



Fermi Solar

Airport Industry 1

Airport Industry 1, Bradford Cl, Bishop Lavis, Cape Town,
7490

Contact person:

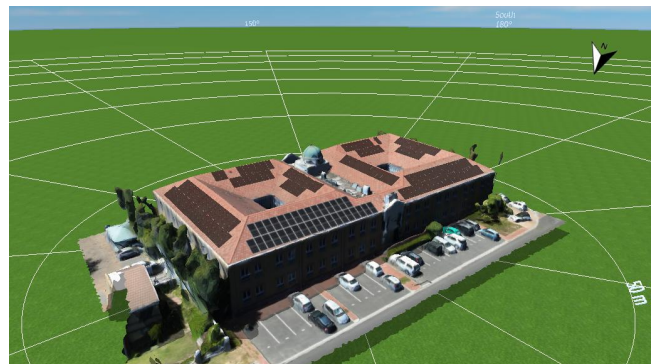
Marius le Roux

Project Name: Triz Engineering Durbanville

2023/02/18

Your PV system from Fermi Solar

Address of Installation



Project Overview

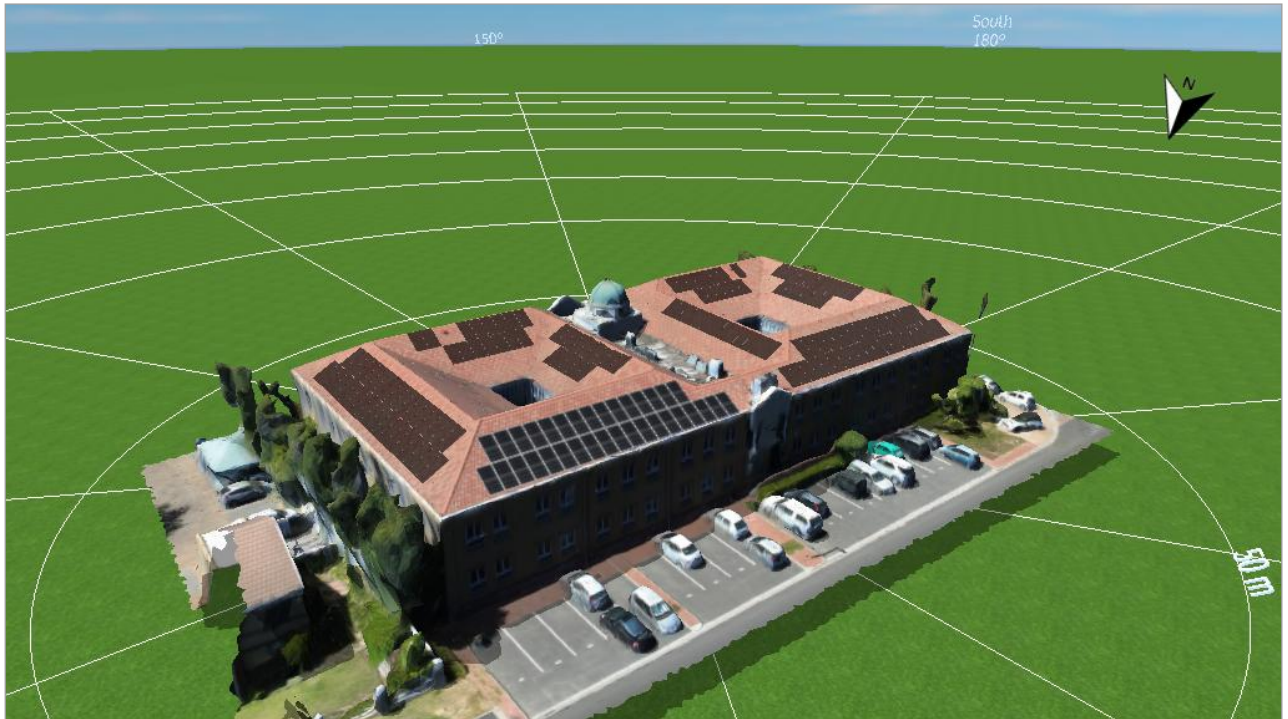


Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV System with Electrical Appliances

Climate Data	Cape Town, ZAF (1996 - 2015)
Values source	Meteonorm 8.1
PV Generator Output	95.04 kWp
PV Generator Surface	451.3 m ²
Number of PV Modules	176
Number of Inverters	3

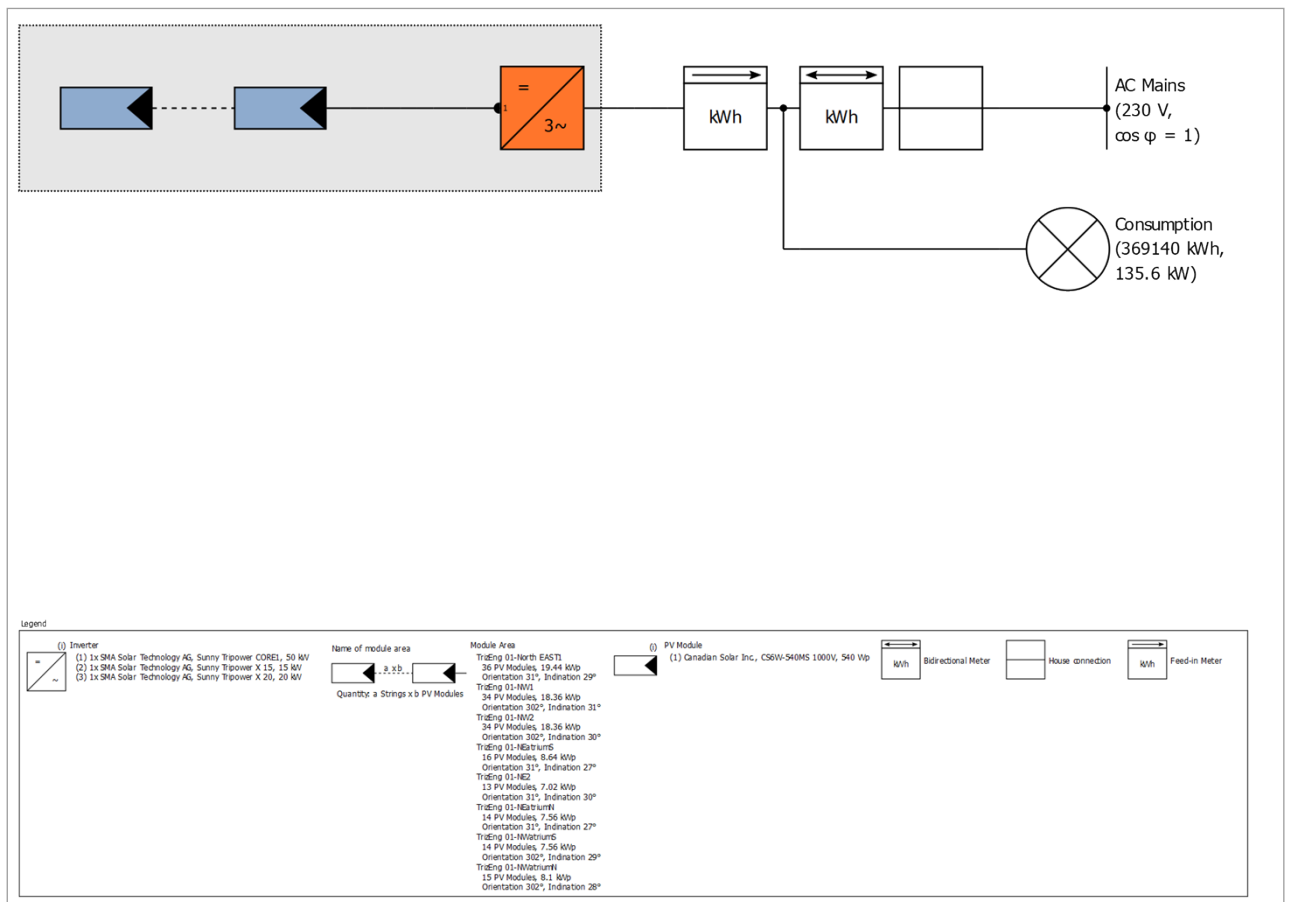


Figure: Schematic diagram

Production Forecast

Production Forecast

PV Generator Output	95.04 kWp
Spec. Annual Yield	1 813.80 kWh/kWp
Performance Ratio (PR)	89.00 %
Yield Reduction due to Shading	0.7 %
PV Generator Energy (AC grid)	172 450 kWh/Year
Own Consumption	142 392 kWh/Year
Down-regulation at Feed-in Point	0 kWh/Year
Grid Feed-in	30 058 kWh/Year
Own Power Consumption	82.6 %
CO ₂ Emissions avoided	81 020 kg / year
Level of Self-sufficiency	38.6 %

Financial Analysis

Your Gain

Total investment costs	0.00 R
Internal Rate of Return (IRR)	32.55 %
Amortization Period	3.8 Years
Electricity Production Costs	0.6188 R/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.

Set-up of the System

Overview

Consumption

Total Consumption	369140 kWh
Triz Engineering Cleaned	369140 kWh
Load Peak	135.6 kW

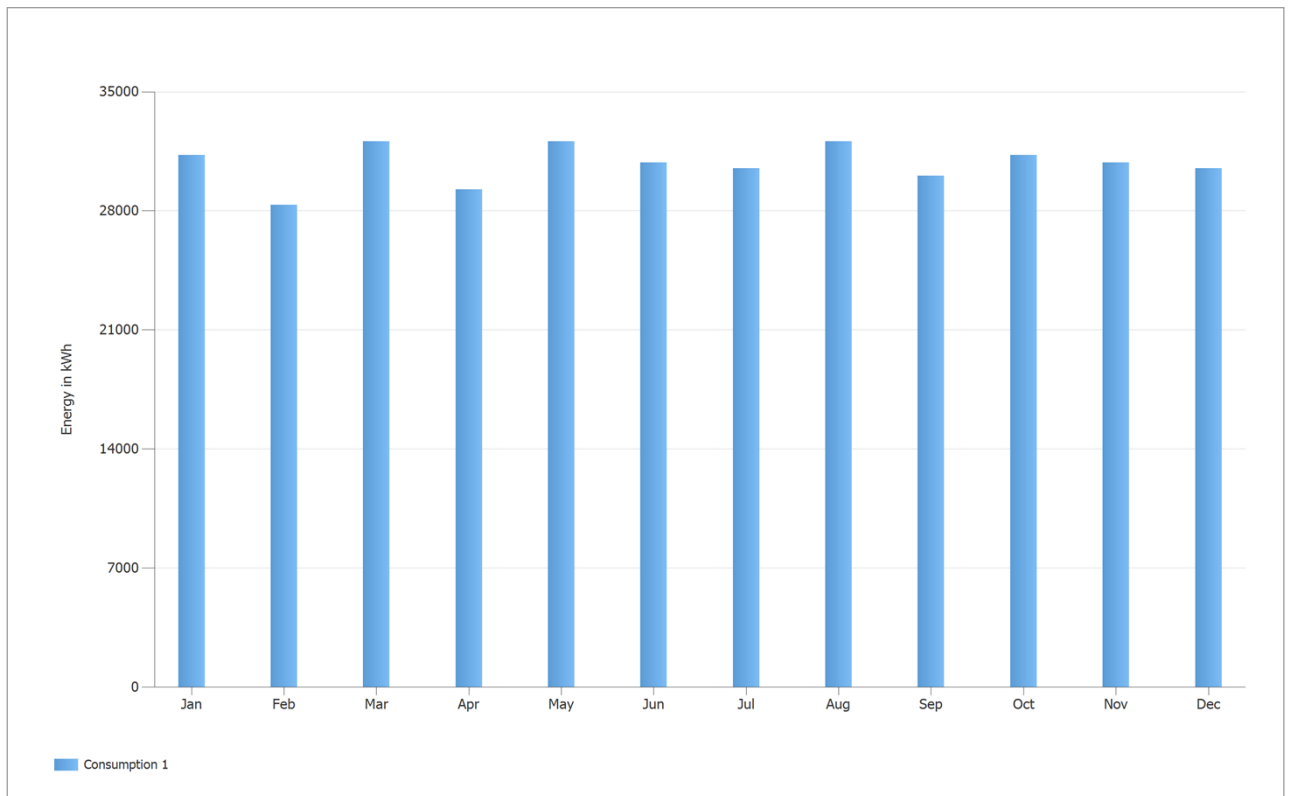


Figure: Consumption

Module Areas

1. Module Area - TrizEng 01-North EAST1

PV Generator, 1. Module Area - TrizEng 01-North EAST1

Name	TrizEng 01-North EAST1
PV Modules	36 x CS6W-540MS 1000V (v2)
Manufacturer	Canadian Solar Inc.
Inclination	29 °
Orientation	Northeast 31 °
Installation Type	Roof parallel
PV Generator Surface	92.3 m ²



Figure: 1. Module Area - TrizEng 01-North EAST1

2. Module Area - TrizEng 01-NW1

PV Generator, 2. Module Area - TrizEng 01-NW1

Name	TrizEng 01-NW1
PV Modules	34 x CS6W-540MS 1000V (v2)
Manufacturer	Canadian Solar Inc.
Inclination	31 °
Orientation	Northwest 302 °
Installation Type	Roof parallel
PV Generator Surface	87.2 m ²



Figure: 2. Module Area - TrizEng 01-NW1

3. Module Area - TrizEng 01-NW2

PV Generator, 3. Module Area - TrizEng 01-NW2

Name	TrizEng 01-NW2
PV Modules	34 x CS6W-540MS 1000V (v2)
Manufacturer	Canadian Solar Inc.
Inclination	30 °
Orientation	Northwest 302 °
Installation Type	Roof parallel
PV Generator Surface	87.2 m ²



Figure: 3. Module Area - TrizEng 01-NW2

4. Module Area - TrizEng 01-NEatriumS

PV Generator, 4. Module Area - TrizEng 01-NEatriumS

Name	TrizEng 01-NEatriumS
PV Modules	16 x CS6W-540MS 1000V (v2)
Manufacturer	Canadian Solar Inc.
Inclination	27 °
Orientation	Northeast 31 °
Installation Type	Roof parallel
PV Generator Surface	41.0 m ²

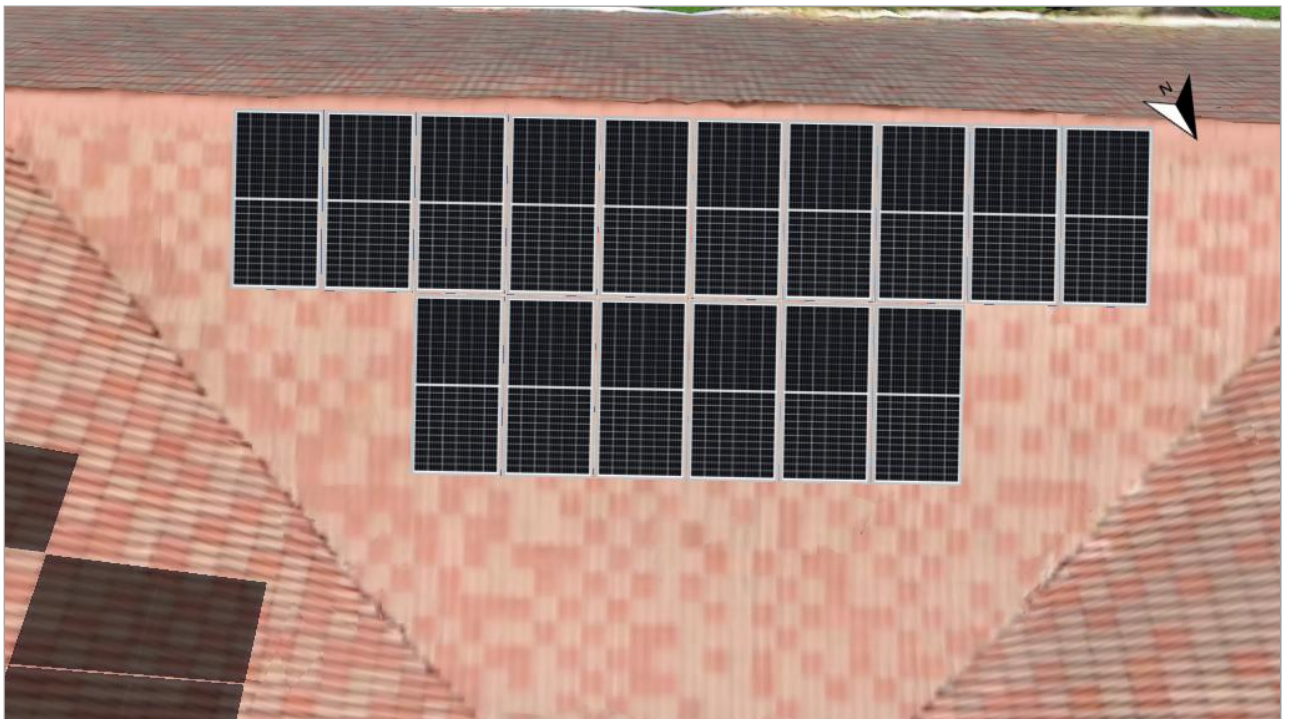


Figure: 4. Module Area - TrizEng 01-NEatriumS

5. Module Area - TrizEng 01-NE2

PV Generator, 5. Module Area - TrizEng 01-NE2

Name	TrizEng 01-NE2
PV Modules	13 x CS6W-540MS 1000V (v2)
Manufacturer	Canadian Solar Inc.
Inclination	30 °
Orientation	Northeast 31 °
Installation Type	Roof parallel
PV Generator Surface	33.3 m ²



Figure: 5. Module Area - TrizEng 01-NE2

6. Module Area - TrizEng 01-NEatriumN

PV Generator, 6. Module Area - TrizEng 01-NEatriumN

Name	TrizEng 01-NEatriumN
PV Modules	14 x CS6W-540MS 1000V (v2)
Manufacturer	Canadian Solar Inc.
Inclination	27 °
Orientation	Northeast 31 °
Installation Type	Roof parallel
PV Generator Surface	35.9 m ²



Figure: 6. Module Area - TrizEng 01-NEatriumN

7. Module Area - TrizEng 01-NWatriumS

PV Generator, 7. Module Area - TrizEng 01-NWatriumS

Name	TrizEng 01-NWatriumS
PV Modules	14 x CS6W-540MS 1000V (v2)
Manufacturer	Canadian Solar Inc.
Inclination	29 °
Orientation	Northwest 302 °
Installation Type	Roof parallel
PV Generator Surface	35.9 m ²

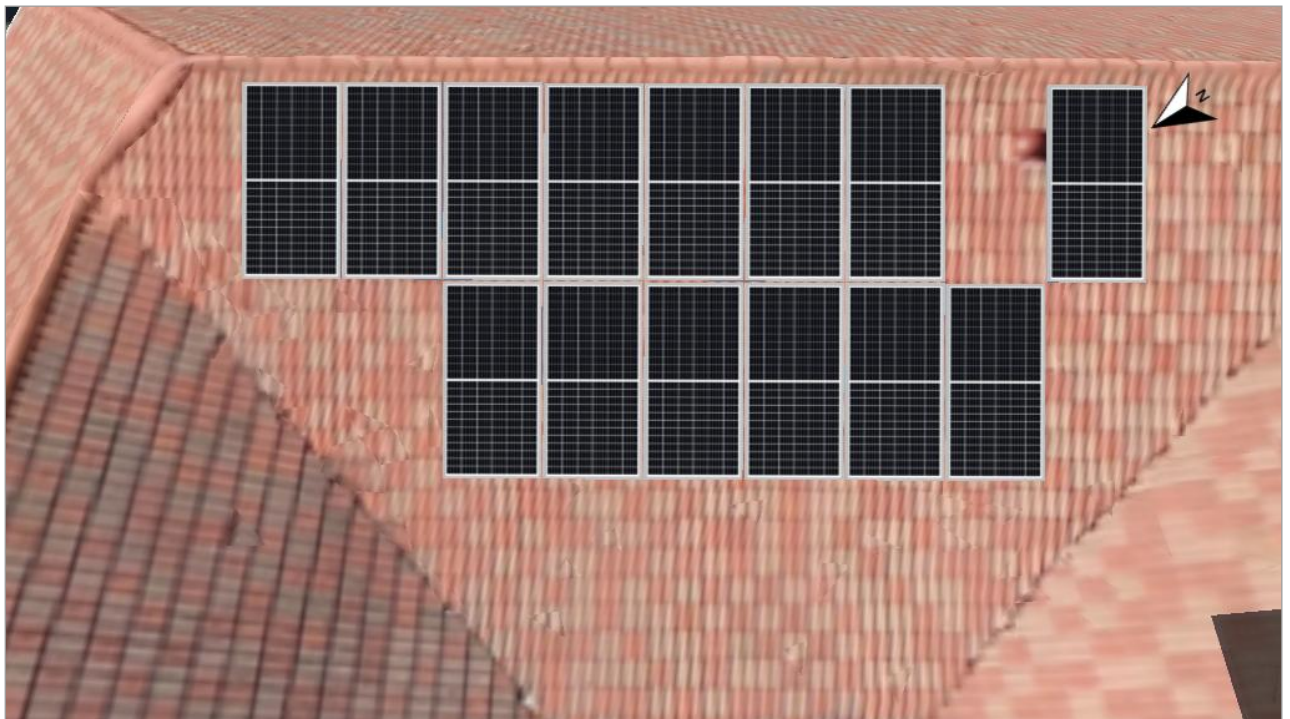


Figure: 7. Module Area - TrizEng 01-NWatriumS

8. Module Area - TrizEng 01-NWatriumN

PV Generator, 8. Module Area - TrizEng 01-NWatriumN

Name	TrizEng 01-NWatriumN
PV Modules	15 x CS6W-540MS 1000V (v2)
Manufacturer	Canadian Solar Inc.
Inclination	28 °
Orientation	Northwest 302 °
Installation Type	Roof parallel
PV Generator Surface	38.5 m²

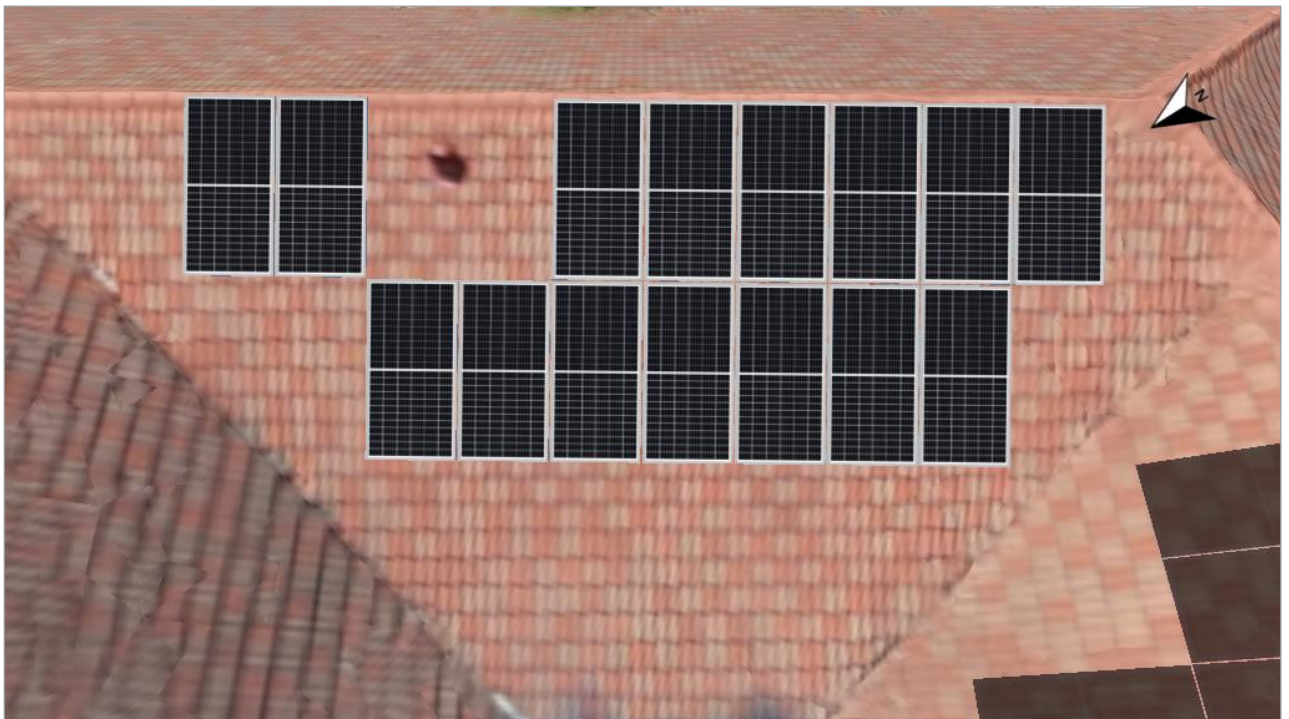


Figure: 8. Module Area - TrizEng 01-NWatriumN

Inverter configuration

Configuration 1

Module Areas	TrizEng 01-North EAST1 + TrizEng 01-NW1 + TrizEng 01-NW2 + TrizEng 01-NEatriumS + TrizEng 01-NE2 + TrizEng 01-NEatriumN + TrizEng 01-NWatriumS + TrizEng 01-NWatriumN	
Inverter 1		
Model	Sunny Tripower CORE1 (v2)	
Manufacturer	SMA Solar Technology AG	
Quantity	1	
Sizing Factor	112.3 %	
Configuration	MPP 1: 1 x 18	
	MPP 2: 1 x 18	
	MPP 3: 1 x 17	
	MPP 4: 1 x 17	
	MPP 5: 1 x 17	
	MPP 6: 1 x 17	
Inverter 2		
Model	Sunny Tripower X 15 (v3)	
Manufacturer	SMA Solar Technology AG	
Quantity	1	
Sizing Factor	104.4 %	
Configuration	MPP 1: 1 x 16	
	MPP 2: 1 x 13	
	MPP 3: not allocated	
Inverter 3		
Model	Sunny Tripower X 20 (v3)	
Manufacturer	SMA Solar Technology AG	
Quantity	1	
Sizing Factor	116.1 %	
Configuration	MPP 1: 1 x 14	
	MPP 2: 1 x 14	
	MPP 3: 1 x 15	

AC Mains

AC Mains

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

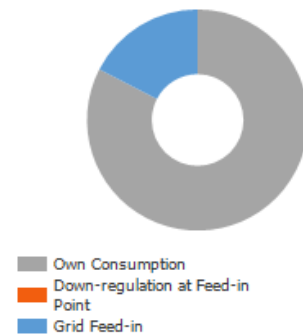
Simulation Results

Results Total System

PV System

PV Generator Output	95.04 kWp
Spec. Annual Yield	1 813.80 kWh/kWp
Performance Ratio (PR)	89.00 %
Yield Reduction due to Shading	0.7 %
PV Generator Energy (AC grid)	172 450 kWh/Year
Own Consumption	142 392 kWh/Year
Down-regulation at Feed-in Point	0 kWh/Year
Grid Feed-in	30 058 kWh/Year
Own Power Consumption	82.6 %
CO ₂ Emissions avoided	81 020 kg / year

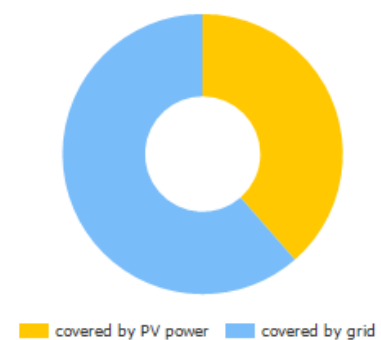
PV Generator Energy (AC grid)



Appliances

Appliances	369 140 kWh/Year
Standby Consumption (Inverter)	66 kWh/Year
Total Consumption	369 206 kWh/Year
covered by PV power	142 392 kWh/Year
covered by grid	226 814 kWh/Year
Solar Fraction	38.6 %

Total Consumption

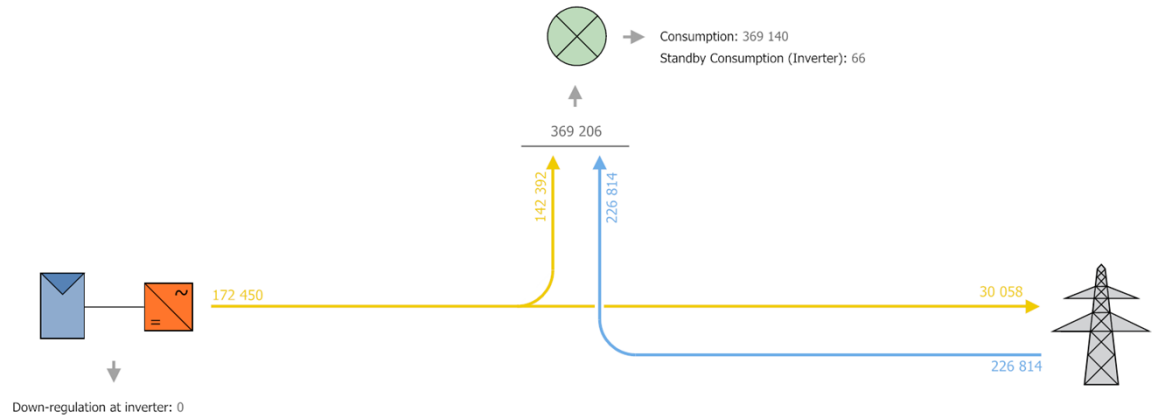


Level of Self-sufficiency

Total Consumption	369 206 kWh/Year
covered by grid	226 814 kWh/Year
Level of Self-sufficiency	38.6 %

Energy Flow Graph

Project: Triz Engineering Durbanville



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

Figure: Energy flow

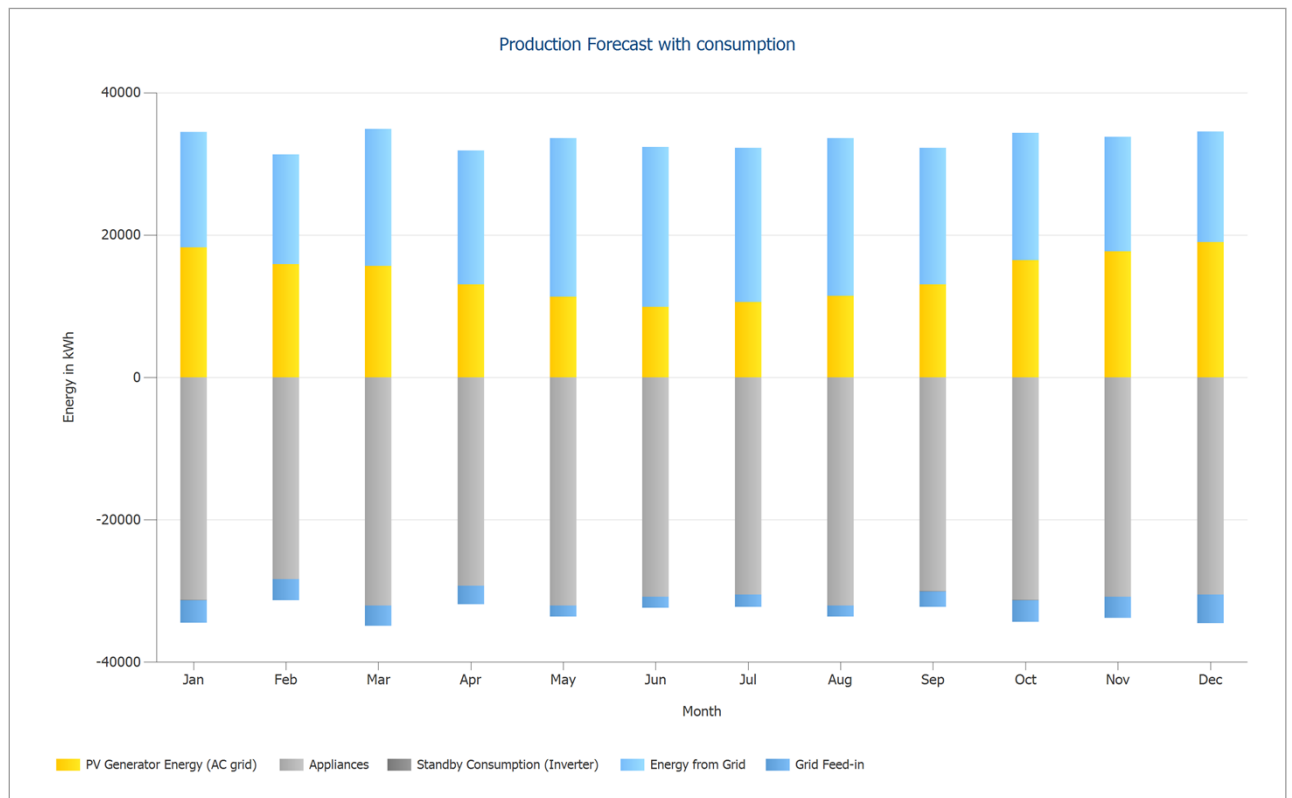


Figure: Production Forecast with consumption

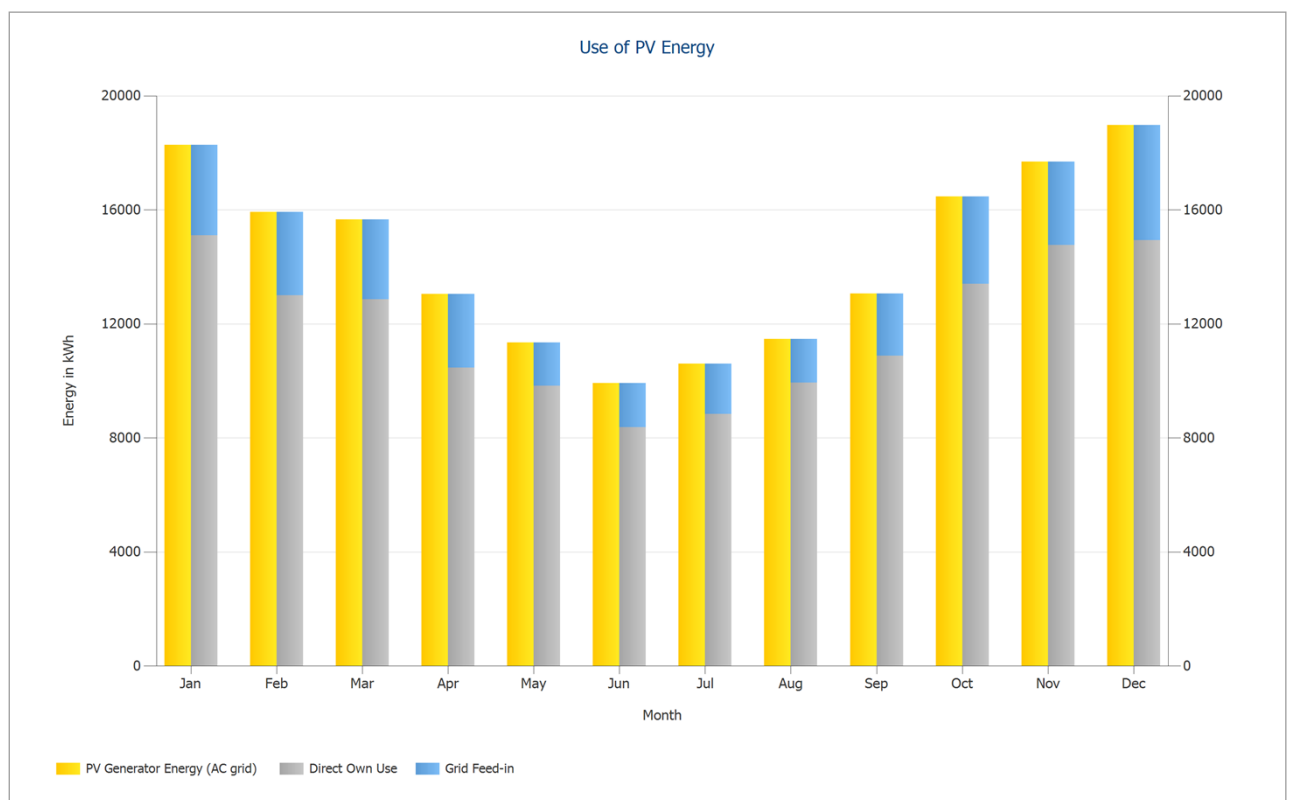


Figure: Use of PV Energy

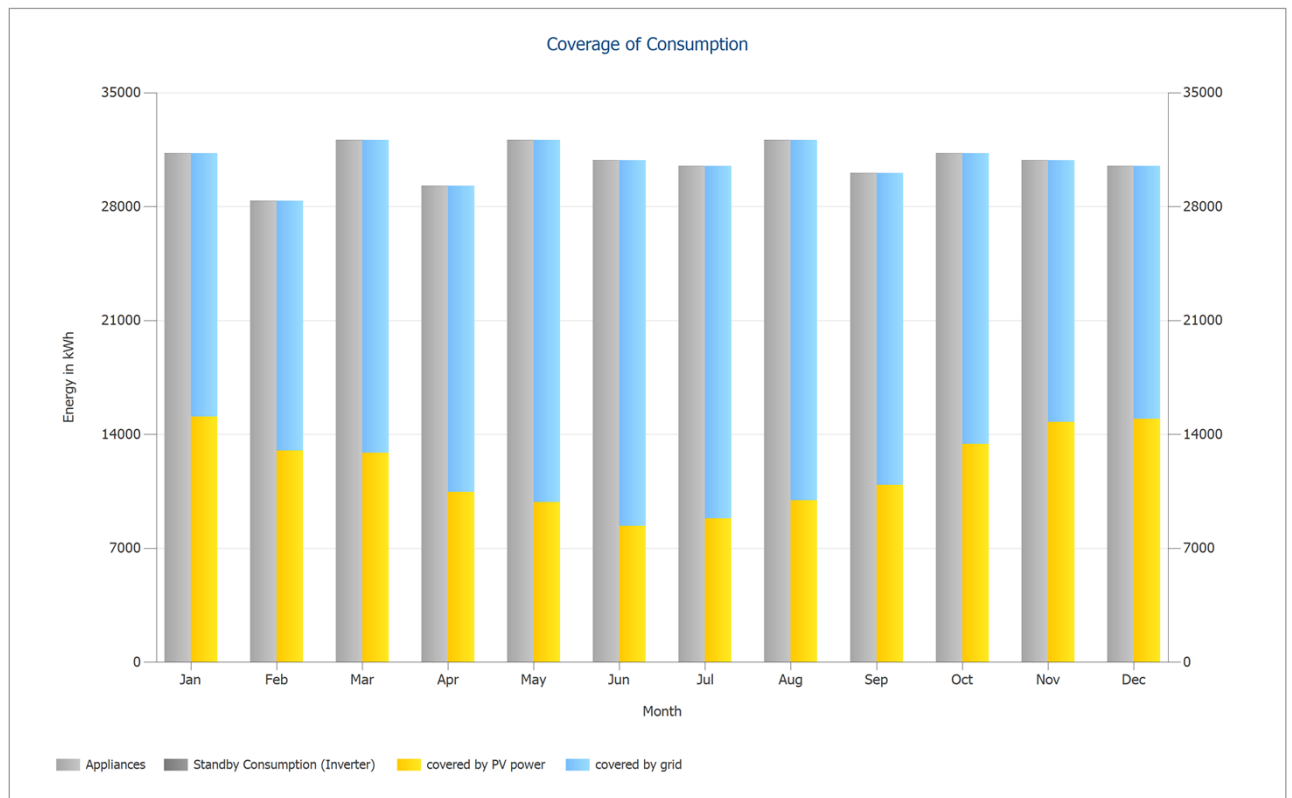


Figure: Coverage of Consumption

Financial Analysis

Overview

System Data

Grid Feed-in in the first year (incl. module degradation)	30 058 kWh/Year
PV Generator Output	95 kWp
Start of Operation of the System	2023/02/18
Assessment Period	15 Years
Interest on Capital	0 %

Economic Parameters

Internal Rate of Return (IRR)	32.55 %
Accrued Cash Flow (Cash Balance)	11 717 163.89 R
Amortization Period	3.8 Years
Electricity Production Costs	0.6188 R/kWh

Payment Overview

Specific Investment Costs	0.00 R/kWp
Investment Costs	0.00 R
One-off Payments	1 600 000.00 R
Incoming Subsidies	0.00 R
Annual Costs	0.00 R/Year
Other Revenue or Savings	0.00 R/Year

Remuneration and Savings

Total Payment from Utility in First Year	36 054.17 R/Year
First year savings	326 495.09 R/Year

R1.13 Feed in - House

Validity	2021/11/19 - 2036/11/18
Specific feed-in / export Remuneration	1.13 R/kWh
Feed-in / Export Tariff	36054.172 R/Year
Inflation Rate for Feed-in / Export Tariff	12.00 %/Year

Cape Town R2.294 (Example)

Energy Price	2.294 R/kWh
Inflation Rate for Energy Price	12 %/Year

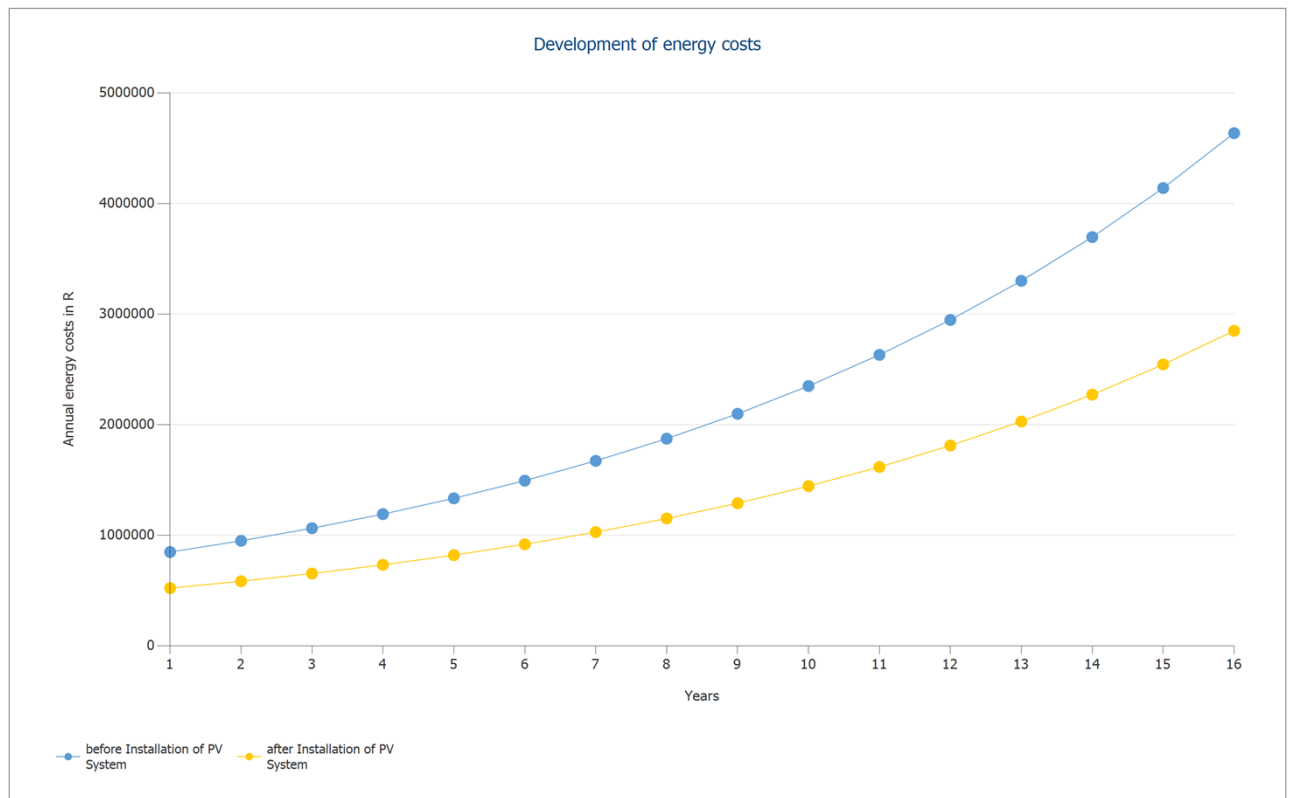


Figure: Development of energy costs

Cash flow

Cash flow

	Year 1	Year 2	Year 3	Year 4	Year 5
One-off Payments	-R1 600 000,00	R0,00	R0,00	R0,00	R0,00
Feed-in / Export Tariff	R34 043,75	R40 626,74	R45 779,23	R51 585,18	R58 127,48
Electricity Savings	R305 468,94	R365 674,50	R409 555,44	R458 702,10	R513 746,23
Annual Cash Flow	-R1 260 487,31	R406 301,25	R455 334,67	R510 287,28	R571 873,71
Accrued Cash Flow (Cash Balance)	-R1 260 487,31	-R854 186,06	-R398 851,39	R111 435,89	R683 309,60

Cash flow

	Year 6	Year 7	Year 8	Year 9	Year 10
One-off Payments	R0,00	R0,00	R0,00	R0,00	R0,00
Feed-in / Export Tariff	R65 499,50	R73 806,47	R83 166,98	R93 714,63	R105 599,99
Electricity Savings	R575 396,01	R644 443,52	R721 776,50	R808 389,77	R905 396,68
Annual Cash Flow	R640 895,51	R718 249,99	R804 943,48	R902 104,40	R1 010 996,68
Accrued Cash Flow (Cash Balance)	R1 324 205,11	R2 042 455,10	R2 847 398,58	R3 749 502,98	R4 760 499,65

Cash flow

	Year 11	Year 12	Year 13	Year 14	Year 15
One-off Payments	R0,00	R0,00	R0,00	R0,00	R0,00
Feed-in / Export Tariff	R118 992,72	R134 083,97	R151 089,18	R110 430,57	R0,00
Electricity Savings	R1 014 044,13	R1 135 729,50	R1 272 017,04	R1 424 659,05	R1 595 618,08
Annual Cash Flow	R1 133 036,85	R1 269 813,47	R1 423 106,22	R1 535 089,62	R1 595 618,08
Accrued Cash Flow (Cash Balance)	R5 893 536,50	R7 163 349,97	R8 586 456,19	R10 121 545,81	R11 717 163,89

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

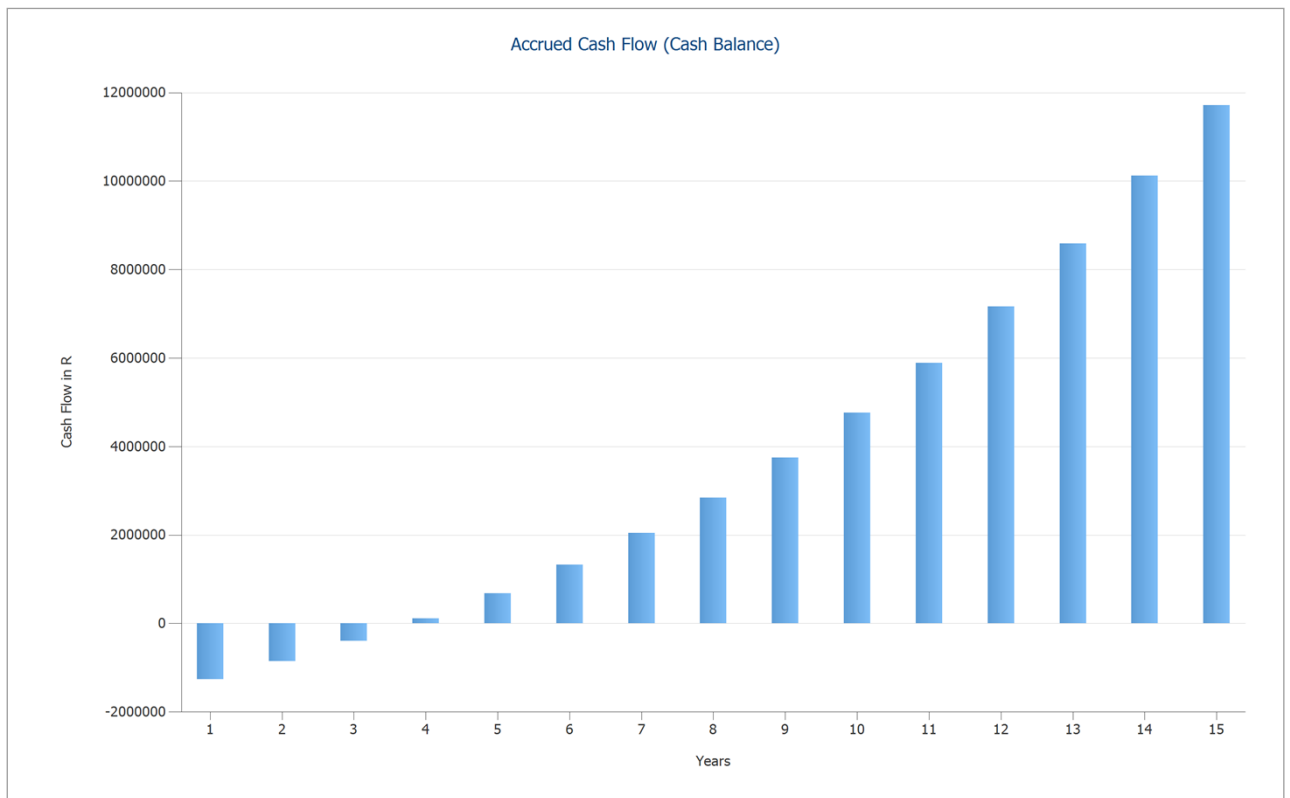


Figure: Accrued Cash Flow (Cash Balance)

Plans and parts list

Circuit Diagram

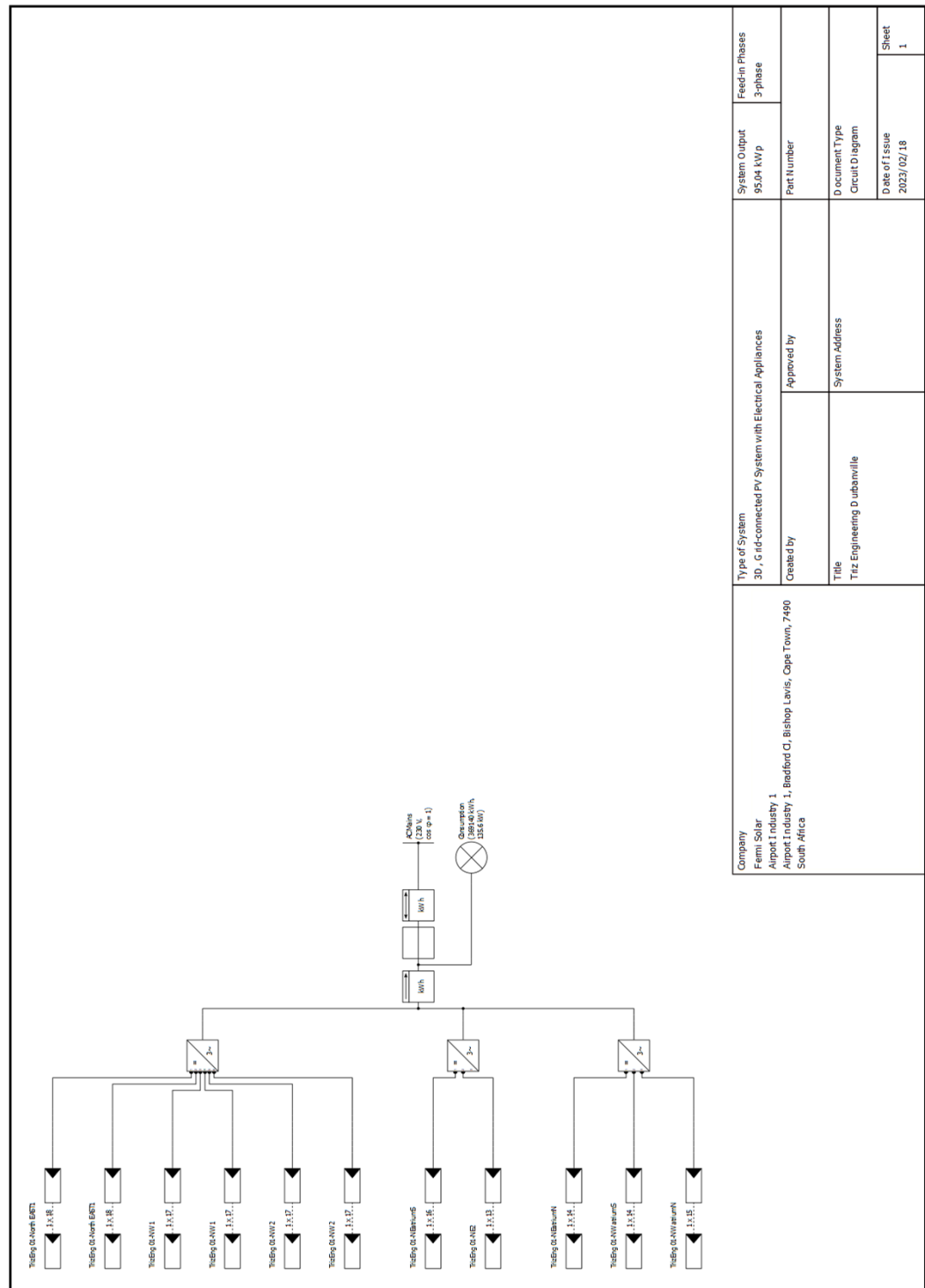


Figure: Circuit Diagram

Overview plan

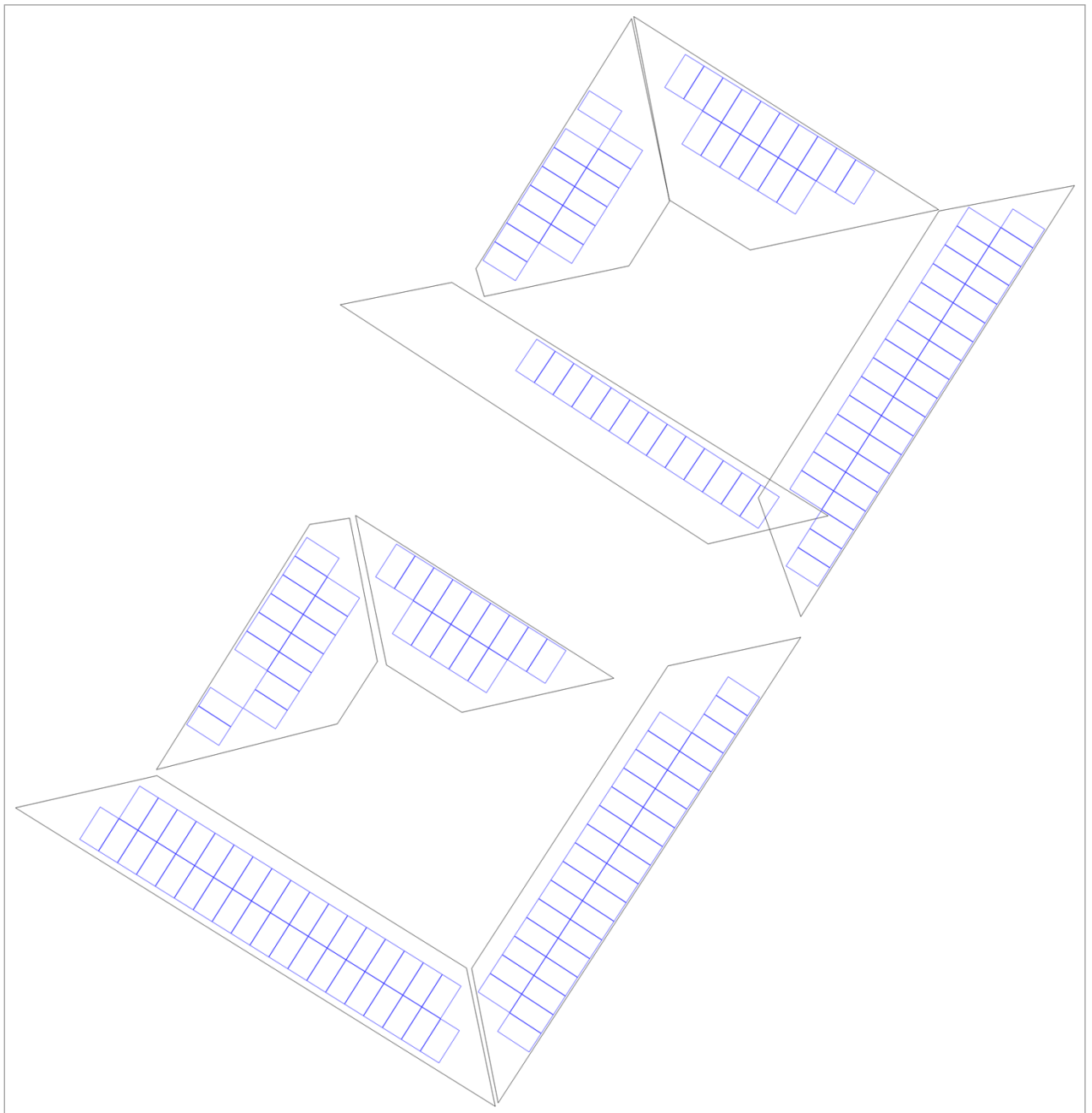


Figure: Overview plan

Dimensioning Plan

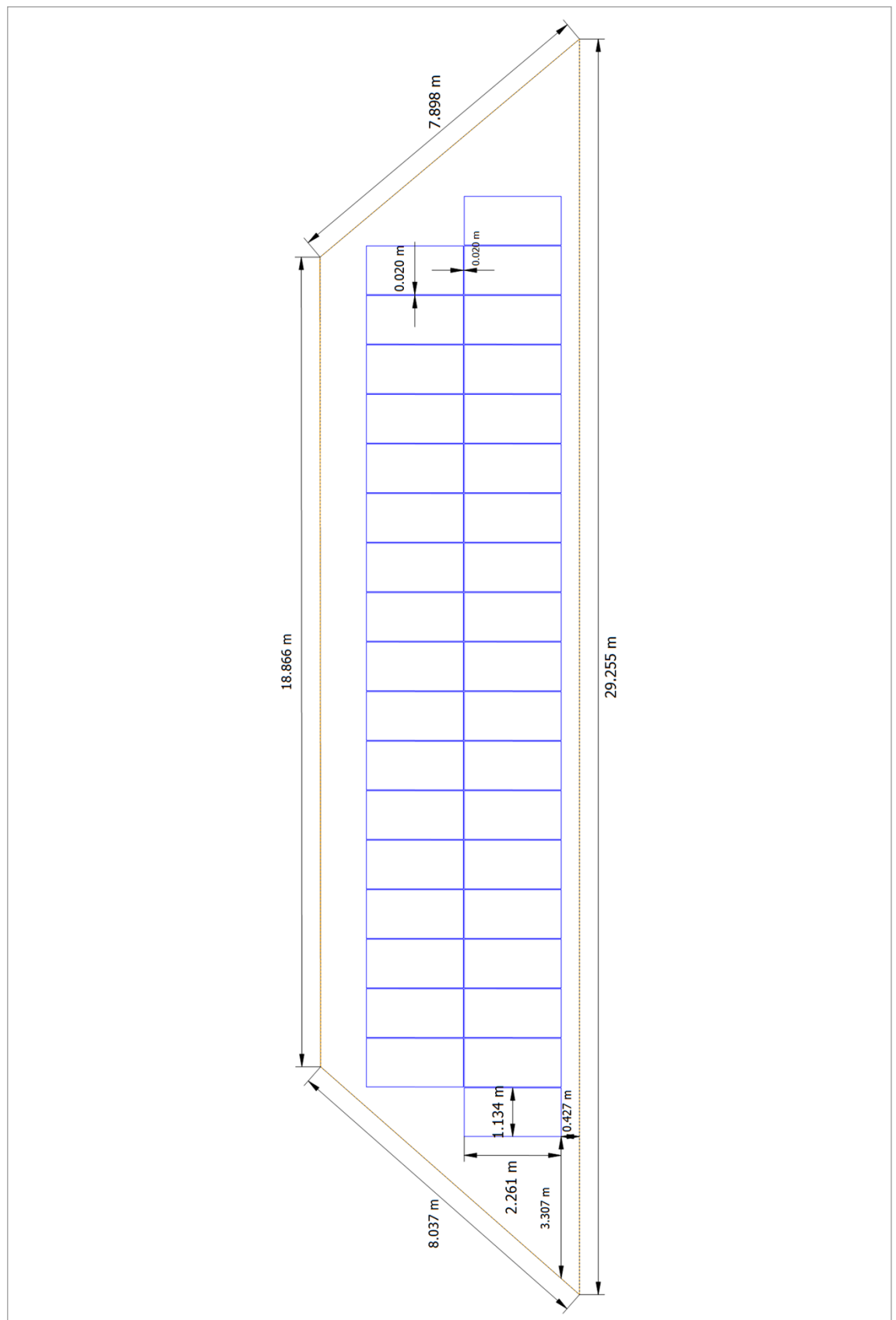


Figure: TrizEng 01-North EAST1

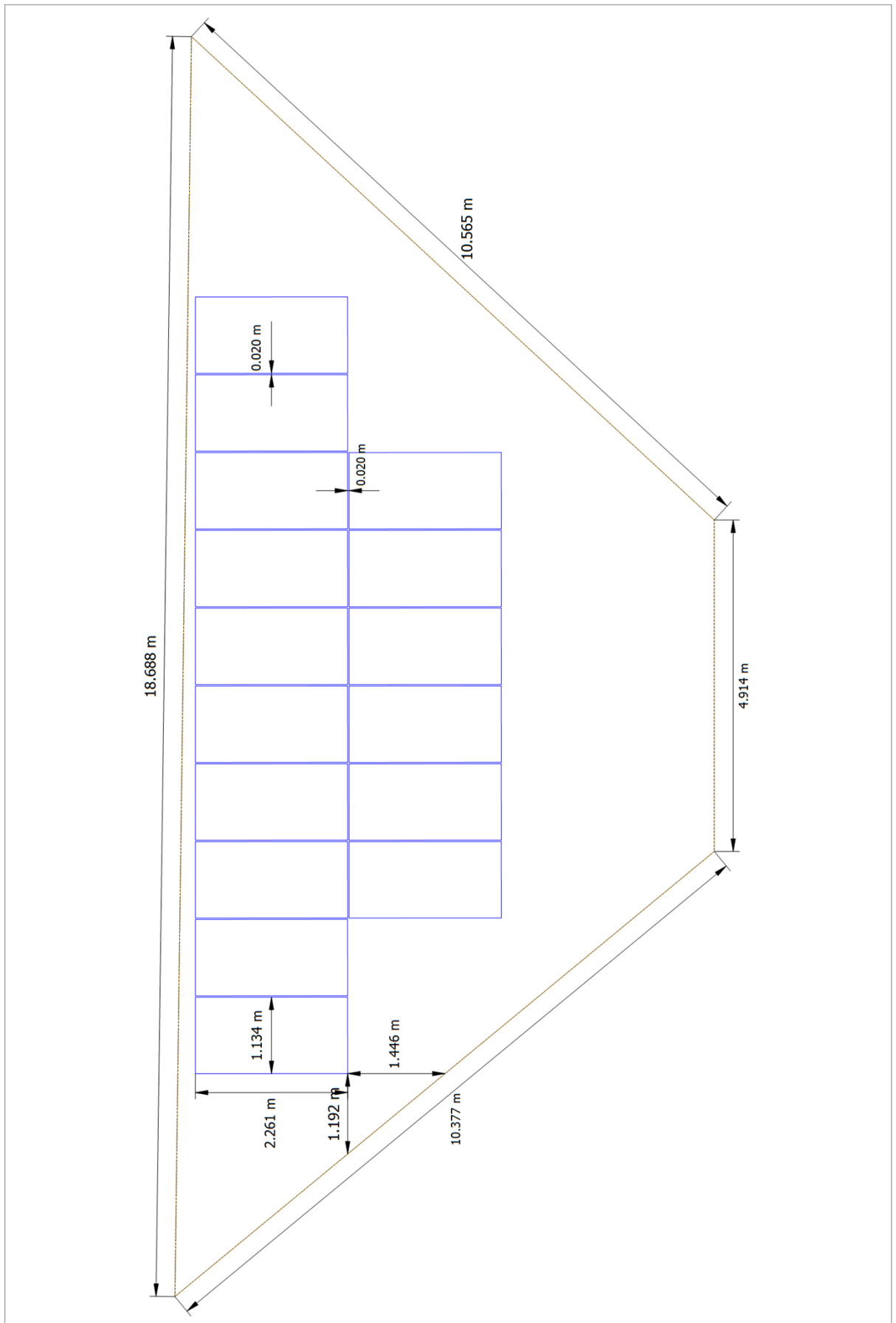


Figure: TrizEng 01-NEatriumS

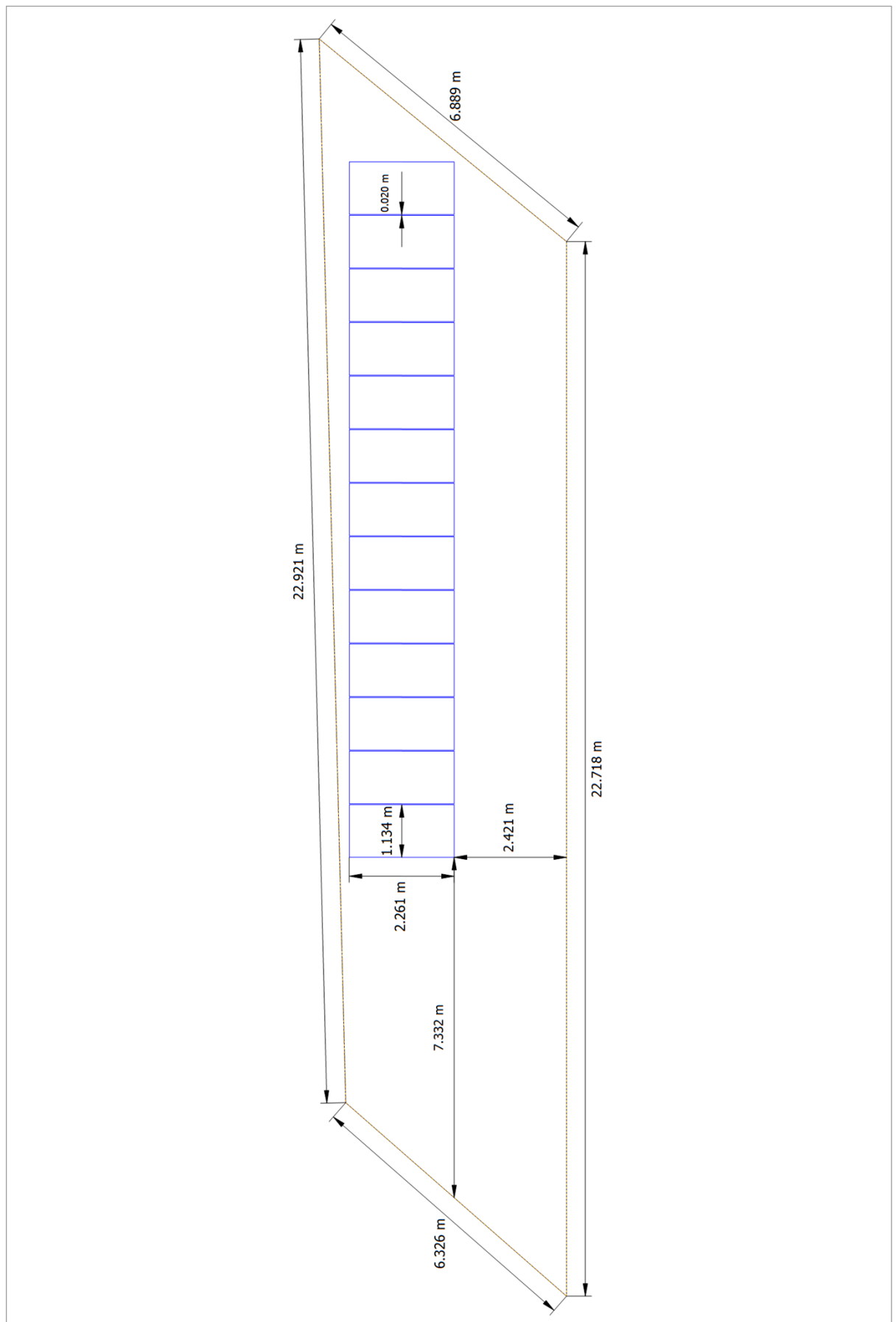


Figure: TrizEng 01-NE2

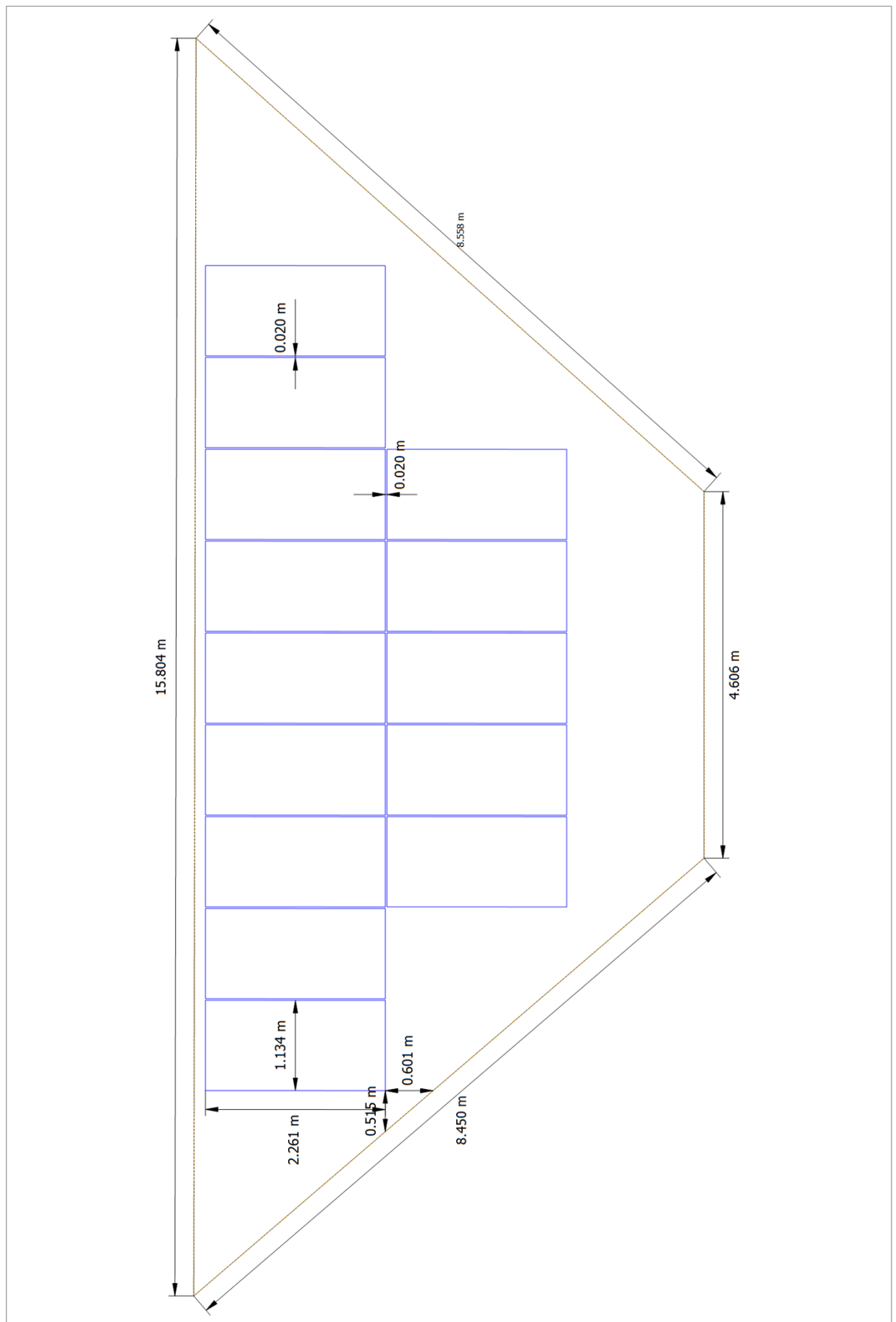


Figure: TrizEng 01-NEatriumN

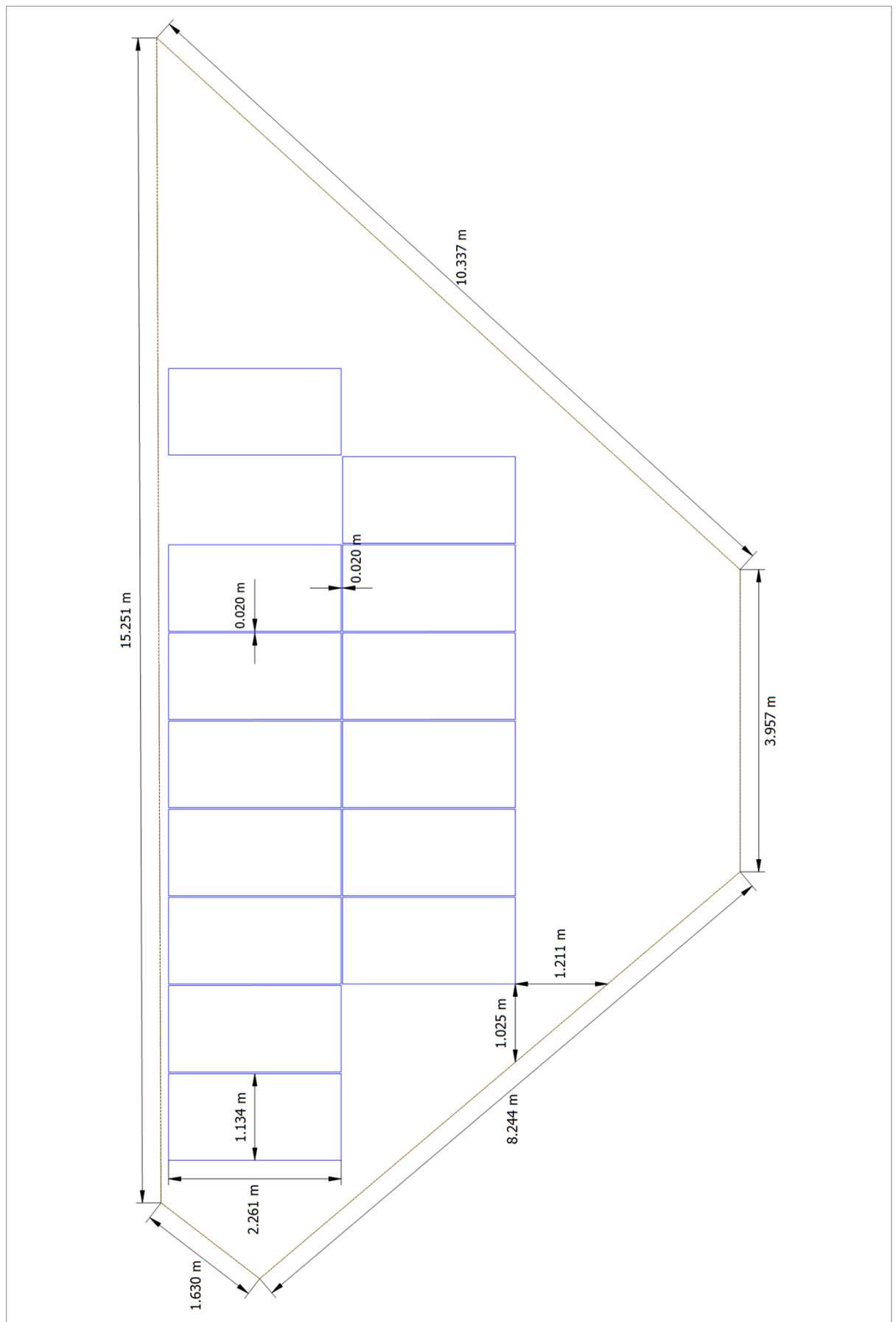


Figure: TrizEng 01-NWatriumS

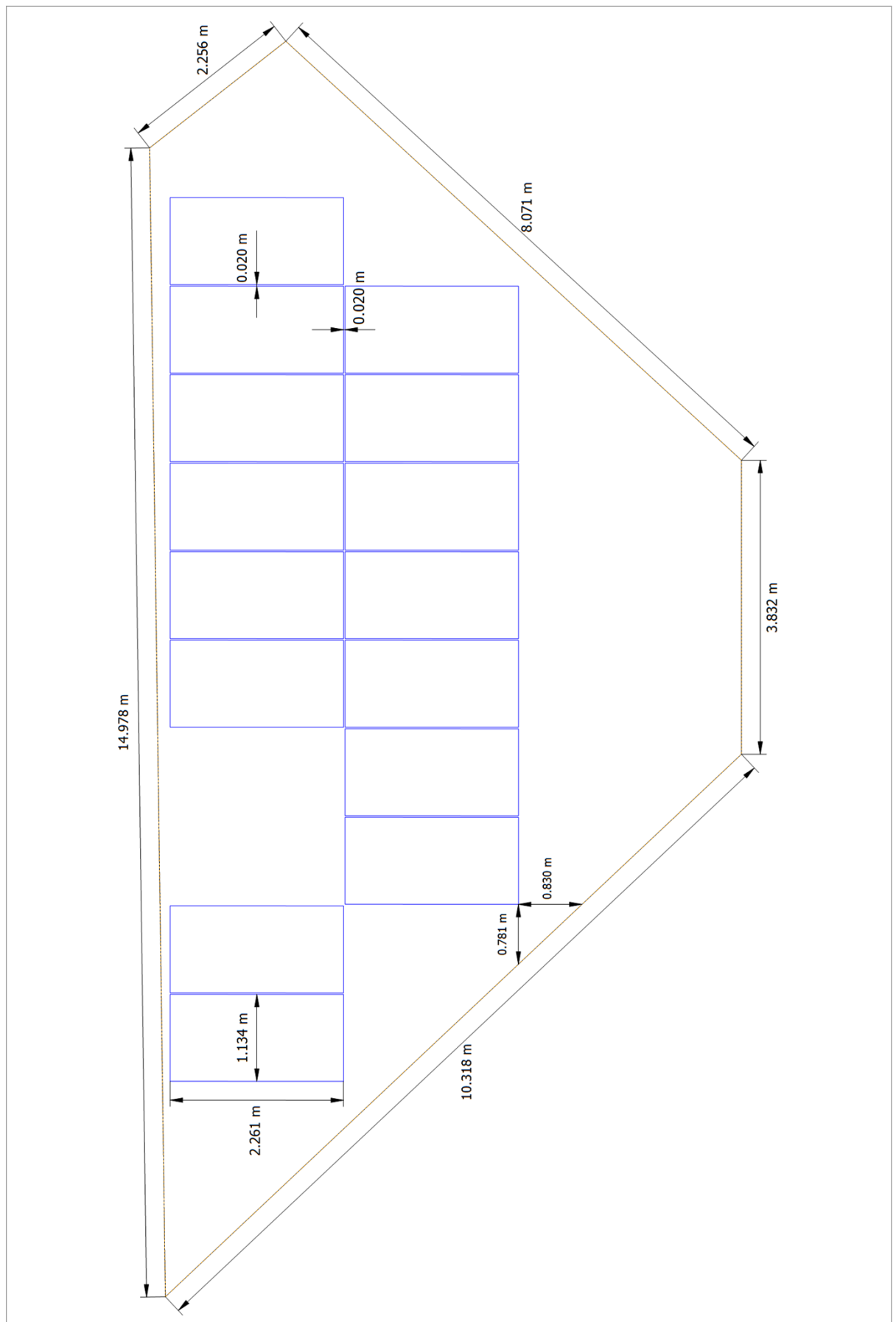


Figure: TrizEng 01-NWatriumN

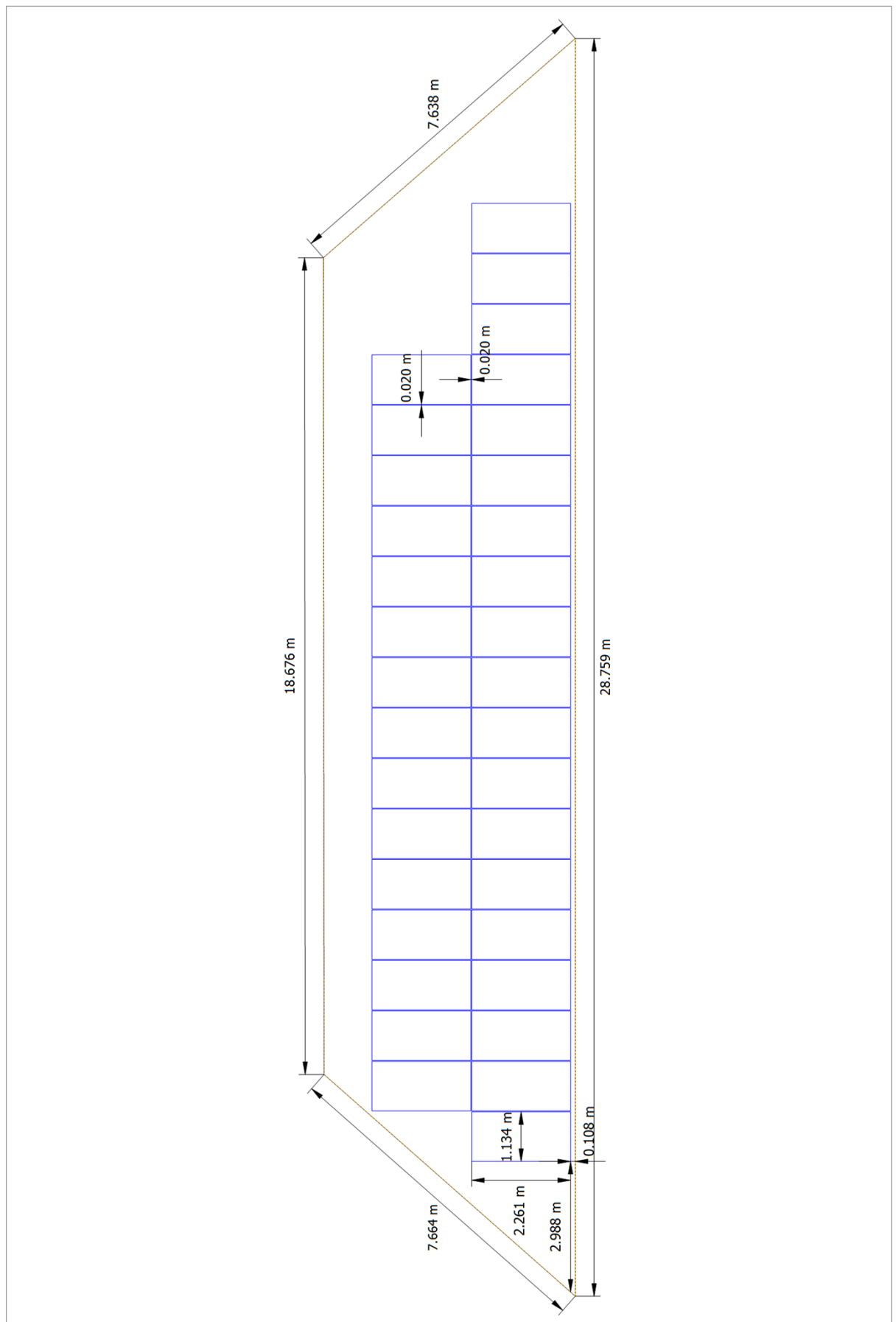


Figure: TrizEng 01-NW1

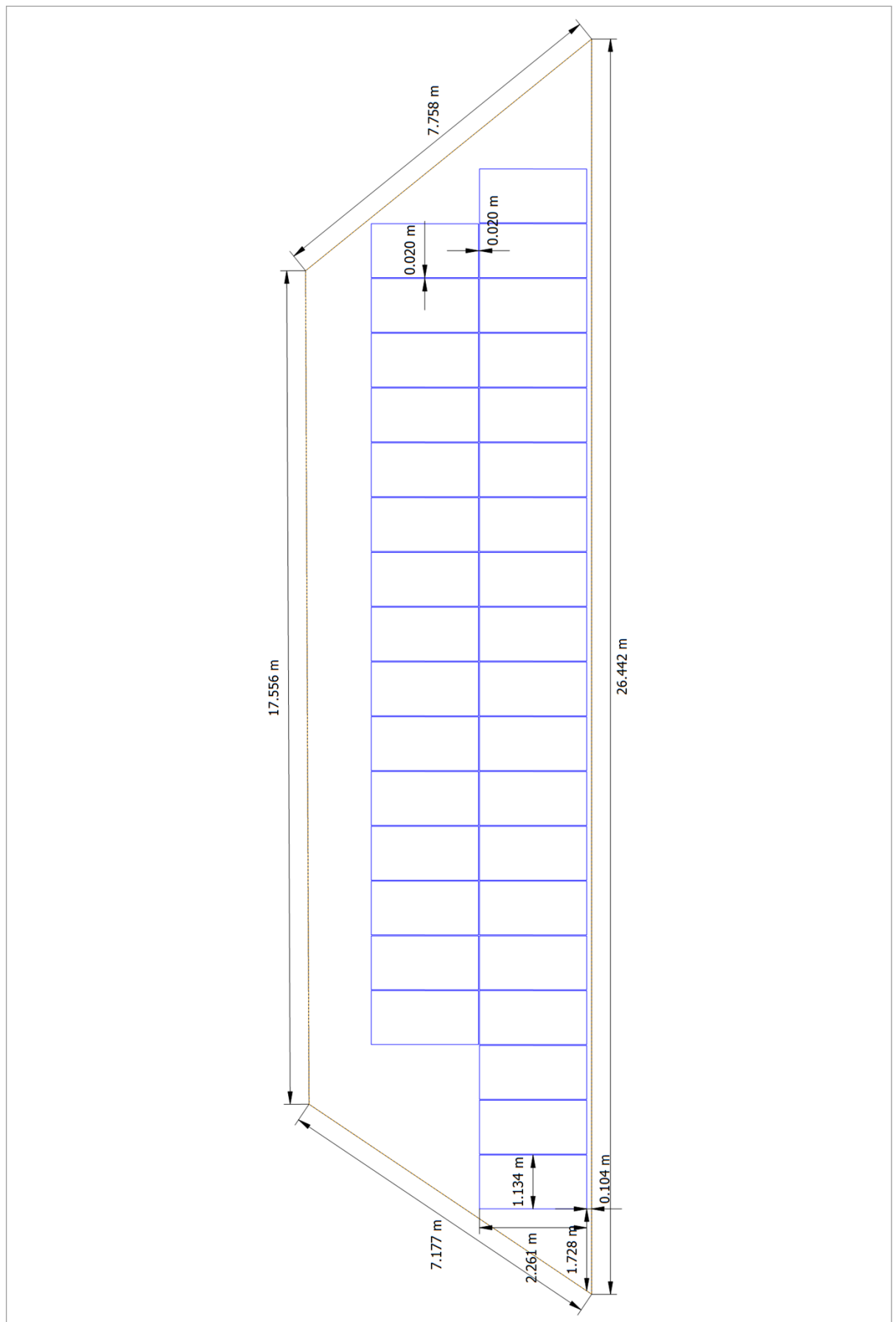


Figure: TrizEng 01-NW2

String Plan

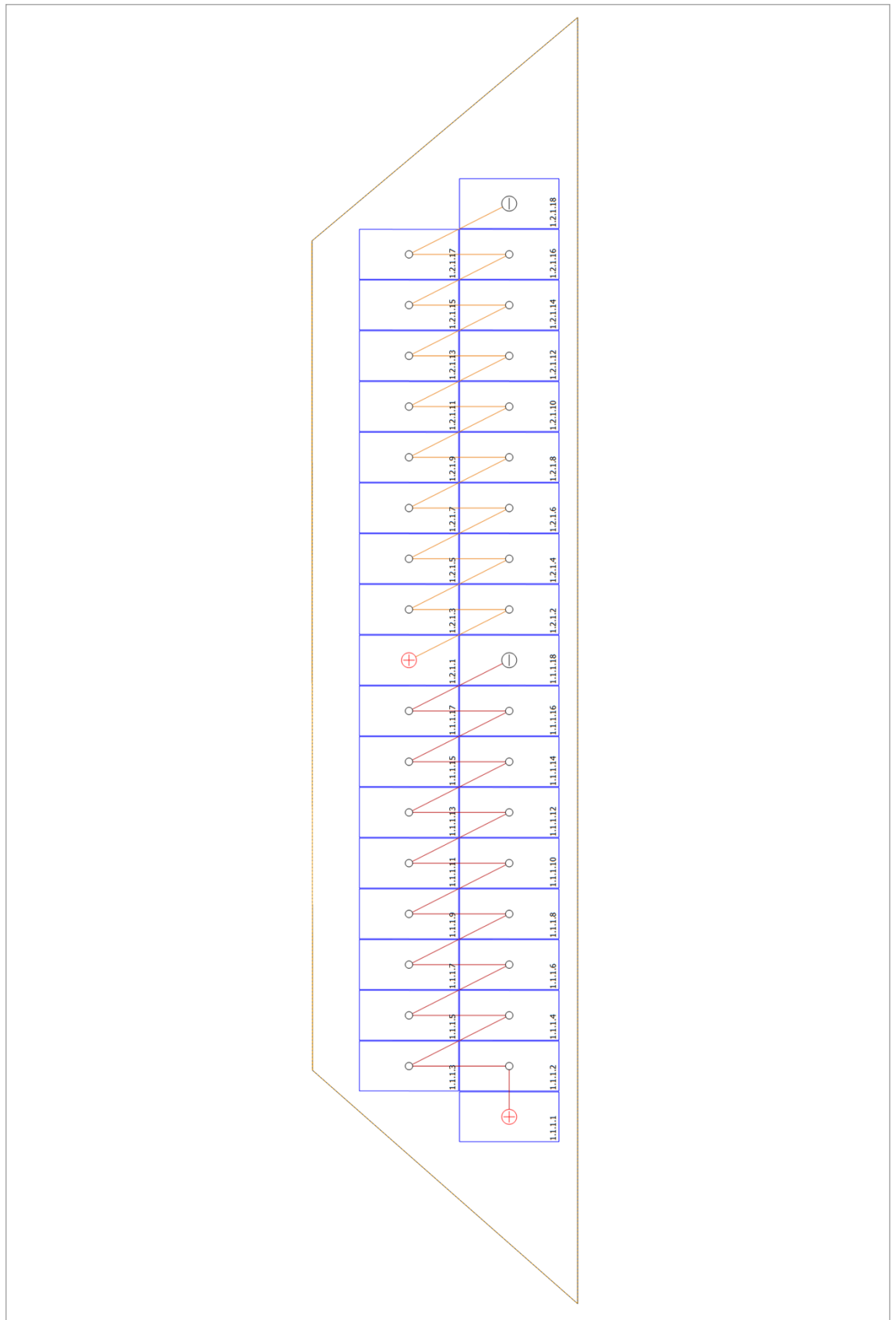


Figure: TrizEng 01-North EAST1

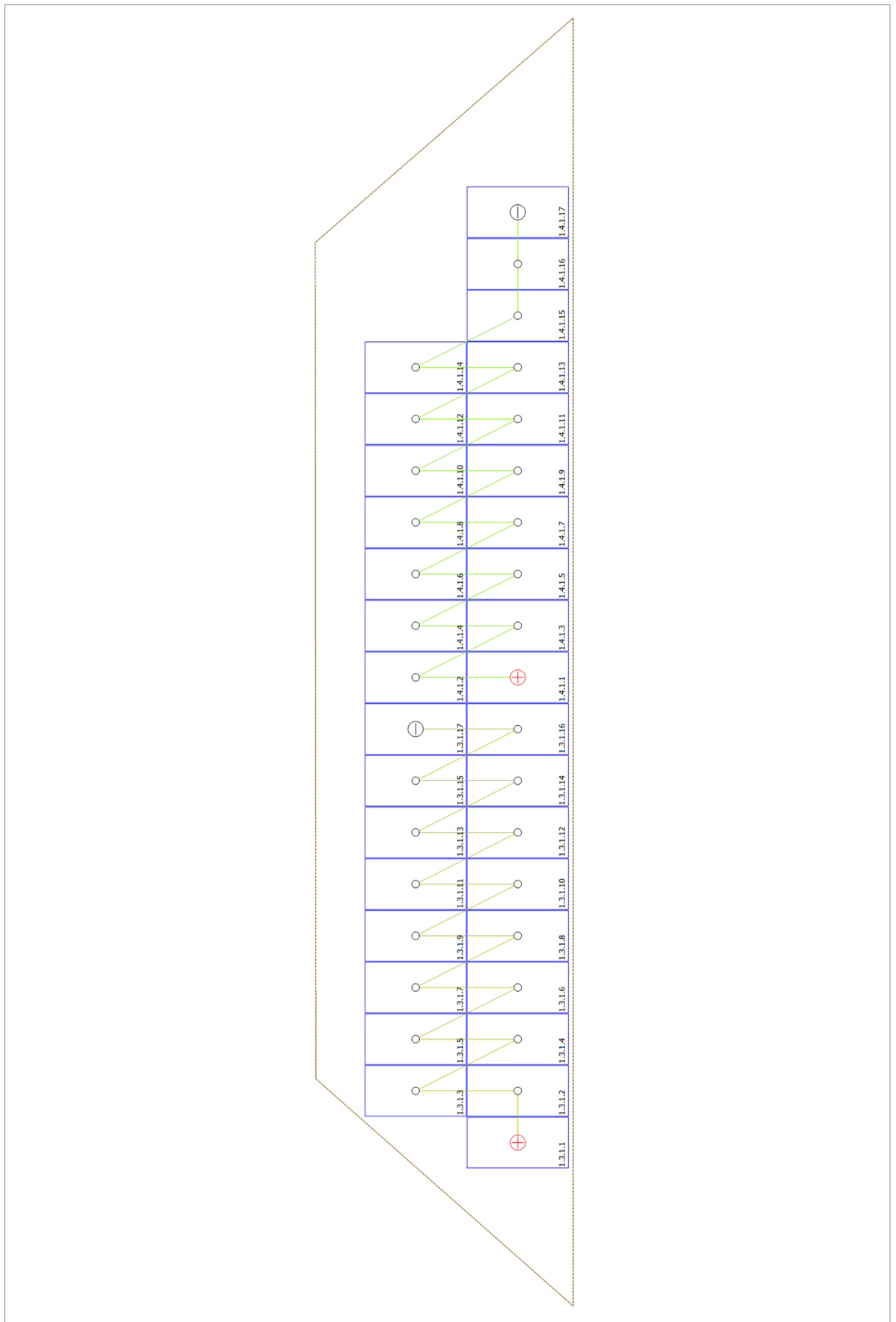


Figure: TrizEng 01-NW1

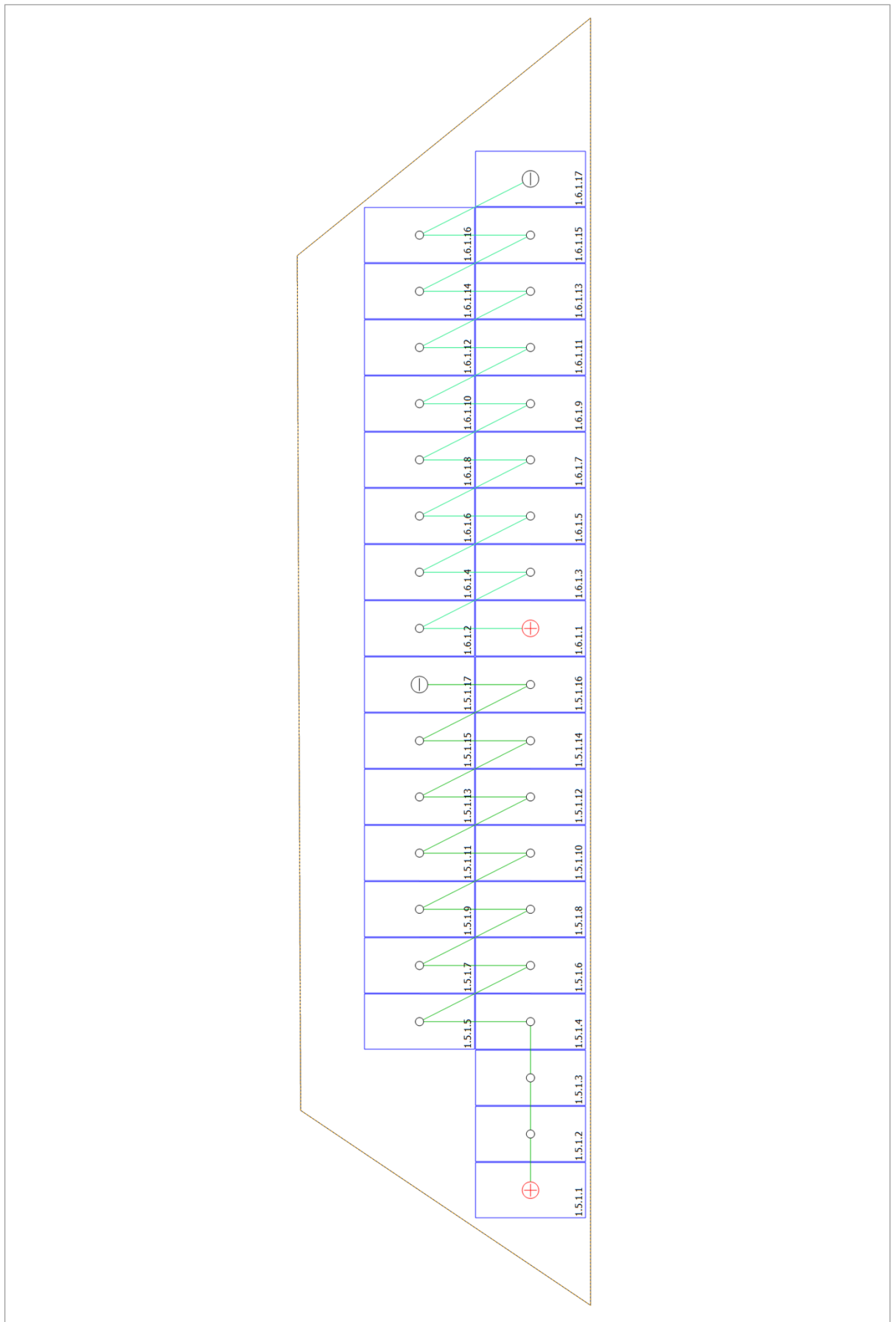


Figure: TrizEng 01-NW2

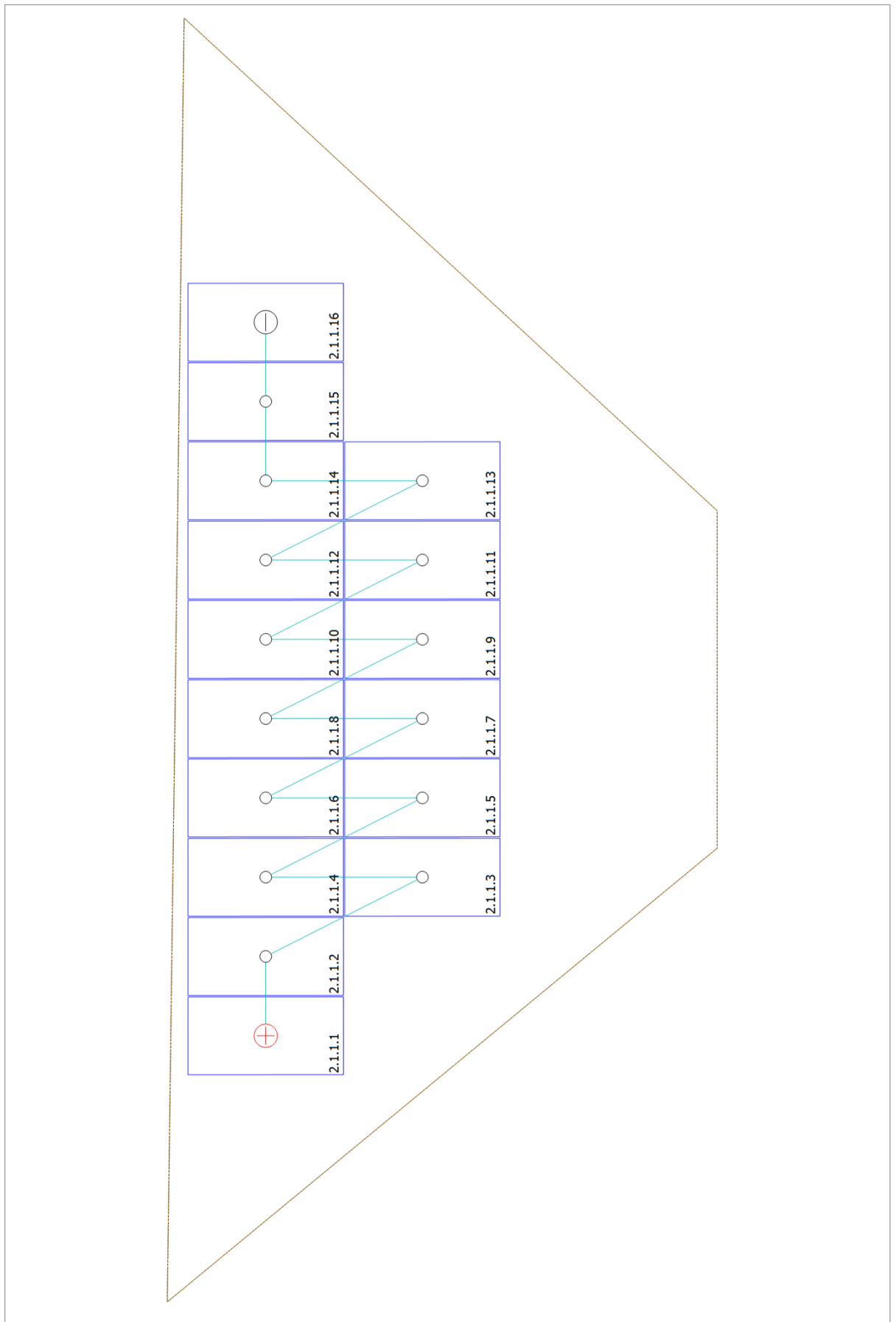


Figure: TrizEng 01-NEatriumS

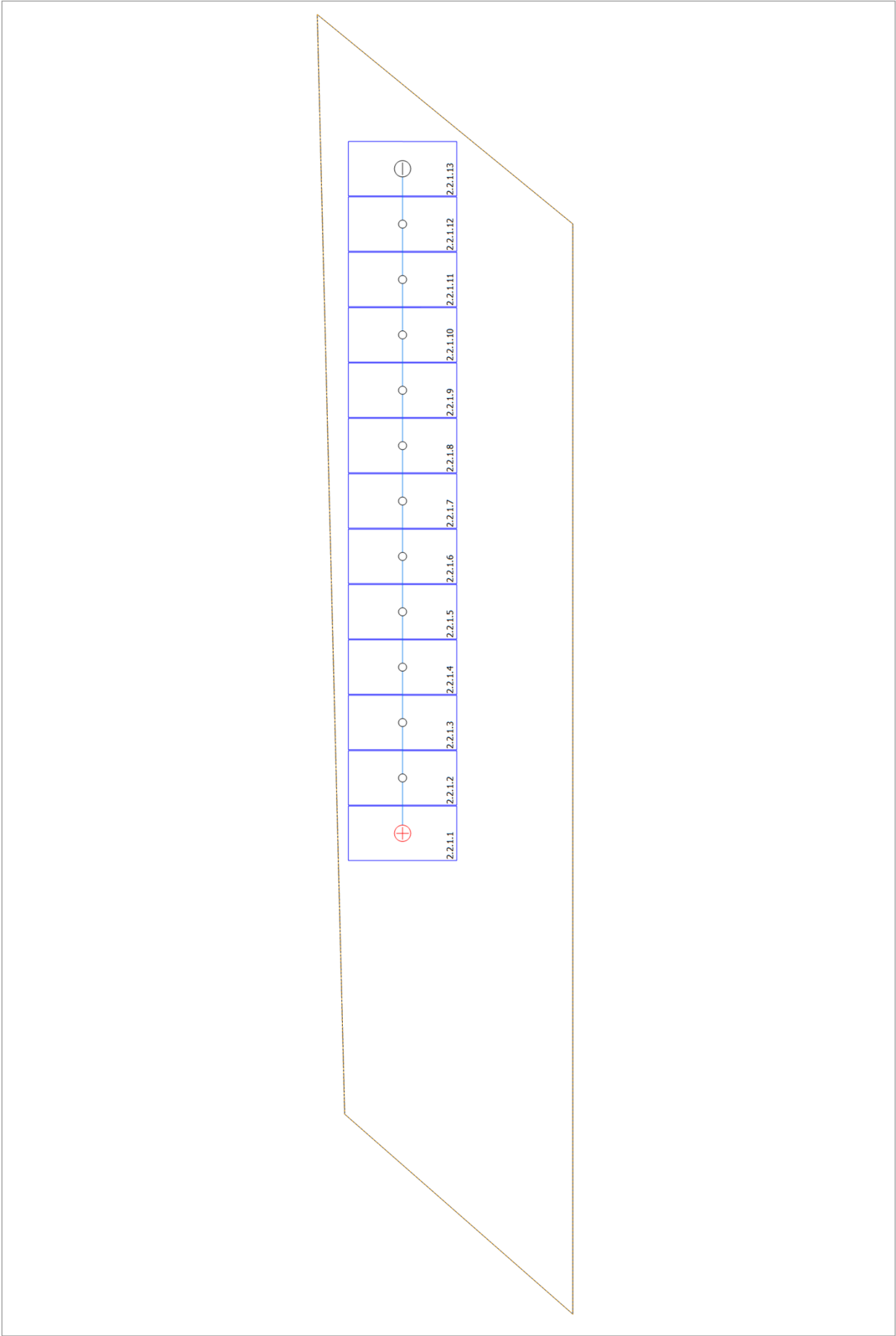


Figure: TrizEng 01-NE2

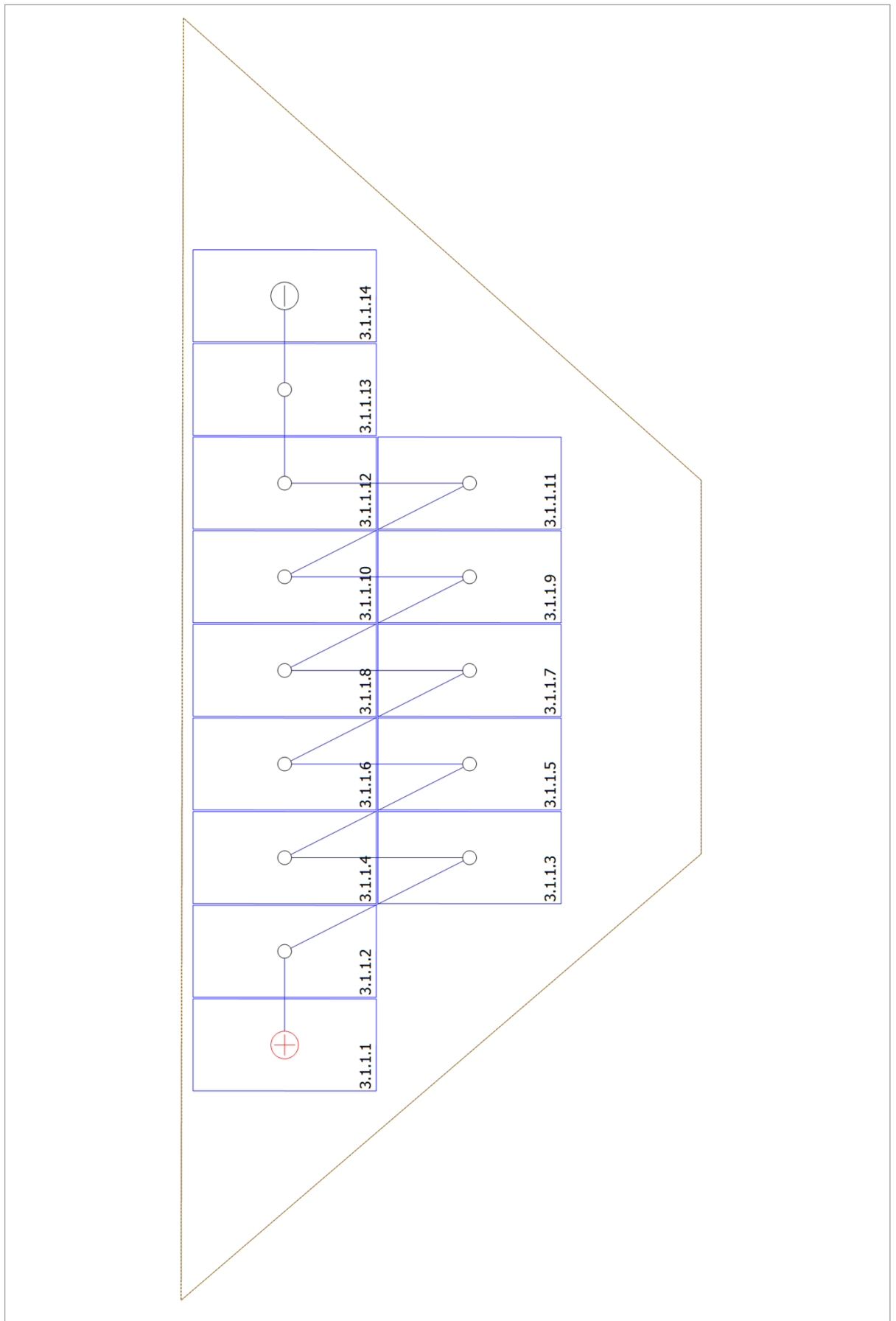


Figure: TrizEng 01-NEatriumN

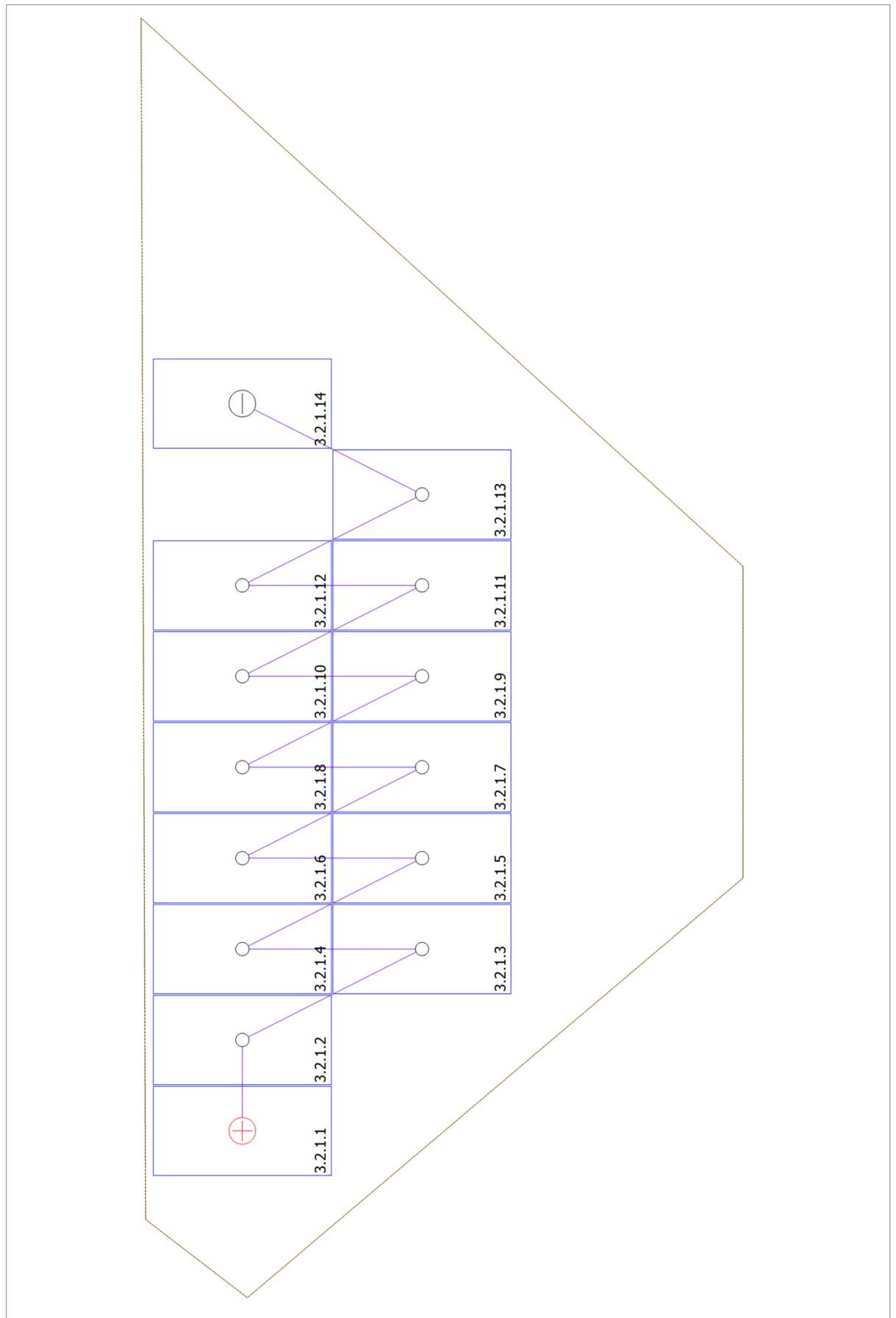


Figure: TrizEng 01-NWatriumS

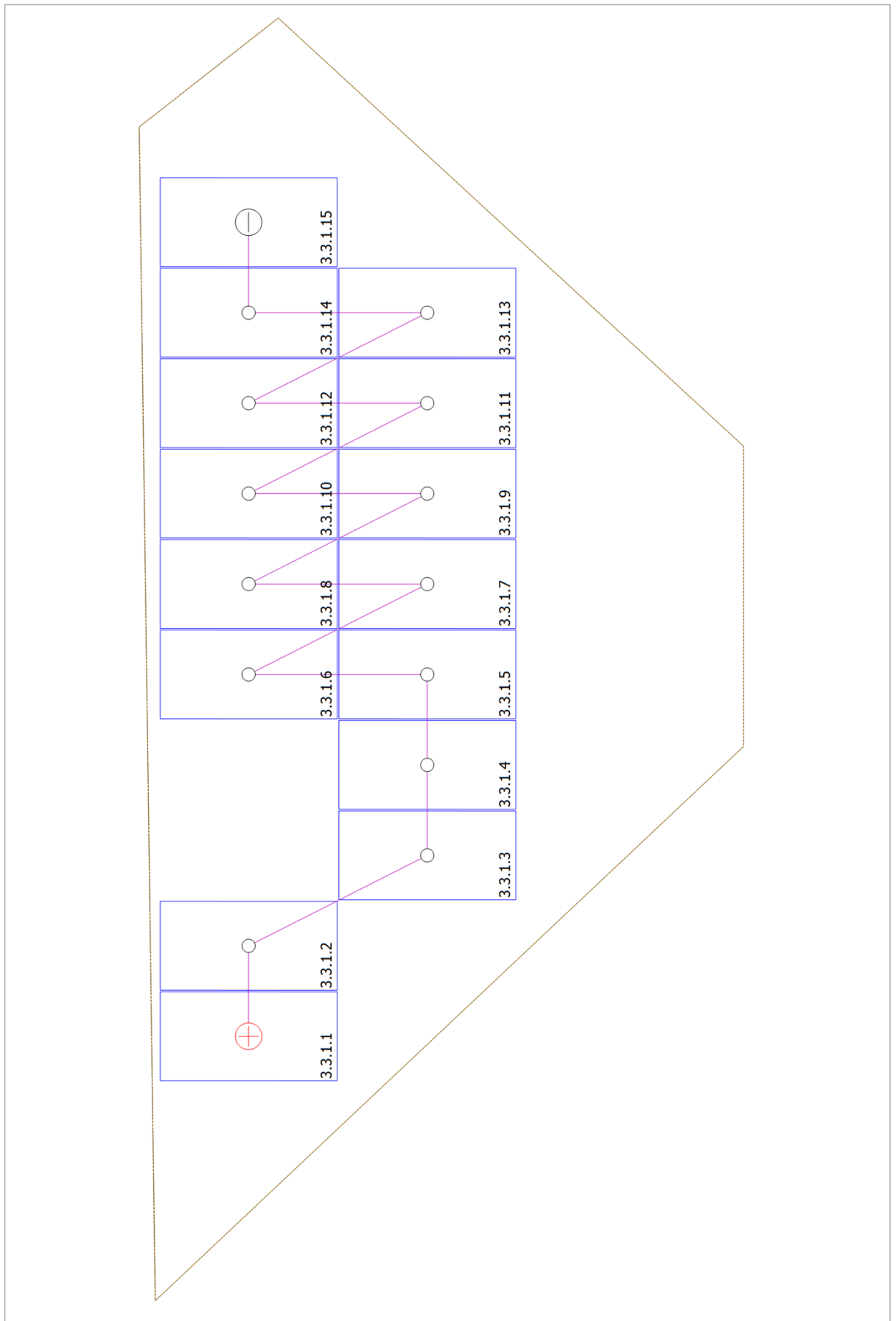


Figure: TrizEng 01-NWatriumN

Parts list

Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		Canadian Solar Inc.	CS6W-540MS 1000V	176	Piece
2	Inverter		SMA Solar Technology AG	Sunny Tripower CORE1	1	Piece
3	Inverter		SMA Solar Technology AG	Sunny Tripower X 15	1	Piece
4	Inverter		SMA Solar Technology AG	Sunny Tripower X 20	1	Piece
5	Components			Feed-in Meter	1	Piece

Screenshots, 3D Design Shading

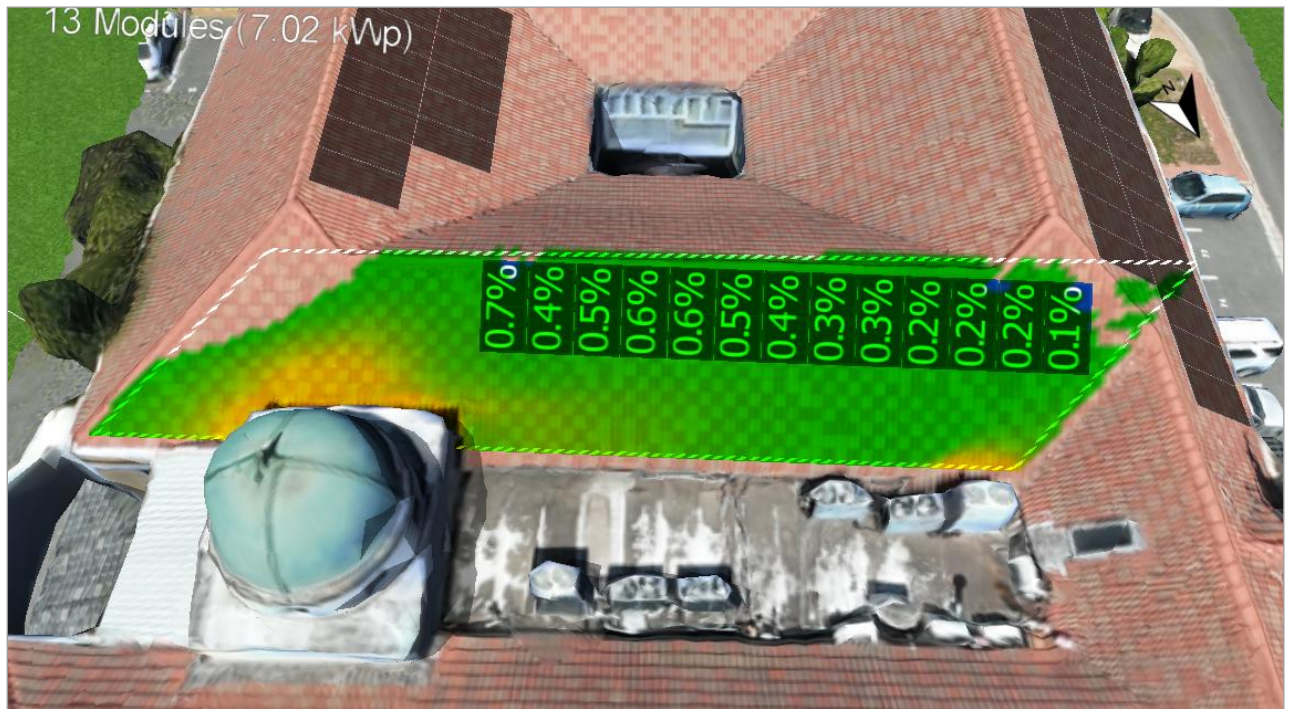


Figure: Screenshot01

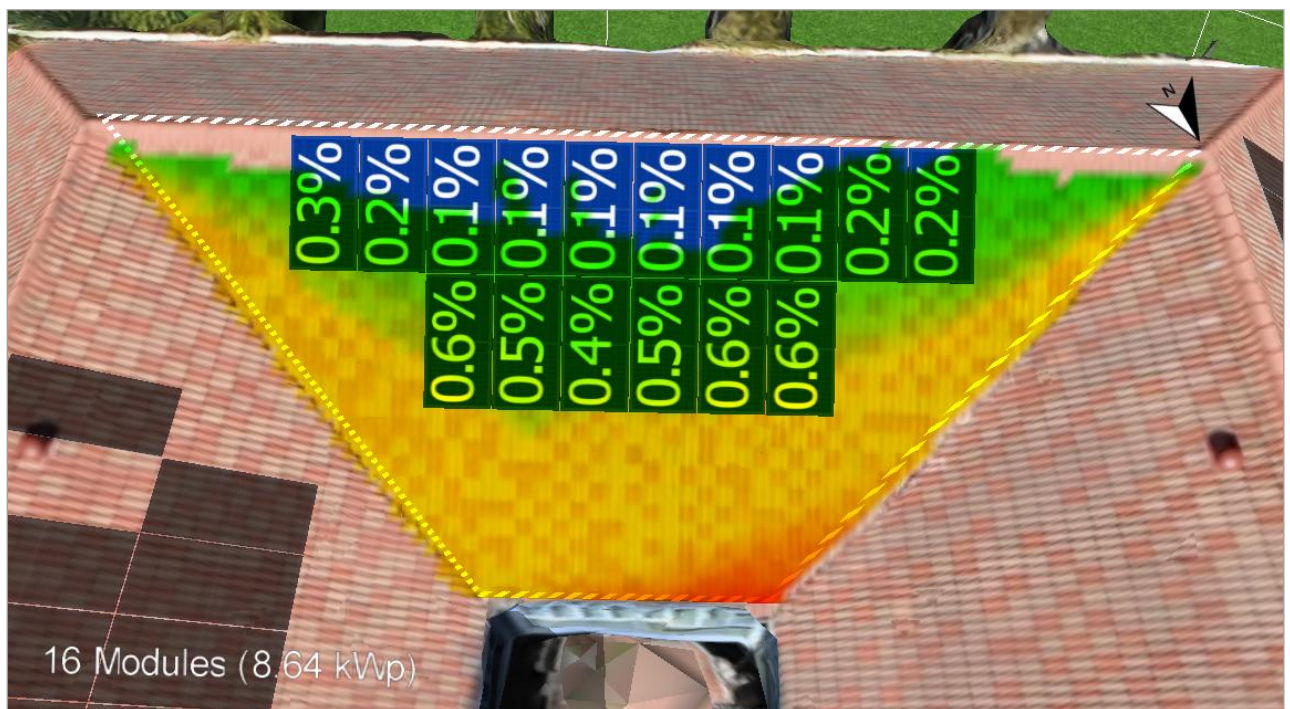


Figure: Screenshot02



Figure: Screenshot03

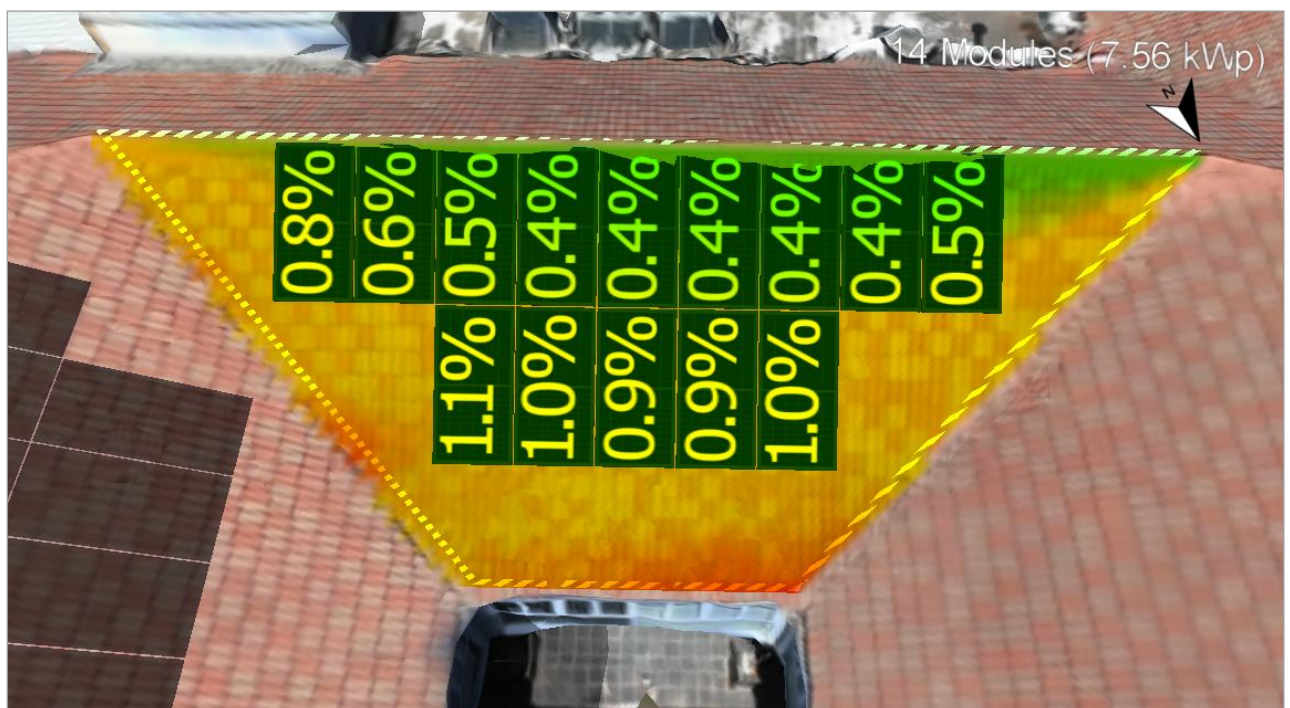


Figure: Screenshot04

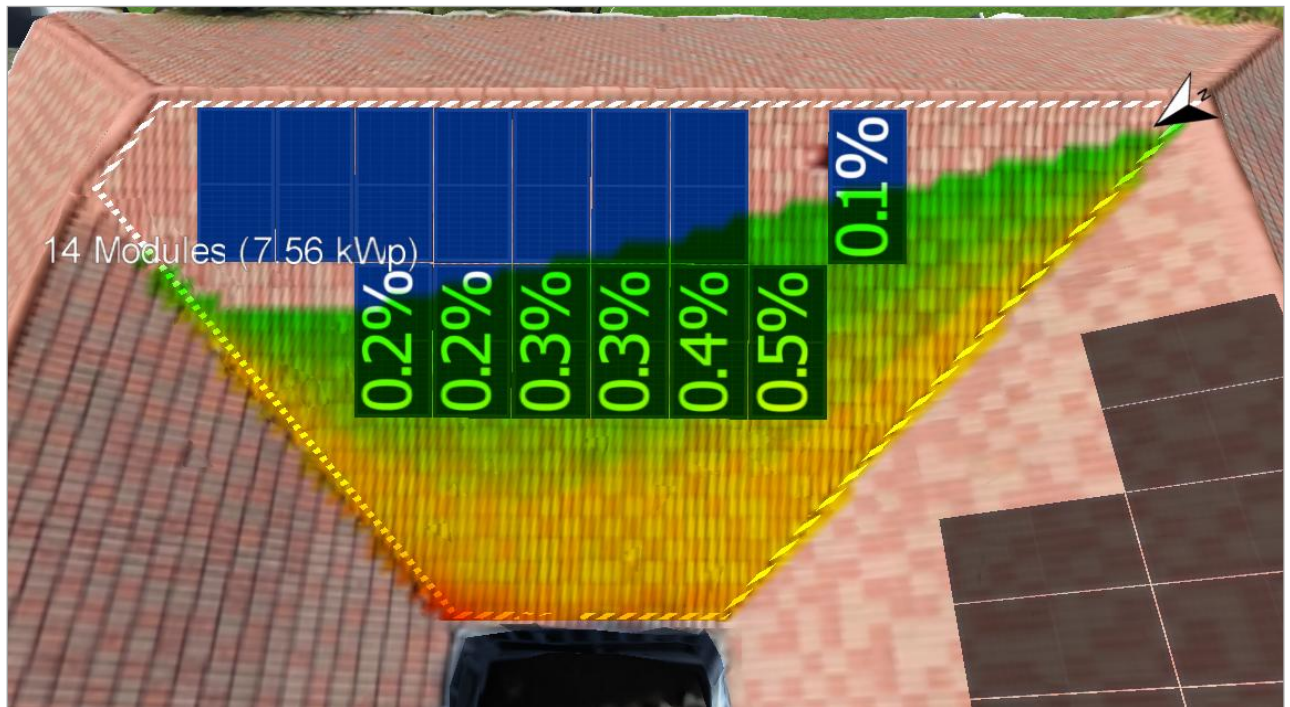


Figure: Screenshot05

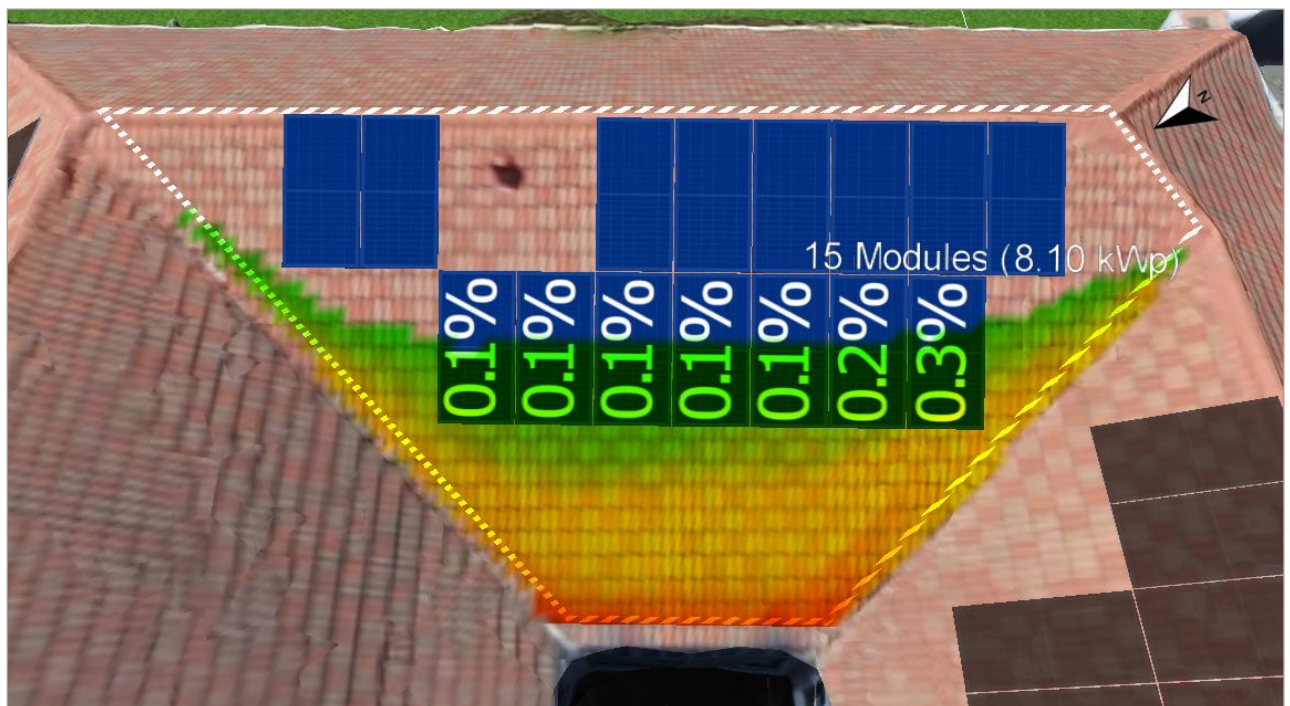


Figure: Screenshot06

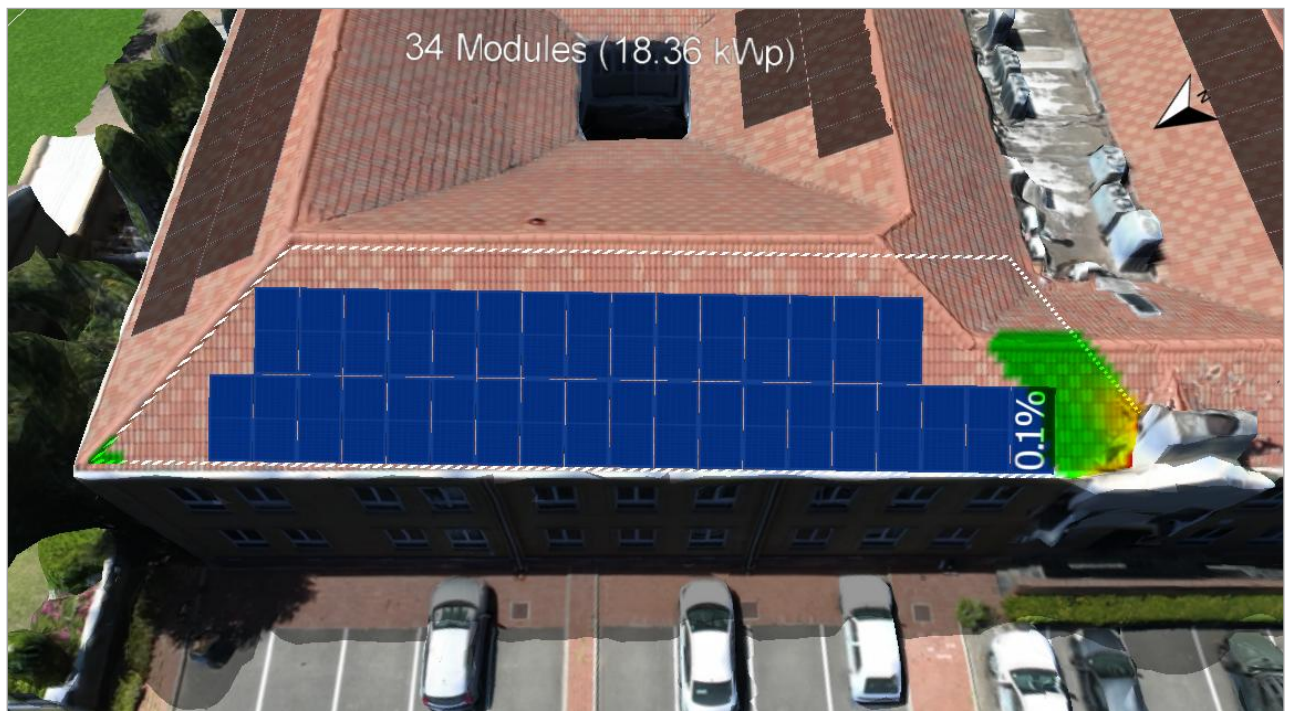


Figure: Screenshot07