

**Project Name:** PV System 190.19 kWp BESS 50kW 107kWh  
**Offer no.:** 20250206-1

27/03/2026

## Documentation- 20250206-1

### Customer Details

|                 |                                              |
|-----------------|----------------------------------------------|
| Company         |                                              |
| Customer Number |                                              |
| Contact person  |                                              |
| Address         | Bury Rd, Radcliffe, Bury, Manchester M26 2WW |
| Phone           |                                              |
| Fax             |                                              |
| E-Mail          |                                              |

### Project Data

|                  |                                                 |
|------------------|-------------------------------------------------|
| Project Name     | PV System 190.19 kWp BESS 50kW<br>107kWh        |
| Offer no.        | 20250206-1                                      |
| Project Designer | George Bartley and Nitin Kumar                  |
| Address          | Bury Rd, Radcliffe, Bury, Manchester M26<br>2WW |



Project Description:  
PV + BESS

PV System 190.19 kWp BESS 50kW 107kWh

Project Designer: George Bartley and Nitin Kumar  
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Project Overview



Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV System with Electrical Appliances and Battery Systems

|                        |                               |
|------------------------|-------------------------------|
| Climate Data           | Manchester, GBR (2001 - 2020) |
| Values source          | Meteonorm 8.2(i)              |
| PV Generator Output    | 190.19 kWp                    |
| PV Generator Surface   | 835.2 m²                      |
| Number of PV Modules   | 418                           |
| Number of Inverters    | 3                             |
| No. of battery systems | 1                             |

## PV System 190.19 kWp BESS 50kW 107kWh

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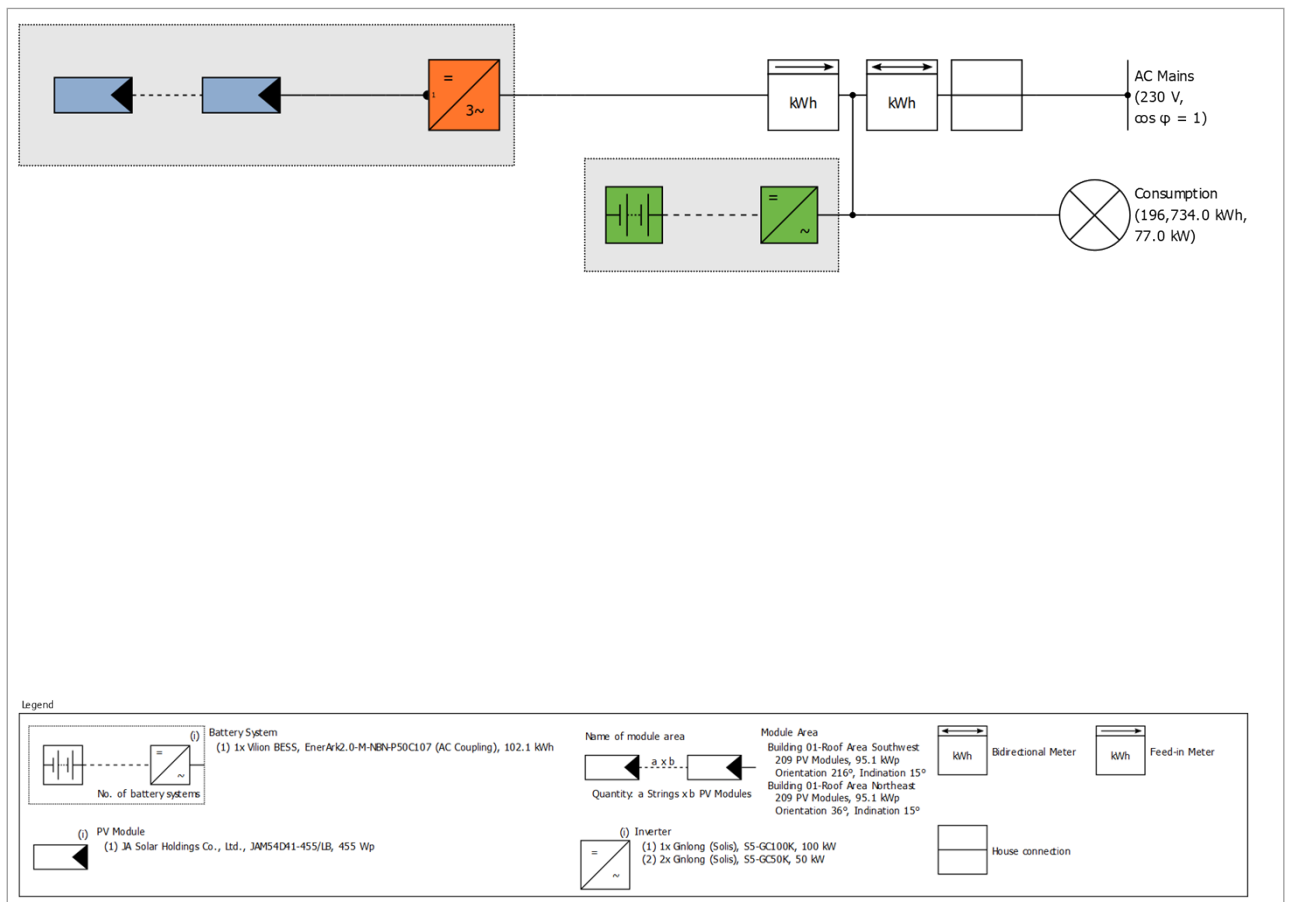


Figure: Schematic diagram

## Production Forecast

### Production Forecast

|                                   |                  |
|-----------------------------------|------------------|
| PV Generator Output               | 190.19 kWp       |
| Spec. Annual Yield                | 912.98 kWh/kWp   |
| Performance Ratio (PR)            | 95.11 %          |
| Yield Reduction due to Shading    | 0.0 %            |
| PV Generator Energy (AC grid)     | 173,683 kWh/Year |
| Direct Own Use                    | 107,301 kWh/Year |
| Battery Charge                    | 17,951 kWh/Year  |
| Clipping at Feed-in Point         | 0 kWh/Year       |
| Grid Export                       | 48,431 kWh/Year  |
| Own Power Consumption             | 72.1 %           |
| CO <sub>2</sub> Emissions avoided | 81,221 kg / year |
| Level of Self-sufficiency         | 63.3 %           |

## PV System 190.19 kWp BESS 50kW 107kWh

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**Offer Number:** 20250206-1

### Financial Analysis

#### Your Gain

|                                |                 |
|--------------------------------|-----------------|
| Total investment costs         | 154,902.00 £    |
| Internal Rate of Return (IRR)  | 22.69 %         |
| Amortization Period            | 4.9 Years       |
| Electricity Production Costs   | 0.0411 £/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.



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# Set-up of the System

## Overview

|                    |                                                                             |
|--------------------|-----------------------------------------------------------------------------|
| System Data        |                                                                             |
| Type of System     | 3D, Grid-connected PV System with Electrical Appliances and Battery Systems |
| Start of Operation | 01/04/2025                                                                  |

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

|                                          |            |
|------------------------------------------|------------|
| Consumption                              |            |
| Total Consumption                        | 196734 kWh |
| Table1-8_ hh Bury radcliffe - Sheet1 (1) | 196734 kWh |
| Load Peak                                | 77 kW      |

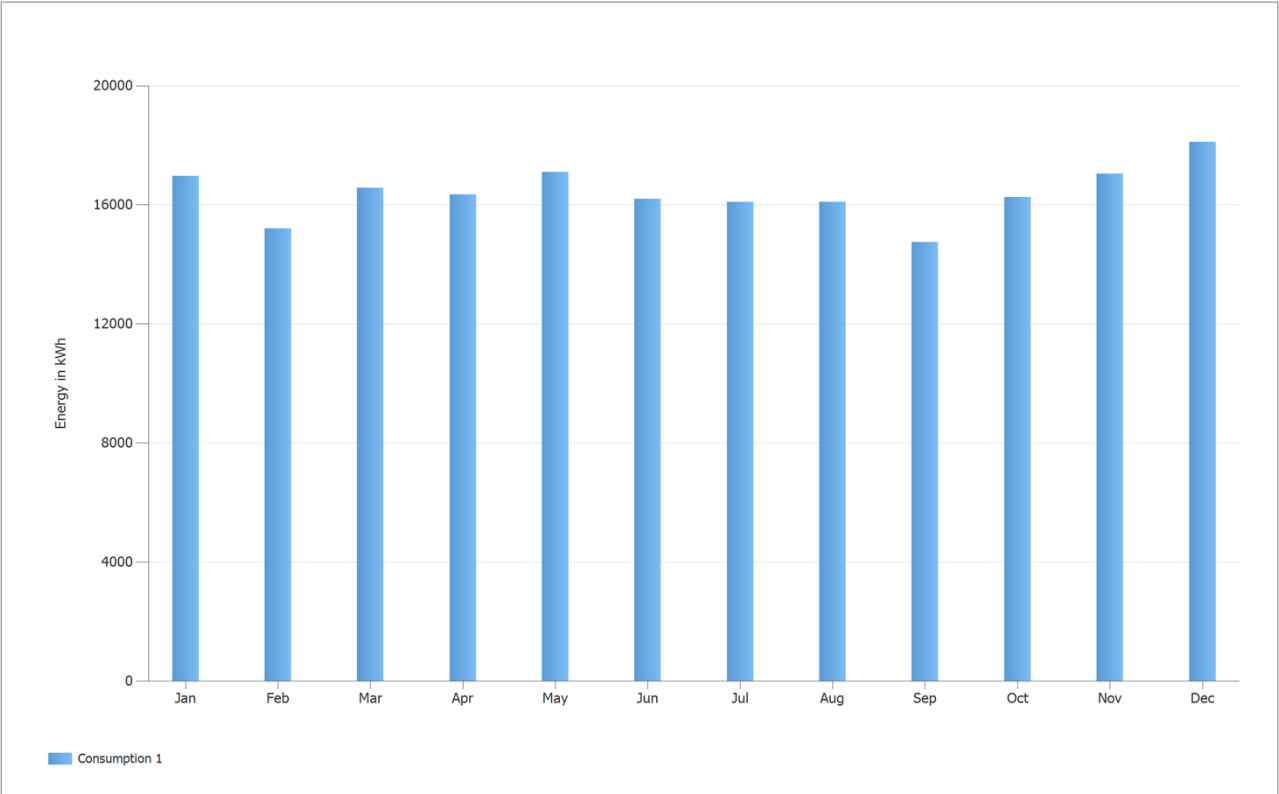


Figure: Consumption

## PV System 190.19 kWp BESS 50kW 107kWh

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### Module Areas

#### 1. Module Area - Building 01-Roof Area Southwest

##### PV Generator, 1. Module Area - Building 01-Roof Area Southwest

|                      |                                 |
|----------------------|---------------------------------|
| Name                 | Building 01-Roof Area Southwest |
| PV Modules           | 209 x JAM54D41-455/LB (v1)      |
| Manufacturer         | JA Solar Holdings Co., Ltd.     |
| Inclination          | 15 °                            |
| Orientation          | Southwest 216 °                 |
| Installation Type    | Mounted - Roof                  |
| PV Generator Surface | 417.6 m <sup>2</sup>            |



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

## PV System 190.19 kWp BESS 50kW 107kWh

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### Degradation of Module, 1. Module Area - Building 01-Roof Area Southwest

Characteristic curve

Linear (straight line)

Remaining power (power output) after 20 years

80 %

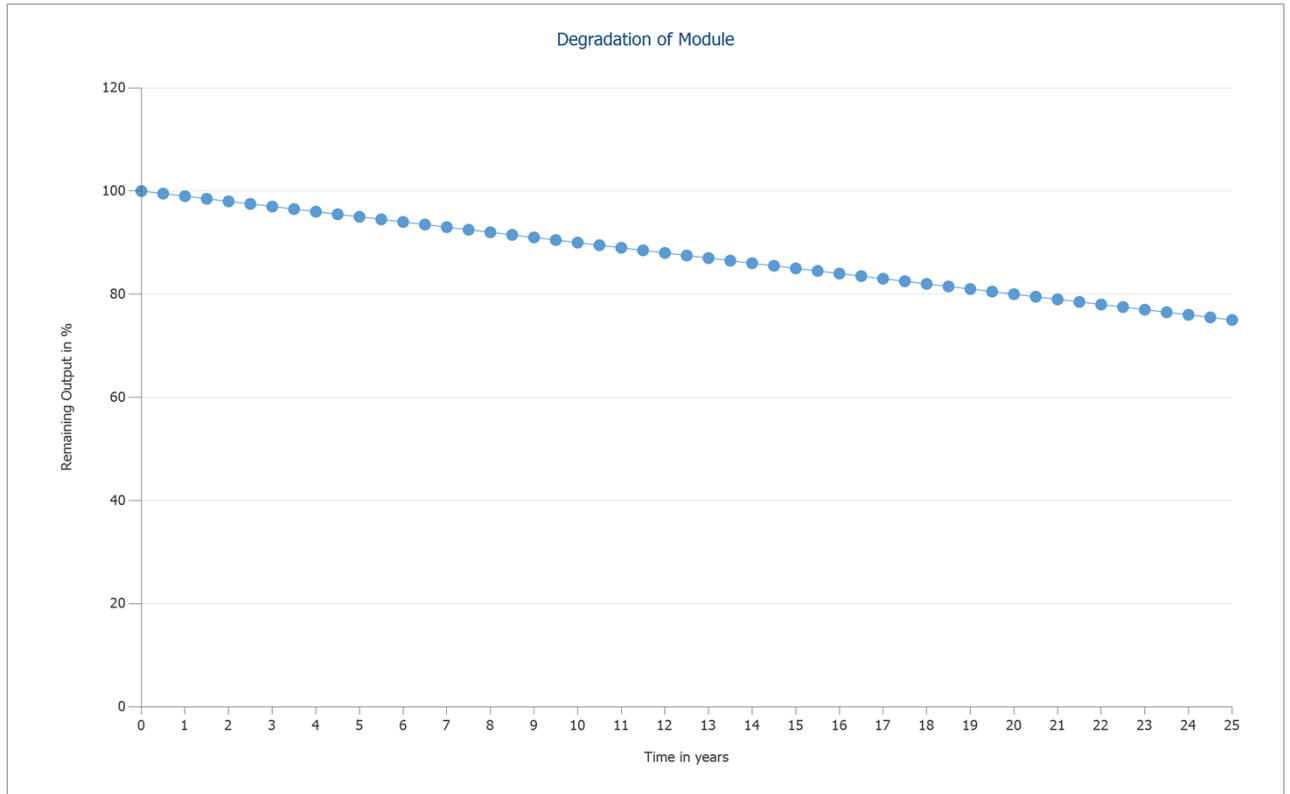


Figure: Degradation of Module, 1. Module Area - Building 01-Roof Area Southwest

## PV System 190.19 kWp BESS 50kW 107kWh

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### 2. Module Area - Building 01-Roof Area Northeast

PV Generator, 2. Module Area - Building 01-Roof Area Northeast

|                      |                                 |
|----------------------|---------------------------------|
| Name                 | Building 01-Roof Area Northeast |
| PV Modules           | 209 x JAM54D41-455/LB (v1)      |
| Manufacturer         | JA Solar Holdings Co., Ltd.     |
| Inclination          | 15 °                            |
| Orientation          | Northeast 36 °                  |
| Installation Type    | Mounted - Roof                  |
| PV Generator Surface | 417.6 m²                        |



Figure: 2. Module Area - Building 01-Roof Area Northeast

## PV System 190.19 kWp BESS 50kW 107kWh

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Offer Number: 20250206-1

### Degradation of Module, 2. Module Area - Building 01-Roof Area Northeast

Characteristic curve

Linear (straight line)

Remaining power (power output) after 20 years

80 %

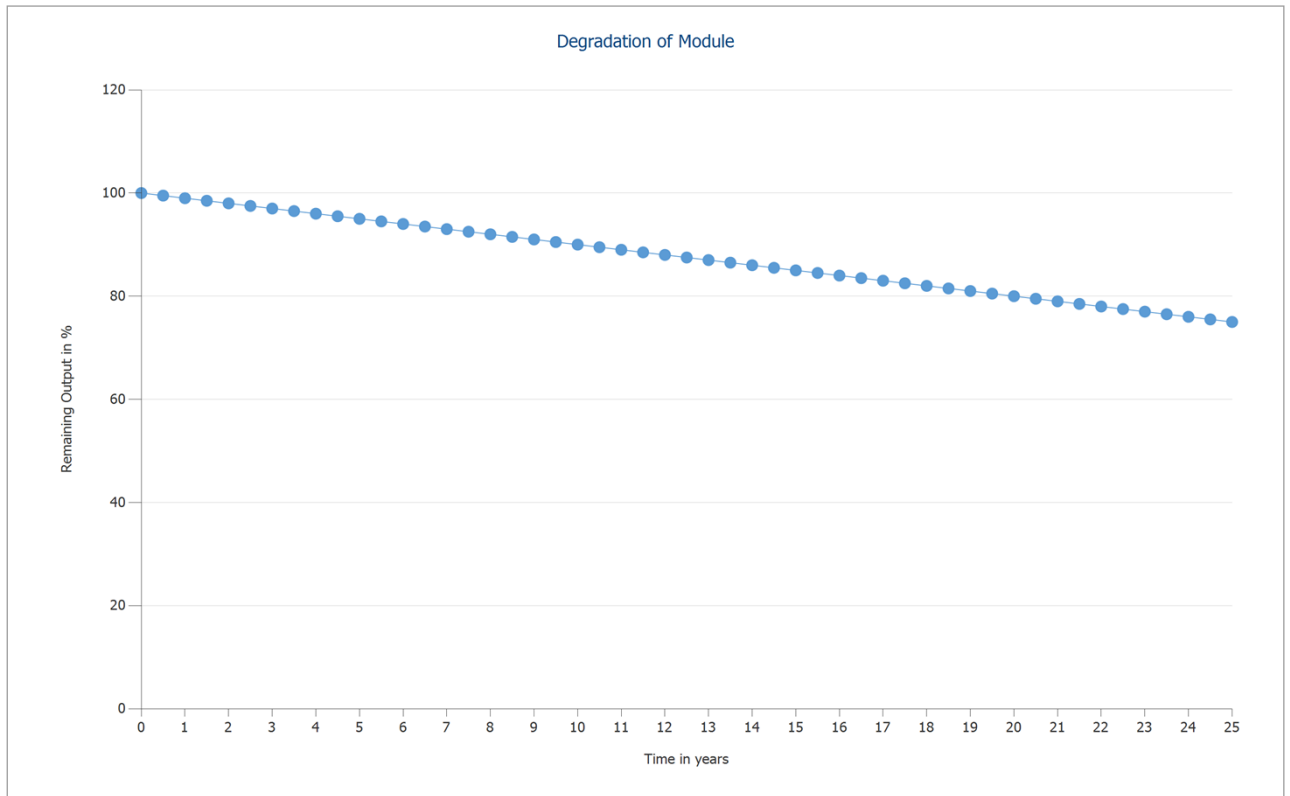


Figure: Degradation of Module, 2. Module Area - Building 01-Roof Area Northeast

## Horizon Line, 3D Design

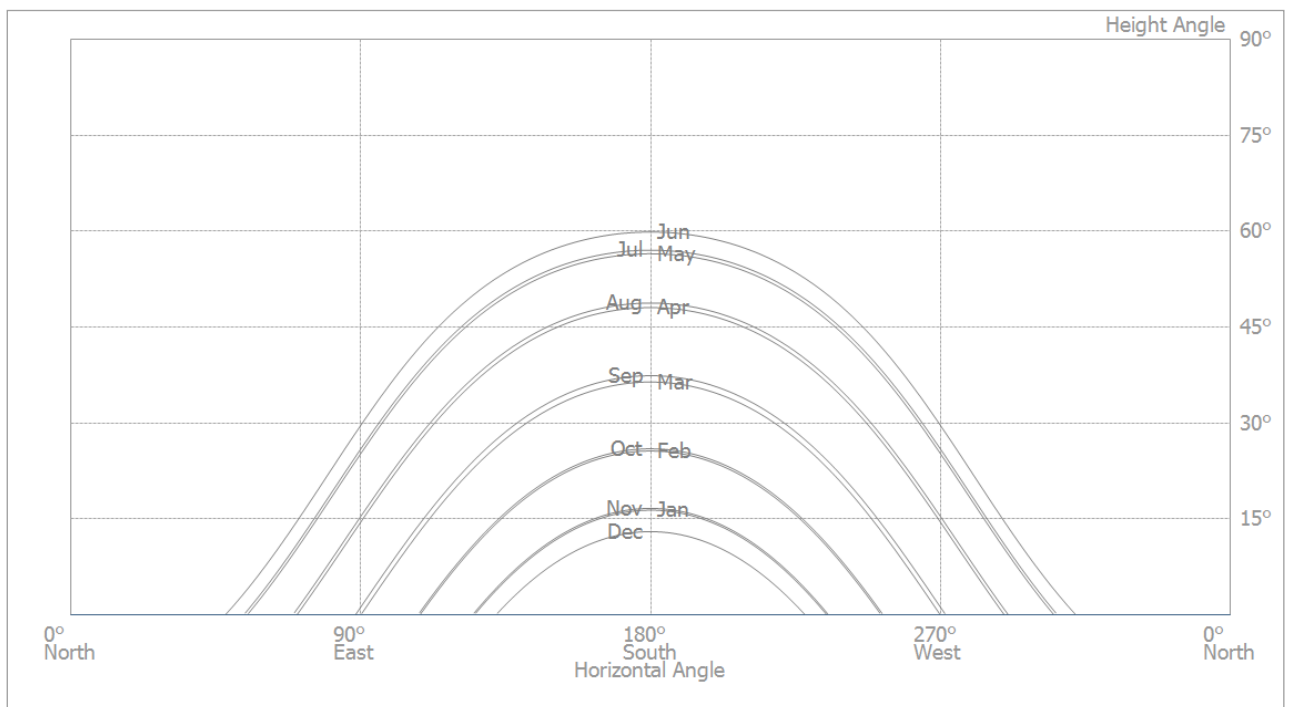


Figure: Horizon (3D Design)

## PV System 190.19 kWp BESS 50kW 107kWh

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### Inverter configuration

#### Configuration 1

|               |                                 |
|---------------|---------------------------------|
| Module Area   | Building 01-Roof Area Southwest |
| Inverter 1    |                                 |
| Model         | S5-GC100K (v2)                  |
| Manufacturer  | Ginlong (Solis)                 |
| Quantity      | 1                               |
| Sizing Factor | 95.1 %                          |
| Configuration | MPP 1: 2 x 14                   |
|               | MPP 2: 1 x 21                   |
|               | MPP 3: 1 x 20                   |
|               | MPP 4: 1 x 20                   |
|               | MPP 5: 1 x 20                   |
|               | MPP 6: 1 x 20                   |
|               | MPP 7: 1 x 20                   |
|               | MPP 8: 1 x 20                   |
|               | MPP 9: 1 x 20                   |
|               | MPP 10: 1 x 20                  |

#### Configuration 2

|               |                                 |
|---------------|---------------------------------|
| Module Area   | Building 01-Roof Area Northeast |
| Inverter 1    |                                 |
| Model         | S5-GC50K (v2)                   |
| Manufacturer  | Ginlong (Solis)                 |
| Quantity      | 1                               |
| Sizing Factor | 95.6 %                          |
| Configuration | MPP 1: 2 x 15                   |
|               | MPP 2: 1 x 21                   |
|               | MPP 3: 1 x 18                   |
|               | MPP 4: 1 x 18                   |
|               | MPP 5: 1 x 18                   |
| Inverter 2    |                                 |
| Model         | S5-GC50K (v2)                   |
| Manufacturer  | Ginlong (Solis)                 |
| Quantity      | 1                               |
| Sizing Factor | 94.6 %                          |
| Configuration | MPP 1: 2 x 15                   |
|               | MPP 2: 1 x 20                   |
|               | MPP 3: 1 x 18                   |
|               | MPP 4: 1 x 18                   |
|               | MPP 5: 1 x 18                   |

### 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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### Battery Systems

#### Battery System - Group 1

|                  |                                             |
|------------------|---------------------------------------------|
| Model            | EnerArk2.0-M-NBN-P50C107 (AC Coupling) (v2) |
| Manufacturer     | Vilion BESS                                 |
| Quantity         | 1                                           |
| Battery Inverter |                                             |
| Type of Coupling | AC coupling                                 |
| Nominal output   | 50 kW                                       |
| Battery          |                                             |
| Manufacturer     | Vilion BESS                                 |
| Model            | EnerArk2.0-M-120S (v1)                      |
| Quantity         | 1                                           |
| Battery Energy   | 102.1 kWh                                   |
| Battery Type     | Lithium iron phosphate                      |

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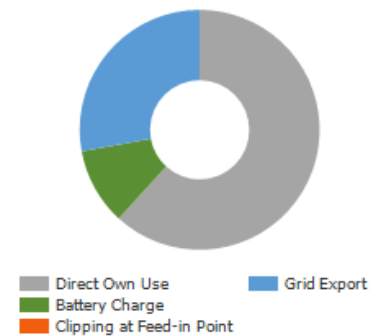
# Simulation Results

## Results Total System

### PV System

|                                   |                  |
|-----------------------------------|------------------|
| PV Generator Output               | 190.19 kWp       |
| Spec. Annual Yield                | 912.98 kWh/kWp   |
| Performance Ratio (PR)            | 95.11 %          |
| Yield Reduction due to Shading    | 0.0 %            |
| PV Generator Energy (AC grid)     | 173,683 kWh/Year |
| Direct Own Use                    | 107,301 kWh/Year |
| Battery Charge                    | 17,951 kWh/Year  |
| Clipping at Feed-in Point         | 0 kWh/Year       |
| Grid Export                       | 48,431 kWh/Year  |
| Own Power Consumption             | 72.1 %           |
| CO <sub>2</sub> Emissions avoided | 81,221 kg / year |

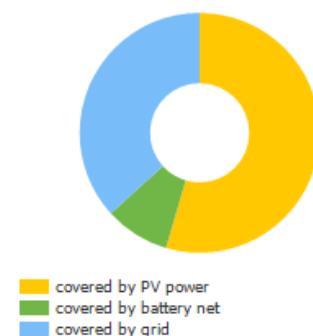
PV Generator Energy (AC grid)



### Appliances

|                                |                  |
|--------------------------------|------------------|
| Appliances                     | 196,734 kWh/Year |
| Standby Consumption (Inverter) | 43 kWh/Year      |
| Total Consumption              | 196,777 kWh/Year |
| covered by PV power            | 107,301 kWh/Year |
| covered by battery net         | 17,223 kWh/Year  |
| covered by grid                | 72,253 kWh/Year  |
| Solar Fraction                 | 63.3 %           |

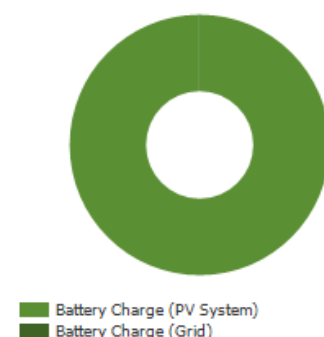
Total Consumption



### Battery System

|                                                |                 |
|------------------------------------------------|-----------------|
| Charge at beginning                            | 102 kWh         |
| Battery Charge (Total)                         | 17,962 kWh/Year |
| Battery Charge (PV System)                     | 17,951 kWh/Year |
| Battery Charge (Grid)                          | 11 kWh/Year     |
| Battery Energy for the Covering of Consumption | 17,234 kWh/Year |
| Battery discharge into the grid                | 0 kWh/Year      |
| Losses due to charging/discharging             | 758 kWh/Year    |
| Losses in Battery                              | 72 kWh/Year     |
| Cycle Load                                     | 3.1 %           |
| Service Life                                   | >20 Years       |

Battery Charge (Total)



### Level of Self-sufficiency

|                           |                  |
|---------------------------|------------------|
| Total Consumption         | 196,777 kWh/Year |
| covered by grid           | 72,253 kWh/Year  |
| Level of Self-sufficiency | 63.3 %           |

## PV System 190.19 kWp BESS 50kW 107kWh

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### Energy Flow Graph

Project: PV System 190.19 kWp BESS 50kW 107kWh

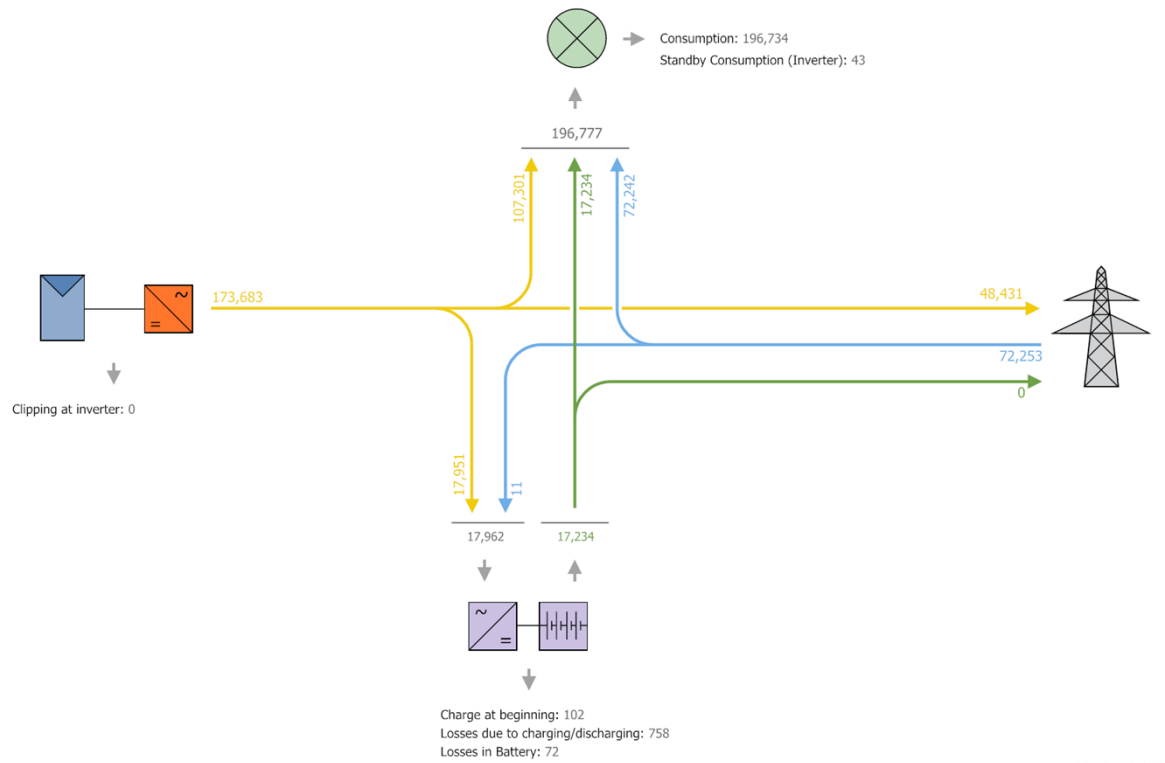


Figure: Energy flow

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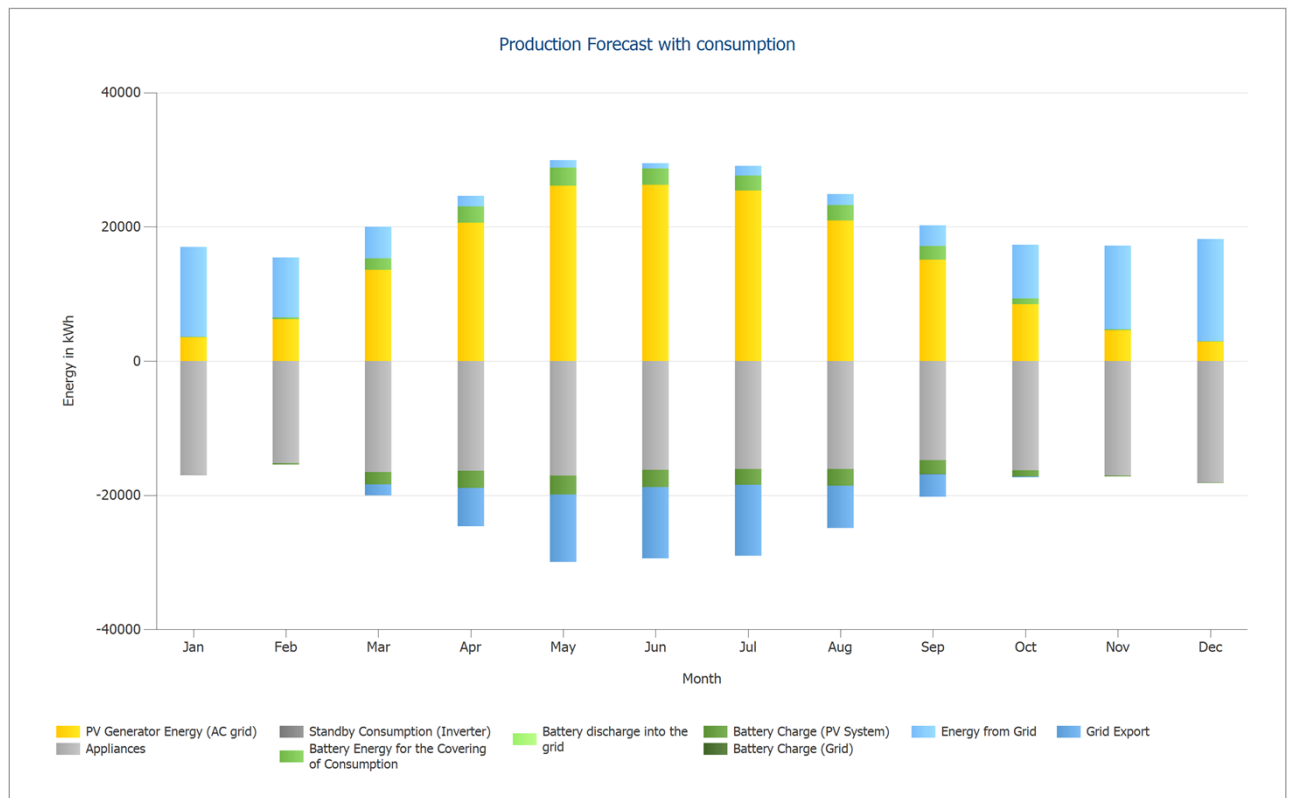


Figure: Production Forecast with consumption

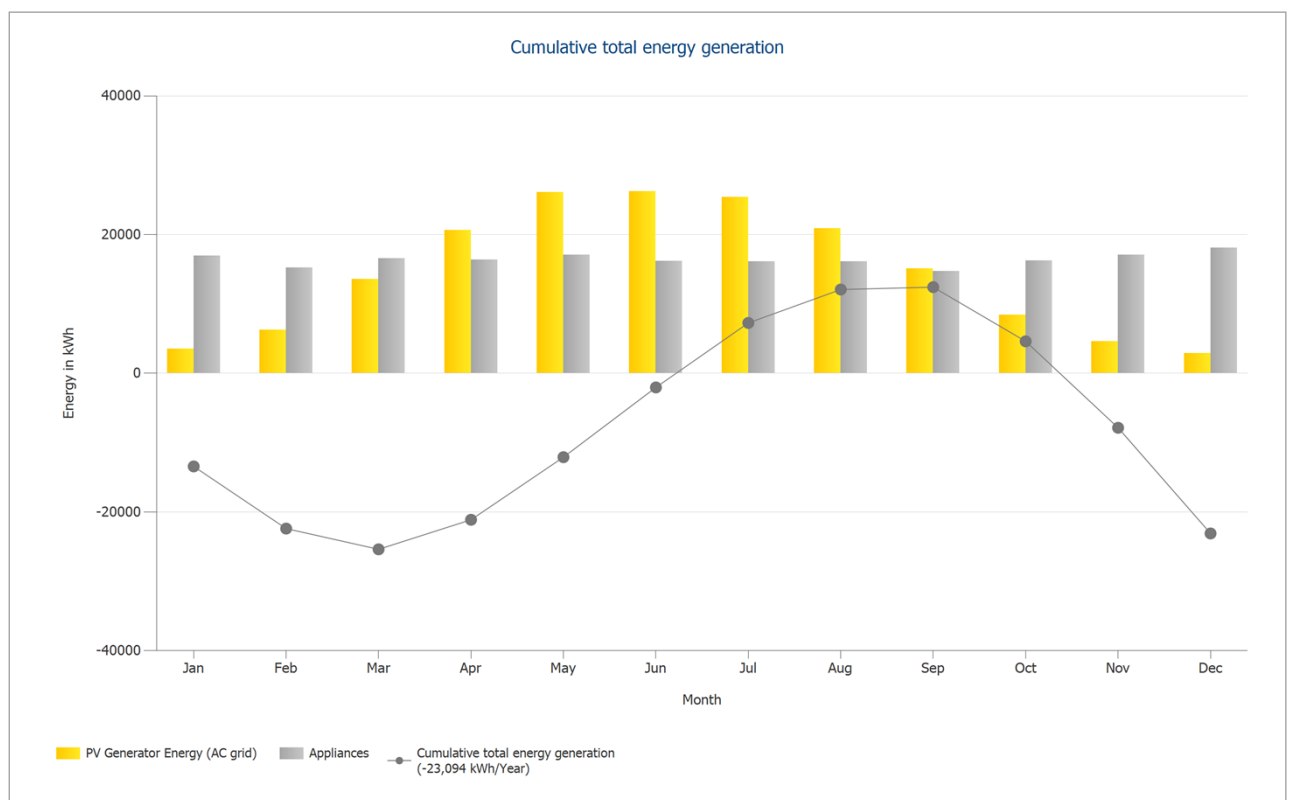


Figure: Cumulative total energy generation

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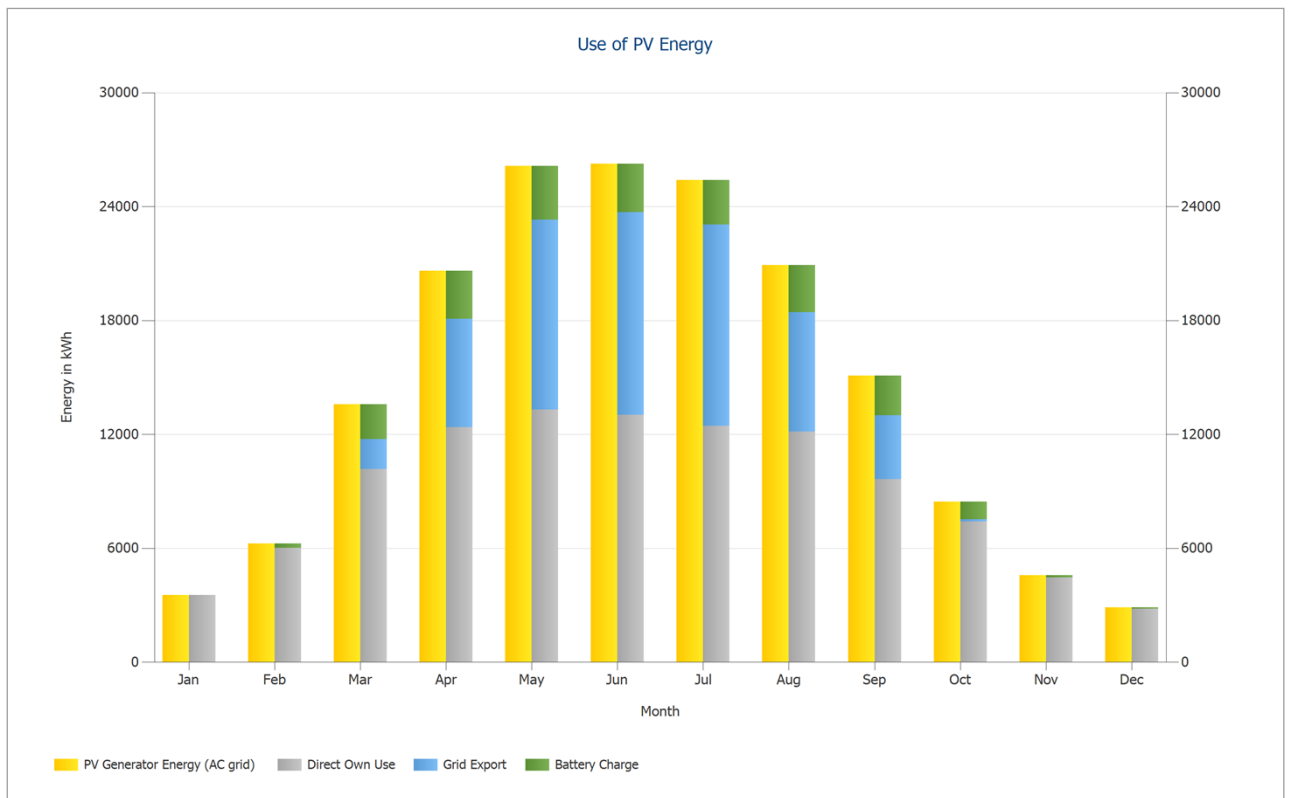


Figure: Use of PV Energy

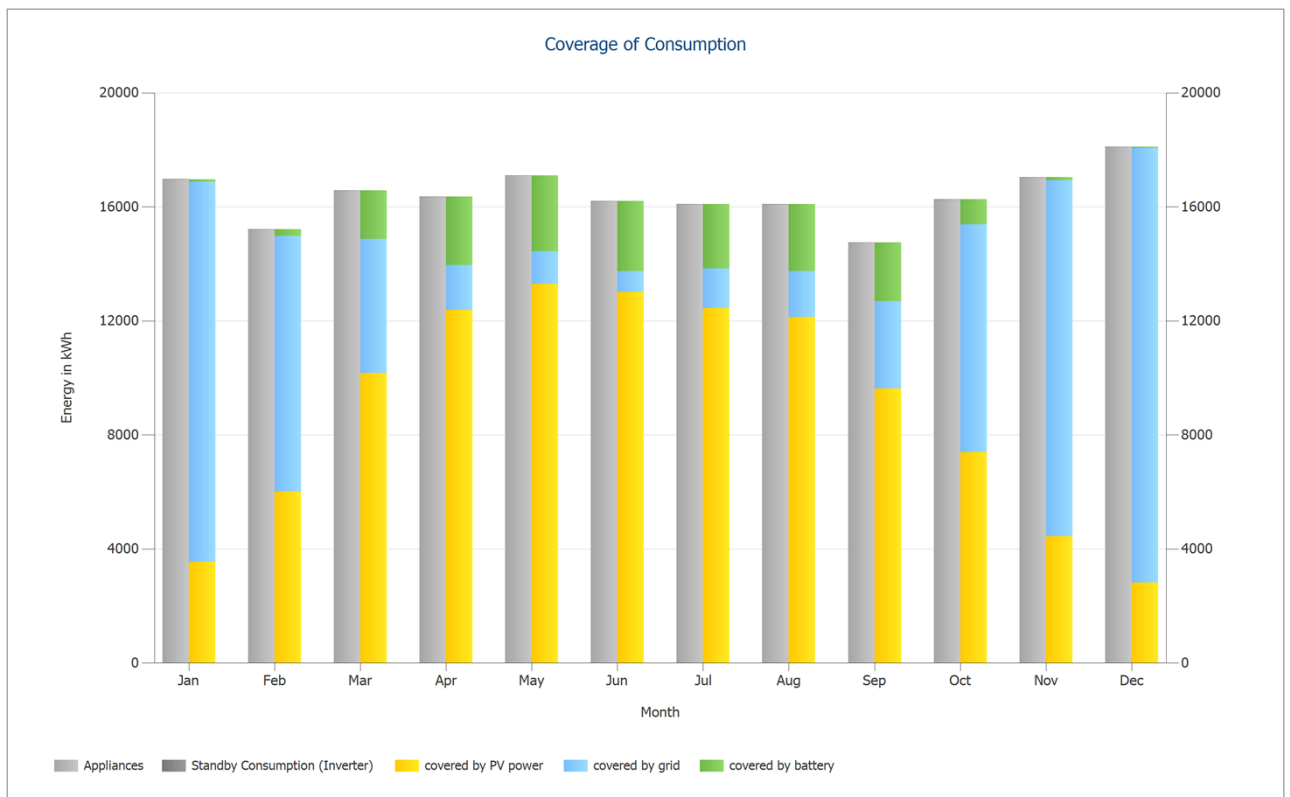


Figure: Coverage of Consumption

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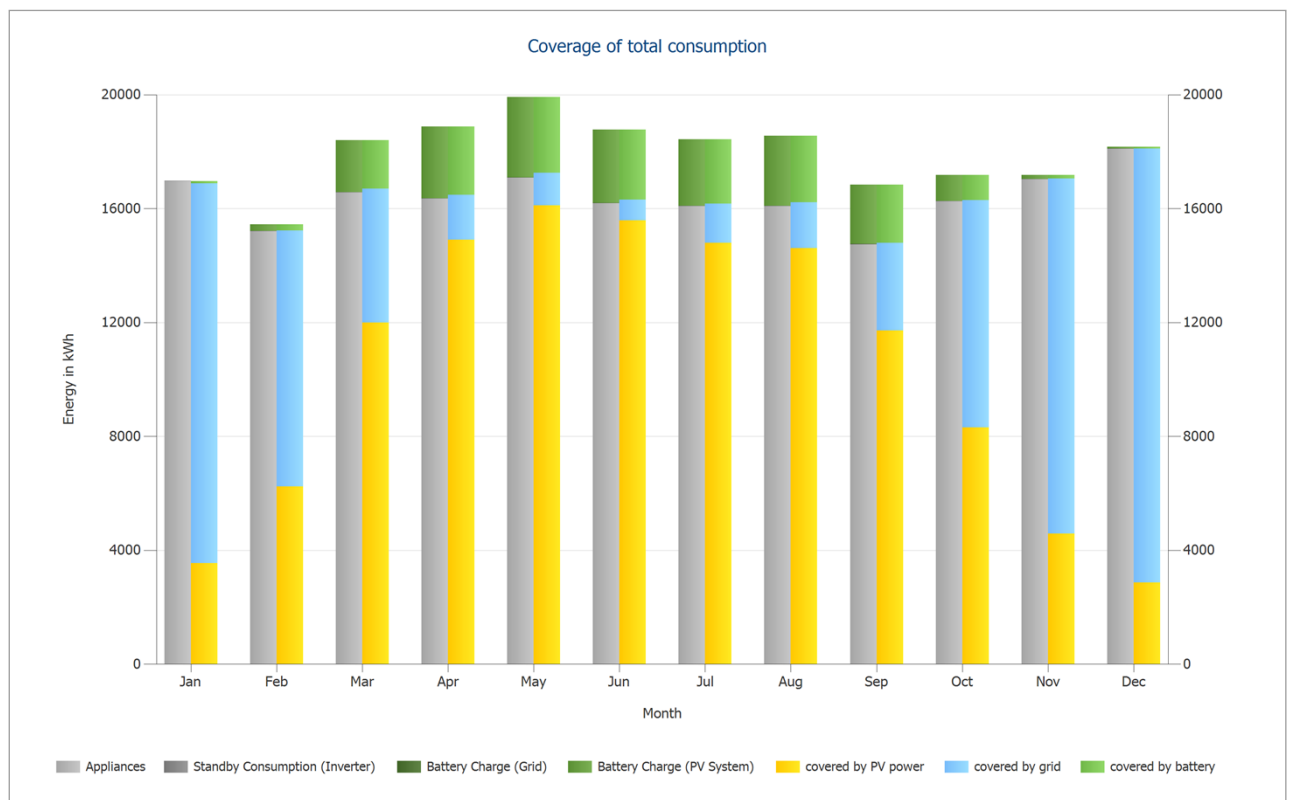


Figure: Coverage of total consumption

## Results per Module Area

### Building 01-Roof Area Southwest

|                                               |                            |
|-----------------------------------------------|----------------------------|
| PV Generator Output                           | 95.10 kWp                  |
| PV Generator Surface                          | 417.60 m <sup>2</sup>      |
| Global Radiation at the Module                | 1058.68 kWh/m <sup>2</sup> |
| Global Radiation on Module without reflection | 1063.95 kWh/m <sup>2</sup> |
| Performance Ratio (PR)                        | 95.25 %                    |
| PV Generator Energy (AC grid)                 | 96384.86 kWh/Year          |
| Spec. Annual Yield                            | 1013.56 kWh/kWp            |

### Building 01-Roof Area Northeast

|                                               |                           |
|-----------------------------------------------|---------------------------|
| PV Generator Output                           | 95.10 kWp                 |
| PV Generator Surface                          | 417.60 m <sup>2</sup>     |
| Global Radiation at the Module                | 849.20 kWh/m <sup>2</sup> |
| Global Radiation on Module without reflection | 855.53 kWh/m <sup>2</sup> |
| Performance Ratio (PR)                        | 95.00 %                   |
| PV Generator Energy (AC grid)                 | 77298.52 kWh/Year         |
| Spec. Annual Yield                            | 812.86 kWh/kWp            |

## PV System 190.19 kWp BESS 50kW 107kWh

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# PV System Energy Balance

### PV System Energy Balance

|                                                     |                                 |          |
|-----------------------------------------------------|---------------------------------|----------|
| <b>Global radiation - horizontal</b>                | <b>987.85 kWh/m<sup>2</sup></b> |          |
| Deviation from standard spectrum                    | -9.88 kWh/m <sup>2</sup>        | -1.00 %  |
| Ground Reflection (Albedo)                          | 3.33 kWh/m <sup>2</sup>         | 0.34 %   |
| Orientation and inclination of the module surface   | -21.56 kWh/m <sup>2</sup>       | -2.20 %  |
| Module-independent shading                          | 0.00 kWh/m <sup>2</sup>         | 0.00 %   |
| Reflection on the Module Surface                    | -5.80 kWh/m <sup>2</sup>        | -0.60 %  |
| Irradiance on the rear side of the module           | 0.00 kWh/m <sup>2</sup>         | 0.00 %   |
| <b>Global Radiation at the Module</b>               | <b>953.94 kWh/m<sup>2</sup></b> |          |
|                                                     | 953.94 kWh/m <sup>2</sup>       |          |
|                                                     | x 835.209 m <sup>2</sup>        |          |
|                                                     | = 796,739.58 kWh                |          |
| <b>Global PV Radiation</b>                          | <b>796,739.58 kWh</b>           |          |
| Bifaciality (80 % of back irradiance)               | 0.00 kWh                        | 0.00 %   |
| Soiling                                             | 0.00 kWh                        | 0.00 %   |
| STC Conversion (Rated Efficiency of Module 22.78 %) | -615,281.78 kWh                 | -77.22 % |
| <b>Rated PV Energy</b>                              | <b>181,457.80 kWh</b>           |          |
| Module-specific Partial Shading                     | 0.00 kWh                        | 0.00 %   |
| Low-light performance                               | -90.47 kWh                      | -0.05 %  |
| Deviation from the nominal module temperature       | -163.57 kWh                     | -0.09 %  |
| Diodes                                              | 0.00 kWh                        | 0.00 %   |
| Mismatch (Manufacturer Information)                 | -3,624.08 kWh                   | -2.00 %  |
| Mismatch (Configuration/Shading)                    | 0.00 kWh                        | 0.00 %   |
| <b>PV Energy (DC) without inverter clipping</b>     | <b>177,579.68 kWh</b>           |          |
| Failing to reach the DC start output                | 0.00 kWh                        | 0.00 %   |
| Clipping on account of the MPP Voltage Range        | 0.00 kWh                        | 0.00 %   |
| Clipping on account of the max. DC Current          | 0.00 kWh                        | 0.00 %   |
| Clipping on account of the max. DC Power            | 0.00 kWh                        | 0.00 %   |
| Clipping on account of the max. AC Power/cos phi    | 0.00 kWh                        | 0.00 %   |
| MPP Matching                                        | -283.42 kWh                     | -0.16 %  |
| <b>PV energy (DC)</b>                               | <b>177,296.26 kWh</b>           |          |
| <b>Energy at the Inverter Input</b>                 | <b>177,296.26 kWh</b>           |          |
| Input voltage deviates from rated voltage           | -130.62 kWh                     | -0.07 %  |
| DC/AC Conversion                                    | -3,482.26 kWh                   | -1.97 %  |
| Standby Consumption (Inverter)                      | -43.47 kWh                      | -0.03 %  |
| Total Cable Losses                                  | 0.00 kWh                        | 0.00 %   |
| <b>PV energy (AC) minus standby use</b>             | <b>173,639.92 kWh</b>           |          |
| <b>PV Generator Energy (AC grid)</b>                | <b>173,683.38 kWh</b>           |          |

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# Energy balance Sankey-Diagram

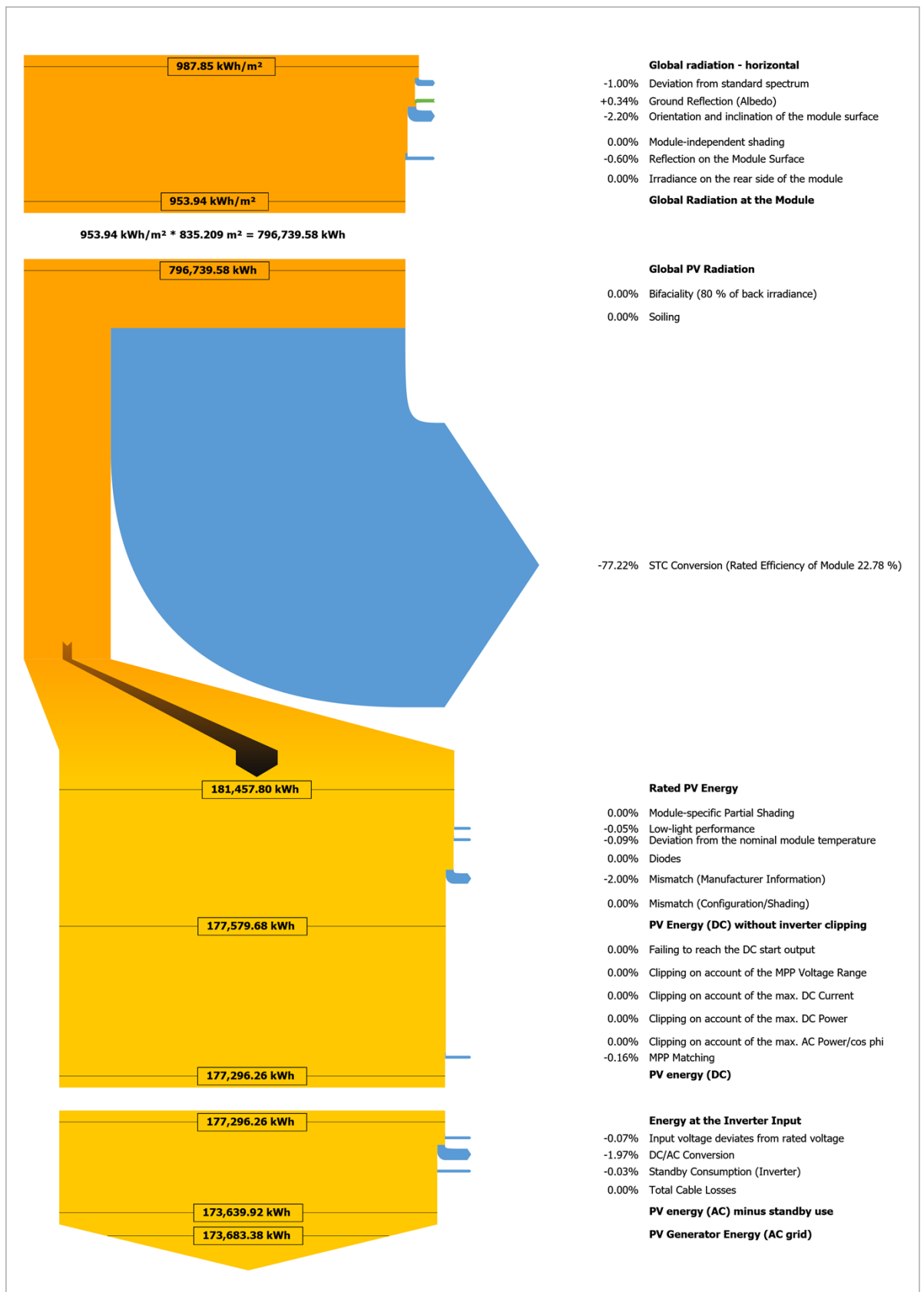


Figure: Energy balance Sankey-Diagram

## PV System 190.19 kWp BESS 50kW 107kWh

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# Financial Analysis

## Overview

### System Data

|                                                          |                 |
|----------------------------------------------------------|-----------------|
| Grid Export in the first year (incl. module degradation) | 48,287 kWh/Year |
| PV Generator Output                                      | 190.2 kWp       |
| Start of Operation of the System                         | 01/04/2025      |
| Assessment Period                                        | 25 Years        |
| Interest on Capital                                      | 1 %             |

### Economic Parameters

|                                  |              |
|----------------------------------|--------------|
| Internal Rate of Return (IRR)    | 22.69 %      |
| Accrued Cash Flow (Cash Balance) | 866,504.03 £ |
| Amortization Period              | 4.9 Years    |
| Electricity Production Costs     | 0.0411 £/kWh |

### Payment Overview

|                           |                     |
|---------------------------|---------------------|
| Specific Investment Costs | 814.46 £/kWp        |
| <b>Investment Costs</b>   | <b>154,902.00 £</b> |
| PV Costs- £800/kWp        | 152,152.00 £        |
| Platform Costs            | 2,750.00 £          |
| 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        | 2,897.25 £/Year  |
| First year savings                              | 27,440.56 £/Year |
| Market Rate (Example)                           |                  |
| Energy Price Tariff period 1                    | 0.1676 £/kWh     |
| Saving Tariff period 1                          | 1,500.72 £/Year  |
| Energy Price Tariff period 2                    | 0.2258 £/kWh     |
| Saving Tariff period 2                          | 26,082.53 £/Year |
| Base Price                                      | 180 £/Month      |
| Inflation Rate for Energy Price                 | 5 %/Year         |
| Remuneration of Electricity sold to Third Party |                  |
| Price of Electricity sold to Third Party        | 0.06 £/kWh       |
| Remuneration of Electricity sold to Third Party | 2,897.25 £/Year  |

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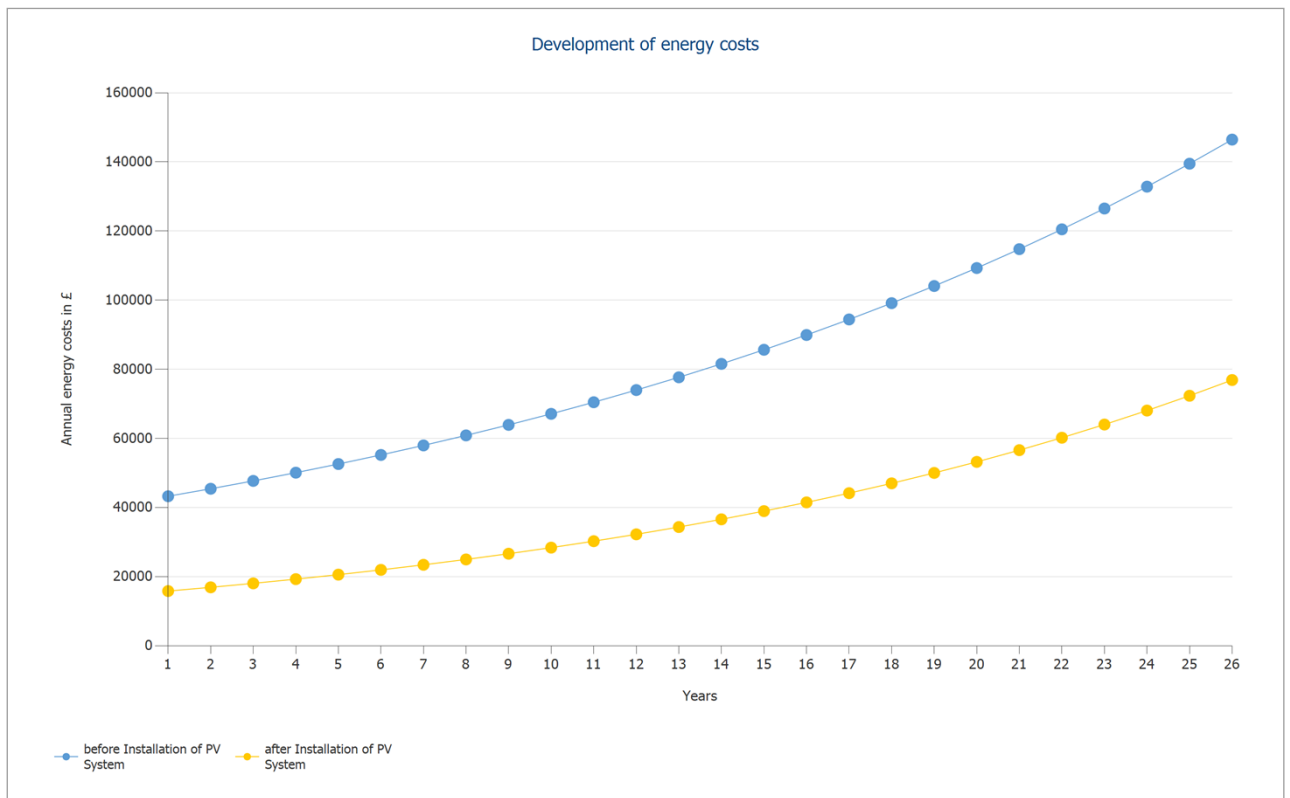


Figure: Development of energy costs

## PV System 190.19 kWp BESS 50kW 107kWh

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### Cash flow

#### Cash flow

|                                  | Year 1              | Year 2            | Year 3            | Year 4            | Year 5            |
|----------------------------------|---------------------|-------------------|-------------------|-------------------|-------------------|
| Investments                      | -£154,902.00        | £0.00             | £0.00             | £0.00             | £0.00             |
| Feed-in / Export Tariff          | £2,868.56           | £2,811.67         | £2,755.63         | £2,700.42         | £2,646.04         |
| Electricity Savings              | £27,168.87          | £27,960.94        | £28,773.14        | £29,605.82        | £30,459.31        |
| <b>Annual Cash Flow</b>          | <b>-£124,864.57</b> | <b>£30,772.61</b> | <b>£31,528.77</b> | <b>£32,306.24</b> | <b>£33,105.35</b> |
| Accrued Cash Flow (Cash Balance) | -£124,864.57        | -£94,091.96       | -£62,563.19       | -£30,256.95       | £2,848.40         |

#### 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          | £2,592.46         | £2,539.69         | £2,487.71         | £2,436.51         | £2,386.08         |
| Electricity Savings              | £31,333.99        | £32,230.16        | £33,148.16        | £34,088.33        | £35,050.98        |
| <b>Annual Cash Flow</b>          | <b>£33,926.46</b> | <b>£34,769.86</b> | <b>£35,635.87</b> | <b>£36,524.84</b> | <b>£37,437.07</b> |
| Accrued Cash Flow (Cash Balance) | £36,774.86        | £71,544.71        | £107,180.58       | £143,705.43       | £181,142.49       |

#### Cash flow

|                                  | Year 11           | Year 12           | Year 13           | Year 14           | Year 15           |
|----------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Investments                      | £0.00             | £0.00             | £0.00             | -£2,416.32        | £0.00             |
| Feed-in / Export Tariff          | £2,336.41         | £2,287.49         | £2,239.31         | £2,191.86         | £2,145.13         |
| Electricity Savings              | £36,036.43        | £37,044.92        | £38,076.79        | £39,132.30        | £40,211.69        |
| <b>Annual Cash Flow</b>          | <b>£38,372.84</b> | <b>£39,332.41</b> | <b>£40,316.10</b> | <b>£38,907.83</b> | <b>£42,356.81</b> |
| Accrued Cash Flow (Cash Balance) | £219,515.33       | £258,847.75       | £299,163.85       | £338,071.69       | £380,428.50       |

#### 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          | £2,099.11         | £2,053.79         | £2,009.16         | £1,965.21         | £1,921.94         |
| Electricity Savings              | £41,315.17        | £42,443.01        | £43,595.36        | £44,772.43        | £45,974.36        |
| <b>Annual Cash Flow</b>          | <b>£43,414.28</b> | <b>£44,496.80</b> | <b>£45,604.52</b> | <b>£46,737.65</b> | <b>£47,896.30</b> |
| Accrued Cash Flow (Cash Balance) | £423,842.78       | £468,339.58       | £513,944.10       | £560,681.75       | £608,578.05       |

#### 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          | £1,879.33         | £1,837.38         | £1,796.08         | £1,755.41         | £1,715.37         |
| Electricity Savings              | £47,201.27        | £48,453.24        | £49,730.34        | £51,032.60        | £52,360.01        |
| <b>Annual Cash Flow</b>          | <b>£49,080.60</b> | <b>£50,290.62</b> | <b>£51,526.42</b> | <b>£52,788.01</b> | <b>£54,075.38</b> |
| Accrued Cash Flow (Cash Balance) | £657,658.65       | £707,949.27       | £759,475.69       | £812,263.70       | £866,339.08       |

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

## PV System 190.19 kWp BESS 50kW 107kWh

**Project Designer:** George Bartley and Nitin Kumar

**Offer Number:** 20250206-1

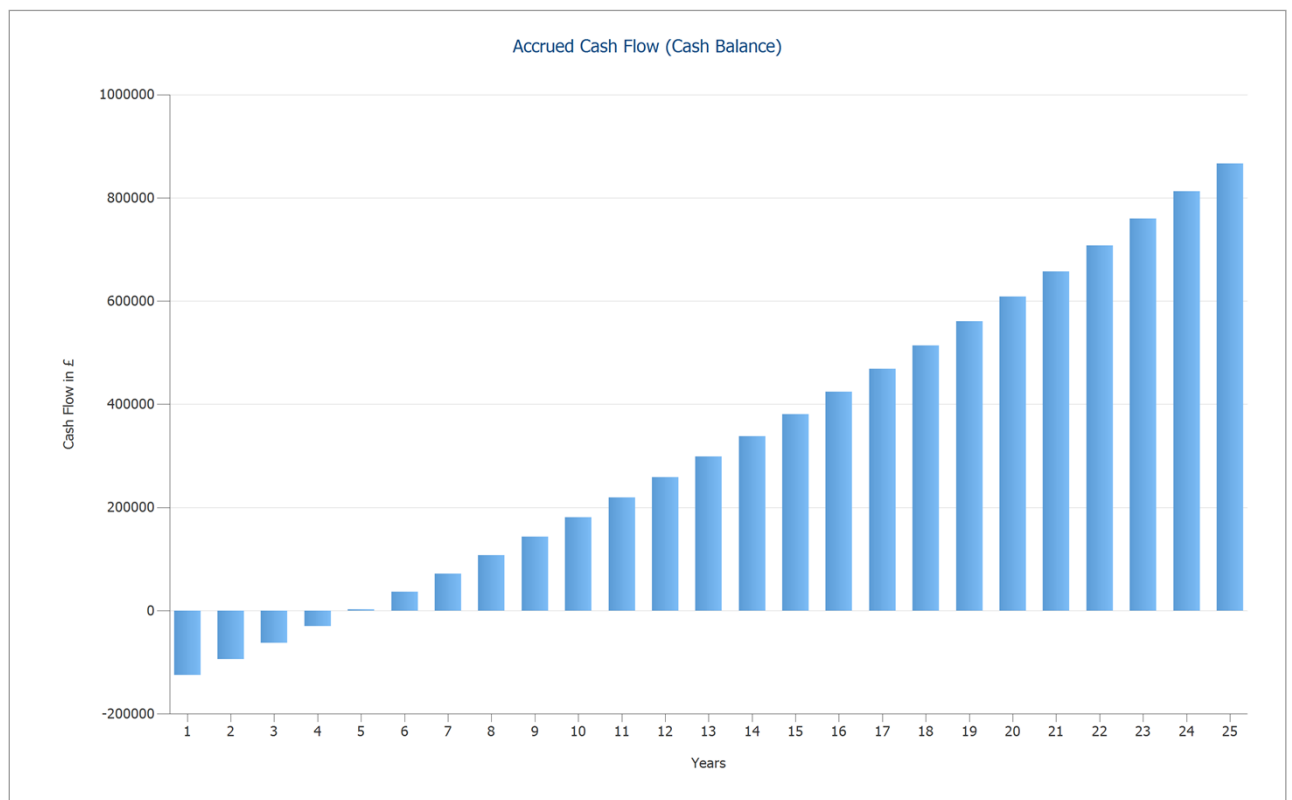


Figure: Accrued Cash Flow (Cash Balance)

## PV System 190.19 kWp BESS 50kW 107kWh

Project Designer: George Bartley and Nitin Kumar

Offer Number: 20250206-1

# Data Sheets

## PV Module Data Sheet

PV Module: JAM54D41-455/LB (v1)

|              |                             |
|--------------|-----------------------------|
| Manufacturer | JA Solar Holdings Co., Ltd. |
| 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                                        | 33 V    |
| MPP Current                                        | 13.79 A |
| Open Circuit Voltage                               | 39.5 V  |
| Short-Circuit Current                              | 14.56 A |
| Increase open circuit voltage before stabilisation | 0 %     |
| Nominal output                                     | 455 W   |
| Fill Factor                                        | 79.13 % |
| Efficiency                                         | 22.78 % |

### I/V Part Load Characteristics

|                                    |                           |
|------------------------------------|---------------------------|
| Values source                      | Manufacturer/user-created |
| Irradiance                         | 200 W/m <sup>2</sup>      |
| Voltage in MPP at Part Load        | 32.586 V                  |
| Current in MPP at Part Load        | 2.782 A                   |
| Open Circuit Voltage (Part Load)   | 37.29 V                   |
| Short Circuit Current at Part Load | 2.912 A                   |

### Additional Parameters

|                                 |             |
|---------------------------------|-------------|
| Temperature Coefficient of Voc  | -113.1 mV/K |
| Temperature Coefficient of Isc  | 6.6 mA/K    |
| Temperature Coefficient of Pmpp | -0.3 %/K    |
| Incident Angle Modifier (IAM)   | 100 %       |
| Bifacial factor                 | 80 %        |
| Maximum System Voltage          | 1500 V      |

### Mechanical Data

|             |         |
|-------------|---------|
| Width       | 1134 mm |
| Height      | 1762 mm |
| Depth       | 30 mm   |
| Frame Width | 28 mm   |
| Weight      | 22 kg   |

## PV System 190.19 kWp BESS 50kW 107kWh

**Project Designer:** George Bartley and Nitin Kumar  
**Offer Number:** 20250206-1

### Inverter Data Sheet

Inverter: S5-GC100K (v2)

|                                                                     |                 |
|---------------------------------------------------------------------|-----------------|
| Manufacturer                                                        | Ginlong (Solis) |
| Available                                                           | Yes             |
| <b>Electrical data - DC</b>                                         |                 |
| DC nominal output                                                   | 100 kW          |
| Max. DC Power                                                       | 140 kW          |
| Nom. DC Voltage                                                     | 600 V           |
| Max. Input Voltage                                                  | 1100 V          |
| Max. Input Current                                                  | 320 A           |
| Max. short circuit current                                          | 400 A           |
| Number of DC Inlets                                                 | 20              |
| <b>Electrical data - AC</b>                                         |                 |
| AC Power Rating                                                     | 100 kW          |
| Max. AC Power                                                       | 110 kVA         |
| Nom. AC Voltage                                                     | 230 V           |
| Number of Phases                                                    | 3               |
| With Transformer                                                    | No              |
| <b>Electrical data - other</b>                                      |                 |
| Change in Efficiency when Input Voltage deviates from Rated Voltage | 0.05 %/100V     |
| Min. Feed-in Power                                                  | 30 W            |
| Standby Consumption                                                 | 10 W            |
| Night Consumption                                                   | 2 W             |
| <b>MPP Tracker</b>                                                  |                 |
| Output Range < 20% of Power Rating                                  | 99.5 %          |
| Output Range > 20% of Power Rating                                  | 99.9 %          |
| Count of MPP Trackers                                               | 10              |
| <b>MPP Tracker 1-10</b>                                             |                 |
| Max. Input Current                                                  | 32 A            |
| Max. short circuit current                                          | 40 A            |
| Max. Input Power                                                    | 21 kW           |
| Min. MPP Voltage                                                    | 180 V           |
| Max. MPP Voltage                                                    | 1000 V          |

## PV System 190.19 kWp BESS 50kW 107kWh

**Project Designer:** George Bartley and Nitin Kumar

**Offer Number:** 20250206-1

### Inverter: S5-GC50K (v2)

|              |                 |
|--------------|-----------------|
| Manufacturer | Ginlong (Solis) |
| Available    | Yes             |

#### Electrical data - DC

|                            |        |
|----------------------------|--------|
| DC nominal output          | 50 kW  |
| Max. DC Power              | 104 kW |
| Nom. DC Voltage            | 600 V  |
| Max. Input Voltage         | 1100 V |
| Max. Input Current         | 160 A  |
| Max. short circuit current | 200 A  |
| Number of DC Inlets        | 10     |

#### Electrical data - AC

|                  |        |
|------------------|--------|
| AC Power Rating  | 50 kW  |
| Max. AC Power    | 55 kVA |
| Nom. AC Voltage  | 230 V  |
| Number of Phases | 3      |
| With Transformer | No     |

#### Electrical data - other

|                                                                     |            |
|---------------------------------------------------------------------|------------|
| Change in Efficiency when Input Voltage deviates from Rated Voltage | 0.2 %/100V |
| Min. Feed-in Power                                                  | 5 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              | 5      |

#### MPP Tracker 1-5

|                            |         |
|----------------------------|---------|
| Max. Input Current         | 32 A    |
| Max. short circuit current | 40 A    |
| Max. Input Power           | 20.8 kW |
| Min. MPP Voltage           | 180 V   |
| Max. MPP Voltage           | 1000 V  |

## PV System 190.19 kWp BESS 50kW 107kWh

**Project Designer:** George Bartley and Nitin Kumar  
**Offer Number:** 20250206-1

### Battery System Data Sheet

#### Battery System: EnerArk2.0-M-NBN-P50C107 (AC Coupling) (v2)

|                           |                        |
|---------------------------|------------------------|
| Manufacturer              | Vilion BESS            |
| Available                 | Yes                    |
| <b>Battery Inverter</b>   |                        |
| Nominal output            | 50 kW                  |
| Maximum Charging Power    | 60 kW                  |
| Maximum Discharge Power   | 60 kW                  |
| Type of Coupling          | AC coupling            |
| <b>Battery</b>            |                        |
| Manufacturer Battery      | Vilion BESS            |
| Model                     | EnerArk2.0-M-120S (v1) |
| Quantity                  | 1 (1x1)                |
| DC Battery System Voltage | 384.0 V                |
| Usable Battery Energy     | 102.1 kWh              |
| Capacity at t=10h         | 280 Ah                 |

### Battery Data Sheet

#### Battery: EnerArk2.0-M-120S (v1)

|                                                      |                        |
|------------------------------------------------------|------------------------|
| Manufacturer                                         | Vilion BESS            |
| Available                                            | Yes                    |
| <b>Electrical Data</b>                               |                        |
| Battery Type                                         | Lithium iron phosphate |
| Cell voltage                                         | 3.2 V                  |
| No. of Cells in Series                               | 120                    |
| Nom. Voltage                                         | 384 V                  |
| Number of Battery Strings                            | 1                      |
| Internal Resistance                                  | 0.25 mΩ                |
| Self-Discharge                                       | 3 %/Month              |
| Service Life in Charge-discharge Cycles (DoD = 40 %) | 7700                   |
| <b>Mechanical Data</b>                               |                        |
| Length                                               | 985 mm                 |
| Width                                                | 378 mm                 |
| Height                                               | 260 mm                 |
| Weight                                               | 148.5 kg               |

**Project Designer:** George Bartley and Nitin Kumar  
**Offer Number:** 20250206-1

## Plans and parts list

## Circuit Diagram

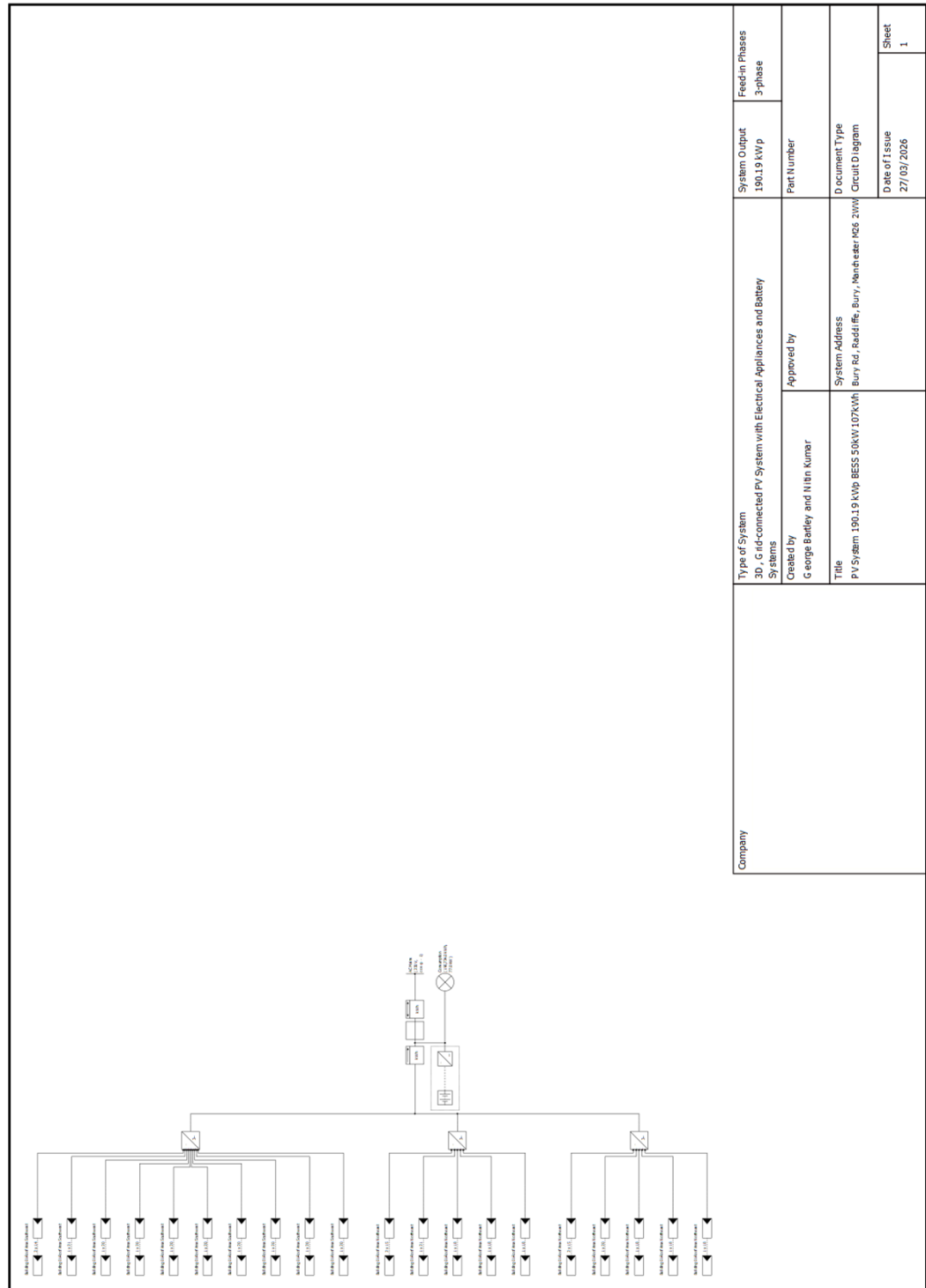


Figure: Circuit Diagram

## PV System 190.19 kWp BESS 50kW 107kWh

**Project Designer:** George Bartley and Nitin Kumar  
**Offer Number:** 20250206-1

### Overview plan

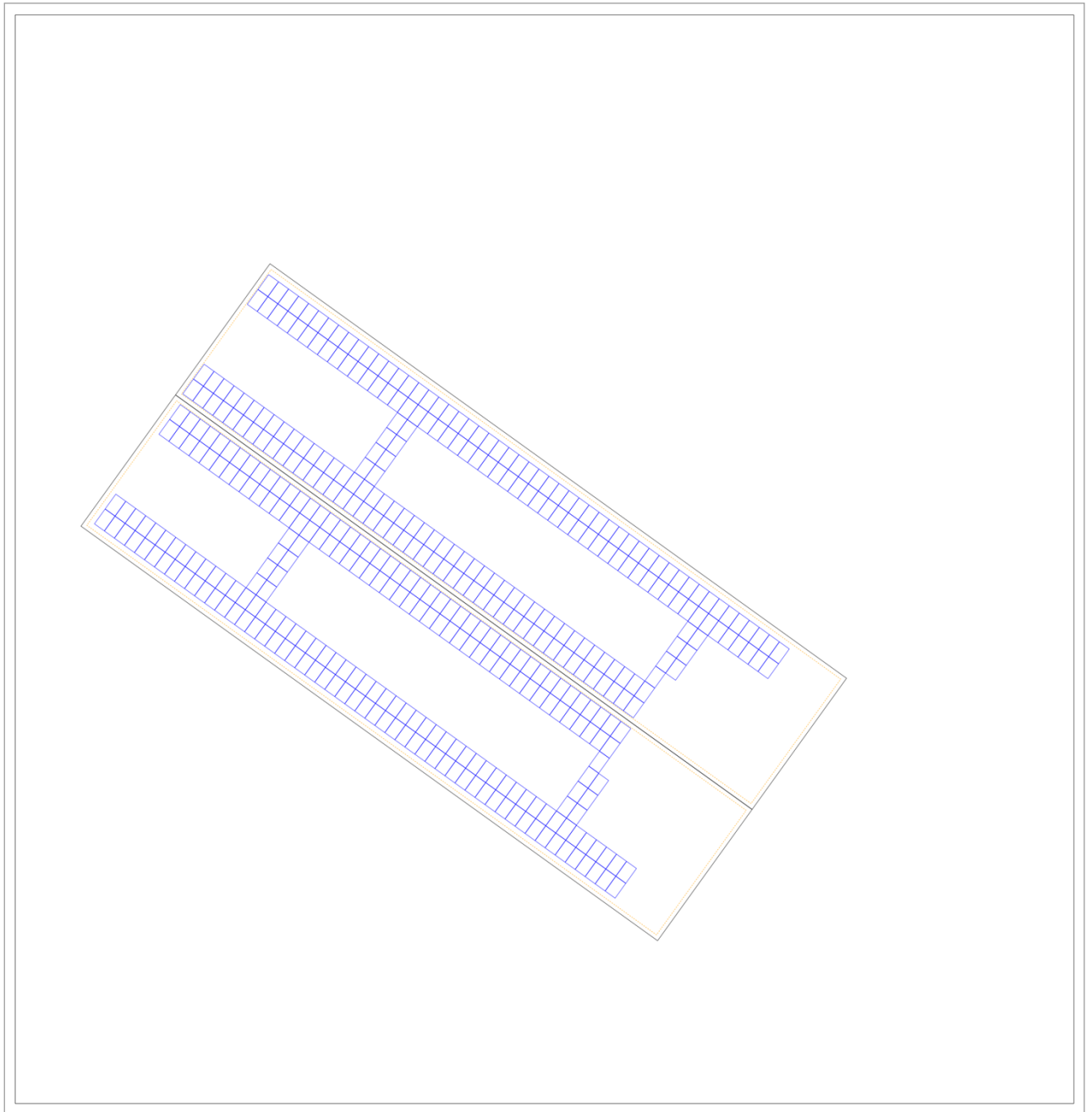


Figure: Overview plan

## PV System 190.19 kWp BESS 50kW 107kWh

Project Designer: George Bartley and Nitin Kumar  
Offer Number: 20250206-1

### Dimensioning Plan

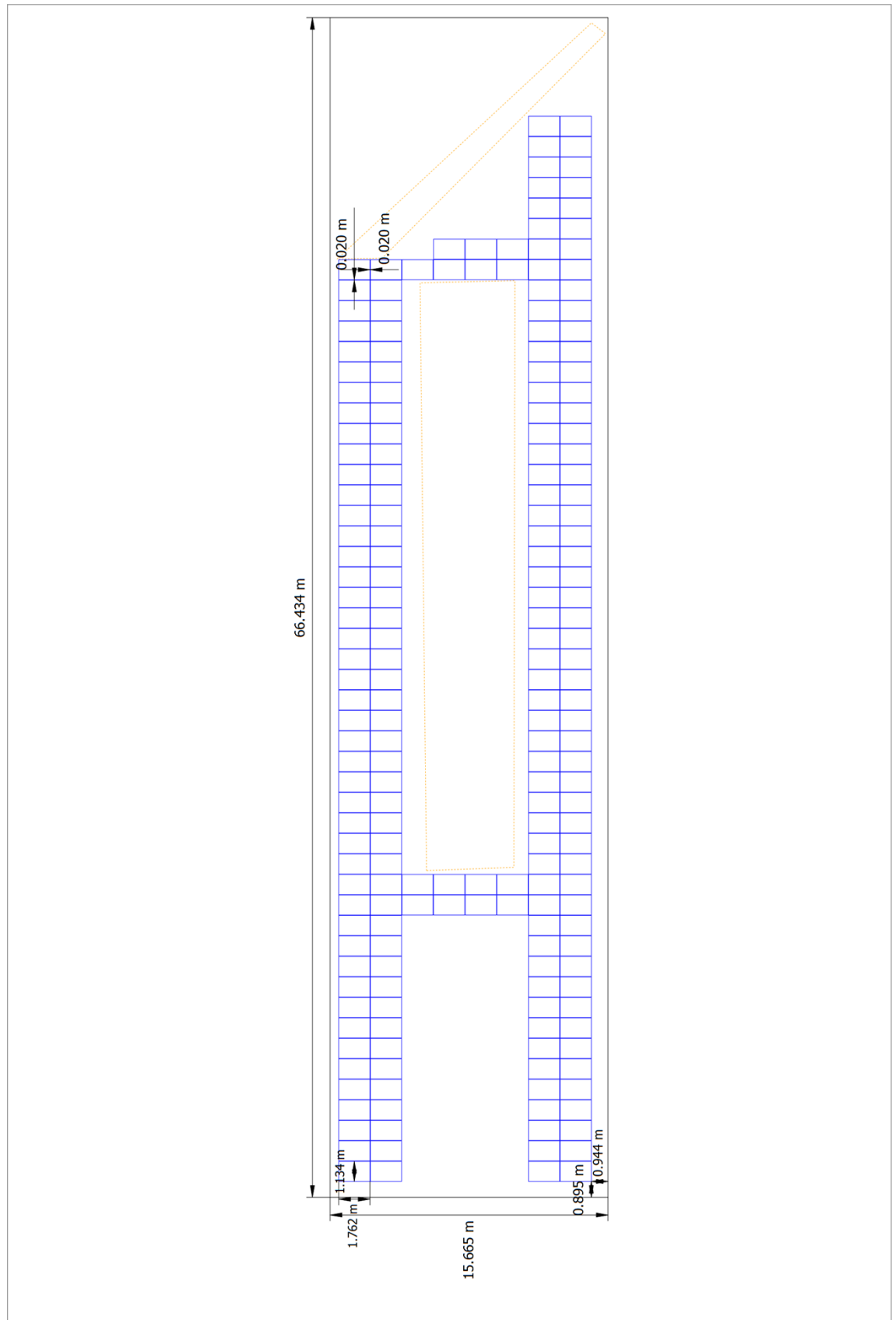


Figure: Building 01 - Roof Area Southwest

## PV System 190.19 kWp BESS 50kW 107kWh

**Project Designer:** George Bartley and Nitin Kumar  
**Offer Number:** 20250206-1

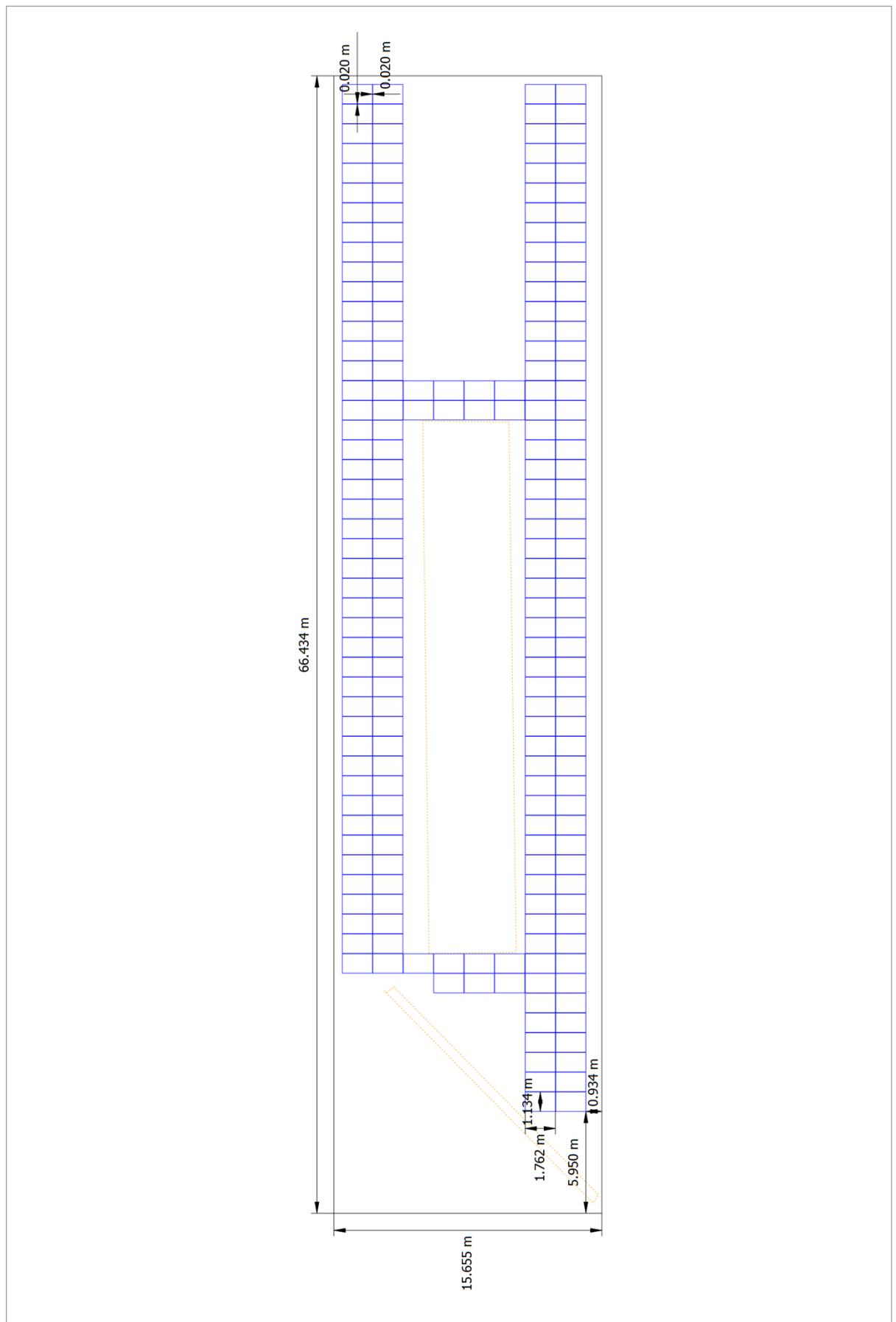


Figure: Building 01 - Roof Area Northeast

## PV System 190.19 kWp BESS 50kW 107kWh

Project Designer: George Bartley and Nitin Kumar  
Offer Number: 20250206-1

### String Plan

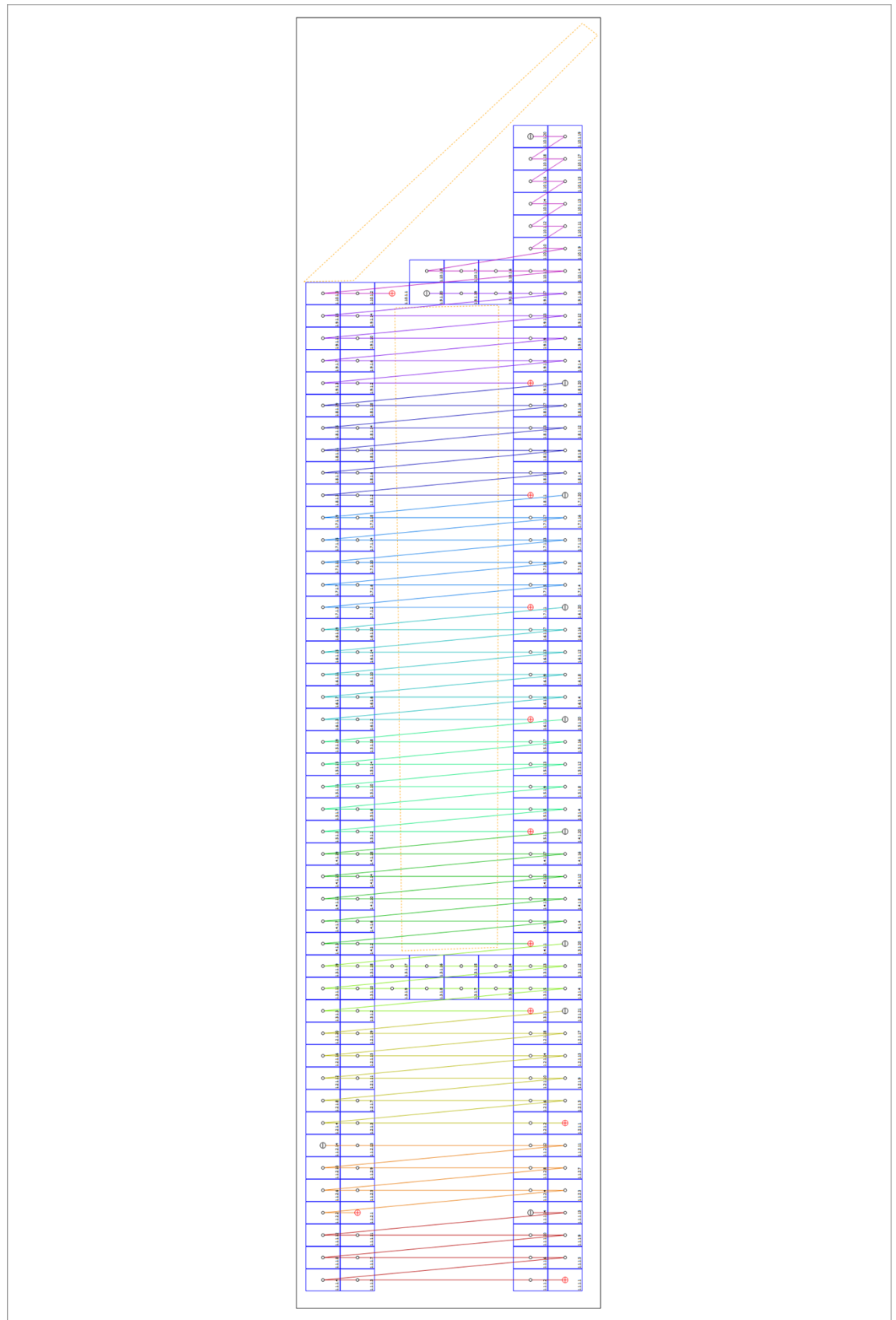


Figure: Building 01 - Roof Area Southwest

## PV System 190.19 kWp BESS 50kW 107kWh

Project Designer: George Bartley and Nitin Kumar  
Offer Number: 20250206-1

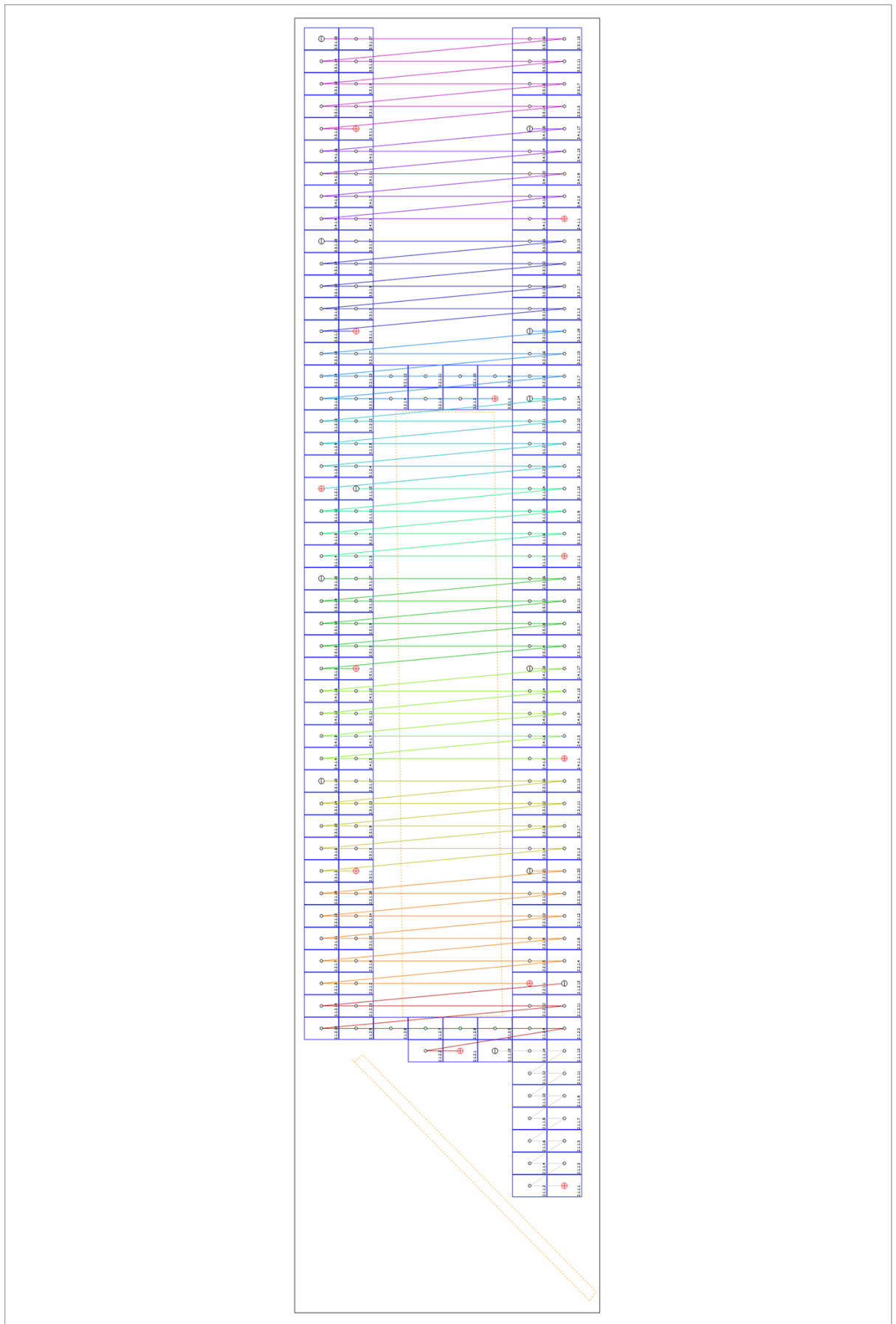


Figure: Building 01 - Roof Area Northeast

## PV System 190.19 kWp BESS 50kW 107kWh

**Project Designer:** George Bartley and Nitin Kumar

**Offer Number:** 20250206-1

### Parts list

#### Parts list

| # | Type           | Item number | Manufacturer                | Name                                   | Quantity | Unit  |
|---|----------------|-------------|-----------------------------|----------------------------------------|----------|-------|
| 1 | PV Module      |             | JA Solar Holdings Co., Ltd. | JAM54D41-455/LB                        | 418      | Piece |
| 2 | Inverter       |             | Ginlong (Solis)             | S5-GC100K                              | 1        | Piece |
| 3 | Inverter       |             | Ginlong (Solis)             | S5-GC50K                               | 2        | Piece |
| 4 | Battery System |             | Vilion BESS                 | EnerArk2.0-M-NBN-P50C107 (AC Coupling) | 1        | Piece |
| 5 | Components     |             |                             | Feed-in Meter                          | 1        | Piece |
| 6 | Components     |             |                             | House connection                       | 1        | Piece |
| 7 | Components     |             |                             | Bidirectional Meter                    | 1        | Piece |