

**Helios Energy LLC**

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**Project Name:** Sheraton PV Plant - Rooftop

13-Apr-23

## Your PV system from Helios Energy LLC

### Address of Installation

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01.17.01.125.001

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### Project Description:

Rooftop PV Plant - Ballroom

# Project Overview

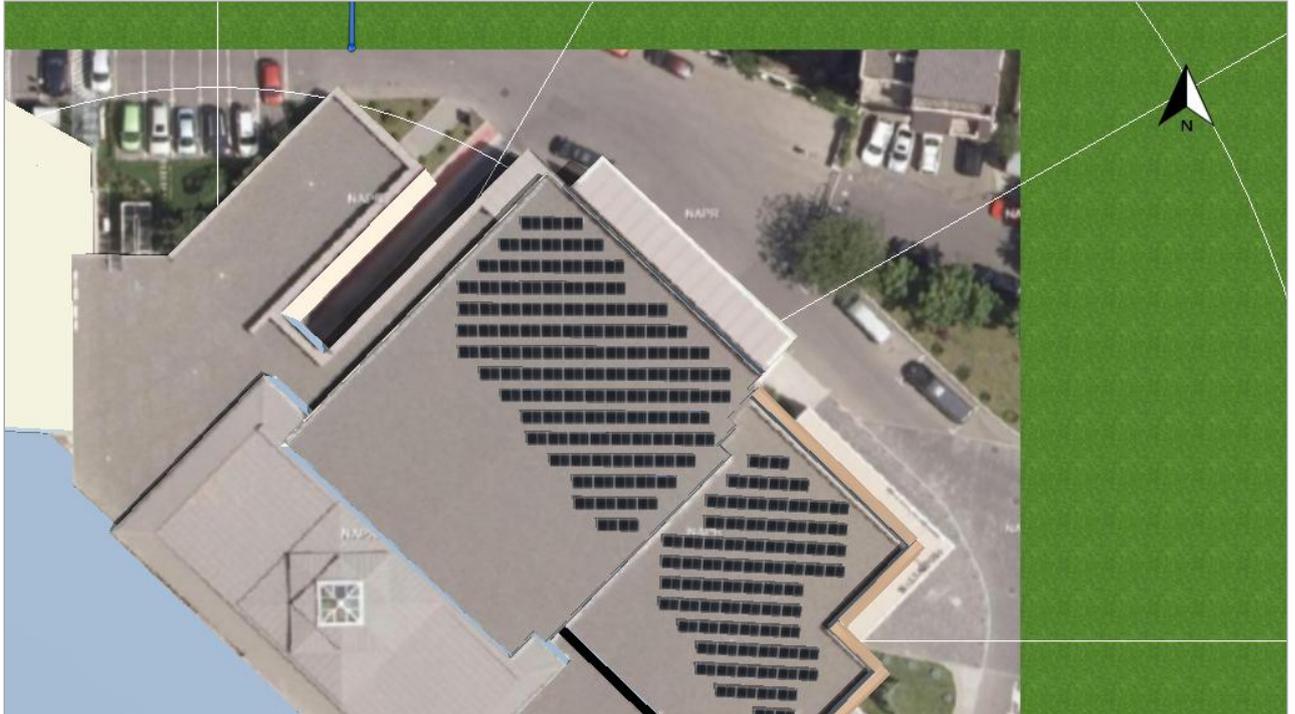


Figure: Overview Image, 3D Design

## PV System

### 3D, Grid-connected PV System

Climate Data	Tbilisi, GEO (1991 - 2010)
PV Generator Output	79.26 kWp
PV Generator Surface	373.0 m <sup>2</sup>
Number of PV Modules	191
Number of Inverters	2

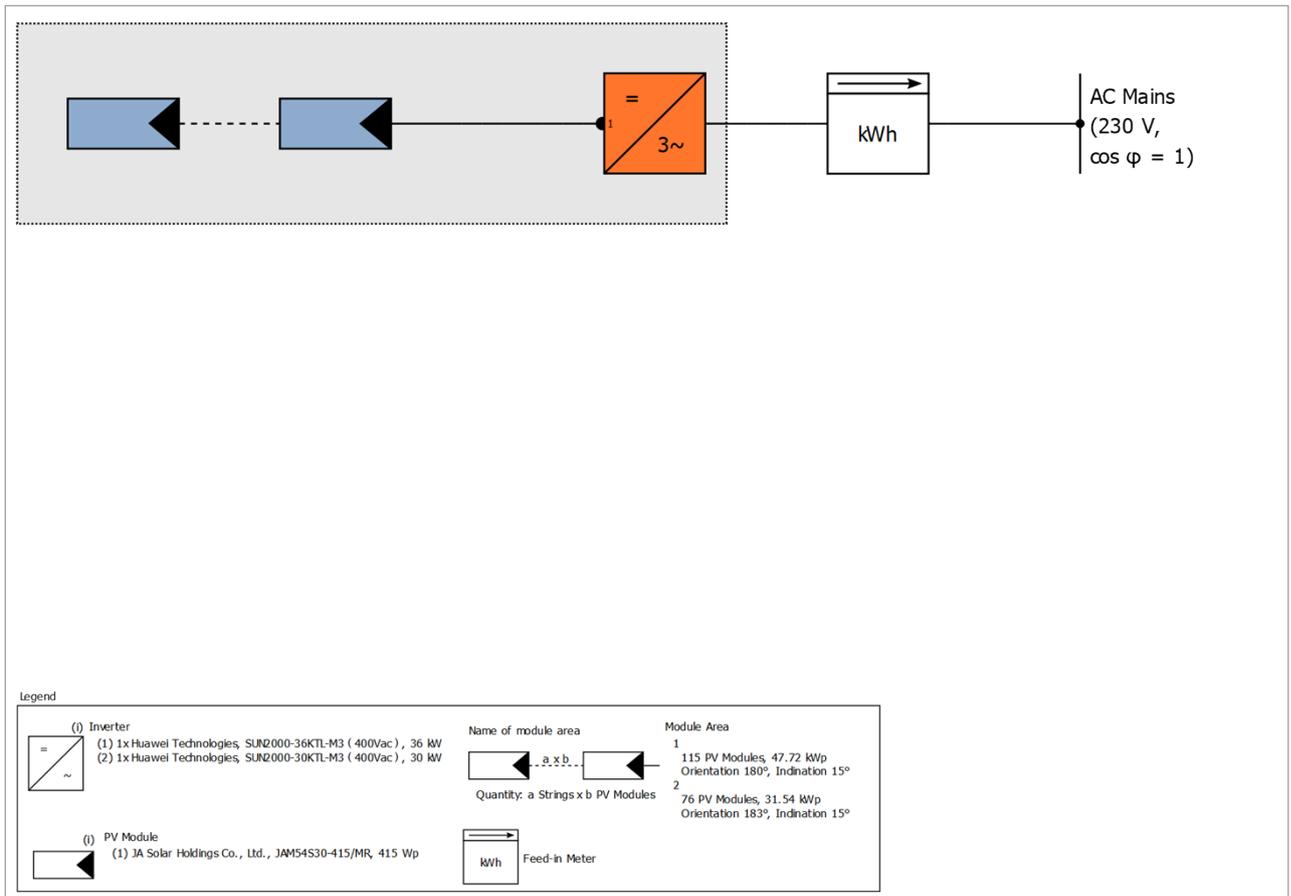


Figure: Schematic diagram

## The yield

### The yield

PV Generator Energy (AC grid)	84,365 kWh
Grid Feed-in	84,365 kWh
Down-regulation at Feed-in Point	0 kWh
Own Power Consumption	0.0 %
Solar Fraction	0.0 %
Spec. Annual Yield	1,063.74 kWh/kWp
Performance Ratio (PR)	78.0 %
Yield Reduction due to Shading	16.6 %/Year
CO <sub>2</sub> Emissions avoided	39,629 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
Start of Operation	08-Sep-22

### Climate Data

Location	Tbilisi, GEO (1991 - 2010)
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

#### PV Generator, 1. Module Area - 1

Name	1
PV Modules	115 x JAM54S30-415/MR (v4)
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	15 °
Orientation	South 180 °
Installation Type	Mounted - Roof
PV Generator Surface	224.6 m <sup>2</sup>



Figure: 1. Module Area - 1

Degradation of Module, 1. Module Area - 1

Remaining power (power output) after 1 year	98 %
Remaining power (power output) after 25 years	84.8 %

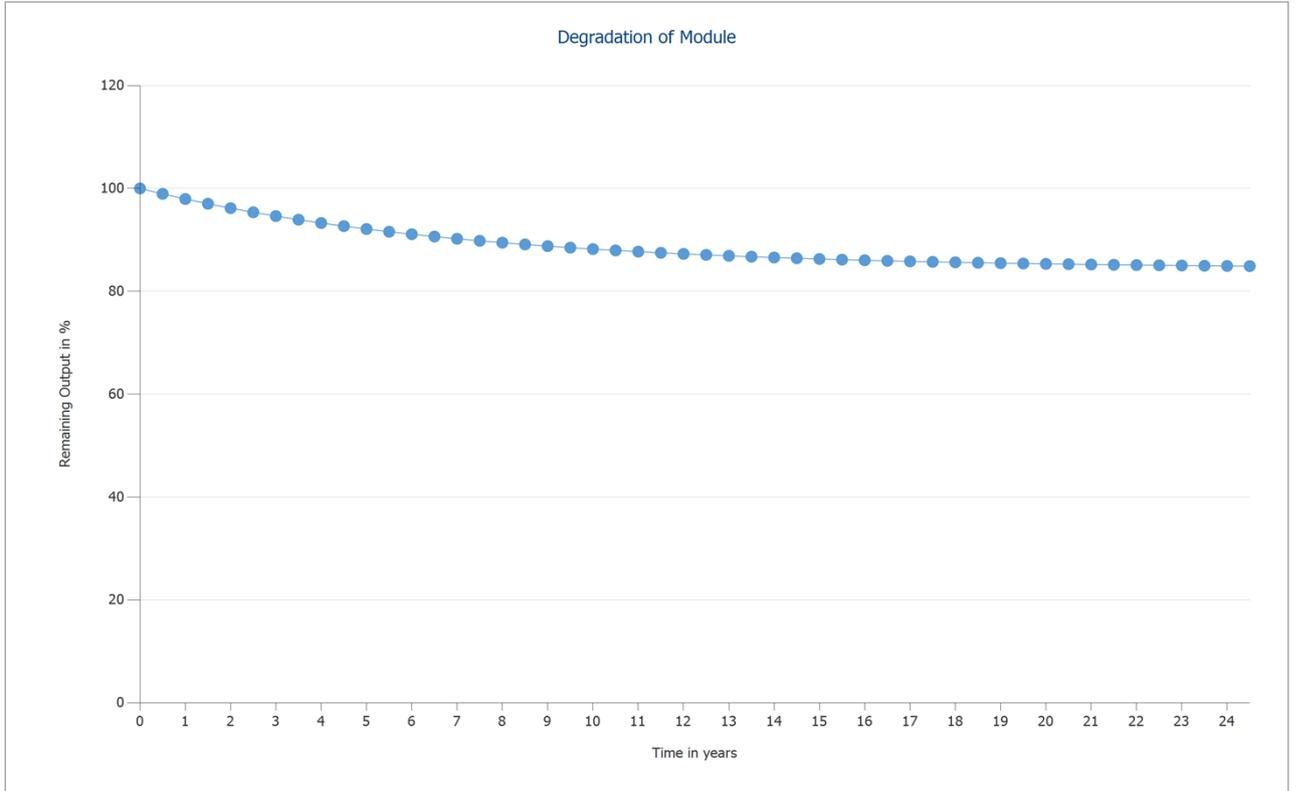


Figure: Degradation of Module, 1. Module Area - 1

## 2. Module Area - 2

### PV Generator, 2. Module Area - 2

Name	2
PV Modules	76 x JAM54S30-415/MR (v4)
Manufacturer	JA Solar Holdings Co., Ltd.
Inclination	15 °
Orientation	South 183 °
Installation Type	Mounted - Roof
PV Generator Surface	148.4 m <sup>2</sup>

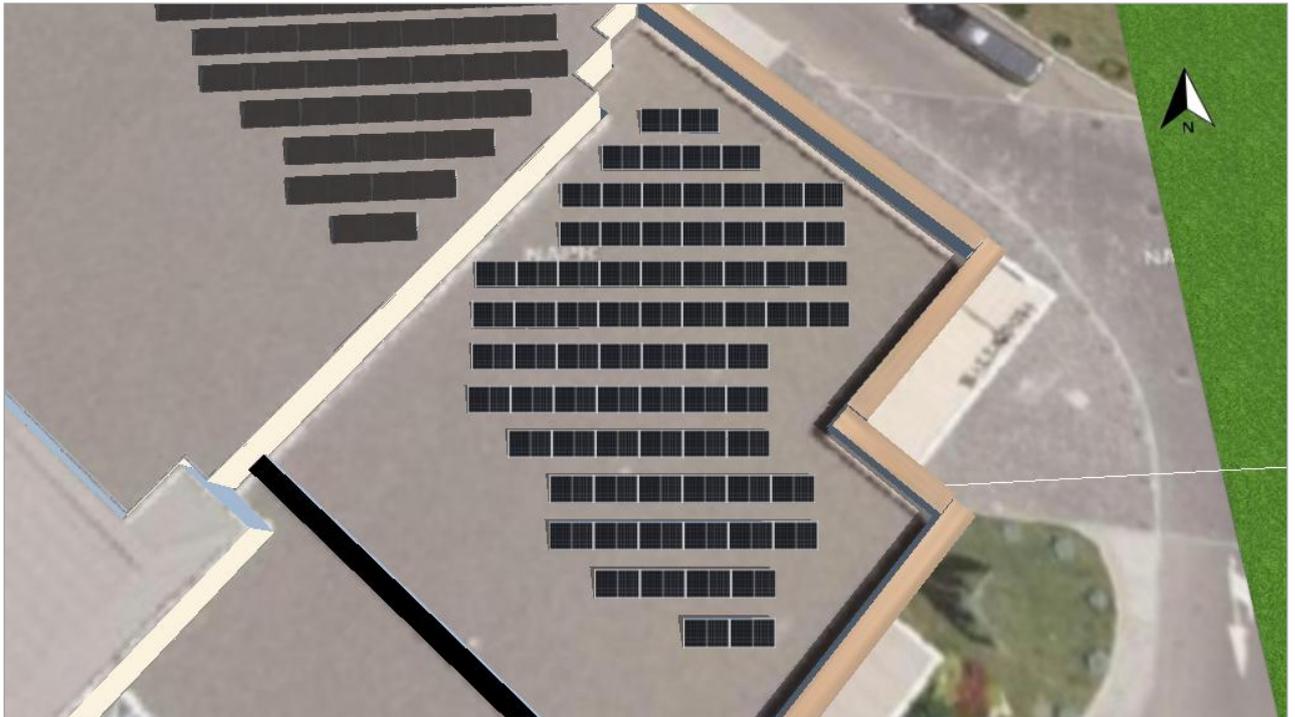


Figure: 2. Module Area - 2

Degradation of Module, 2. Module Area - 2

Remaining power (power output) after 1 year	98 %
Remaining power (power output) after 25 years	84.8 %

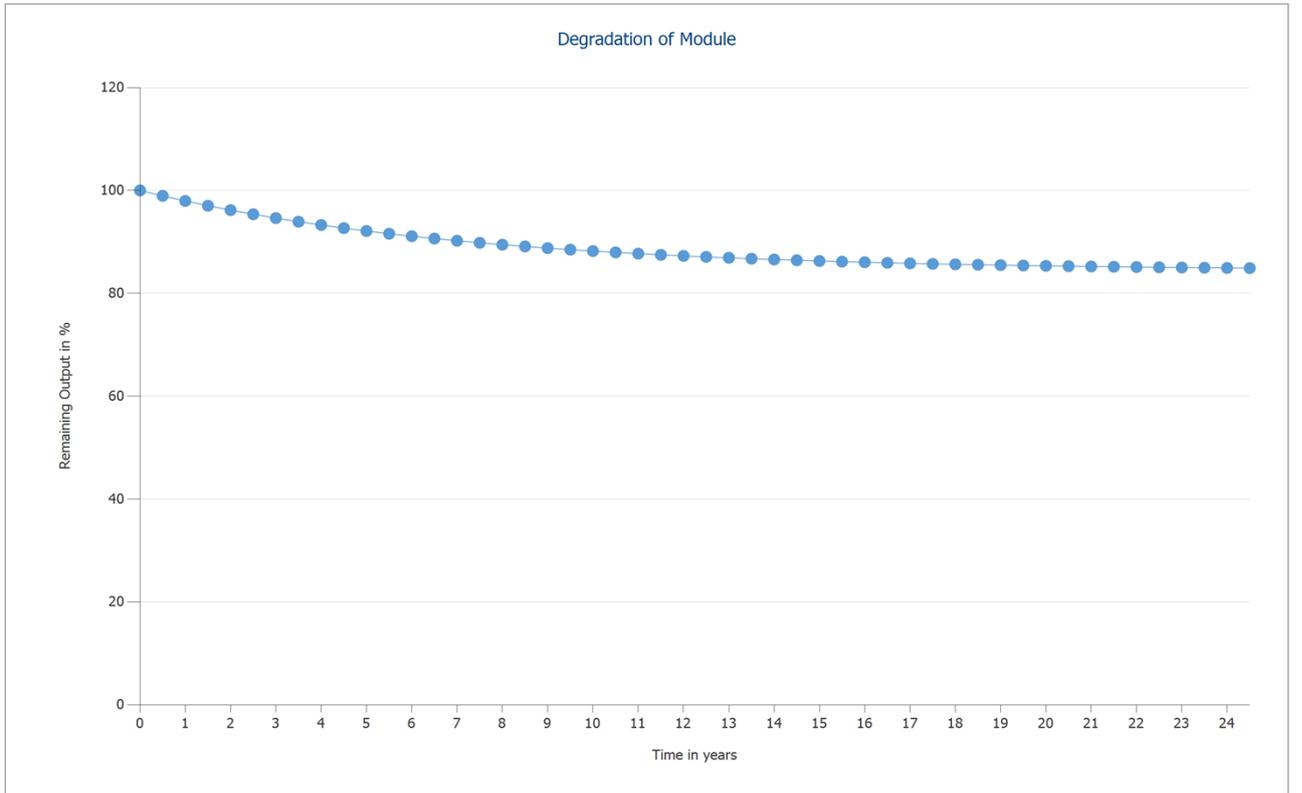


Figure: Degradation of Module, 2. Module Area - 2

Horizon Line, 3D Design

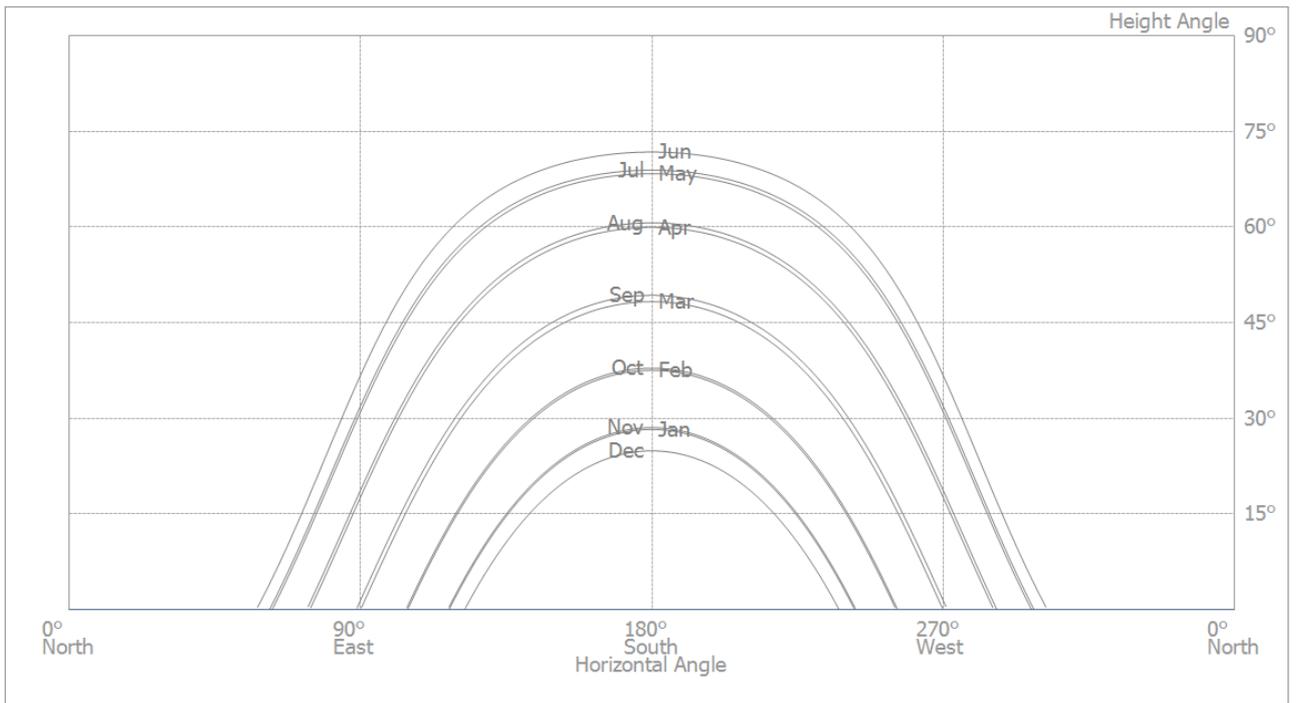


Figure: Horizon (3D Design)

## Inverter configuration

### Configuration 1

Module Areas		1 + 2
Inverter 1		
Model	SUN2000-36KTL-M3 (400Vac) (v1)	
Manufacturer		Huawei Technologies
Quantity		1
Sizing Factor		119.9 %
Configuration		MPP 1: 1 x 26
		MPP 2: 1 x 26
		MPP 3: 1 x 26
		MPP 4: 1 x 26
Inverter 2		
Model	SUN2000-30KTL-M3 (400Vac) (v1)	
Manufacturer		Huawei Technologies
Quantity		1
Sizing Factor		120.3 %
Configuration		MPP 1: 1 x 11
		MPP 2: 1 x 25
		MPP 3: 1 x 25
		MPP 4: 1 x 26

## 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	79.3 kWp
Spec. Annual Yield	1,063.74 kWh/kWp
Performance Ratio (PR)	78.0 %
Yield Reduction due to Shading	16.6 %/Year
Grid Feed-in	84,365 kWh/Year
Grid Feed-in in the first year (incl. module degradation)	83,225 kWh/Year
Standby Consumption (Inverter)	48 kWh/Year
CO <sub>2</sub> Emissions avoided	39,629 kg / year

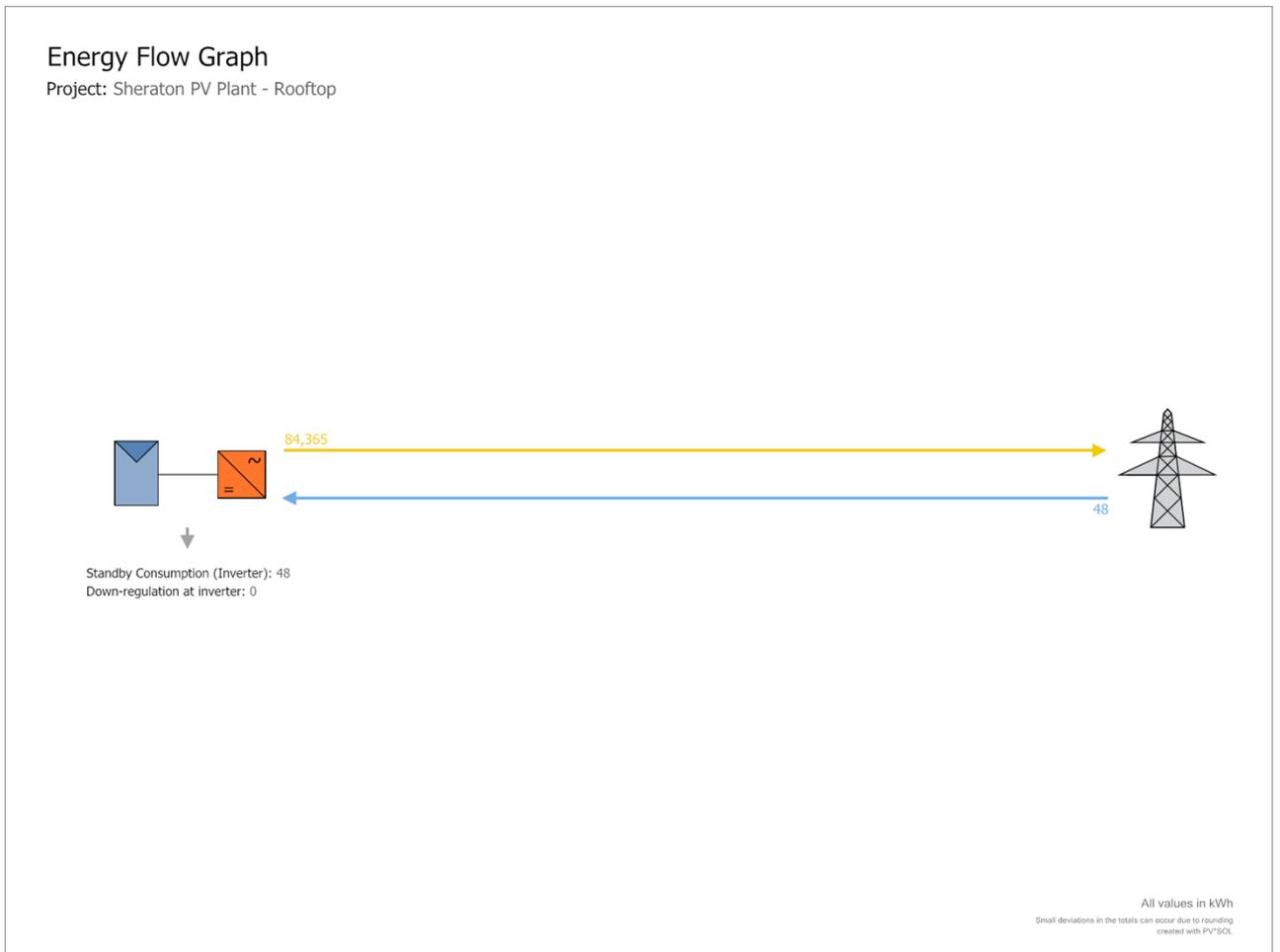


Figure: Energy Flow Graph

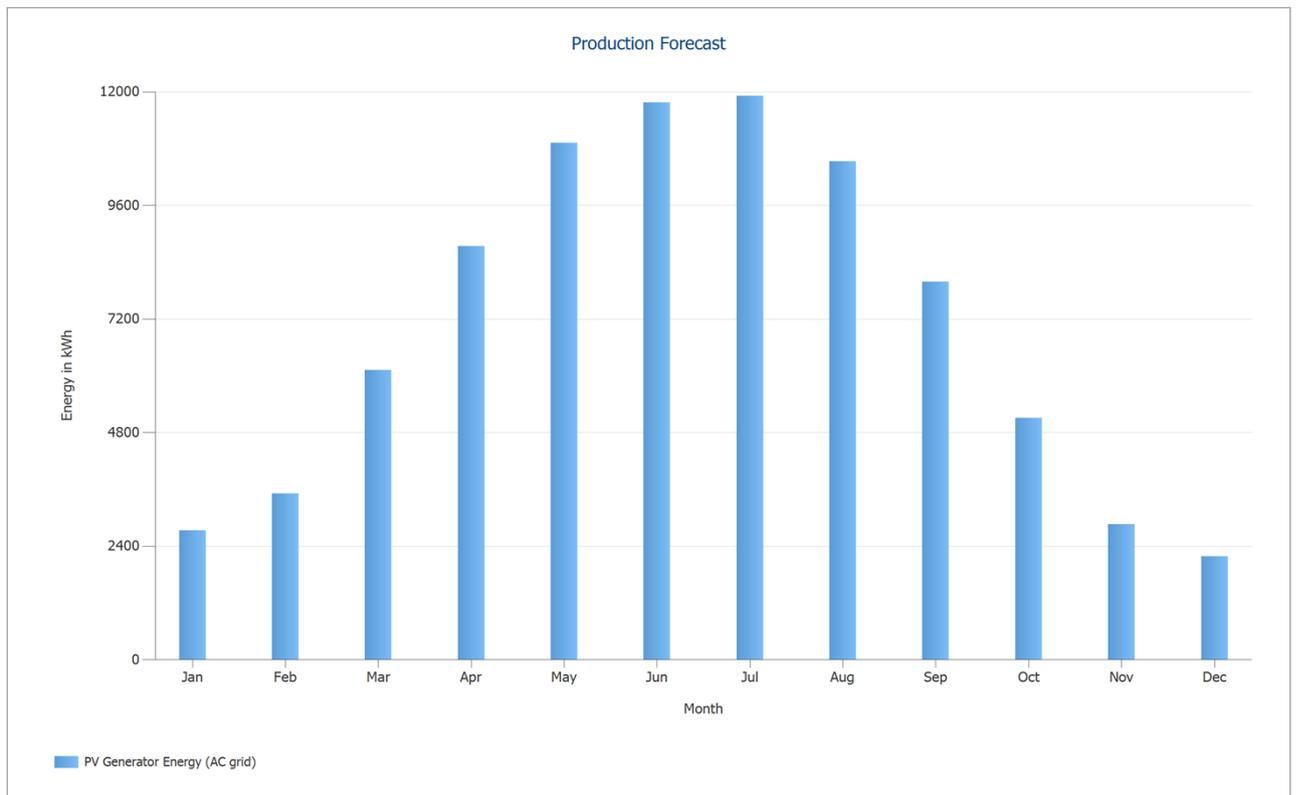


Figure: Production Forecast

## Results per Module Area

1

PV Generator Output	47.72 kWp
PV Generator Surface	224.57 m <sup>2</sup>
Global Radiation at the Module	1340.73 kWh/m <sup>2</sup>
Global Radiation on Module without reflection	1368.06 kWh/m <sup>2</sup>
Performance Ratio (PR)	78.85 %
PV Generator Energy (AC grid)	51488.11 kWh/Year
Spec. Annual Yield	1078.85 kWh/kWp

2

PV Generator Output	31.54 kWp
PV Generator Surface	148.41 m <sup>2</sup>
Global Radiation at the Module	1330.17 kWh/m <sup>2</sup>
Global Radiation on Module without reflection	1357.27 kWh/m <sup>2</sup>
Performance Ratio (PR)	76.79 %
PV Generator Energy (AC grid)	32876.77 kWh/Year
Spec. Annual Yield	1042.38 kWh/kWp

## PV System Energy Balance

### PV System Energy Balance

<b>Global radiation - horizontal</b>	<b>1,334.70 kWh/m<sup>2</sup></b>	
Deviation from standard spectrum	-13.35 kWh/m <sup>2</sup>	-1.00 %
Ground Reflection (Albedo)	4.50 kWh/m <sup>2</sup>	0.34 %
Orientation and inclination of the module surface	89.23 kWh/m <sup>2</sup>	6.73 %
Module-independent shading	-51.32 kWh/m <sup>2</sup>	-3.63 %
Reflection on the Module Interface	-27.24 kWh/m <sup>2</sup>	-2.00 %
<b>Global Radiation at the Module</b>	<b>1,336.53 kWh/m<sup>2</sup></b>	
	1,336.53 kWh/m <sup>2</sup>	
	x 372.975 m <sup>2</sup>	
	= 498,491.14 kWh	
<b>Global PV Radiation</b>	<b>498,491.14 kWh</b>	
Soiling	0.00 kWh	0.00 %
STC Conversion (Rated Efficiency of Module 21.25 %)	-392,541.26 kWh	-78.75 %
<b>Rated PV Energy</b>	<b>105,949.88 kWh</b>	
Module-specific Partial Shading	-12,745.46 kWh	-12.03 %
Low-light performance	-250.08 kWh	-0.27 %
Deviation from the nominal module temperature	-2,758.97 kWh	-2.97 %
Diodes	-205.32 kWh	-0.23 %
Mismatch (Manufacturer Information)	-1,799.80 kWh	-2.00 %
Mismatch (Configuration/Shading)	-520.42 kWh	-0.59 %
String Cable	-464.09 kWh	-0.53 %
<b>PV Energy (DC) without inverter down-regulation</b>	<b>87,205.73 kWh</b>	
Failing to reach the DC start output	0.00 kWh	0.00 %
Down-regulation on account of the MPP Voltage Range	-116.10 kWh	-0.13 %
Down-regulation on account of the max. DC Current	0.00 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	-54.10 kWh	-0.06 %
MPP Matching	-10.80 kWh	-0.01 %
<b>PV energy (DC)</b>	<b>87,024.73 kWh</b>	
<b>Energy at the Inverter Input</b>	<b>87,024.73 kWh</b>	
Input voltage deviates from rated voltage	-281.03 kWh	-0.32 %
DC/AC Conversion	-1,942.93 kWh	-2.24 %
Standby Consumption (Inverter)	-47.60 kWh	-0.06 %
AC cables	-435.88 kWh	-0.51 %
<b>PV energy (AC) minus standby use</b>	<b>84,317.28 kWh</b>	
<b>PV Generator Energy (AC grid)</b>	<b>84,364.88 kWh</b>	

# Plans and parts list

## Circuit Diagram

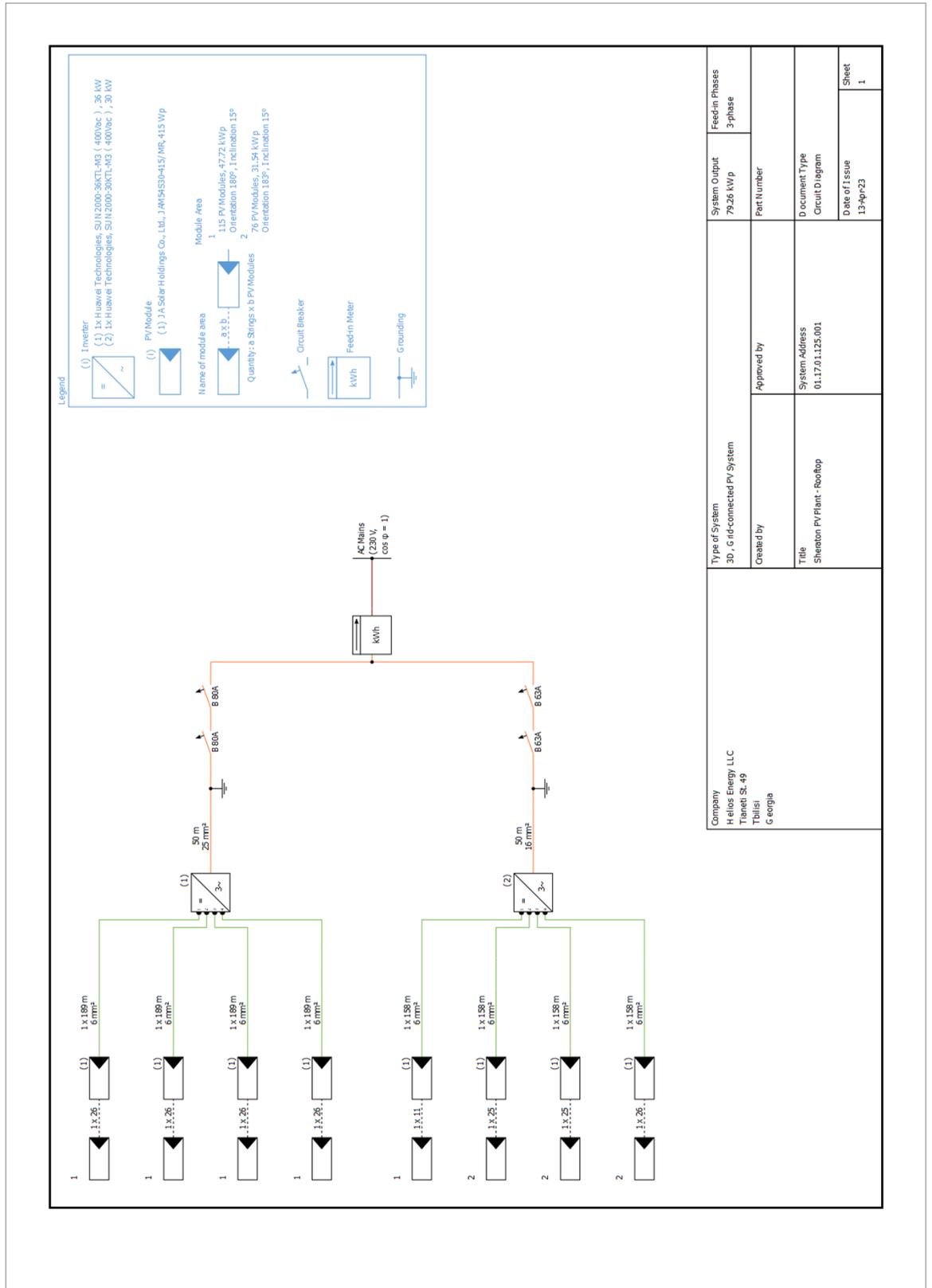


Figure: Circuit Diagram

# Dimensioning Plan

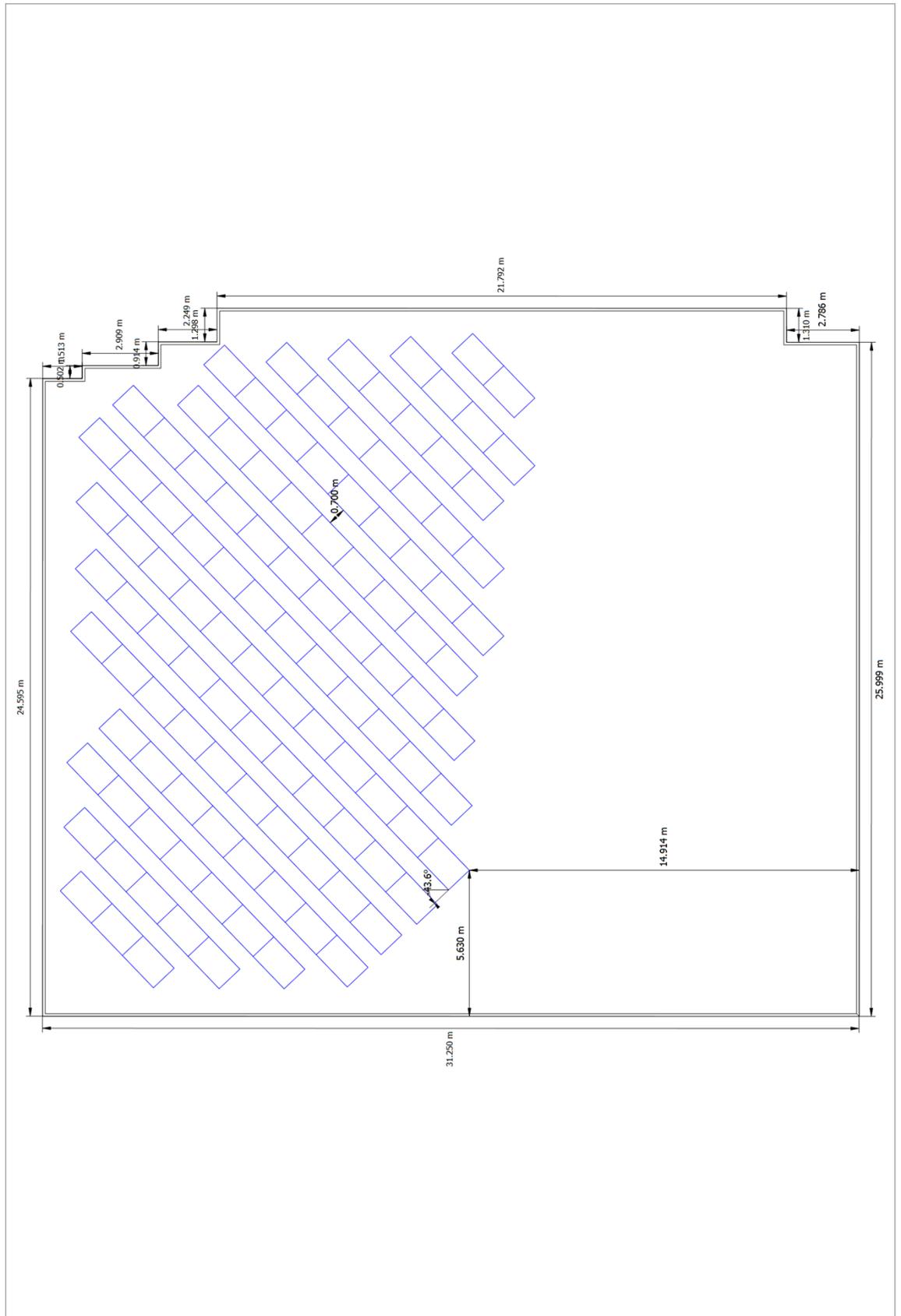


Figure: Arbitrary Building 14-Mounting Surface Southwest

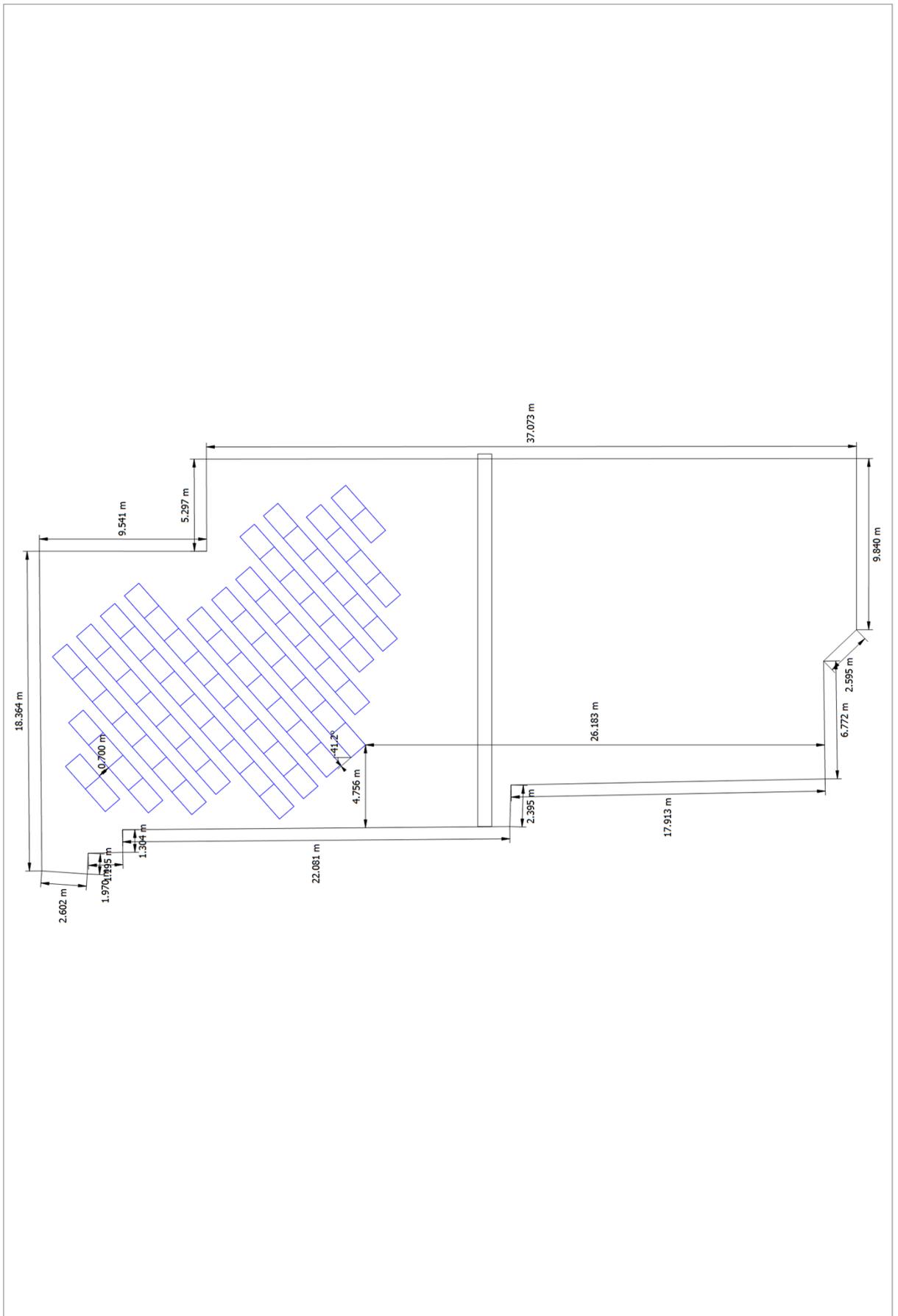


Figure: Arbitrary Building 15-Mounting Surface Southwest

# String Plan

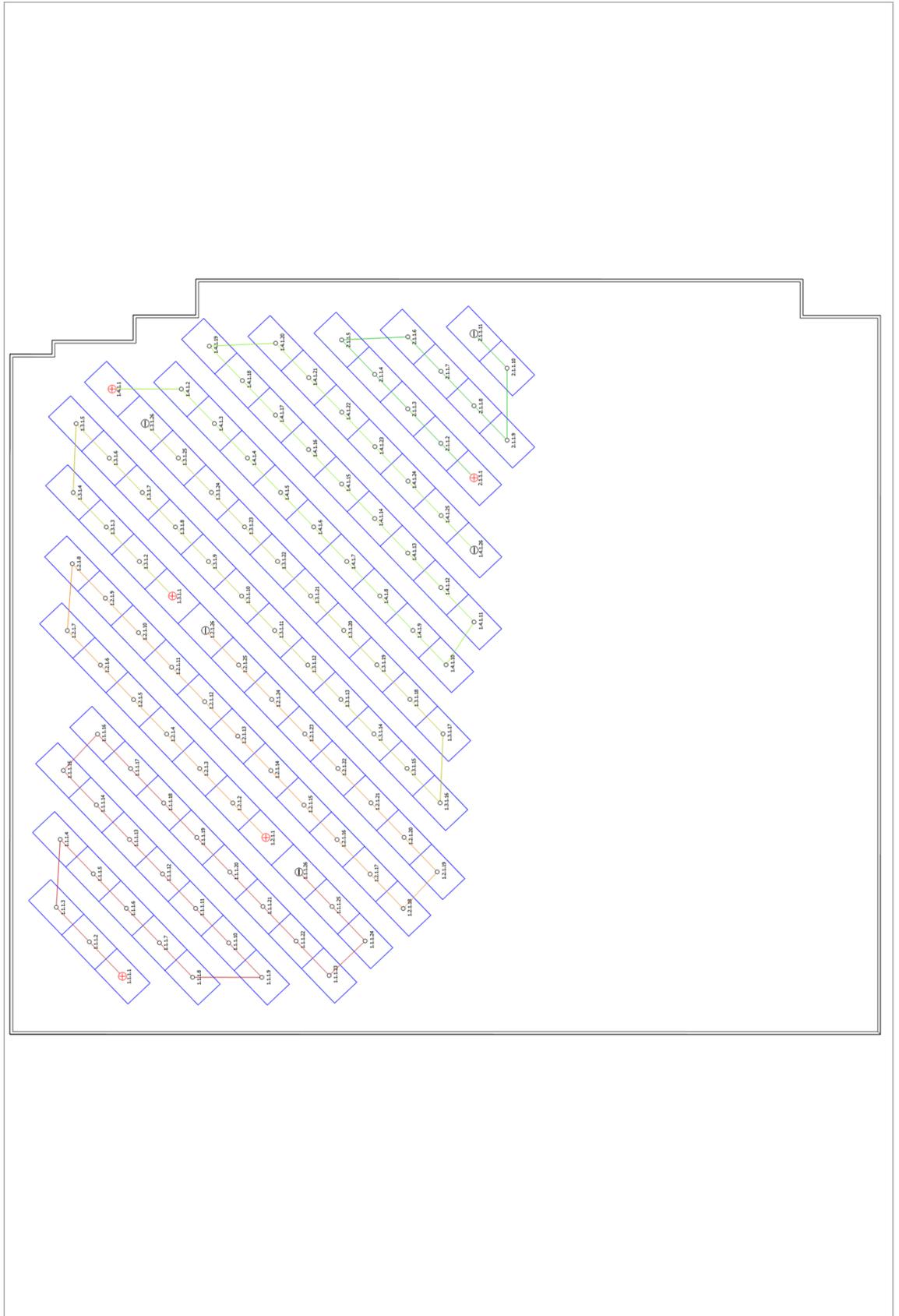


Figure: Arbitrary Building 14-Mounting Surface Southwest

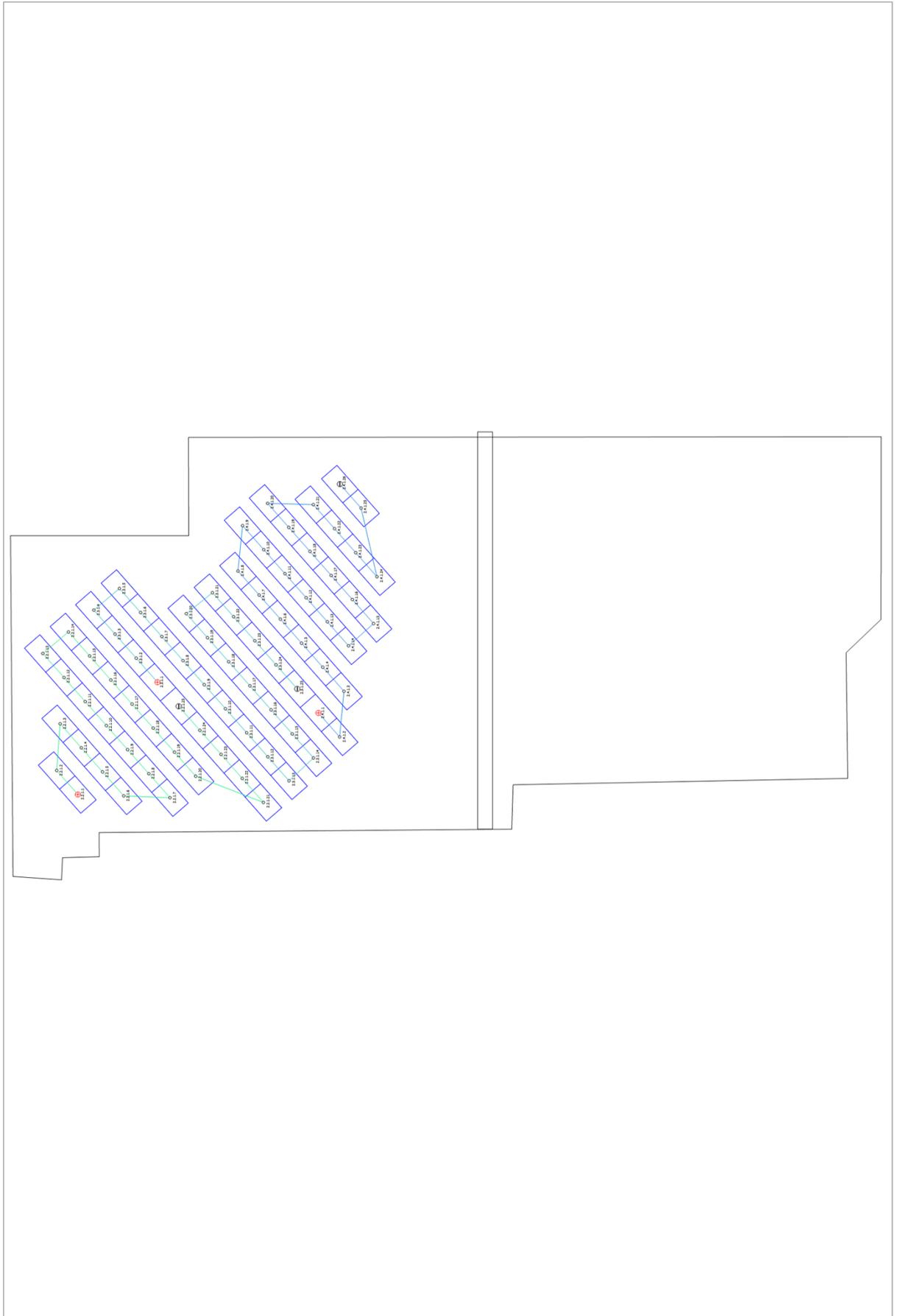


Figure: Arbitrary Building 15-Mounting Surface Southwest

## Parts list

### Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		JA Solar Holdings Co., Ltd.	JAM54S30-415/MR	191	Piece
2	Inverter		Huawei Technologies	SUN2000-36KTL-M3 (400Vac)	1	Piece
3	Inverter		Huawei Technologies	SUN2000-30KTL-M3 (400Vac)	1	Piece
4	Cable			AC cables 3-phase 16 mm <sup>2</sup> Copper	50	m
5	Cable			AC cables 3-phase 25 mm <sup>2</sup> Copper	50	m
6	Cable			String Cable 6 mm <sup>2</sup> Copper	1388	m
7	Components			Feed-in Meter	1	Piece
8	Components			Circuit Breaker B 80A	2	Piece
9	Components			Circuit Breaker B 63A	2	Piece

# Screenshots, 3D Design Environment

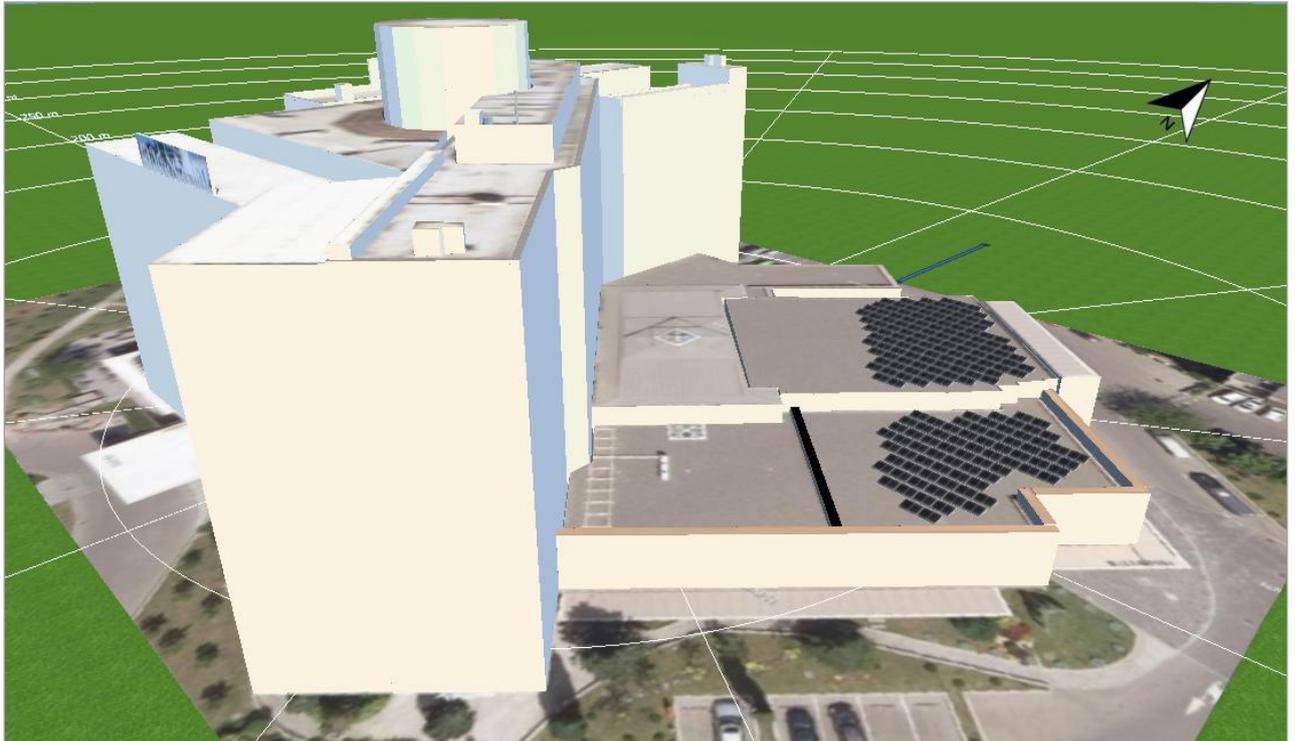


Figure: Screenshot03

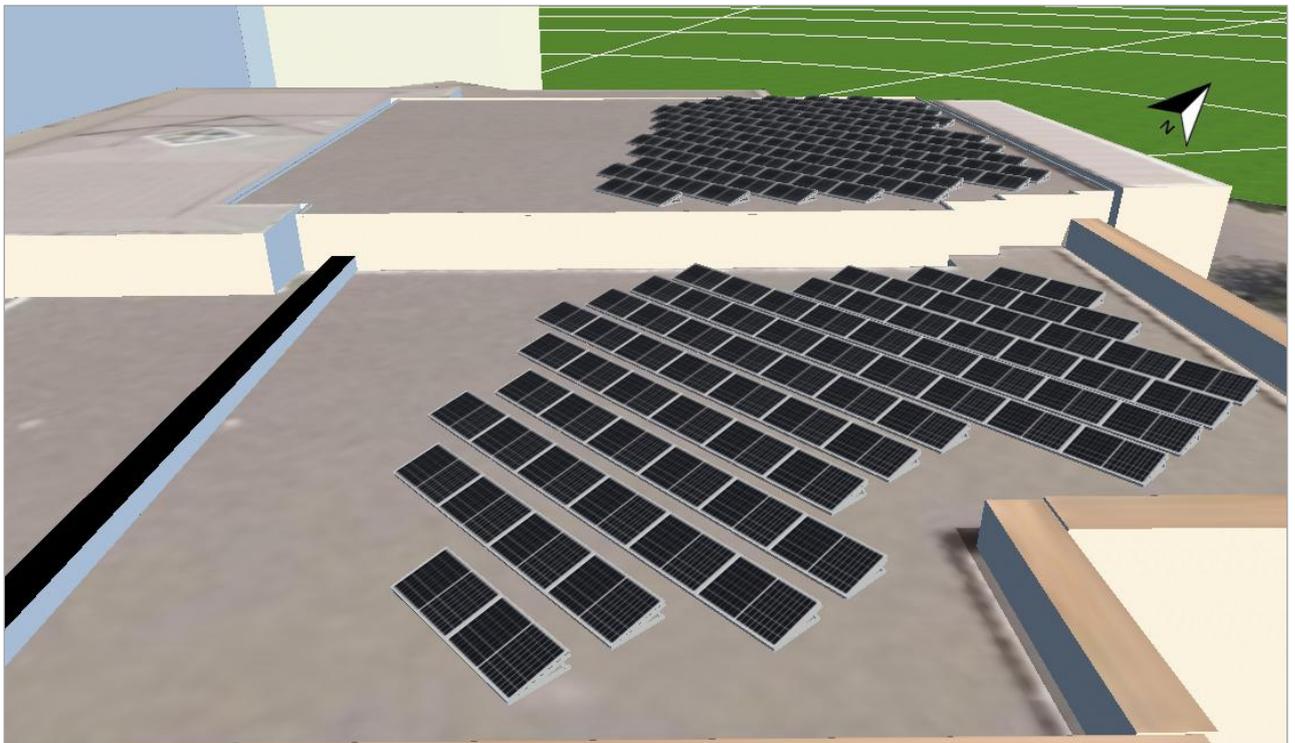


Figure: Screenshot04

