance	-3,311.56 kWh	-2.10 %
Deviation from the nominal module temperature	-1,406.56 kWh	-0.91 %
Diodes	-557.51 kWh	-0.37 %
Mismatch (Manufacturer Information)	-2,910.80 kWh	-1.91 %
Mismatch (Configuration/Shading)	-2,770.79 kWh	-1.86 %
Power optimizer (DC conversion/down-regulation)	-28.47 kWh	-0.02 %
PV Energy (DC) without inverter down-regulation	146,421.31 kWh	
Failing to reach the DC start output	-3.84 kWh	0.00 %
Down-regulation on account of the MPP Voltage Range	-47.17 kWh	-0.03 %
Down-regulation on account of the max. DC Current	-0.51 kWh	0.00 %
Down-regulation on account of the max. DC Power	0.00 kWh	0.00 %
Down-regulation on account of the max. AC Power/cos phi	0.00 kWh	0.00 %
MPP Matching	-21.35 kWh	-0.01 %
PV energy (DC)	146,348.45 kWh	
Energy at the Inverter Input	146,348.45 kWh	
Input voltage deviates from rated voltage	-3.09 kWh	0.00 %
DC/AC Conversion	-3,970.90 kWh	-2.71 %
Standby Consumption (Inverter)	-112.35 kWh	-0.08 %
Total Cable Losses	0.00 kWh	0.00 %
PV energy (AC) minus standby use	142,262.11 kWh	
PV Generator Energy (AC grid)	142,374.46 kWh	

Data Sheets

PV Module Data Sheet

PV Module: Q.PEAK DUO M-G11S+ 415 Rev1 (v1)

Manufacturer	Hanwha Q.CELLS
Available	Yes

Electrical Data

Cell Type	Si monocrystalline
Half-cell module	Yes
Cell Count	108
Number of Bypass Diodes	3
Loss voltage per bypass diode	1 V
Integrated power optimizer	No
Only Transformer Inverters suitable	No

I/V Characteristics at STC

MPP Voltage	31.05 V
MPP Current	13.37 A
Open Circuit Voltage	37.14 V
Short-Circuit Current	13.99 A
Increase open circuit voltage before stabilisation	0 %
Nominal output	415 W
Fill Factor	79.9 %
Efficiency	21.26 %

I/V Part Load Characteristics

Values source	Manufacturer/user-created
Irradiance	200 W/m ²
Voltage in MPP at Part Load	29.84 V
Current in MPP at Part Load	2.671 A
Open Circuit Voltage (Part Load)	34.72 V
Short Circuit Current at Part Load	2.8 A

Additional Parameters

Temperature Coefficient of Voc	-100.1 mV/K
Temperature Coefficient of Isc	5.6 mA/K
Temperature Coefficient of Pmpp	-0.34 %/K
Incident Angle Modifier (IAM)	100 %
Maximum System Voltage	1000 V

Mechanical Data

Width	1134 mm
Height	1722 mm
Depth	30 mm
Frame Width	13 mm
Weight	21.1 kg

Power Optimizer Data Sheet

Power Optimizer: TS4-A-O 700 W (v2)

Manufacturer	Tigo Energy, Inc.
Available	Yes

Electrical Data

module-integrated	No
Optimizer mode	Buck
DC nominal output	700 W
Max. Input Voltage	80 V
Max. output voltage	-1 V
Max. Input Current	15 A
Max. output current	-1 A
Min. MPP Voltage	16 V
Max. MPP Voltage	80 V
Reduction of the open circuit voltage	0 %
Maximum string mismatch	25 %

Inverter Data Sheet

Inverter: SG33CX-P2 (v1)

Manufacturer	Sungrow Power Supply Co., Ltd.
Available	Yes
Electrical data - DC	
DC nominal output	33 kW
Max. DC Power	46.2 kW
Nom. DC Voltage	600 V
Max. Input Voltage	1040 V
Max. Input Current	90 A
Max. short circuit current	120 A
Number of DC Inlets	6
Electrical data - AC	
AC Power Rating	33 kW
Max. AC Power	36.3 kVA
Number of Phases	3
With Transformer	No
Electrical data - other	
Change in Efficiency when Input Voltage deviates from Rated Voltage	0.02 %/100V
Min. Feed-in Power	20 W
Standby Consumption	20 W
Night Consumption	4 W
MPP Tracker	
Output Range < 20% of Power Rating	99.9 %
Output Range > 20% of Power Rating	100 %
Count of MPP Trackers	3
MPP Tracker 1-3	
Max. Input Current	30 A
Max. short circuit current	35 A
Max. Input Power	22.1 kW
Min. MPP Voltage	200 V
Max. MPP Voltage	1000 V

Inverter: SG40CX (v3)

Manufacturer	Sungrow Power Supply Co., Ltd.
Available	Yes

Electrical data - DC

DC nominal output	40 kW
Max. DC Power	60 kW
Nom. DC Voltage	585 V
Max. Input Voltage	1100 V
Max. Input Current	139.2 A
Max. short circuit current	139.2 A
Number of DC Inlets	8

Electrical data - AC

AC Power Rating	40 kW
Max. AC Power	44 kVA
Number of Phases	3
With Transformer	No

Electrical data - other

Change in Efficiency when Input Voltage deviates from Rated Voltage	0.02 %/100V
Min. Feed-in Power	20 W
Standby Consumption	2 W
Night Consumption	2 W

MPP Tracker

Output Range < 20% of Power Rating	99.9 %
Output Range > 20% of Power Rating	100 %
Count of MPP Trackers	4

MPP Tracker 1-4

Max. Input Current	26 A
Max. short circuit current	26 A
Max. Input Power	22.1 kW
Min. MPP Voltage	200 V
Max. MPP Voltage	1000 V

Inverter: SG50CX-P2 (v1)

Manufacturer	Sungrow Power Supply Co., Ltd.
Available	Yes

Electrical data - DC

DC nominal output	50 kW
Max. DC Power	70 kW
Nom. DC Voltage	600 V
Max. Input Voltage	1040 V
Max. Input Current	120 A
Max. short circuit current	160 A
Number of DC Inlets	8

Electrical data - AC

AC Power Rating	50 kW
Max. AC Power	55 kVA
Number of Phases	3
With Transformer	No

Electrical data - other

Change in Efficiency when Input Voltage deviates from Rated Voltage	0.02 %/100V
Min. Feed-in Power	20 W
Standby Consumption	20 W
Night Consumption	4 W

MPP Tracker

Output Range < 20% of Power Rating	99.9 %
Output Range > 20% of Power Rating	100 %
Count of MPP Trackers	4

MPP Tracker 1-4

Max. Input Current	30 A
Max. short circuit current	35 A
Max. Input Power	22.1 kW
Min. MPP Voltage	200 V
Max. MPP Voltage	1000 V

Plans and parts list

Parts list

Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		Hanwha Q.CELLS	Q.PEAK DUO M-G11S+ 415 Rev1	365	Piece
2	Inverter		Sungrow Power Supply Co., Ltd.	SG33CX-P2	2	Piece
3	Inverter		Sungrow Power Supply Co., Ltd.	SG40CX	1	Piece
4	Inverter		Sungrow Power Supply Co., Ltd.	SG50CX-P2	1	Piece
5	Power Optimizer		Tigo Energy, Inc.	TS4-A-O 700 W	18	Piece

Screenshots, 3D Design

Environment



Figure: Pietūs



Figure: Screenshot02

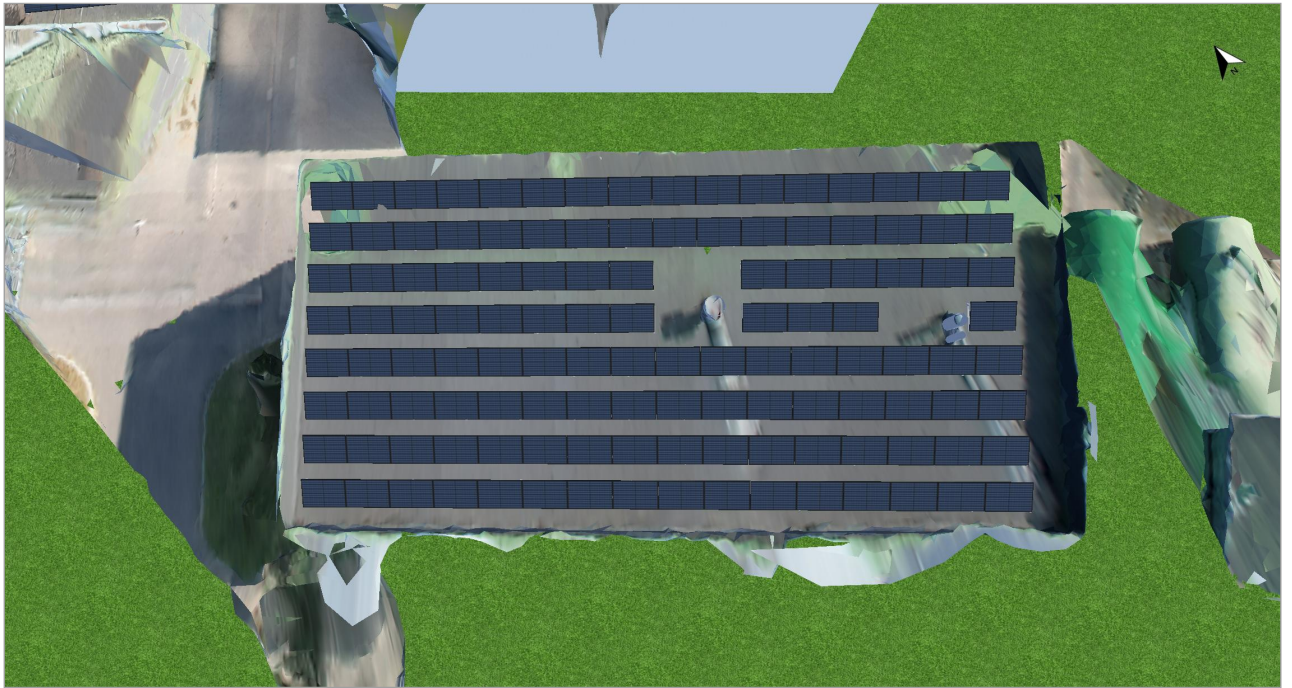


Figure: Screenshot03

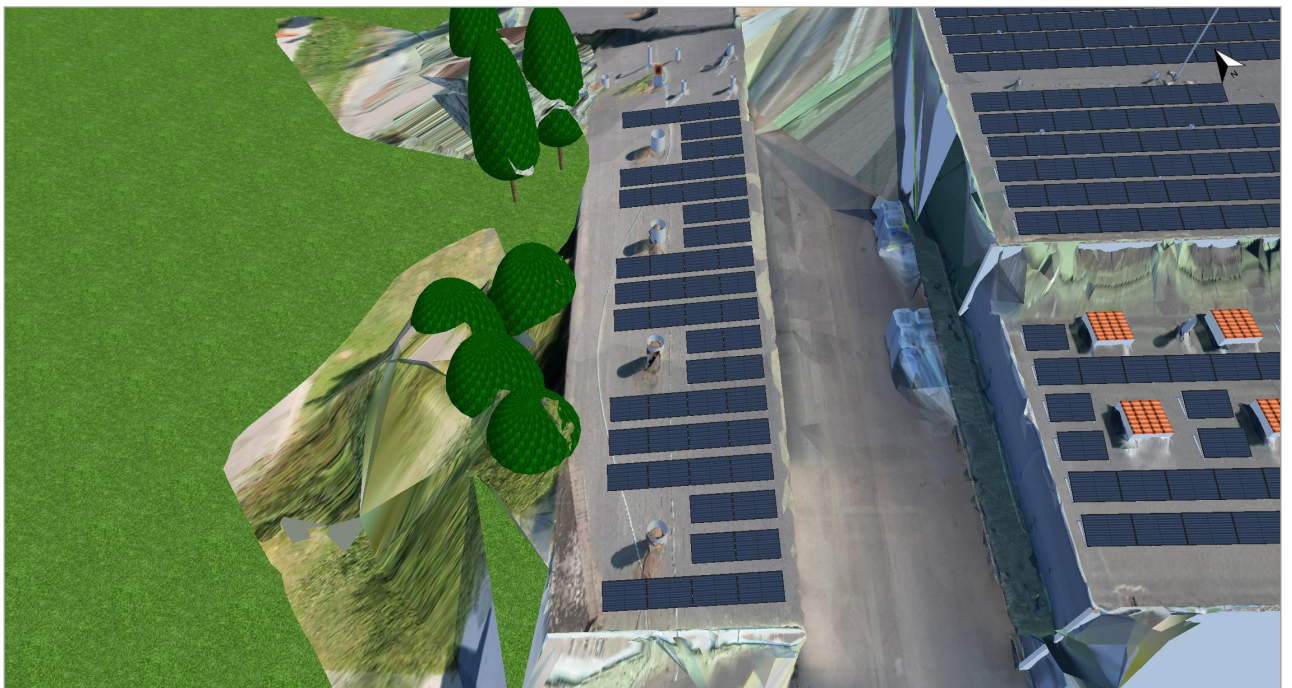


Figure: Screenshot04

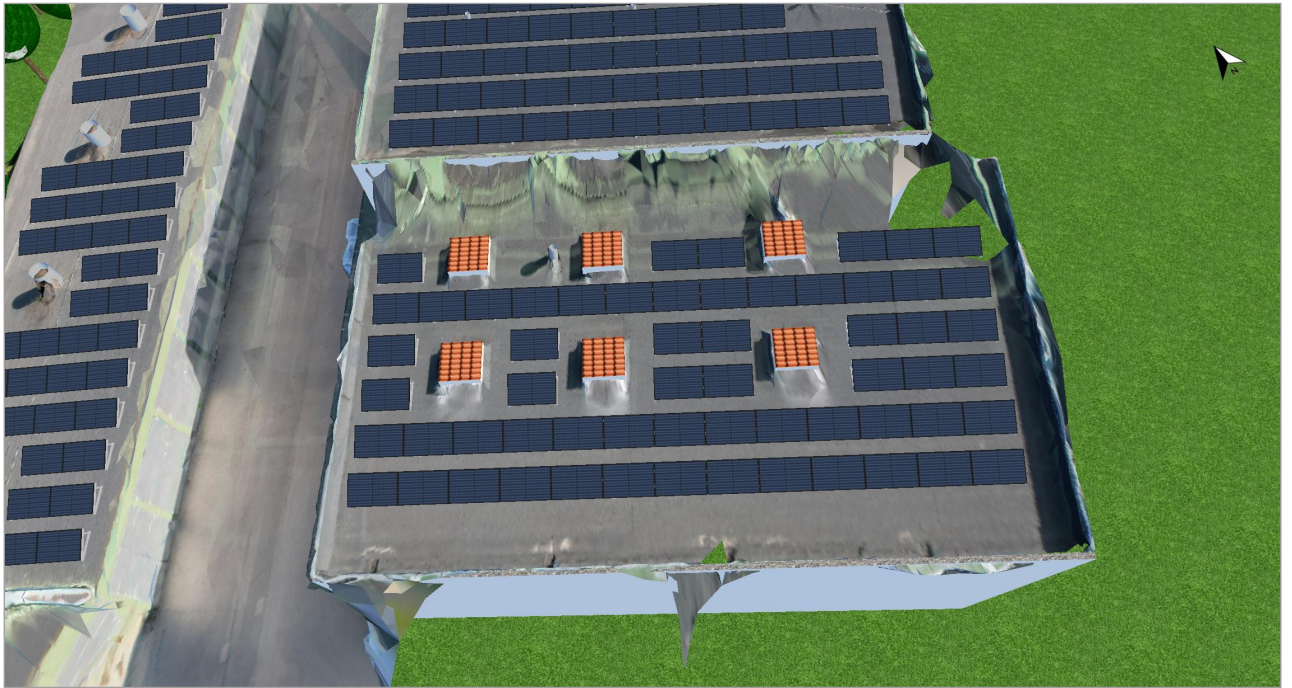


Figure: Screenshot05

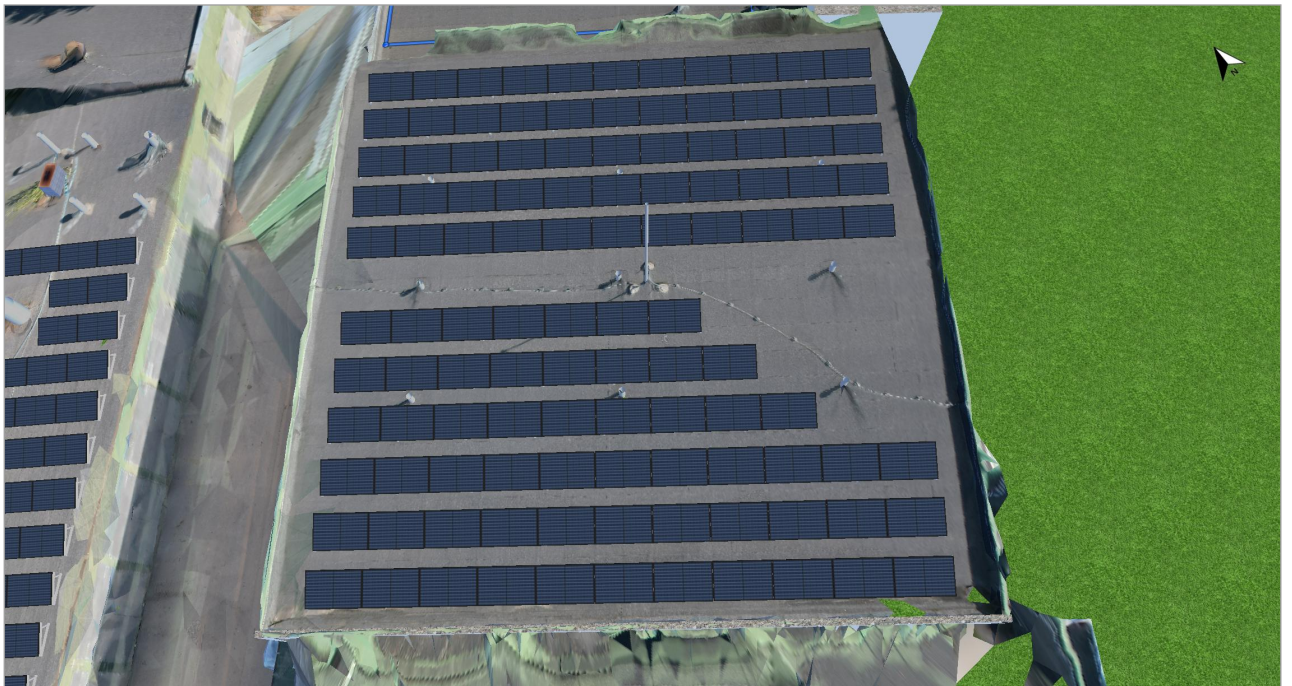


Figure: Screenshot06

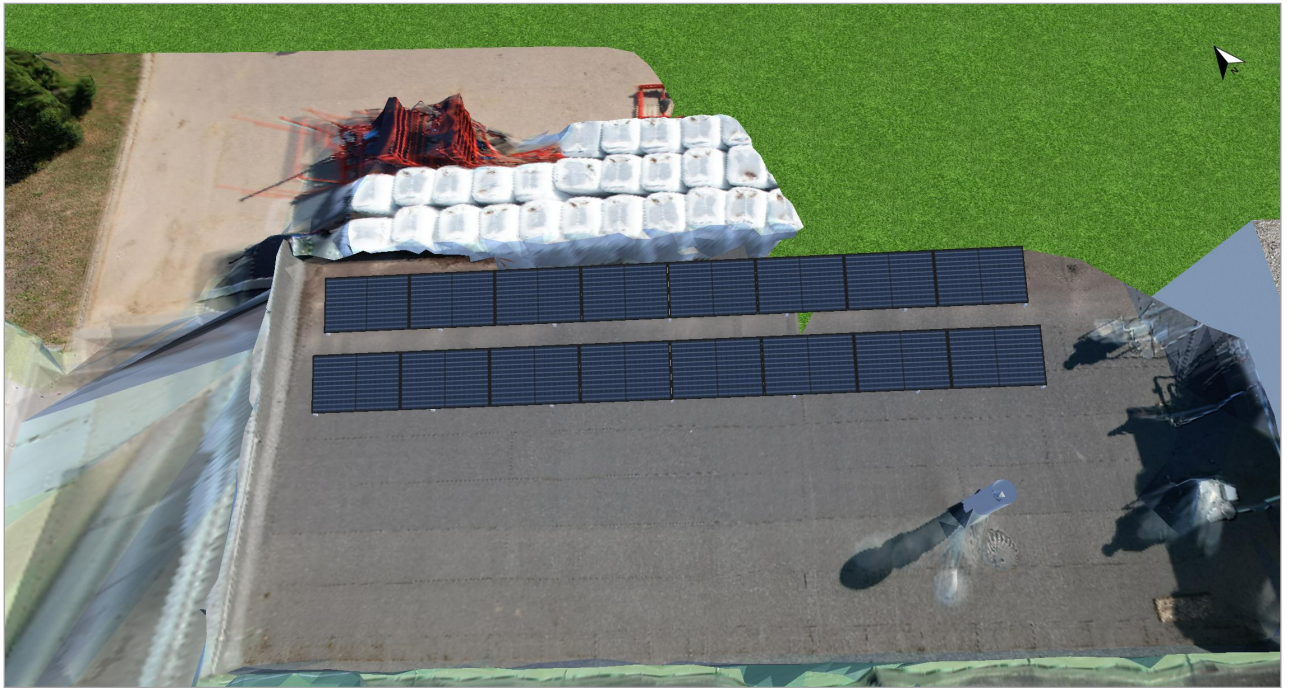


Figure: Screenshot07

Configuration



Figure: optimizuoti moduliai

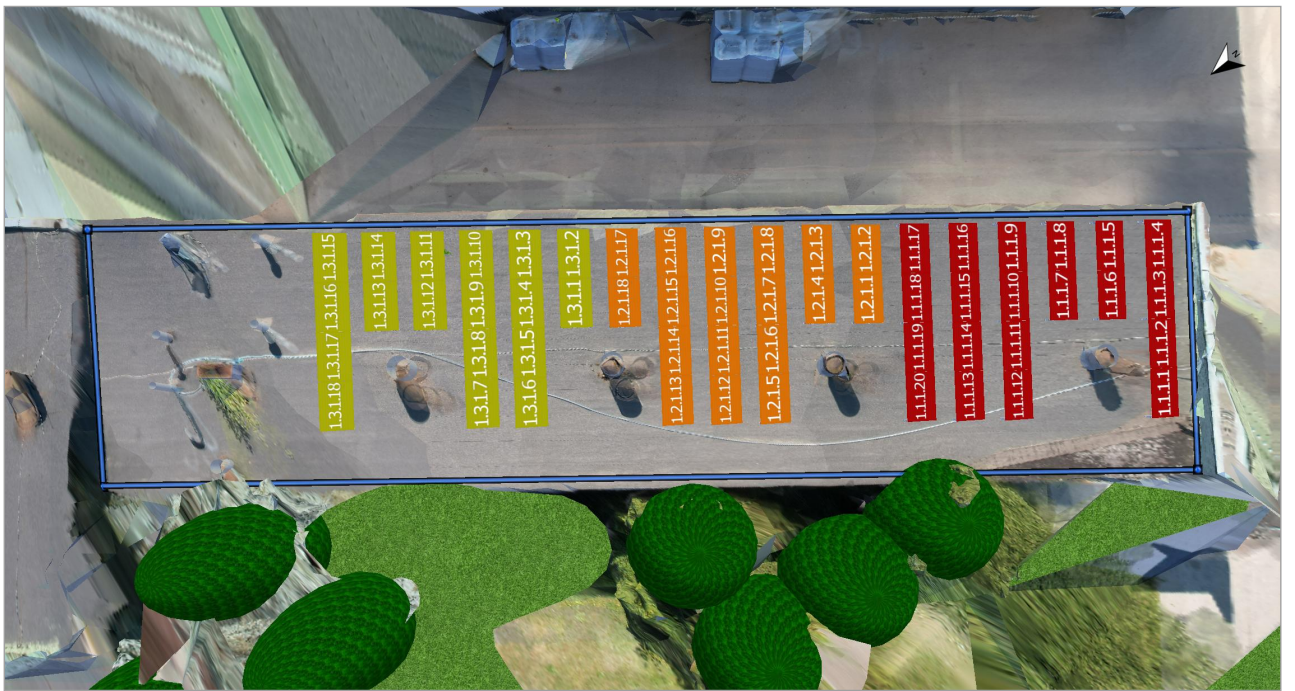


Figure: 33CX-P2

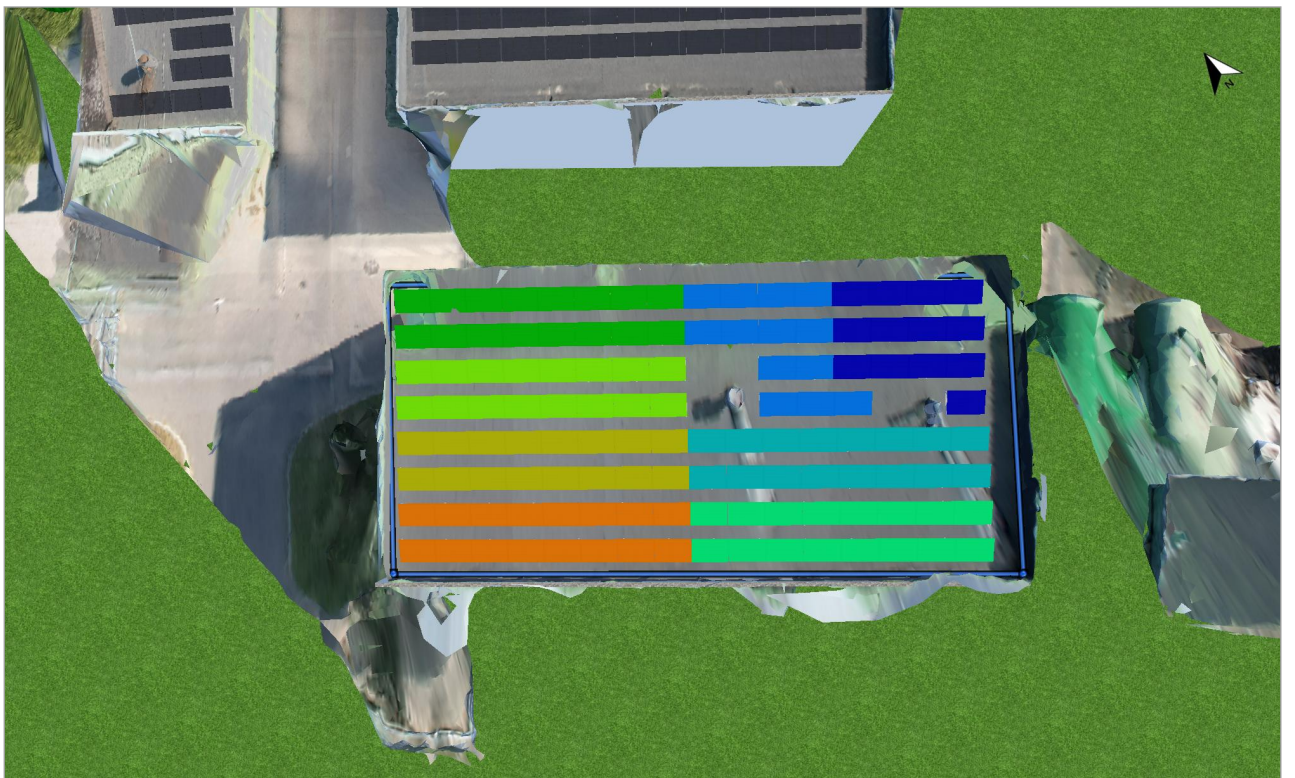


Figure: 50CX-P2

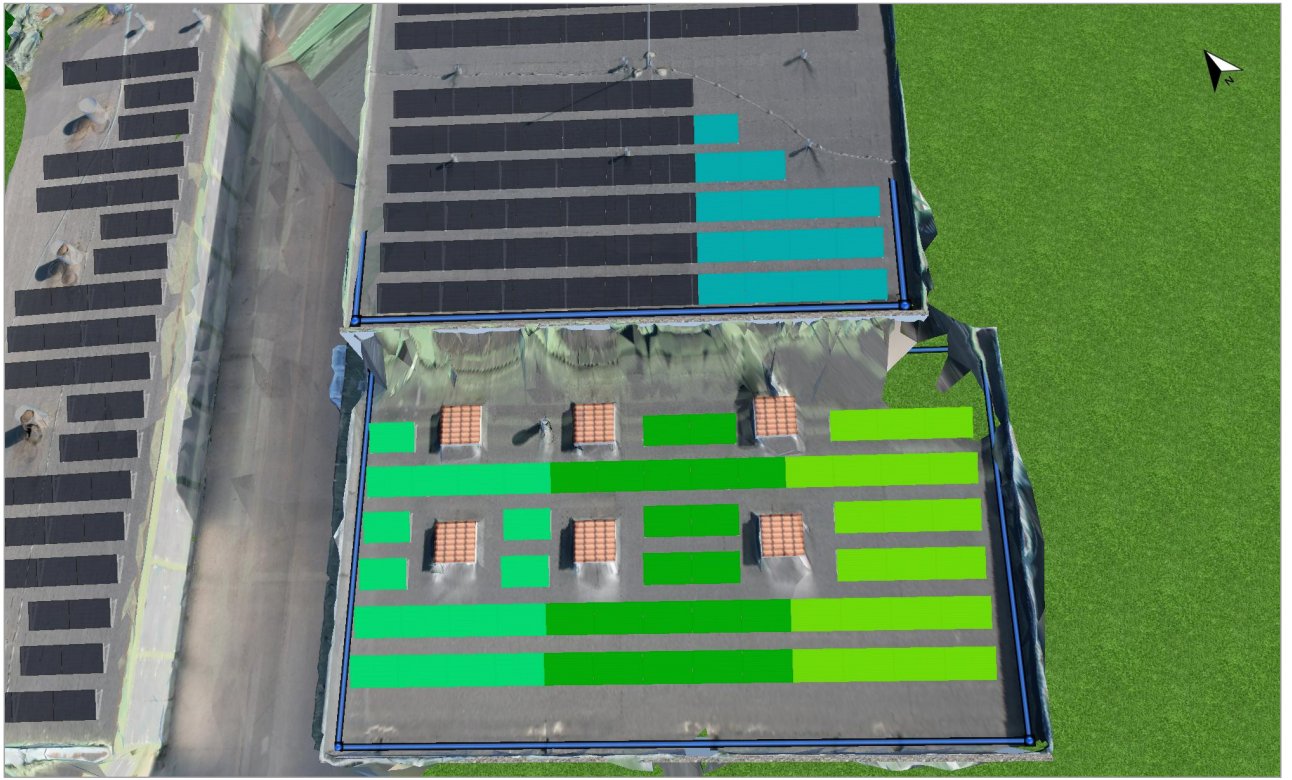


Figure: 33CX-P2

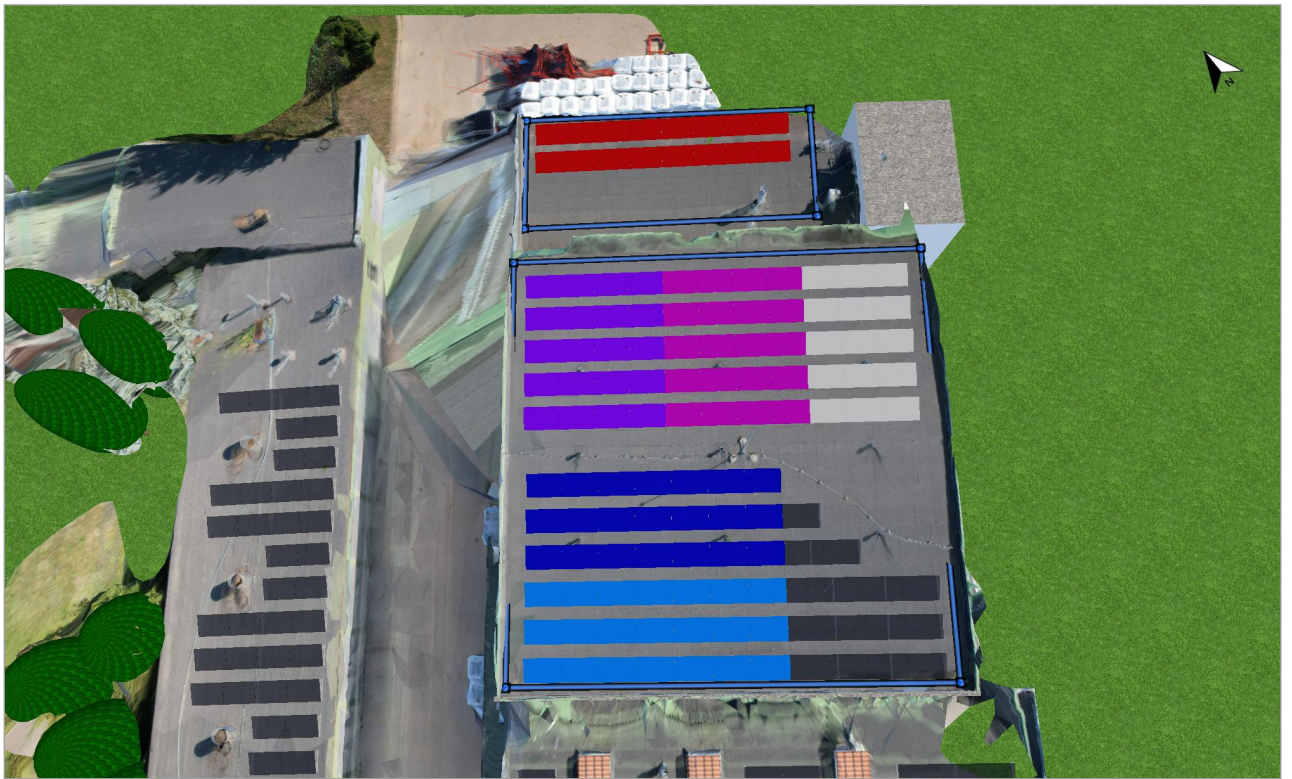


Figure: 40CX

Shading



Figure: Screenshot09



Figure: Screenshot10

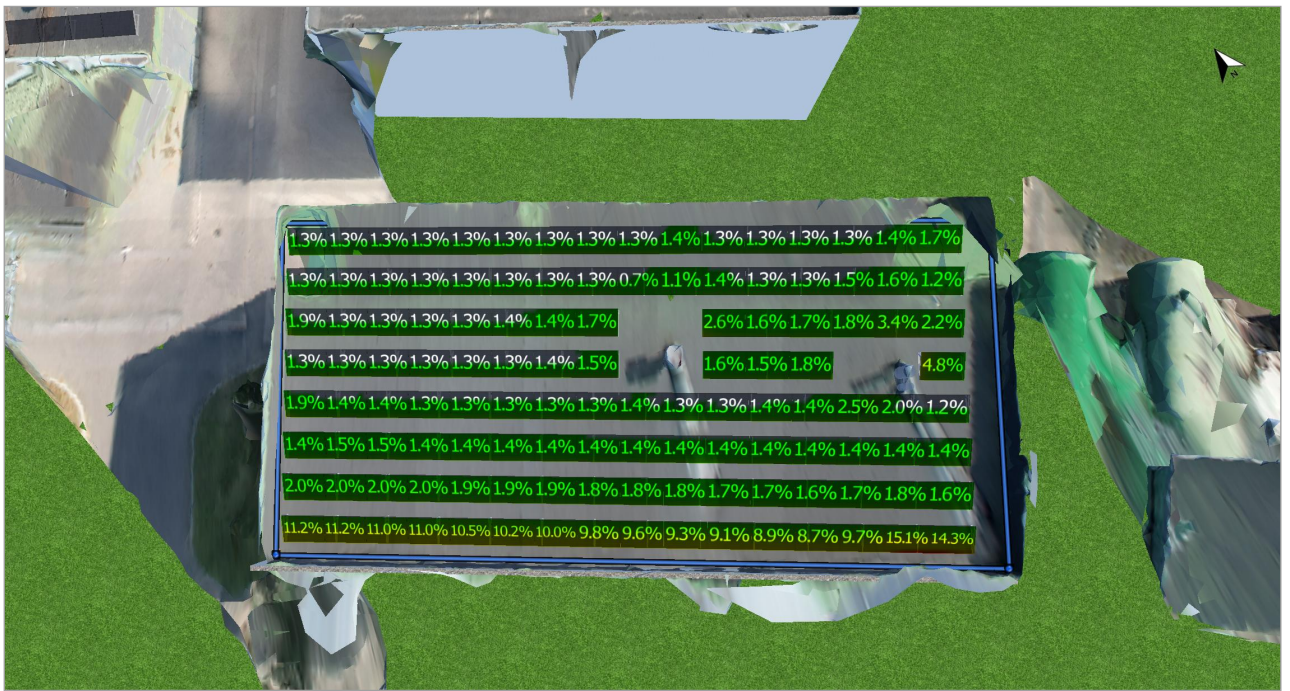


Figure: Screenshot11



Figure: Screenshot12

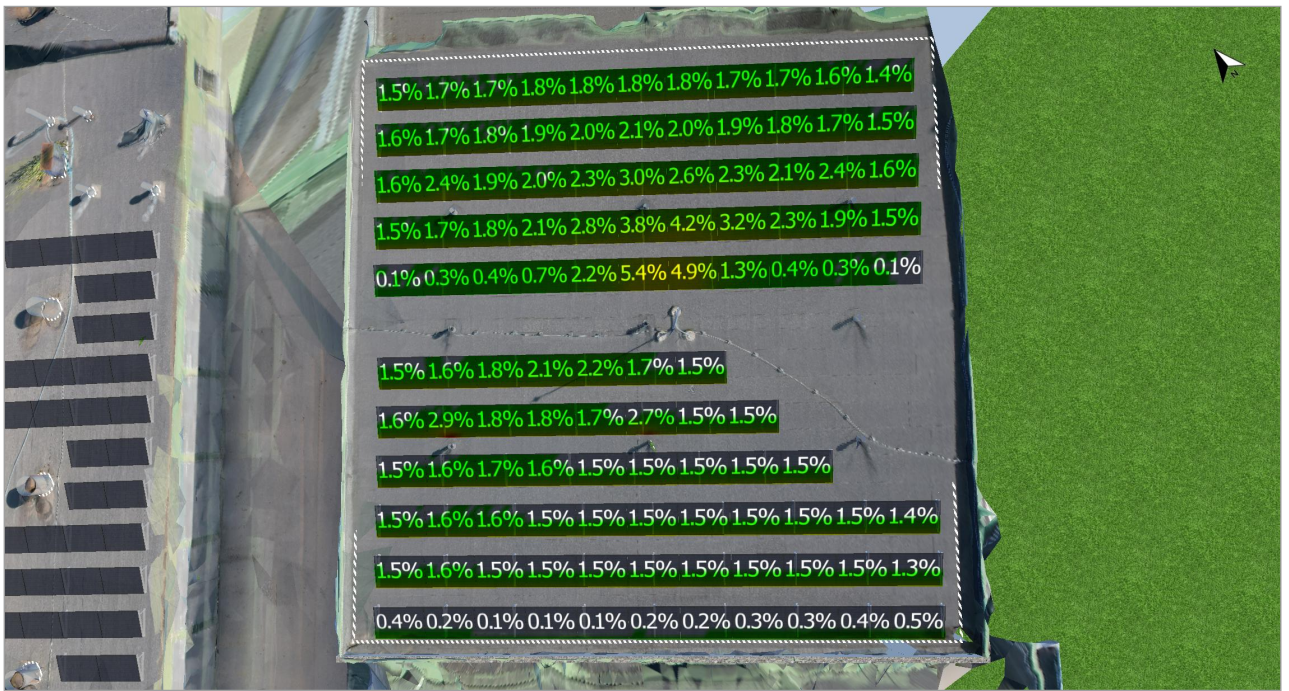


Figure: Screenshot13

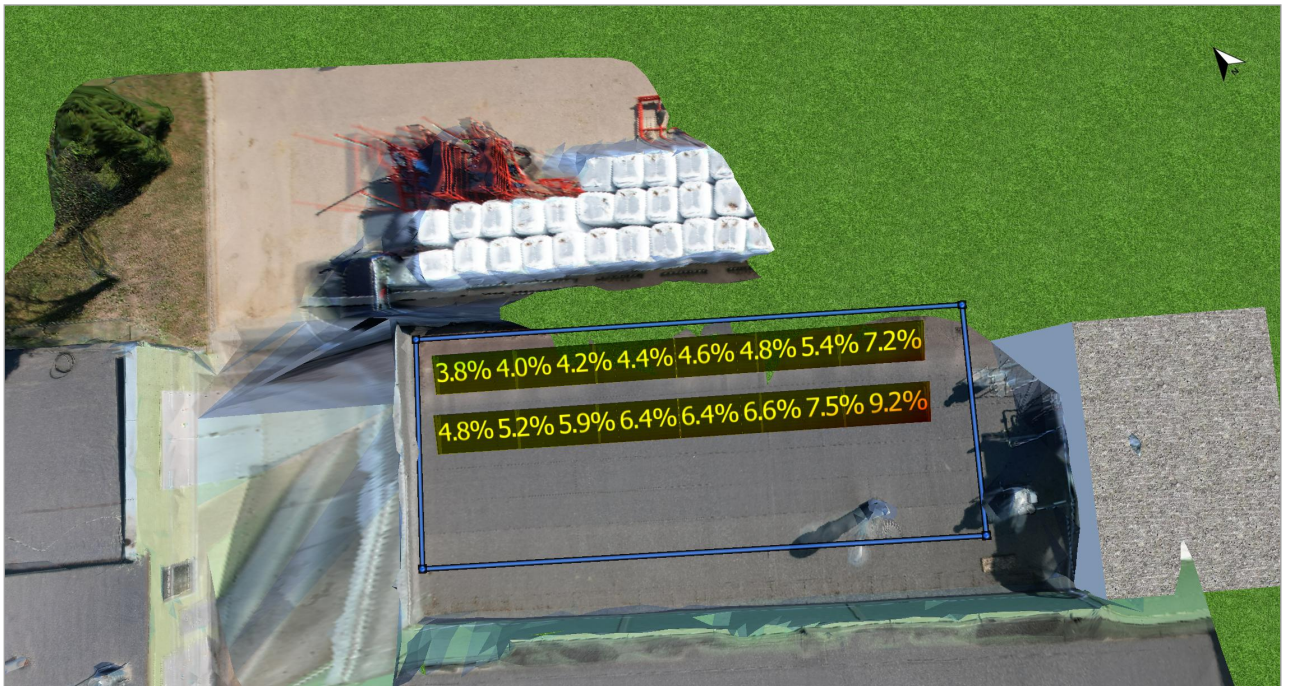


Figure: Screenshot14