



Solar Roof Design
10 Mill Grange
Mallusk
Ireland

Customer No.: 123
Project Name: East / West Roof 300Kwp facing @ 88.5 degrees
Offer no.: 001

10/09/2023

Documentation- 001

Customer Details

Company	Sample Install Company Name
Customer Number	123
Contact person	Mr Installer
Address	123 anystreet Anytown Any Country Any Postcode
Phone	123456789
Fax	N/A
E-Mail	info@sampleinstaler.com

Project Data

Project Name	East / West Roof 300Kwp facing @ 88.5 degrees
Offer no.	001
Project Designer	Noel Hynes
Address	Any Street Any Town Any City Any Postcode



Project Description:

Location :Sample Commercial
Size : 300Kwp with 6no 50Kwp Inverters
Unit Cost from Utility €0.40
Feed in Tariff €0.21
Consumption based on 98% @ 450,000kwh/pa



East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

Project Overview

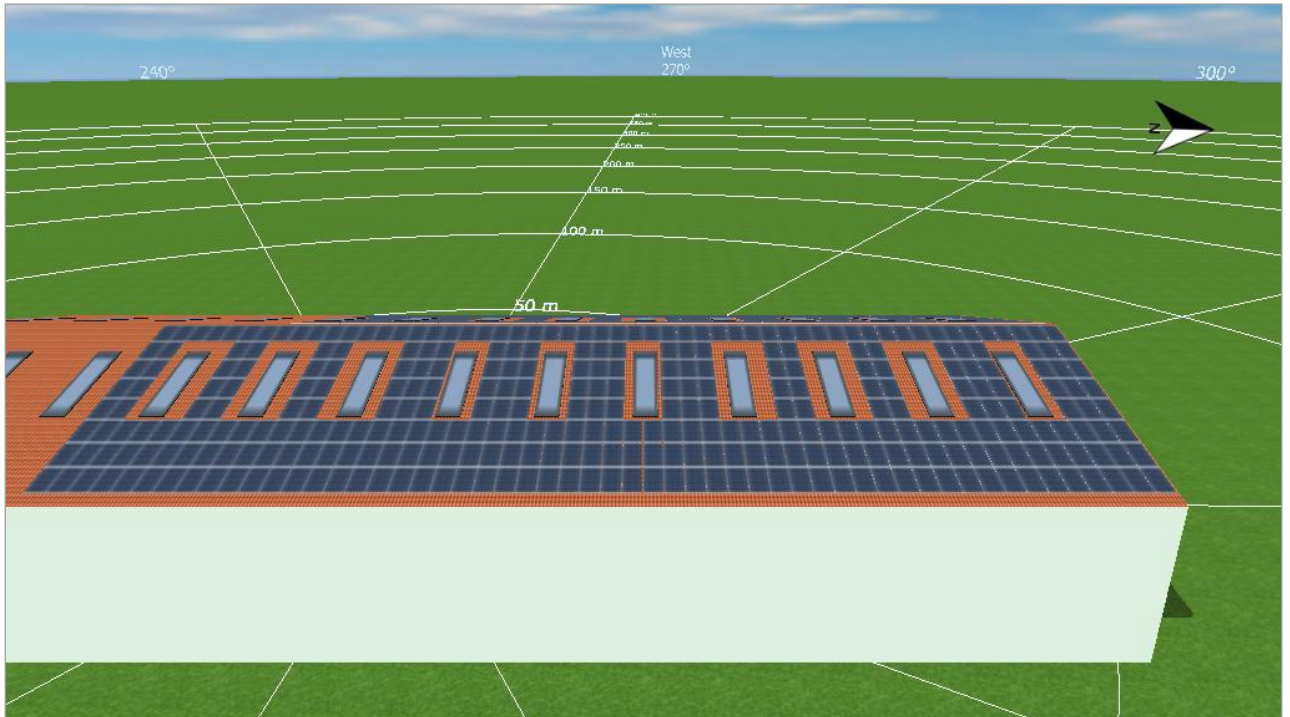


Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV System with Electrical Appliances

Climate Data	Valentia, IRL (1996 - 2015)
Values source	Meteonorm 8.1
PV Generator Output	306 kWp
PV Generator Surface	1,453.3 m ²
Number of PV Modules	612
Number of Inverters	6

East / West Roof 300Kwp facing @ 88.5 degrees

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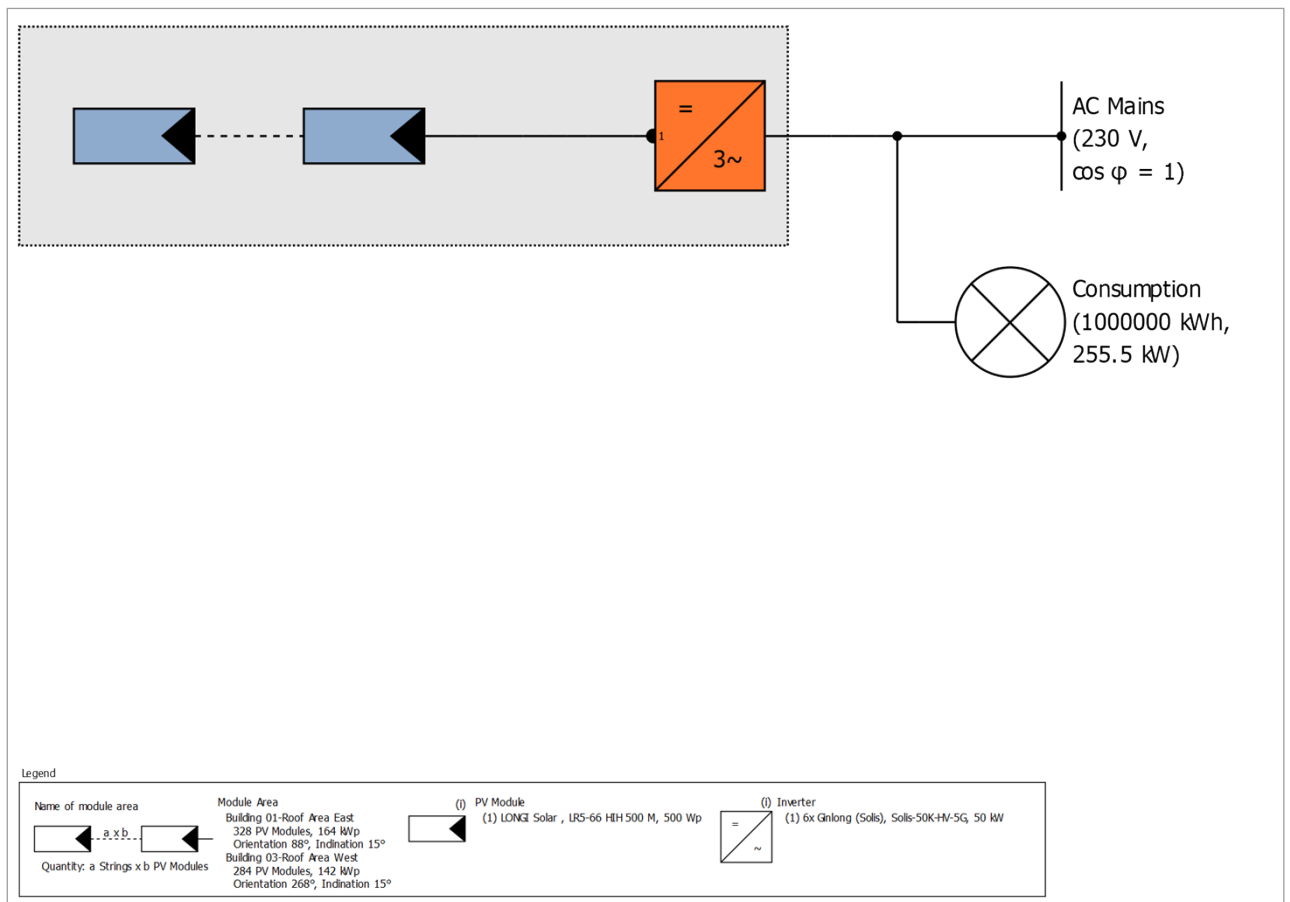


Figure: Schematic diagram

Production Forecast

Production Forecast

PV Generator Output	306.00 kWp
Spec. Annual Yield	885.10 kWh/kWp
Performance Ratio (PR)	92.93 %
Yield Reduction due to Shading	0.0 %
PV Generator Energy (AC grid)	270,918 kWh/Year
Own Consumption	265,621 kWh/Year
Down-regulation at Feed-in Point	0 kWh/Year
Grid Export	5,297 kWh/Year
Own Power Consumption	98.0 %
CO ₂ Emissions avoided	127,294 kg / year
Level of Self-sufficiency	26.6 %

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Financial Analysis

Your Gain

Total investment costs	286,000.00 €
Internal Rate of Return (IRR)	36.94 %
Amortization Period	2.8 Years
Electricity Production Costs	0.0479 €/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.



East / West Roof 300Kwp facing @ 88.5 degrees

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Set-up of the System

Overview

System Data

Type of System	3D, Grid-connected PV System with Electrical Appliances
Start of Operation	01/01/2024

Climate Data

Location	Valentia, IRL (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

Consumption

Total Consumption	1000000 kWh
NH Max Consumption	1000000 kWh
Load Peak	255.5 kW

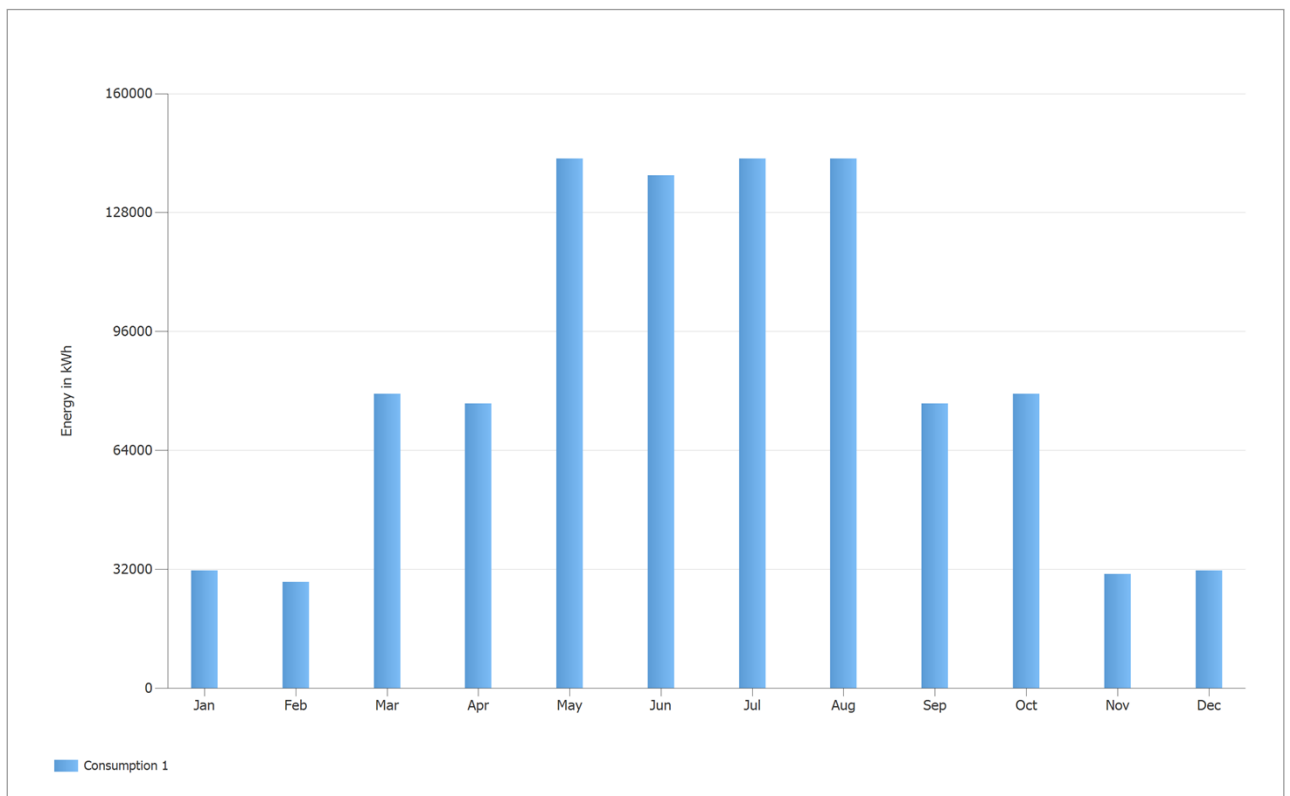


Figure: Consumption

East / West Roof 300Kwp facing @ 88.5 degrees

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Module Areas

1. Module Area - Building 01-Roof Area East

PV Generator, 1. Module Area - Building 01-Roof Area East

Name	Building 01-Roof Area East
PV Modules	328 x LR5-66 HIH 500 M (v2)
Manufacturer	LONGI Solar
Inclination	15 °
Orientation	East 88 °
Installation Type	Roof parallel
PV Generator Surface	778.9 m ²

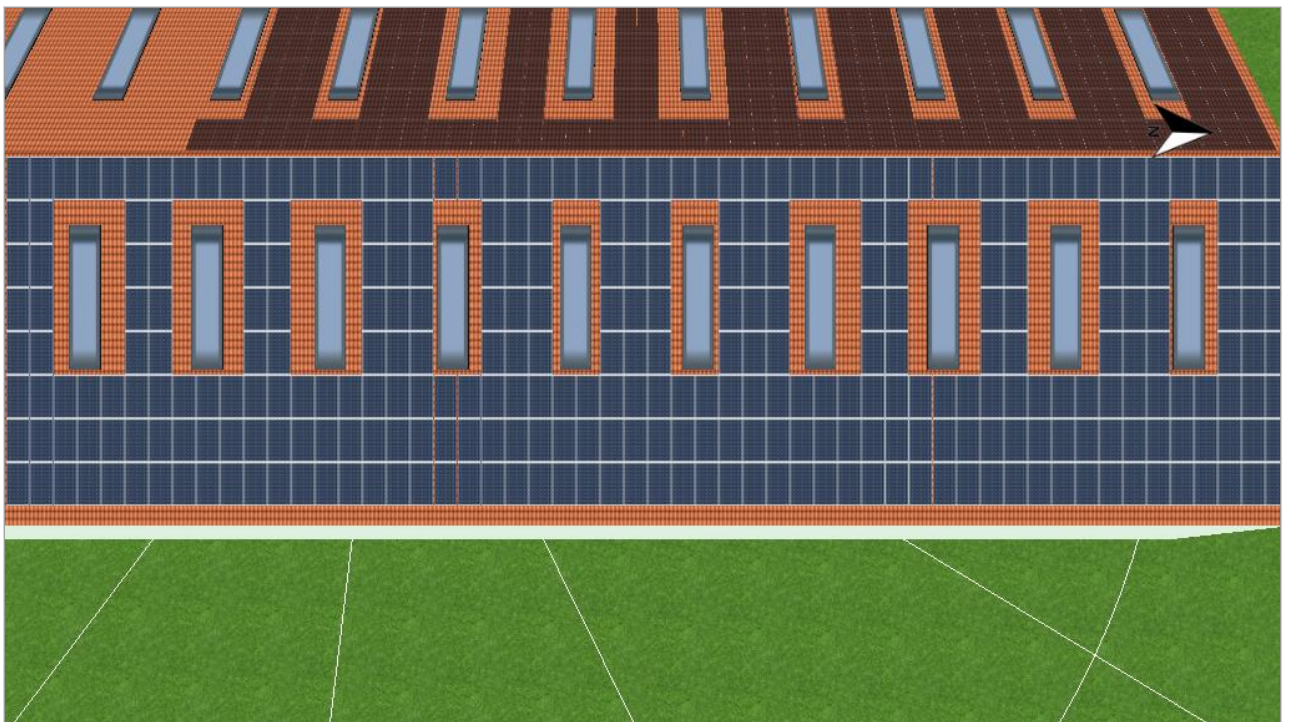


Figure: 1. Module Area - Building 01-Roof Area East

East / West Roof 300Kwp facing @ 88.5 degrees

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Degradation of Module, 1. Module Area - Building 01-Roof Area East

Characteristic curve	Exponential
Remaining power (power output) after 1 year	97.5 %
Remaining power (power output) after 20 years	80 %

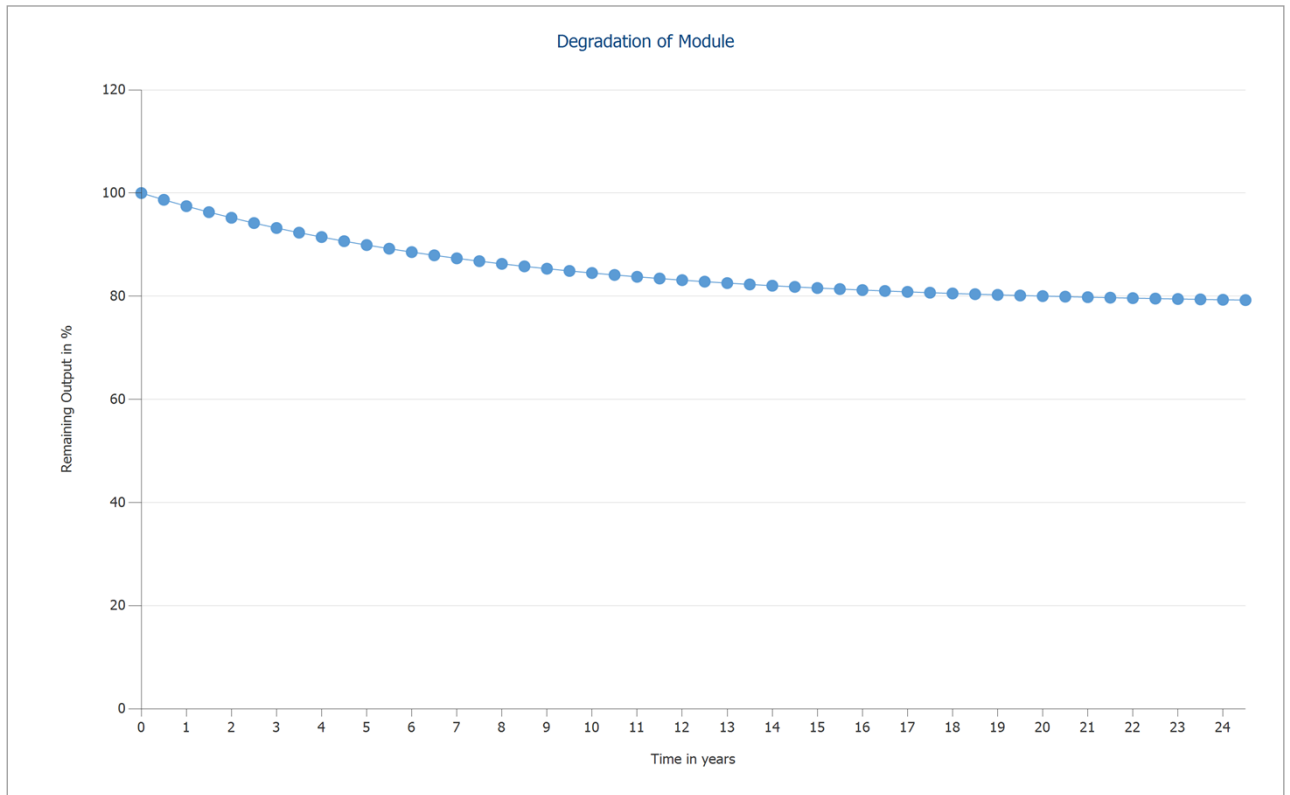


Figure: Degradation of Module, 1. Module Area - Building 01-Roof Area East

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2. Module Area - Building 03-Roof Area West

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

Name	Building 03-Roof Area West
PV Modules	284 x LR5-66 HIH 500 M (v2)
Manufacturer	LONGI Solar
Inclination	15 °
Orientation	West 268 °
Installation Type	Roof parallel
PV Generator Surface	674.4 m ²



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

East / West Roof 300Kwp facing @ 88.5 degrees

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Degradation of Module, 2. Module Area - Building 03-Roof Area West

Characteristic curve	Exponential
Remaining power (power output) after 1 year	97.5 %
Remaining power (power output) after 20 years	80 %

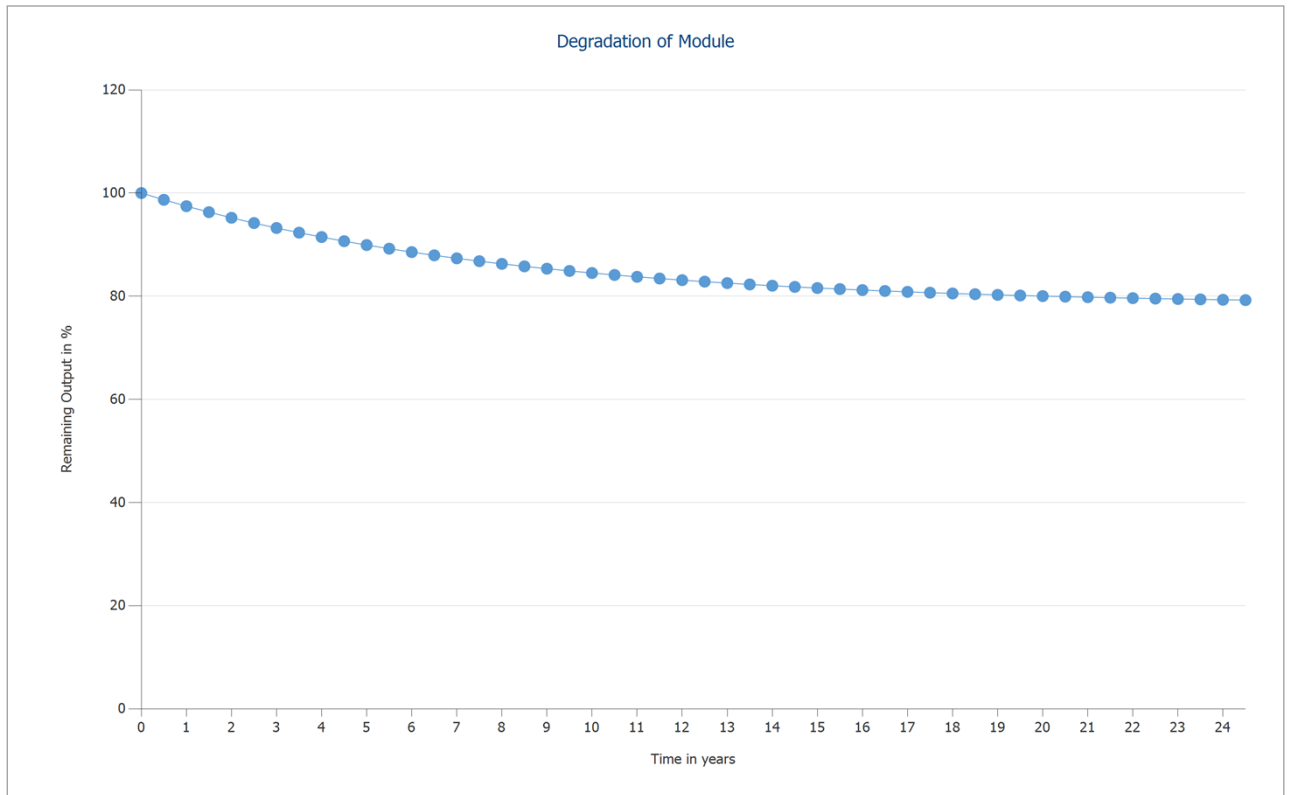


Figure: Degradation of Module, 2. Module Area - Building 03-Roof Area West

East / West Roof 300Kwp facing @ 88.5 degrees

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Horizon Line, 3D Design

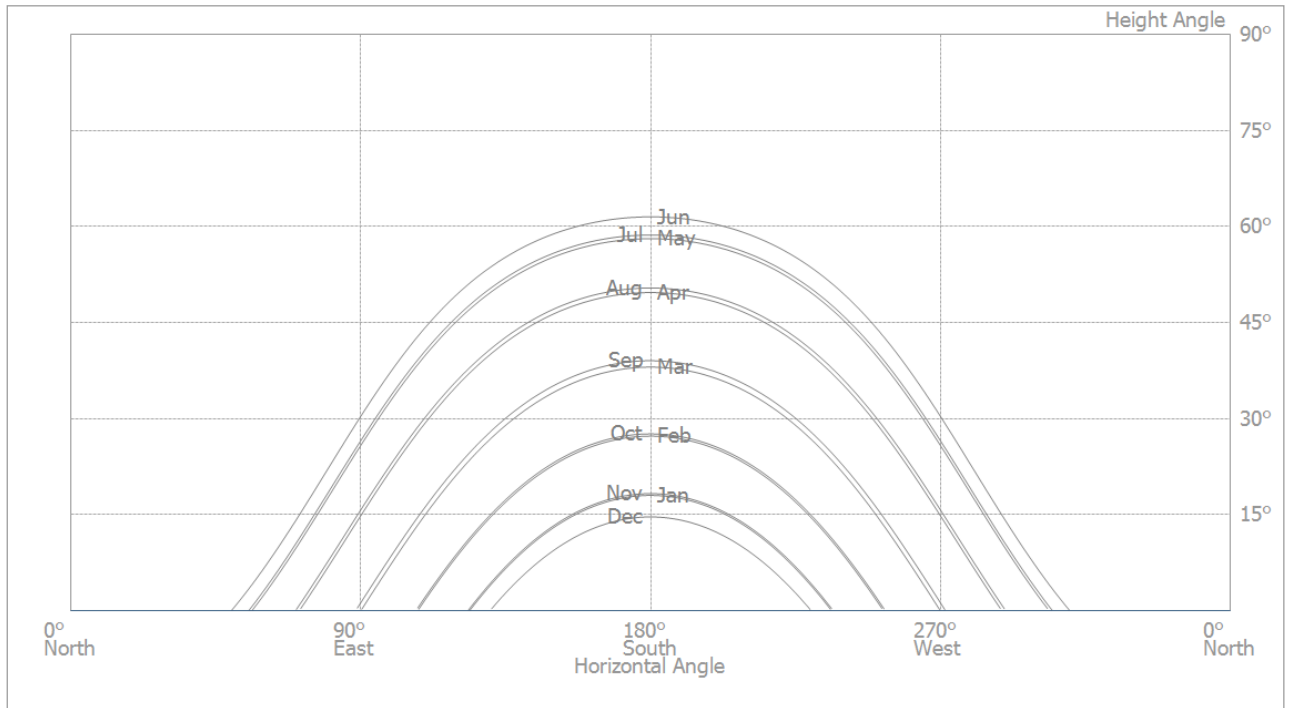


Figure: Horizon (3D Design)

East / West Roof 300Kwp facing @ 88.5 degrees

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Inverter configuration

Configuration 1

East / West Roof 300Kwp facing @ 88.5 degrees

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Module Areas	Building 01-Roof Area East + Building 03-Roof Area West
Inverter 1	
Model	Solis-50K-HV-5G (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	109 %
Configuration	MPP 1: 2 x 15
	MPP 2: 2 x 15
	MPP 3: 2 x 14
	MPP 4: 1 x 21
Inverter 2	
Model	Solis-50K-HV-5G (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	109 %
Configuration	MPP 1: 2 x 15
	MPP 2: 2 x 15
	MPP 3: 2 x 14
	MPP 4: 1 x 21
Inverter 3	
Model	Solis-50K-HV-5G (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	110 %
Configuration	MPP 1: 2 x 15
	MPP 2: 2 x 15
	MPP 3: 2 x 13
	MPP 4: 2 x 12
Inverter 4	
Model	Solis-50K-HV-5G (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	95 %
Configuration	MPP 1: 2 x 14
	MPP 2: 2 x 14
	MPP 3: 2 x 11
	MPP 4: 1 x 17
Inverter 5	
Model	Solis-50K-HV-5G (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	95 %
Configuration	MPP 1: 2 x 14
	MPP 2: 2 x 14
	MPP 3: 2 x 11
	MPP 4: 1 x 17
Inverter 6	
Model	Solis-50K-HV-5G (v2)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	94 %
Configuration	MPP 1: 2 x 14
	MPP 2: 2 x 14

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MPP 3: 2 x 11

MPP 4: 1 x 16

AC Mains

AC Mains

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

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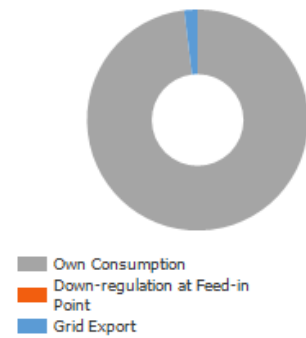
Simulation Results

Results Total System

PV System

PV Generator Output	306.00 kWp
Spec. Annual Yield	885.10 kWh/kWp
Performance Ratio (PR)	92.93 %
Yield Reduction due to Shading	0.0 %
PV Generator Energy (AC grid)	270,918 kWh/Year
Own Consumption	265,621 kWh/Year
Down-regulation at Feed-in Point	0 kWh/Year
Grid Export	5,297 kWh/Year
Own Power Consumption	98.0 %
CO ₂ Emissions avoided	127,294 kg / year

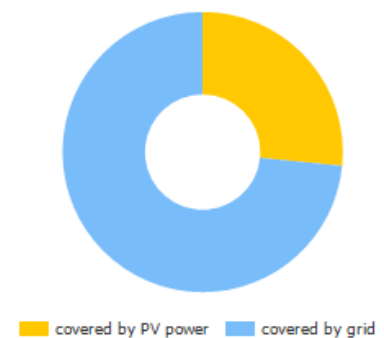
PV Generator Energy (AC grid)



Appliances

Appliances	1,000,000 kWh/Year
Standby Consumption (Inverter)	78 kWh/Year
Total Consumption	1,000,078 kWh/Year
covered by PV power	265,621 kWh/Year
covered by grid	734,458 kWh/Year
Solar Fraction	26.6 %

Total Consumption



Level of Self-sufficiency

Total Consumption	1,000,078 kWh/Year
covered by grid	734,458 kWh/Year
Level of Self-sufficiency	26.6 %

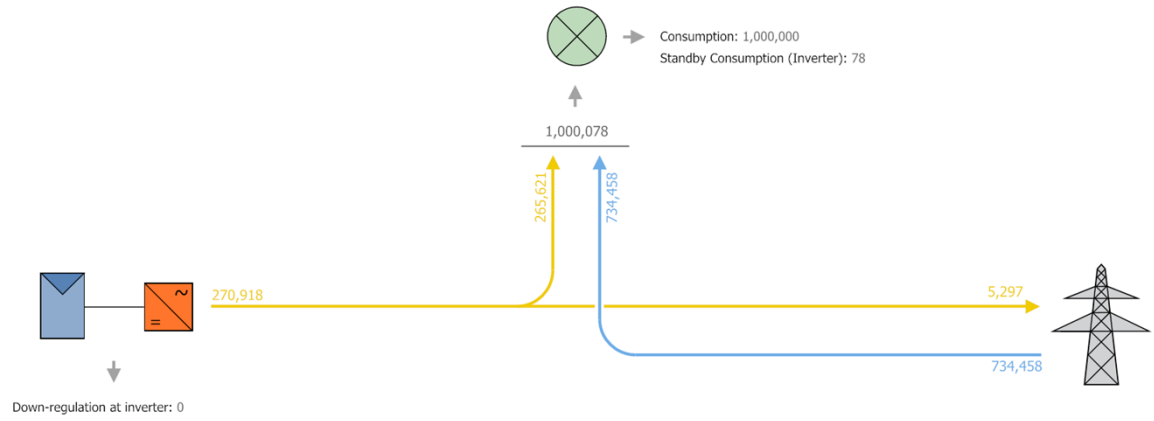
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Energy Flow Graph

Project: East / West Roof 300Kwp facing @ 88.5 degrees



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

Figure: Energy flow

East / West Roof 300Kwp facing @ 88.5 degrees

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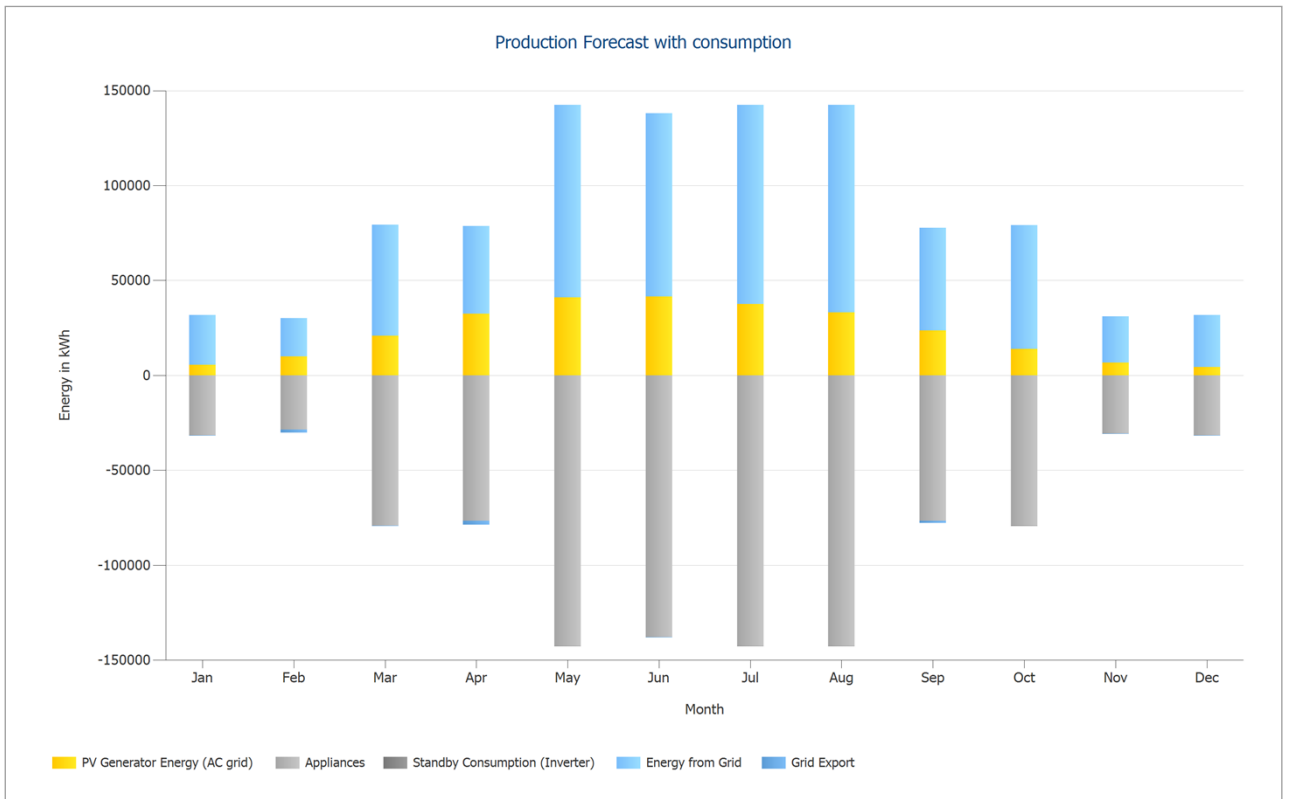


Figure: Production Forecast with consumption

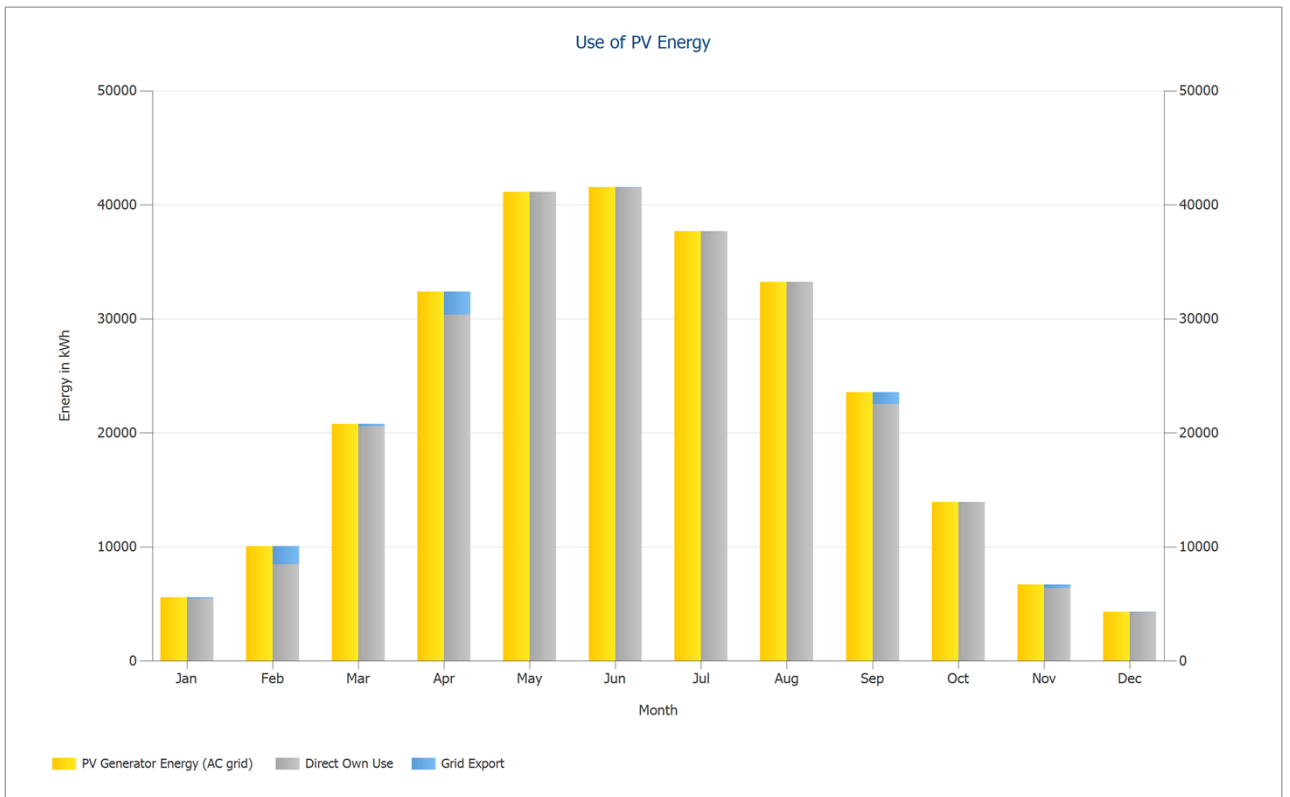


Figure: Use of PV Energy

East / West Roof 300Kwp facing @ 88.5 degrees

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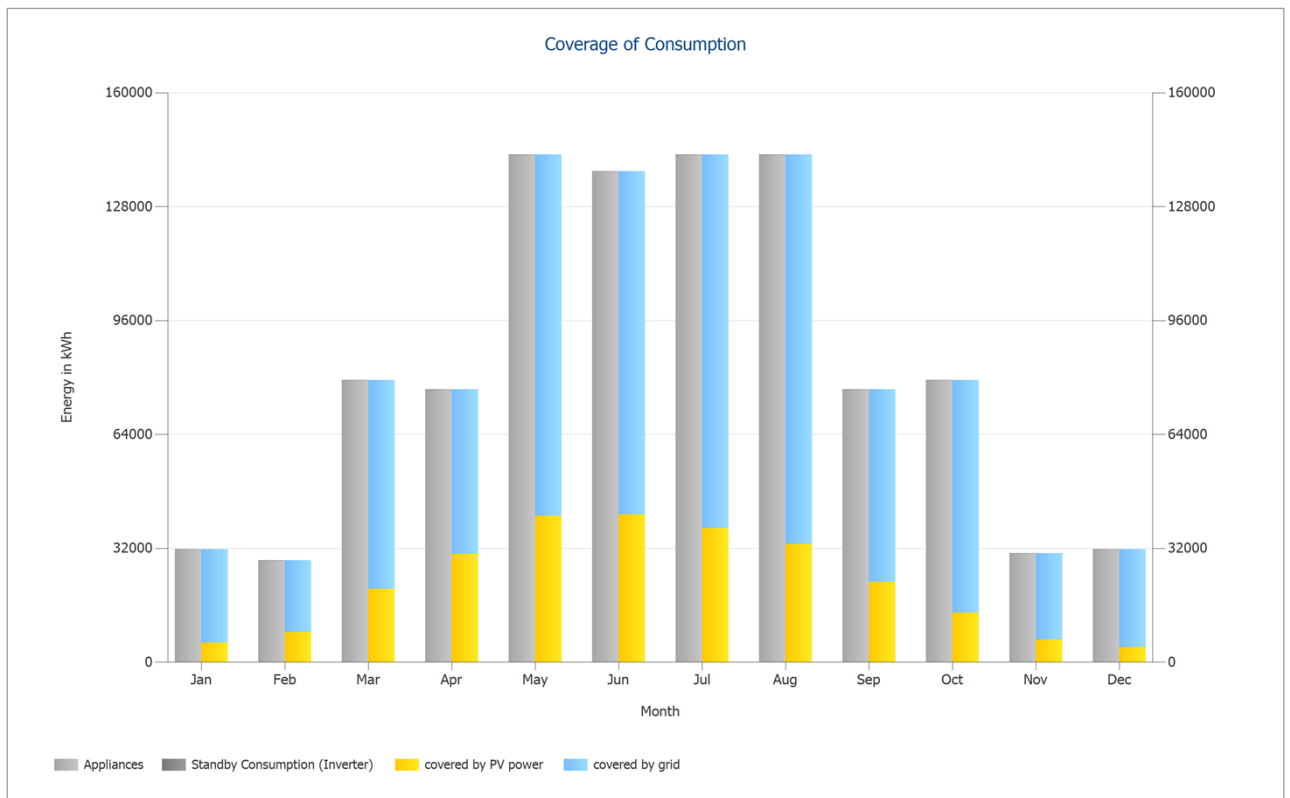


Figure: Coverage of Consumption

Results per Module Area

Building 01-Roof Area East

PV Generator Output	164.00 kWp
PV Generator Surface	778.87 m ²
Global Radiation at the Module	943.39 kWh/m ²
Global Radiation on Module without reflection	949.77 kWh/m ²
Performance Ratio (PR)	93.07 %
PV Generator Energy (AC grid)	145003.86 kWh/Year
Spec. Annual Yield	884.17 kWh/kWp

Building 03-Roof Area West

PV Generator Output	142.00 kWp
PV Generator Surface	674.39 m ²
Global Radiation at the Module	948.66 kWh/m ²
Global Radiation on Module without reflection	955.10 kWh/m ²
Performance Ratio (PR)	92.82 %
PV Generator Energy (AC grid)	125913.83 kWh/Year
Spec. Annual Yield	886.72 kWh/kWp

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PV System Energy Balance

PV System Energy Balance

Global radiation - horizontal	978.53 kWh/m²	
Deviation from standard spectrum	-9.79 kWh/m ²	-1.00 %
Ground Reflection (Albedo)	3.30 kWh/m ²	0.34 %
Orientation and inclination of the module surface	-19.81 kWh/m ²	-2.04 %
Module-independent shading	0.00 kWh/m ²	0.00 %
Reflection on the Module Interface	-6.40 kWh/m ²	-0.67 %
Global Radiation at the Module	945.84 kWh/m²	
	945.84 kWh/m ²	
	x 1453.253 m ²	
	= 1,374,541.20 kWh	
Global PV Radiation	1,374,541.20 kWh	
Soiling	0.00 kWh	0.00 %
STC Conversion (Rated Efficiency of Module 21.06 %)	-1,085,061.96 kWh	-78.94 %
Rated PV Energy	289,479.23 kWh	
Module-specific Partial Shading	0.00 kWh	0.00 %
Low-light performance	-4,744.40 kWh	-1.64 %
Deviation from the nominal module temperature	245.47 kWh	0.09 %
Diodes	0.00 kWh	0.00 %
Mismatch (Manufacturer Information)	-5,699.61 kWh	-2.00 %
Mismatch (Configuration/Shading)	0.00 kWh	0.00 %
PV Energy (DC) without inverter down-regulation	279,280.70 kWh	
Failing to reach the DC start output	-15.77 kWh	-0.01 %
Down-regulation on account of the MPP Voltage Range	0.00 kWh	0.00 %
Down-regulation on account of the max. DC Current	-0.32 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	-0.36 kWh	0.00 %
MPP Matching	-415.63 kWh	-0.15 %
PV energy (DC)	278,848.62 kWh	
Energy at the Inverter Input	278,848.62 kWh	
Input voltage deviates from rated voltage	-326.31 kWh	-0.12 %
DC/AC Conversion	-7,604.62 kWh	-2.73 %
Standby Consumption (Inverter)	-78.40 kWh	-0.03 %
Total Cable Losses	0.00 kWh	0.00 %
PV energy (AC) minus standby use	270,839.29 kWh	
PV Generator Energy (AC grid)	270,917.68 kWh	

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Financial Analysis

Overview

System Data

Grid Export in the first year (incl. module degradation)	5,242 kWh/Year
PV Generator Output	306 kWp
Start of Operation of the System	01/01/2024
Assessment Period	25 Years
Interest on Capital	1 %

Economic Parameters

Internal Rate of Return (IRR)	36.94 %
Accrued Cash Flow (Cash Balance)	2,242,131.51 €
Amortization Period	2.8 Years
Electricity Production Costs	0.0479 €/kWh

Payment Overview

Specific Investment Costs	934.64 €/kWp
Investment Costs	286,000.00 €
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	1,100.86 €/Year
First year savings	104,778.30 €/Year

New Tariff - Building System

Validity	20/06/2023 - 19/06/2048
Specific feed-in / export Remuneration	0.21 €/kWh
Feed-in / Export Tariff	1100.8578 €/Year

Every Day Tariff (sse Ireland)

Energy Price	0.4 €/kWh
Base Price	70 €/Month
Inflation Rate for Energy Price	2 %/Year

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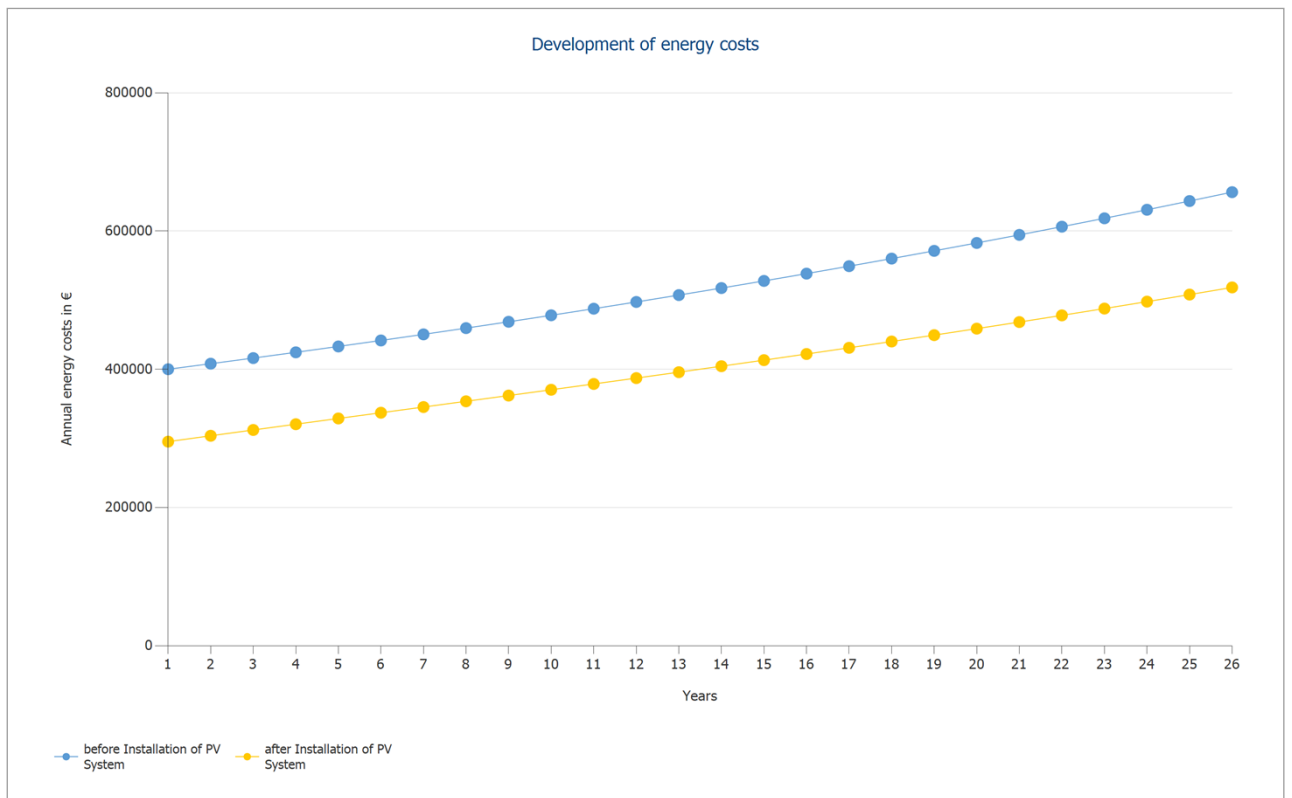


Figure: Development of energy costs

East / West Roof 300Kwp facing @ 88.5 degrees

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Cash flow

Cash flow

	Year 1	Year 2	Year 3	Year 4	Year 5
Investments	-€286,000.00	€0.00	€0.00	€0.00	€0.00
Feed-in / Export Tariff	€1,089.96	€1,052.71	€1,019.16	€988.84	€961.36
Electricity Savings	€103,740.89	€102,231.29	€100,980.90	€99,962.67	€99,152.44
Annual Cash Flow	-€181,169.15	€103,284.00	€102,000.06	€100,951.51	€100,113.81
Accrued Cash Flow (Cash Balance)	-€181,169.15	-€77,885.15	€24,114.91	€125,066.42	€225,180.23

Cash flow

	Year 6	Year 7	Year 8	Year 9	Year 10
Investments	€0.00	€0.00	€0.00	€0.00	€0.00
Feed-in / Export Tariff	€936.38	€913.59	€892.71	€873.53	€855.84
Electricity Savings	€98,528.78	€98,072.36	€97,766.30	€97,595.12	€97,545.48
Annual Cash Flow	€99,465.16	€98,985.95	€98,659.02	€98,468.65	€98,401.32
Accrued Cash Flow (Cash Balance)	€324,645.39	€423,631.34	€522,290.36	€620,759.01	€719,160.33

Cash flow

	Year 11	Year 12	Year 13	Year 14	Year 15
Investments	€0.00	€0.00	€0.00	€0.00	€0.00
Feed-in / Export Tariff	€839.46	€824.24	€810.03	€796.72	€784.21
Electricity Savings	€97,605.02	€97,763.17	€98,010.26	€98,337.69	€98,737.83
Annual Cash Flow	€98,444.48	€98,587.40	€98,820.29	€99,134.42	€99,522.04
Accrued Cash Flow (Cash Balance)	€817,604.81	€916,192.22	€1,015,012.51	€1,114,146.93	€1,213,668.97

Cash flow

	Year 16	Year 17	Year 18	Year 19	Year 20
Investments	€0.00	€0.00	€0.00	€0.00	€0.00
Feed-in / Export Tariff	€772.40	€761.22	€750.59	€740.46	€730.77
Electricity Savings	€99,203.88	€99,729.92	€100,310.38	€100,940.62	€101,616.33
Annual Cash Flow	€99,976.29	€100,491.14	€101,060.97	€101,681.08	€102,347.09
Accrued Cash Flow (Cash Balance)	€1,313,645.26	€1,414,136.40	€1,515,197.38	€1,616,878.46	€1,719,225.56

Cash flow

	Year 21	Year 22	Year 23	Year 24	Year 25
Investments	€0.00	€0.00	€0.00	€0.00	€0.00
Feed-in / Export Tariff	€721.46	€712.51	€703.88	€695.53	€507.06
Electricity Savings	€102,333.69	€103,089.38	€103,880.42	€104,704.04	€105,557.99
Annual Cash Flow	€103,055.15	€103,801.89	€104,584.30	€105,399.56	€106,065.05
Accrued Cash Flow (Cash Balance)	€1,822,280.71	€1,926,082.60	€2,030,666.90	€2,136,066.46	€2,242,131.51

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

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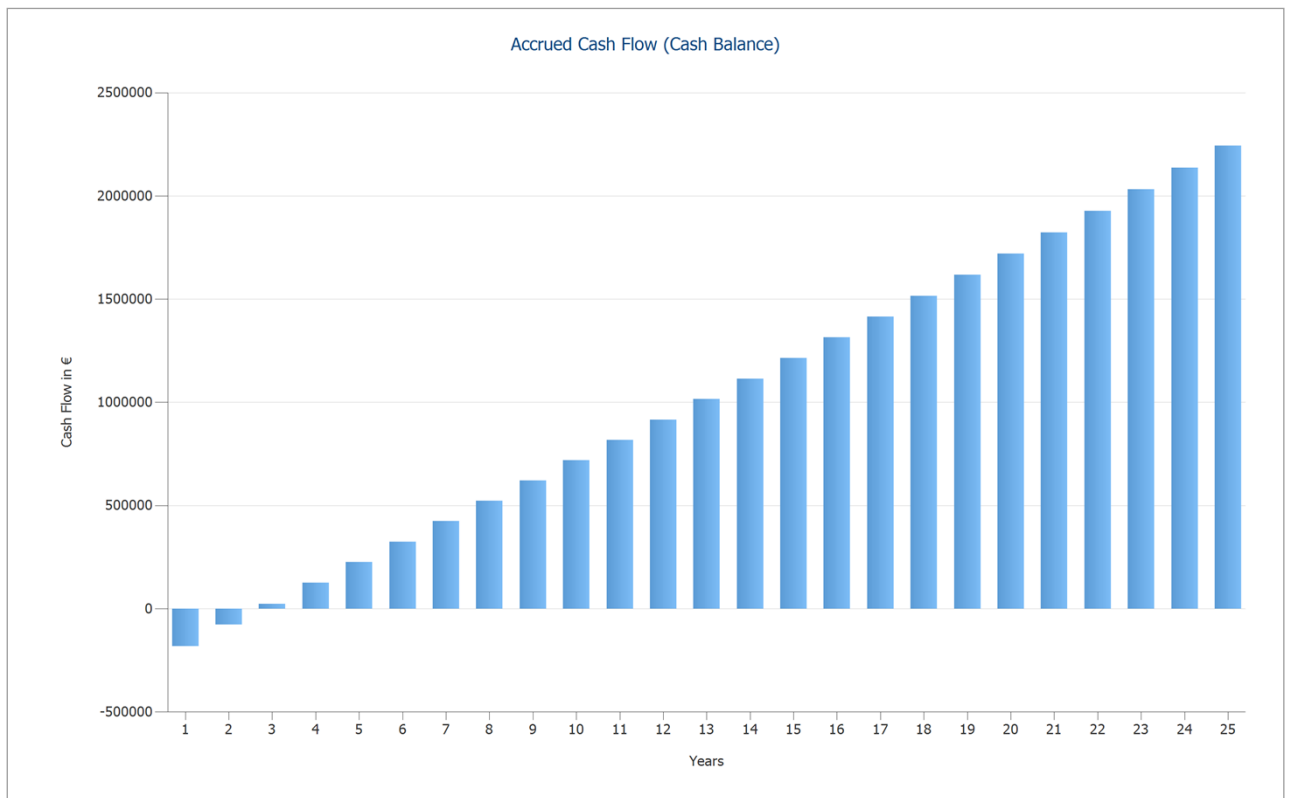


Figure: Accrued Cash Flow (Cash Balance)

East / West Roof 300Kwp facing @ 88.5 degrees

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Data Sheets

PV Module Data Sheet

PV Module: LR5-66 HIH 500 M (v2)

Manufacturer	LONGI Solar
Available	Yes

Electrical Data

Cell Type	Si monocrystalline
Half-cell module	Yes
Cell Count	66
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	38.38 V
MPP Current	13.03 A
Open Circuit Voltage	45.55 V
Short-Circuit Current	13.9 A
Increase open circuit voltage before stabilisation	0 %
Nominal output	500 W
Fill Factor	78.99 %
Efficiency	21.06 %

I/V Part Load Characteristics

Values source	Manufacturer/user-created
Irradiance	200 W/m ²
Voltage in MPP at Part Load	36.847 V
Current in MPP at Part Load	2.652 A
Open Circuit Voltage (Part Load)	42.689 V
Short Circuit Current at Part Load	2.827 A

Additional Parameters

Temperature Coefficient of Voc	-129.4 mV/K
Temperature Coefficient of Isc	6.9 mA/K
Temperature Coefficient of Pmpp	-0.35 %/K
Incident Angle Modifier (IAM)	100 %
Maximum System Voltage	1500 V

Mechanical Data

Width	1134 mm
Height	2094 mm
Depth	35 mm
Frame Width	11 mm
Weight	25.1 kg

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Inverter Data Sheet

Inverter: Solis-50K-HV-5G (v2)

Manufacturer	Ginlong (Solis)
Available	Yes

Electrical data - DC

DC nominal output	50 kW
Max. DC Power	75 kW
Nom. DC Voltage	600 V
Max. Input Voltage	1100 V
Max. Input Current	104 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
Nom. AC Voltage	277 V
Number of Phases	3
With Transformer	No

Electrical data - other

Change in Efficiency when Input Voltage deviates from Rated Voltage	0.15 %/100V
Min. Feed-in Power	35 W
Standby Consumption	10 W
Night Consumption	1 W

MPP Tracker

Output Range < 20% of Power Rating	99.6 %
Output Range > 20% of Power Rating	99.9 %
Count of MPP Trackers	4

MPP Tracker 1-4

Max. Input Current	26 A
Max. short circuit current	40 A
Max. Input Power	22.1 kW
Min. MPP Voltage	200 V
Max. MPP Voltage	1000 V

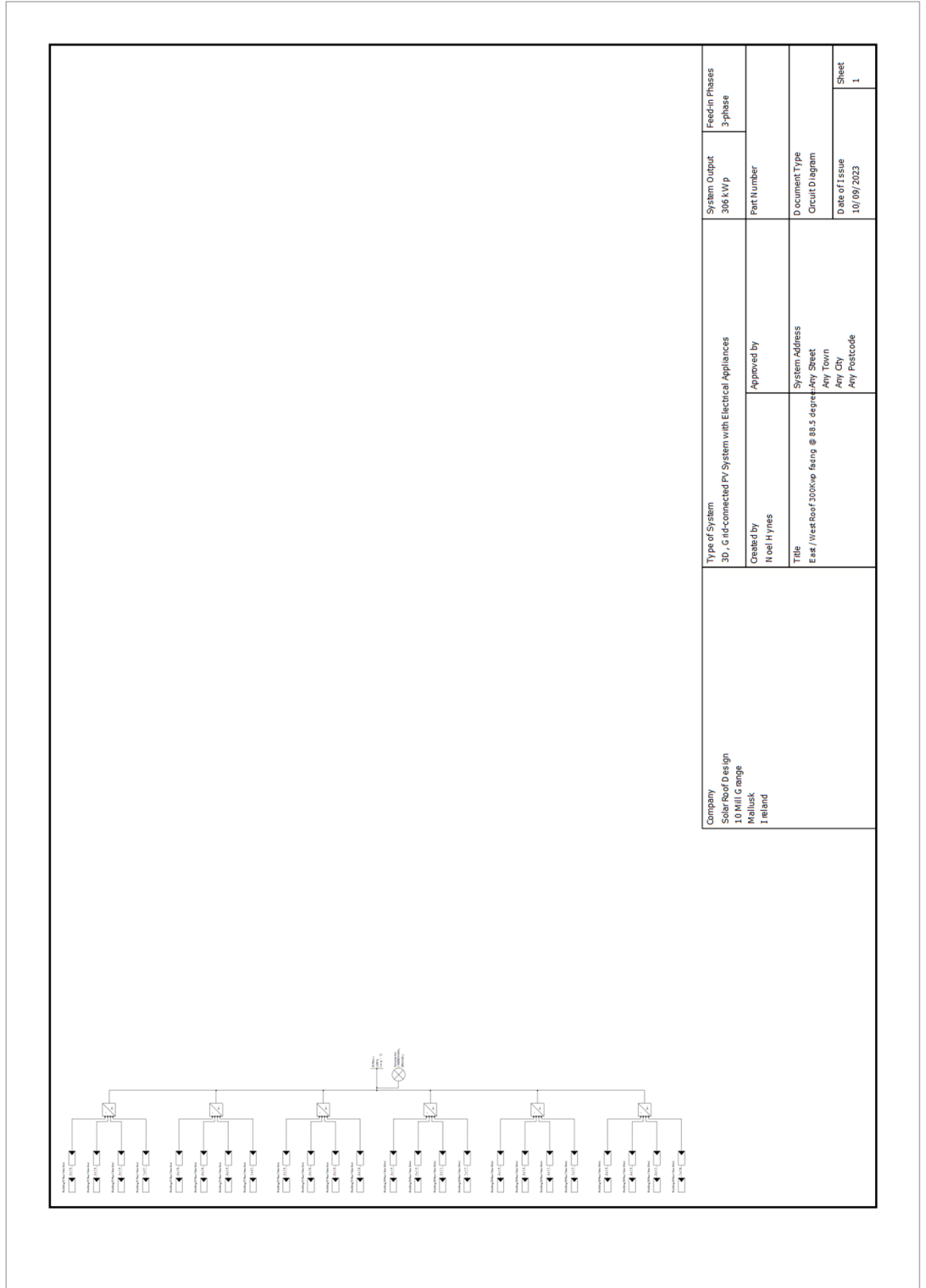
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Customer No.: 123

Plans and parts list

Circuit Diagram



Company Solar Roof Design 10 Mill G range Mullusk Ireland	Type of System 3D / Grid-connected PV System with Electrical Appliances		System Output 306 kWp	Feed-in Phases 3-phase
	Created by Noel Hynes	Approved by System Address Any Street Any Town Any City Any Postcode	Part Number Document Type Circuit Diagram	Date of Issue 10/09/2023
Title East / West Roof 300kw facing @ 88.5 degree				

Figure: Circuit Diagram

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

Overview plan

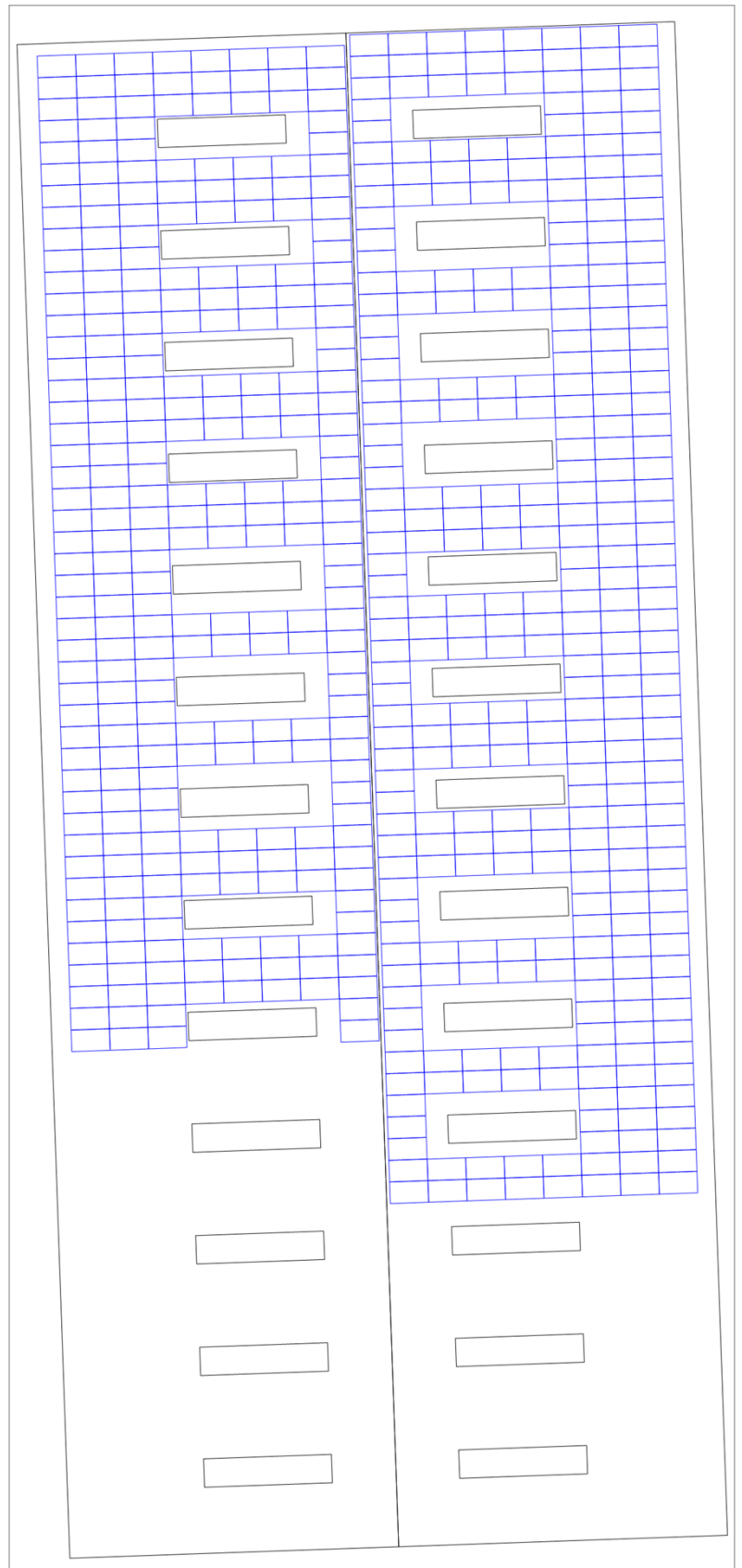


Figure: Overview plan

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

Dimensioning Plan

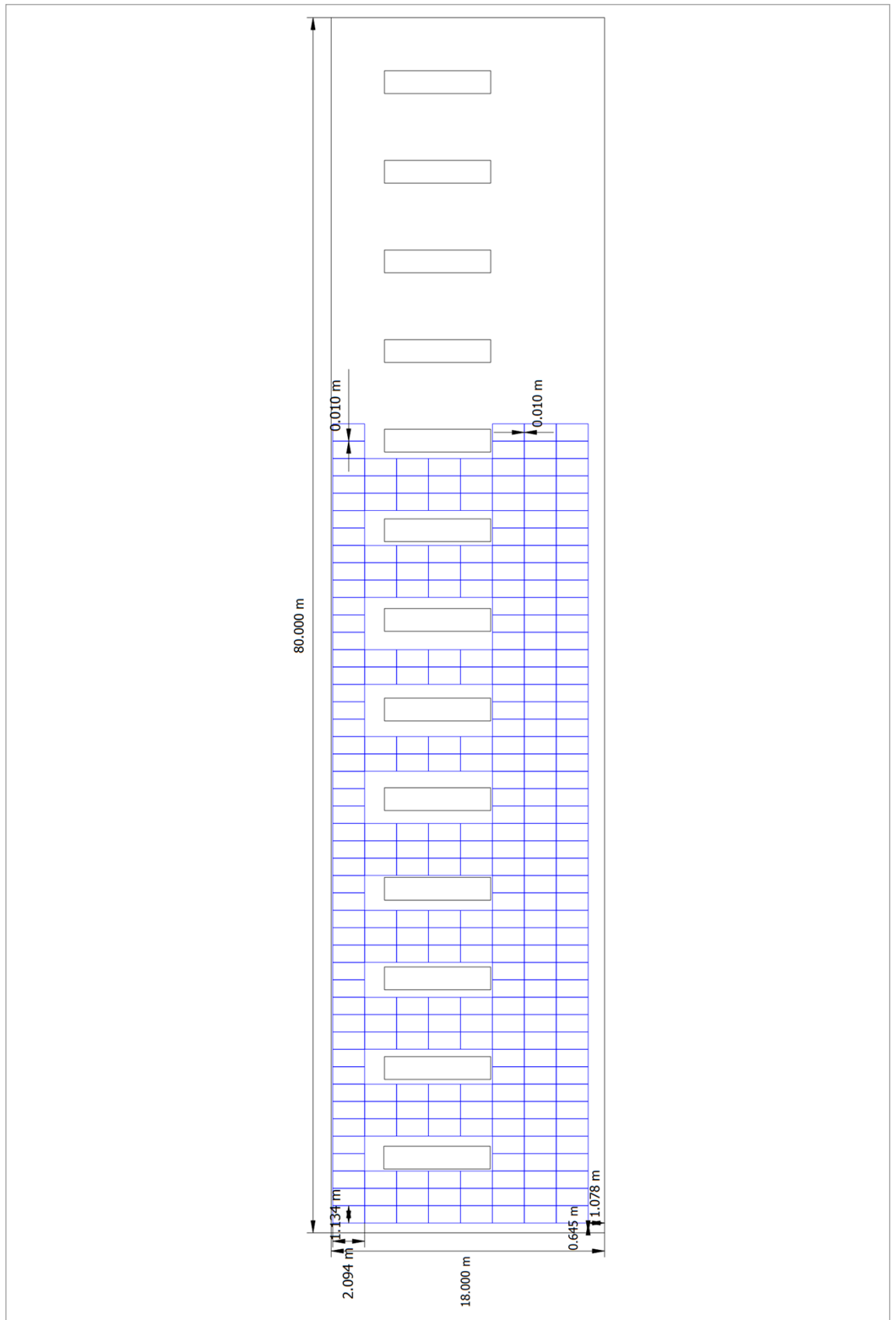


Figure: Building 03 - Roof Area West

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

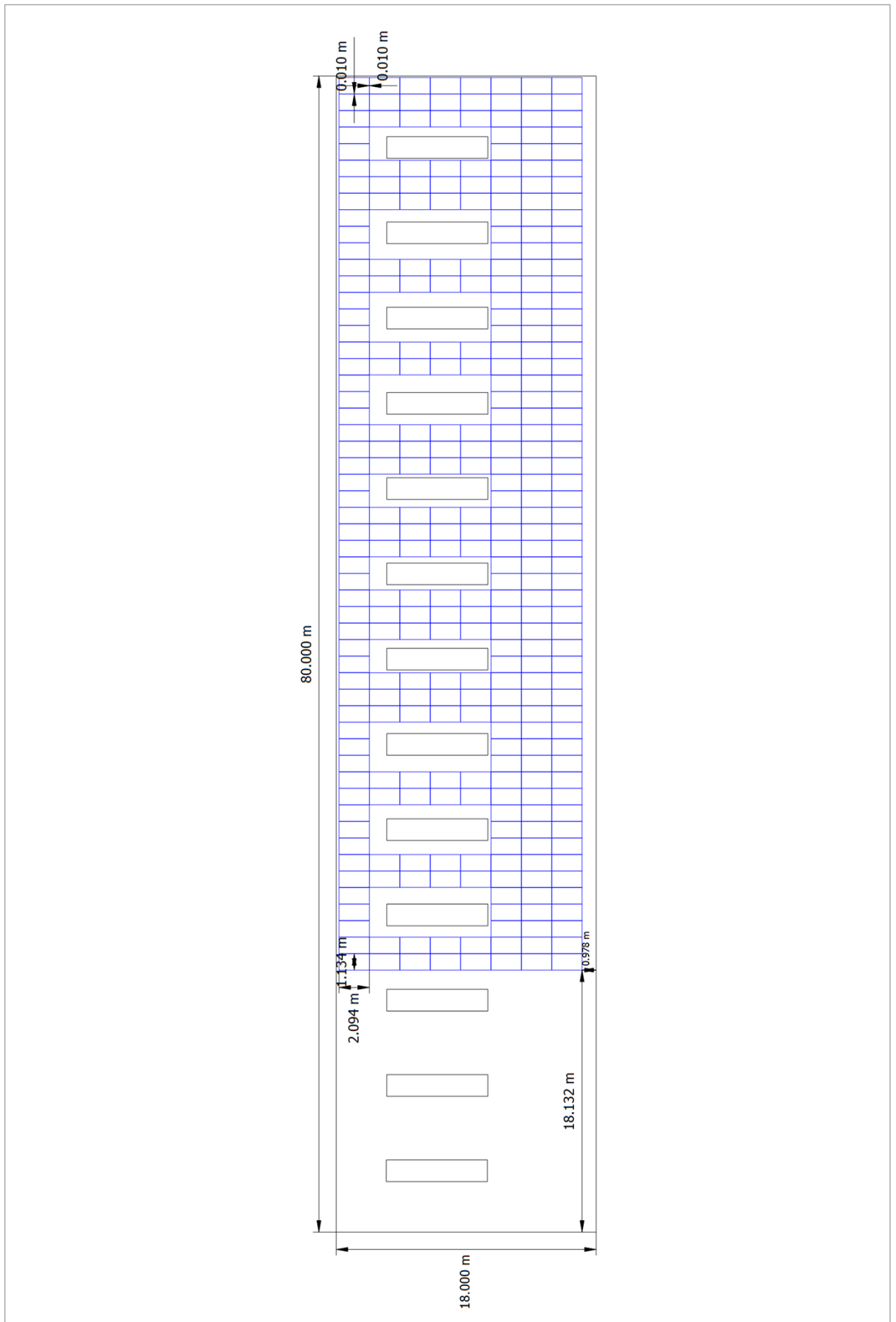


Figure: Building 01 - Roof Area East

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

String Plan

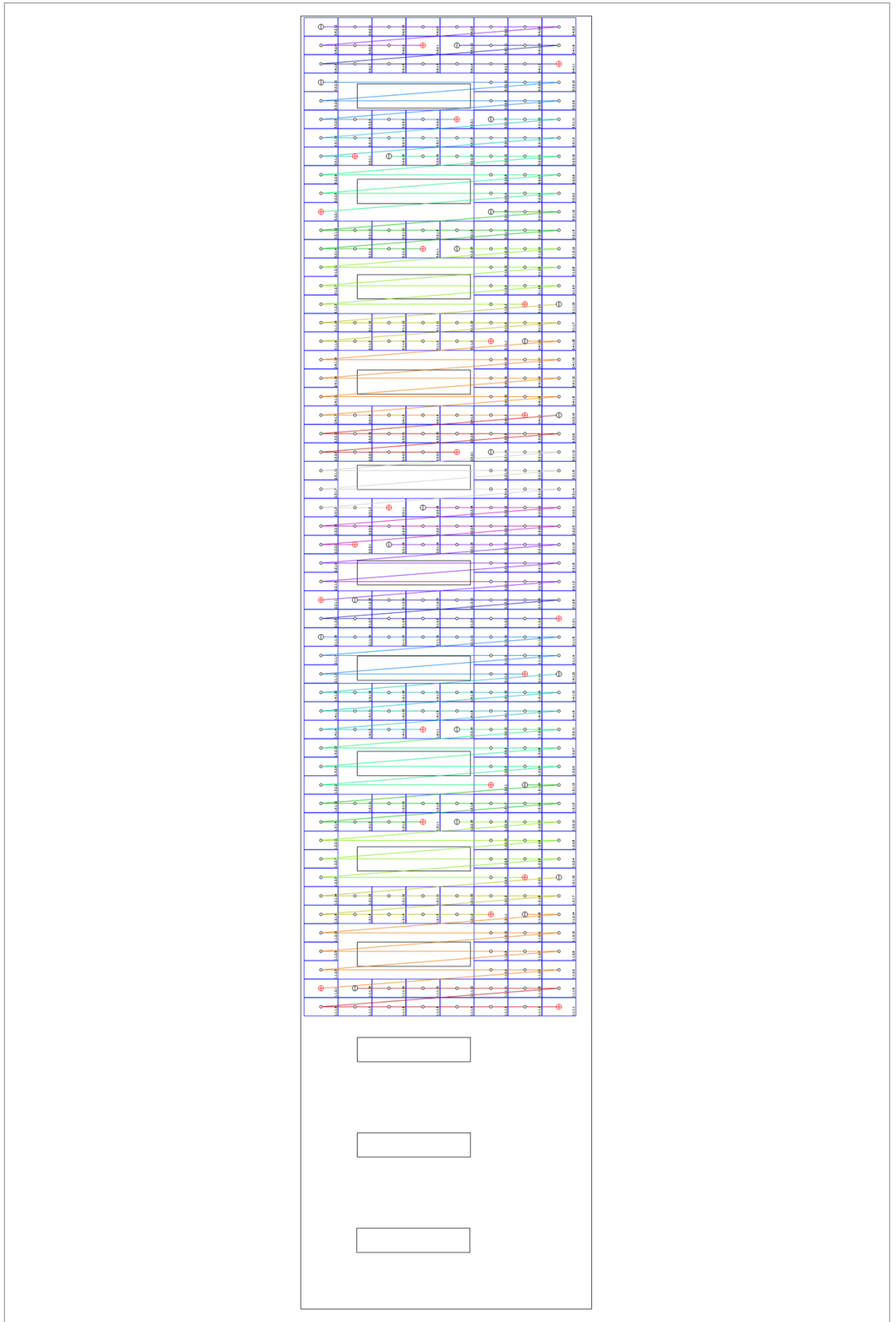


Figure: Building 01 - Roof Area East

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

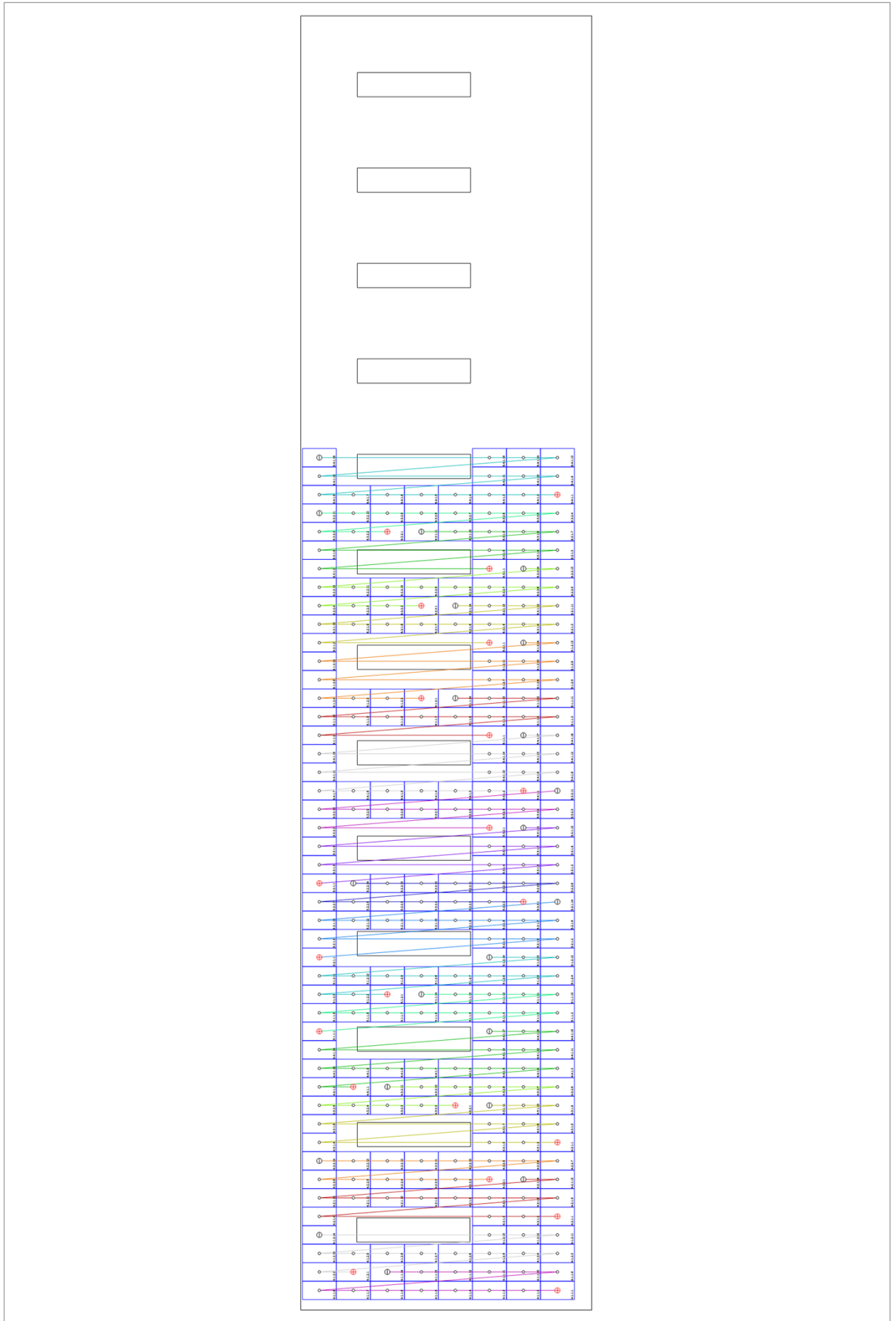


Figure: Building 03 - Roof Area West

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

Parts list

Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		LONGI Solar	LR5-66 HIH 500 M	612	Piece
2	Inverter		Ginlong (Solis)	Solis-50K-HV-5G	6	Piece

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

Screenshots, 3D Design Environment

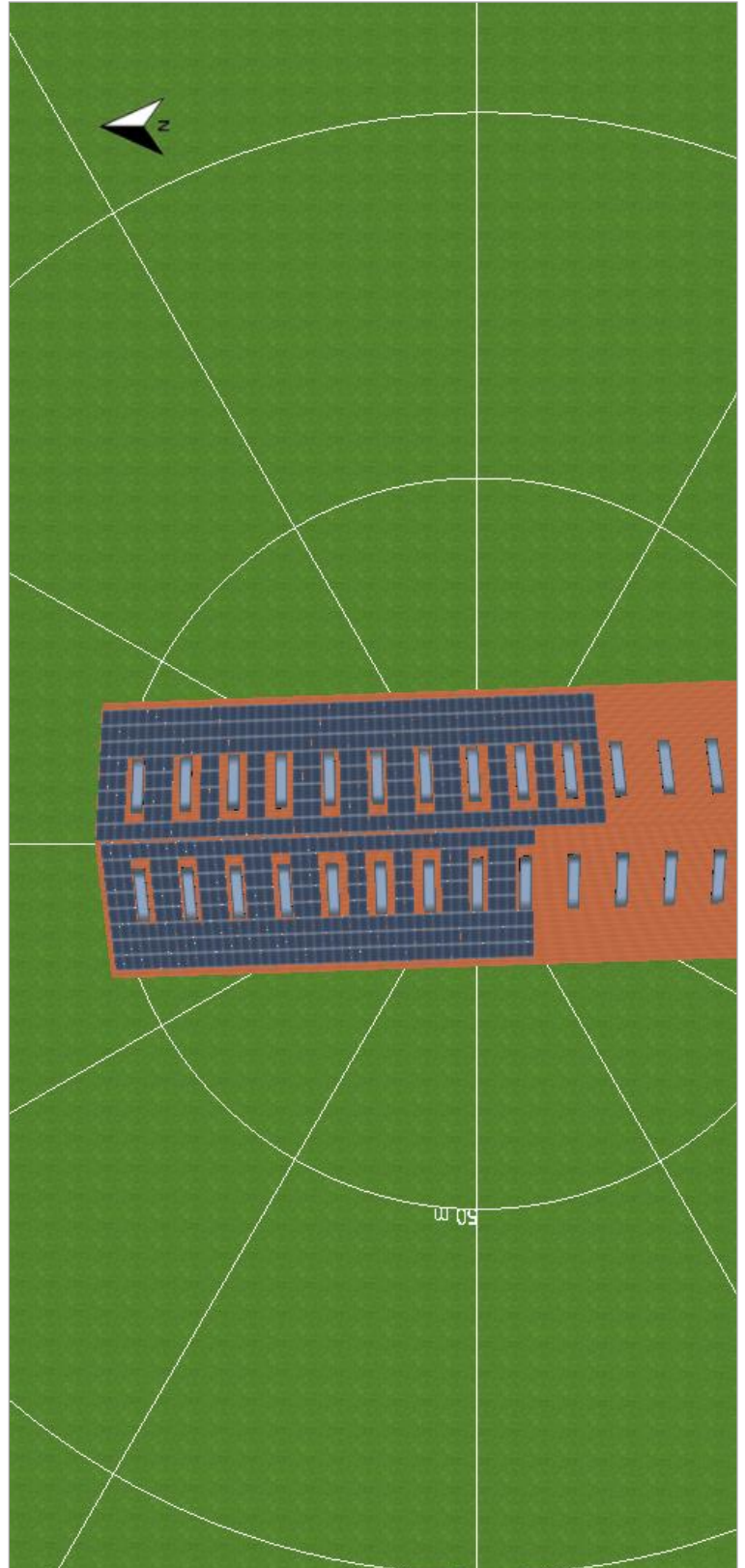


Figure: Screenshot01

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

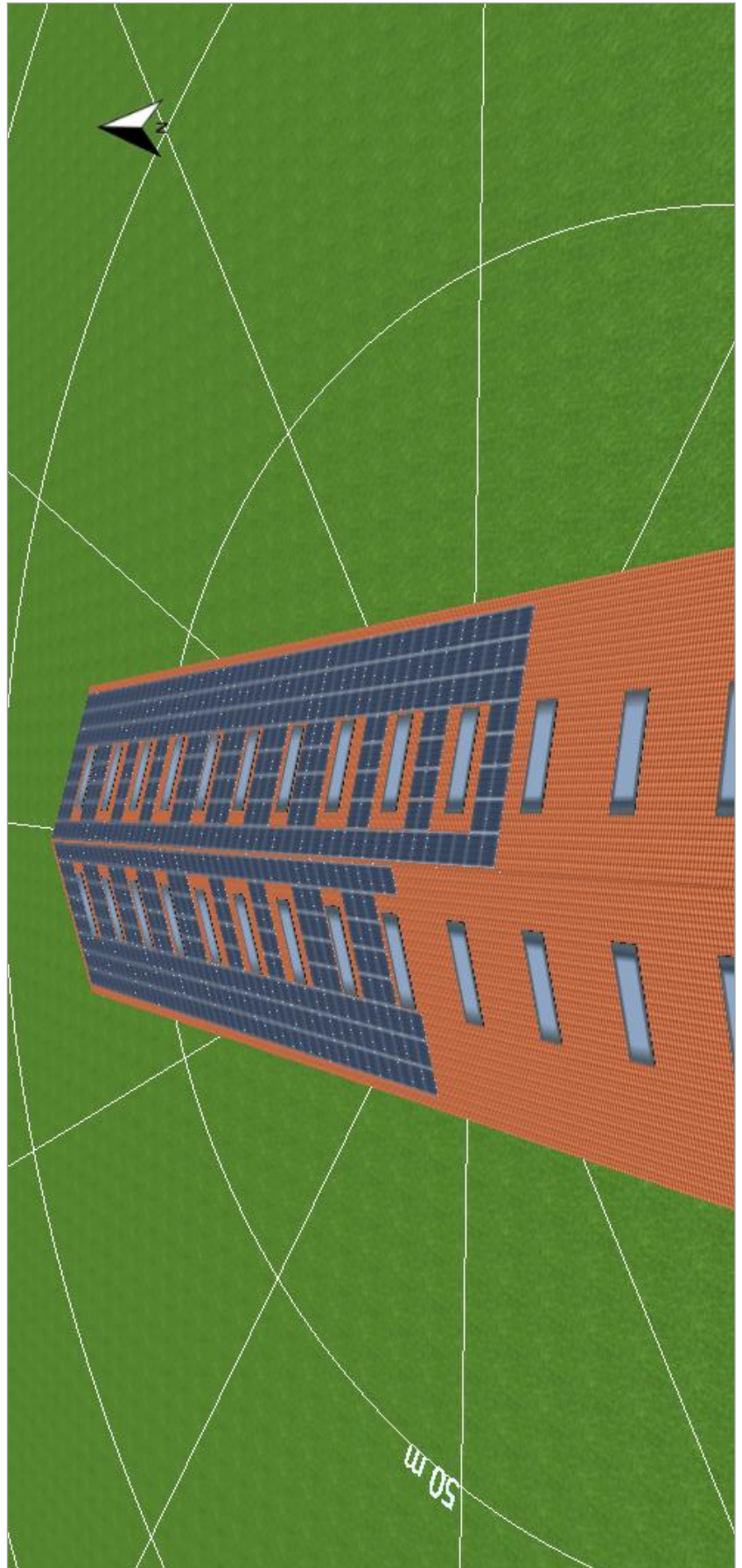


Figure: Screenshot02

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

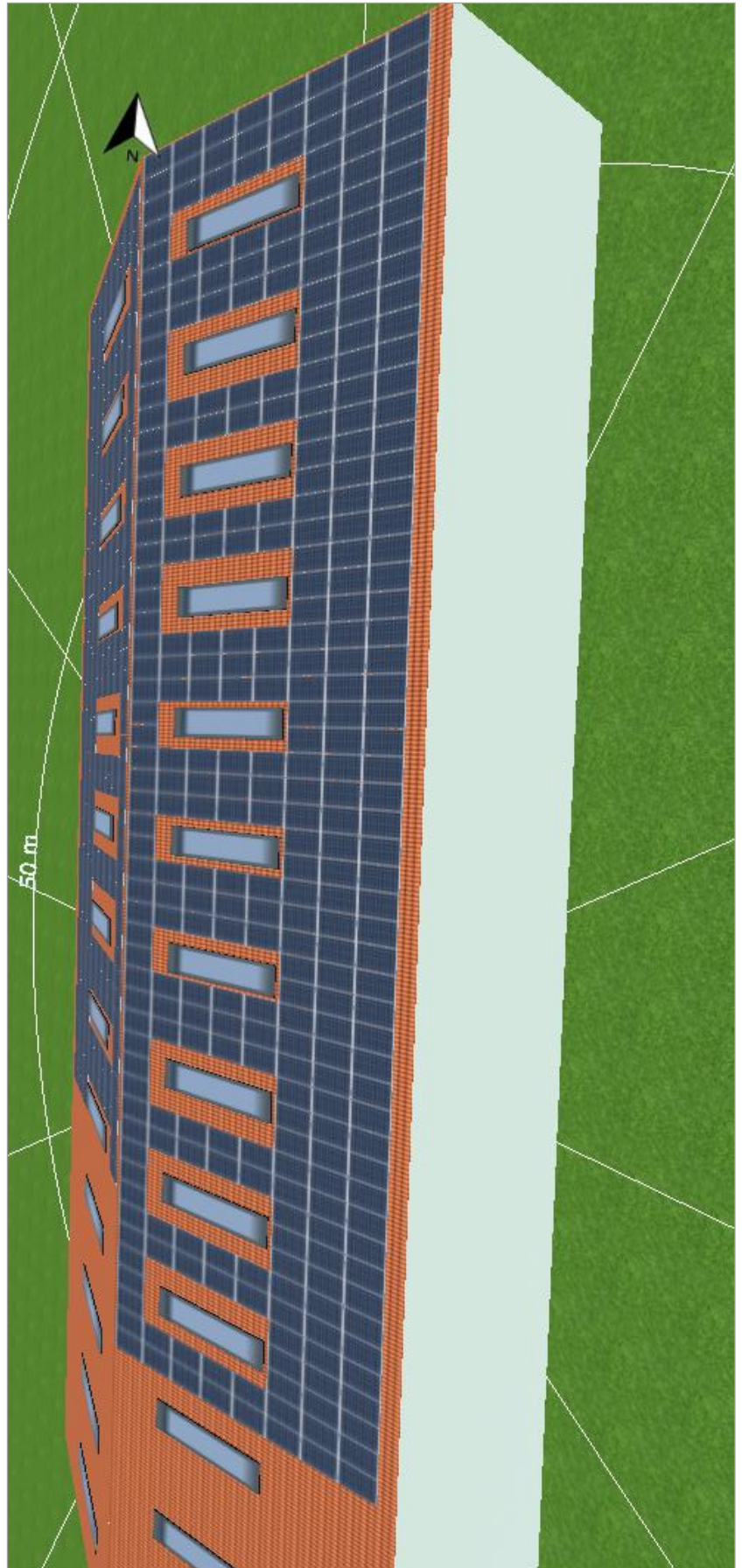


Figure: Screenshot03

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

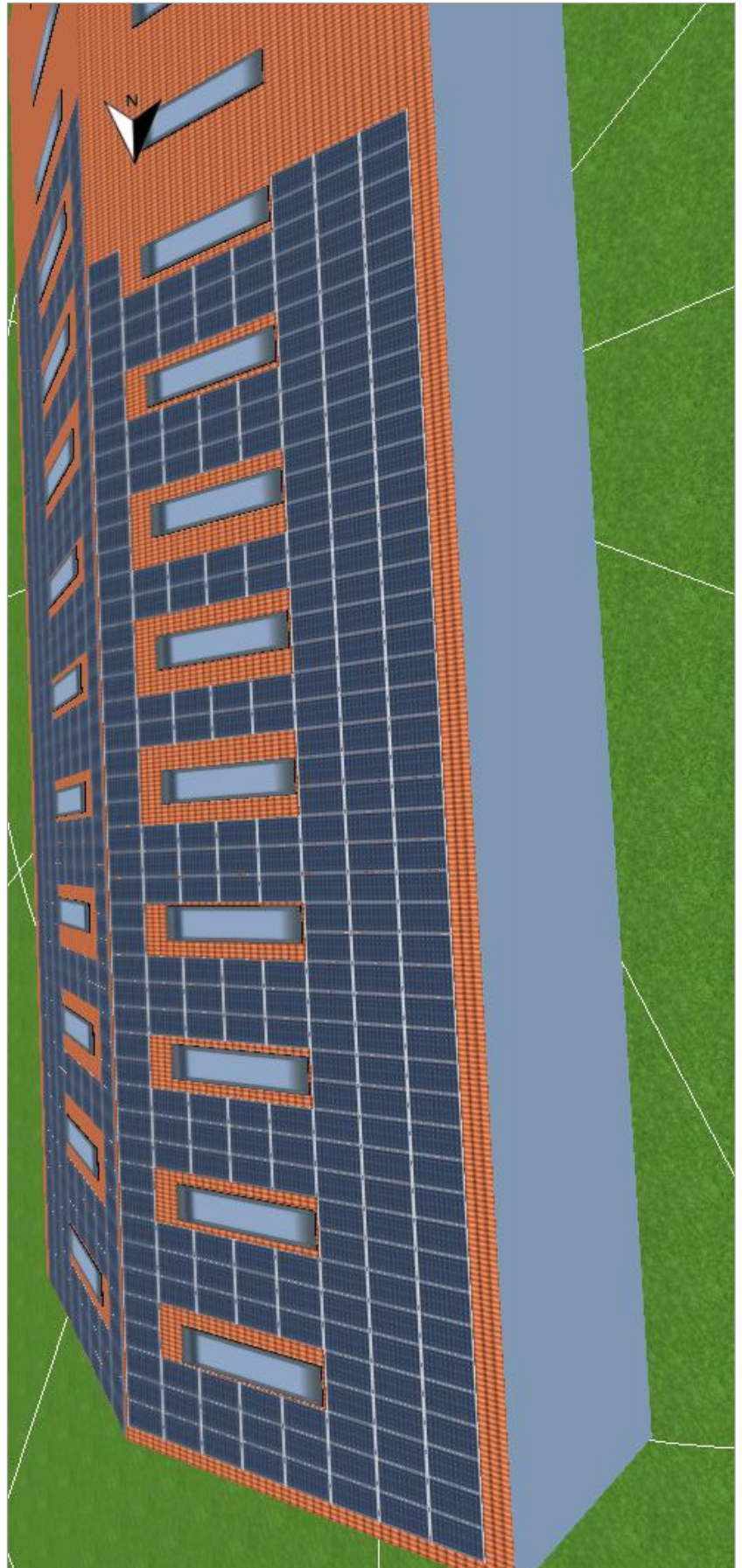


Figure: Screenshot04

East / West Roof 300Kwp facing @ 88.5 degrees

Project Designer: Noel Hynes
Offer Number: 001

Client: Sample Install Company Name , Mr Installer
Customer No.: 123

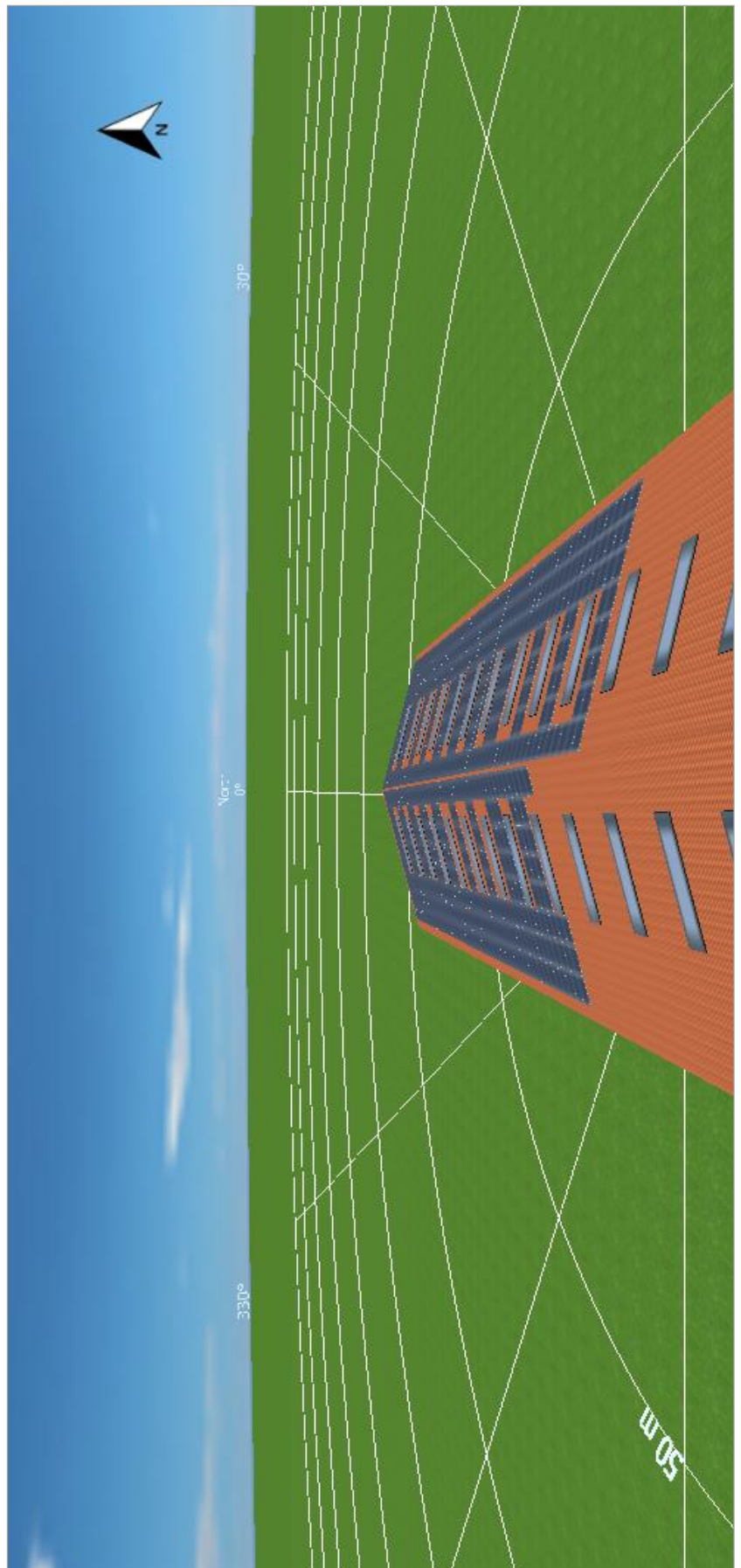


Figure: Screenshot05