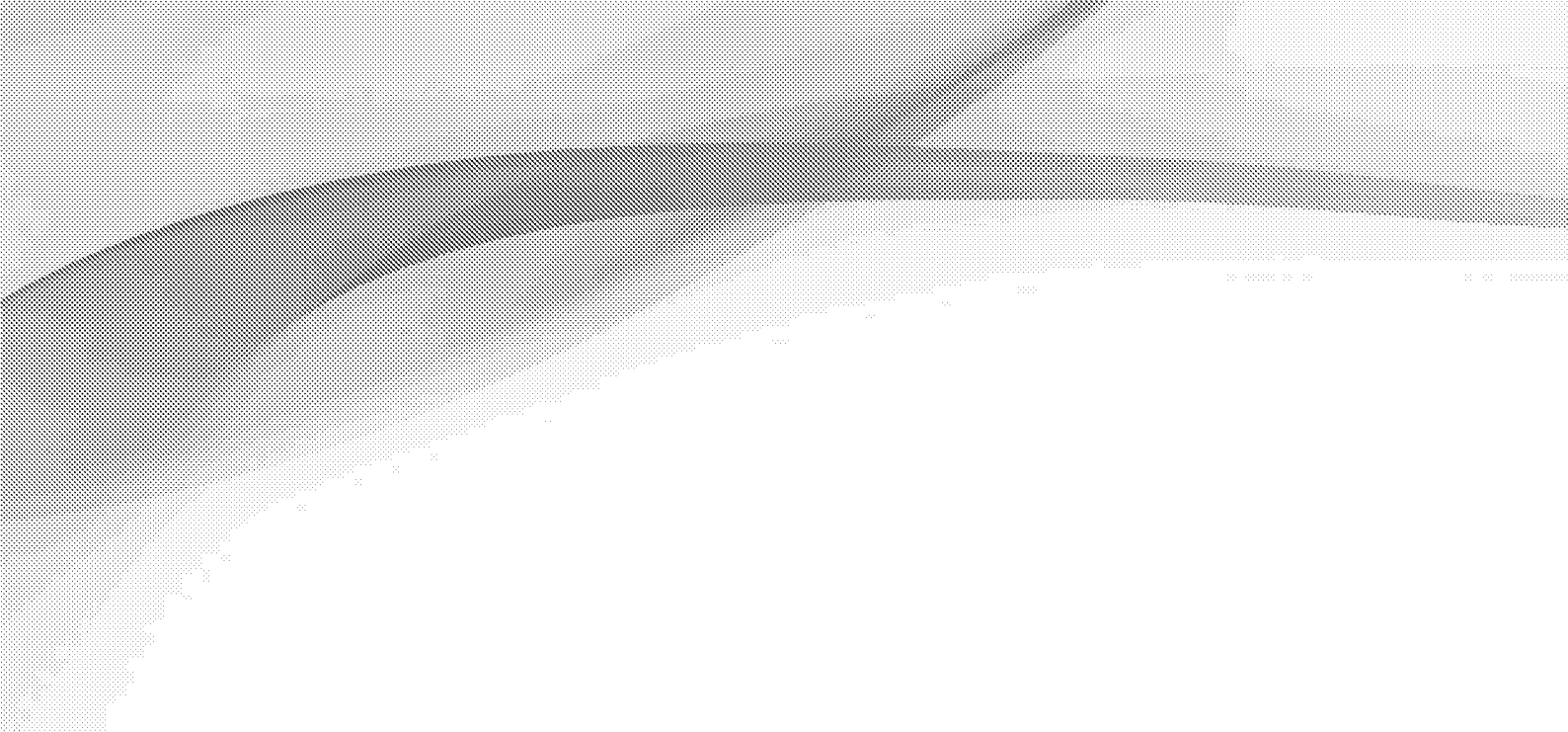




ccsolar

Project Name: 27th August 2020

Client: CREATIVE HEART

Address: 42 Beach Road Littlehampton West Sussex, BN17 5HT

Date Created: 27th August 2020

Designer: trevor waller

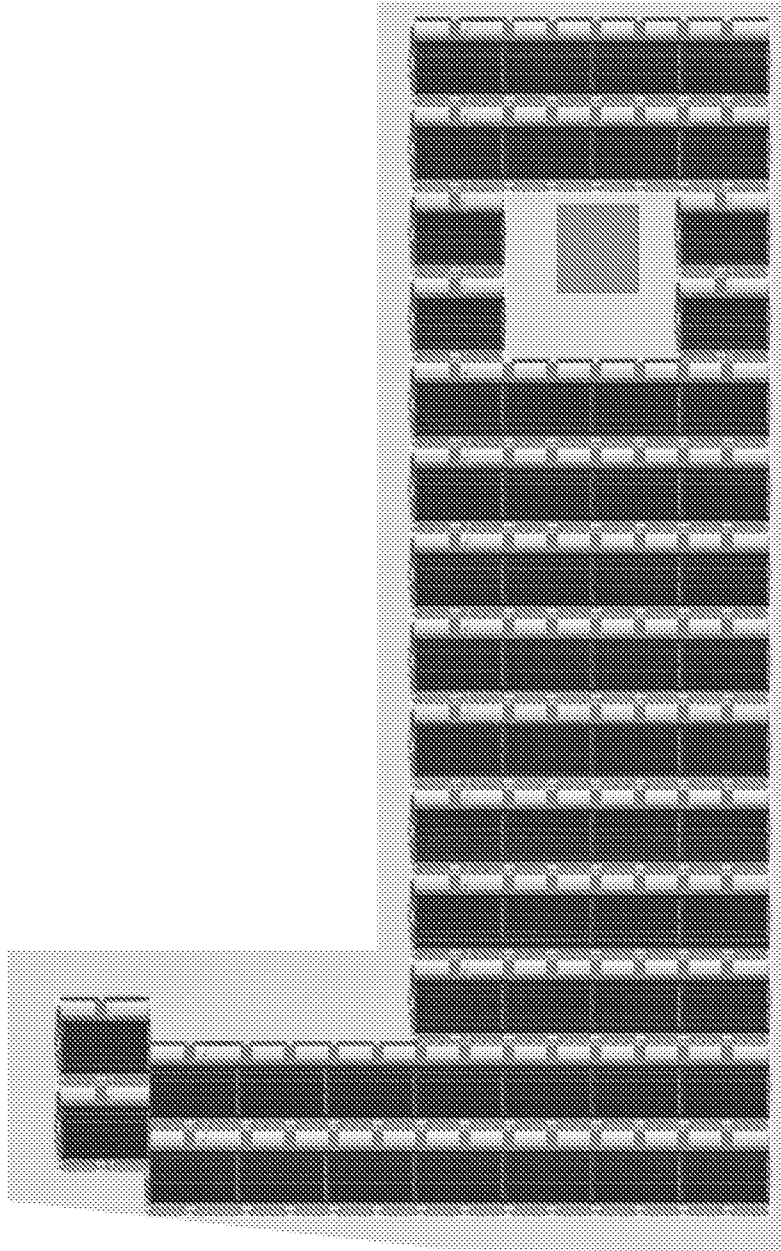


Solar · Storage · EV Charging

YOUR LOCAL INSTALLER

Roof Layout

Roof 1



Quotation

CREATIVE HEART
42 Beach Road Littlehampton West Sussex
BN17 5HT



24th March 2021

Quotation

Ref:

Please find below your quote for the installation of a solar PV system.

Equipment costs

60x Trina 325W All Black Split Cell Mono solar panel
SolaX X3 Hybrid 10.0kW inverter
Elster A1100 - 3 Phase
Label sheet
Solis Wifi Stick DLS-W
BMS for Triple Power Batteries T-BAT BMS (MC0500)
Eastron SDM630-1 modbus v2 Meter for 3ph SolaX Direct connect
2x AC isolator - KN Newbury 20A 4-pole
3x Solax Triple Power Battery 4.5kWh
DC isolator - KGD40-4
6x Pair of MC4 connectors
DC isolator - KG20-4
2x 50m reel of 4mm² solar cable
138x Solion console
23x Rear flange
468x 16mm M6 screw
18x Rear cable shutter
102x Arched cover
18x Side cover (right)
324x 11mm M6 screw
72x Cable cover
18x Side cover (left)
240x Panel clamp 35mm
240x 20mm M6 screw
scaffolding

Labour costs

LABOUR AND ACCERSORIES



Inverter Compatibility

SolaX X3 Hybrid 10.0kW

Panels		Inverter	
PV power:	19500 W	Rated AC output	10000 W

Input 1: 20 Trina 325W All Black Split Cell Mono solar panels in 2 strings

Panels		Inverter	
PV power:	13000 W		
Open circuit voltage at -10° C	885 V	Max DC voltage	1000 V
V _{mpp} at 40° C:	646 V	V _{mpp} lower limit	330 V
V _{mpp} at -10° C:	736 V	V _{mpp} upper limit	800 V
I _{mpp} at 40° C:	19 A	Max DC input current	20 A

- ✓ The open circuit voltage of the solar panels never exceeds the voltage limit of the inverter.
- ✓ The maximum power point voltage of the solar panels is always above the lower limit of the inverter MPPT tracker. The maximum power point voltage of the solar panels is always below the upper limit of the inverter MPPT tracker.
- ✓ The maximum power point current of the solar panels is always below the maximum current for the inverter MPPT tracker.

Input 2: 20 Trina 325W All Black Split Cell Mono solar panels in 1 strings

Panels

PV power: **6500 W**

Open circuit voltage at -10° C **885 V**

V_{mpp} at 40° C: **646 V**

V_{mpp} at -10° C: **736 V**

I_{mpp} at 40° C: **10 A**

Inverter

Max DC voltage **1000 V**

V_{mpp} lower limit **330 V**

V_{mpp} upper limit **800 V**

Max DC input current **11 A**



The open circuit voltage of the solar panels never exceeds the voltage limit of the inverter.



The maximum power point voltage of the solar panels is always above the lower limit of the inverter MPPT tracker. The maximum power point voltage of the solar panels is always below the upper limit of the inverter MPPT tracker.



The maximum power point current of the solar panels is always below the maximum current for the inverter MPPT tracker.

AC Charging Power: **10000 W**

Batteries

Name **Solax Triple Power Battery**

Round Trip Efficiency **95%**

Quantity **3**

Total Battery Capacity **13.5 Wh**



13.5kWh of battery capacity assigned



The battery capacity is appropriate for the charging power of the inverter

Electrical

SolaX X3 Hybrid 10.0kW

AC Isolator

A AC isolator - KN Newbury 20A 4-pole has been specified for this input



The rated isolator current (20A) is greater than the rated inverter current (15A)



The isolator is suitable for use on a three phase inverter.

Input 1

DC Isolator



This inverter contains an integrated DC Isolator.

Cable

10m of 4mm² solar cable has been specified



Voltage drop at maximum power point at 40°C will be around **1.62 V (0.25 percent)**

Input 2

DC Isolator



This inverter contains an integrated DC Isolator.

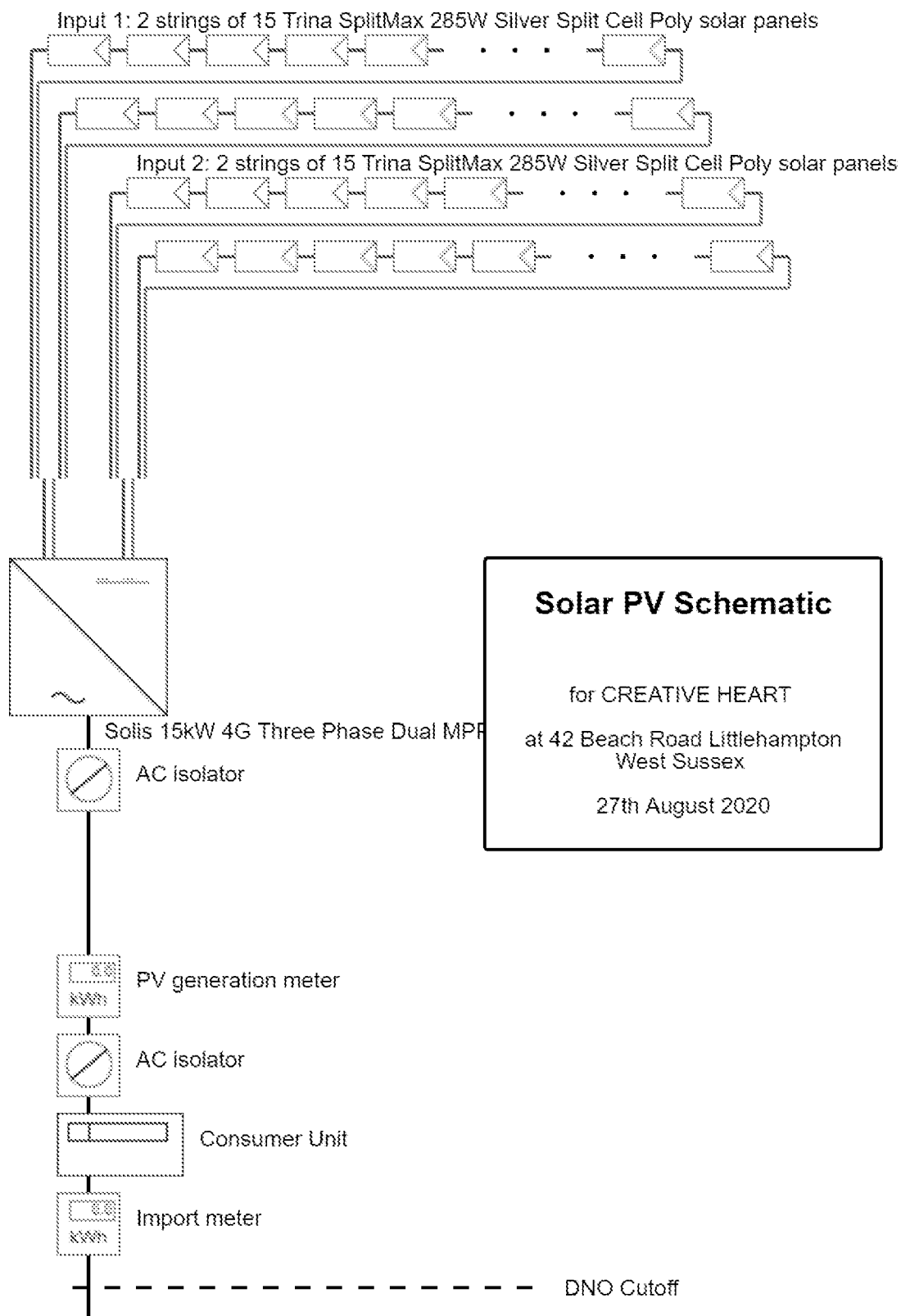
Cable

10m of 4mm² solar cable has been specified



Voltage drop at maximum power point at 40°C will be around **0.85 V (0.13 percent)**

Schematic diagram



Annual Output Performance Estimate

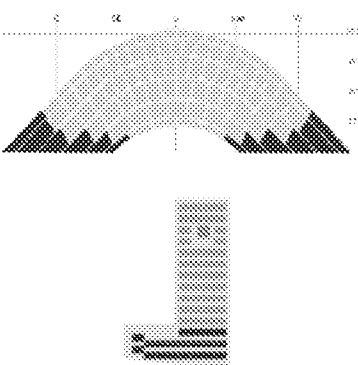
Site Details	
Client	CREATIVE HEART
Address	42 Beach Road Littlehampton West Sussex BN17 5HT
Postcode zone	Zone 2

The sunpath diagram shows the arcs of the sky that the sun passes through at different times of the day and year as yellow blocks. The shaded area indicates the horizon as seen from the location of the solar array. Where objects on the horizon are within 10m of the array, an added semi-circle is drawn to represent the increased shading. Blocks of the sky that are shaded by objects on the horizon are coloured red, and a shading factor is calculated from the number of red blocks.

The performance of the solar array is calculated by multiplying the size of the array (kWp) by the shading factor (sf) and a site correction factor (kk), taken from tables which take account of the geographical location, orientation and inclination of the array.

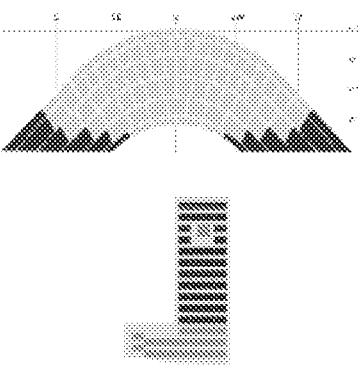
Inverter 1: SolaX X3 Hybrid 10.0kW

Input 1



A: Installation data	
Installed capacity	13.000 kWp
Orientation	20°
Inclination	15°
B: Calculations	
kWh/kWp (kk)	1048
Shade factor (sf)	1.00
Estimated output	13624 kWh

Input 2



A: Installation data	
Installed capacity	6.500 kWp
Orientation	20°
Inclination	15°
B: Calculations	
kWh/kWp (kk)	1048
Shade factor (sf)	1.00
Estimated output	6812 kWh

Total output over all inverter inputs: 20436 kWh

Disclaimer

The performance of solar PV systems is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. This estimate is based upon the standard MCS procedure and is given as guidance only. It should not be considered a guarantee of performance.

The shade assessment has been undertaken using the standard MCS procedure. It is estimated that this method will yield results within 10% of the actual annual energy yield for most systems.

Important Note: The energy performance and benefits of EESS is impossible to predict with certainty due to the numerous functions a system can be programmed to perform. This estimate is based upon the standard MCS procedure and is given as guidance only. It should not be considered as a guarantee of performance

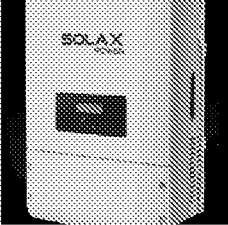
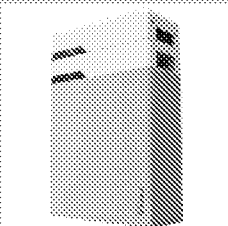
The solar PV self-consumption has been calculated in accordance with MCS document MGD 003. It does not account for the impact of power diverters, electric space heating, electric water heating or electric vehicle charging.

Self-consumption modelling

	Consumption Electricity consumed in the property each year	18000 kWh
	Generation Electricity generated by the PV array each year	20436 kWh
	Self consumption Proportion of PV generation used in the property	49 %
	Independence Proportion of electricity consumption provided by PV	54 %
	Import / Export Electricity import / export each year from the property	8346 / 10381 kWh
	Utilisation Average daily utilisation of the storage battery	85 %

We model here the performance of a solar PV system with battery storage over the course of a year, using high resolution minute-by-minute generation data for a typical PV system and consumption data for a typical house, and calculating the flow of energy from the solar panels to the house and the battery during the day, and from the storage battery back to the house at night - or from the grid to the house when the battery is empty or loads exceed the discharge capacity of the system.

We provide yearly profiles of generation, consumption, import / export and battery utilisation, along with detailed profiles for a typical spring day.

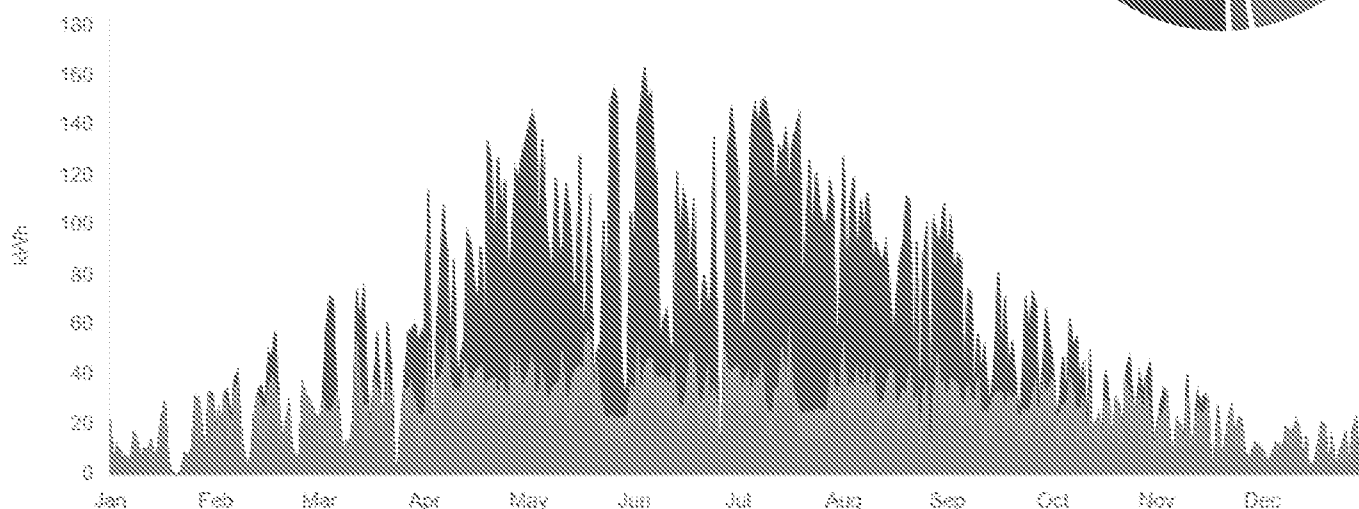
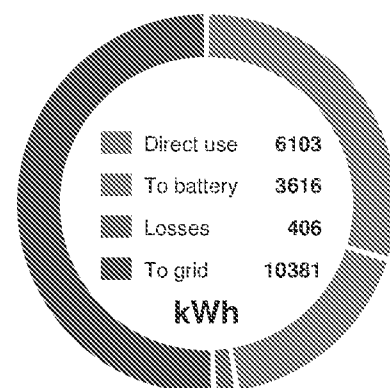
	Battery system specification	
	SolaX X3 Hybrid 10.0kW with 3 Solax Triple Power Battery 4.5kWh batteries	
	Charge rate	10000 W
	Inverter charge efficiency	97.0 %
	Inverter discharge efficiency	97.0 %
	Battery efficiency	95.0 %
	Round trip efficiency	89.4 %
	Battery bank capacity	13.5 kWh
	Max discharge depth	90 %
	Usable capacity	12.15 kWh

Generation projections

Yearly

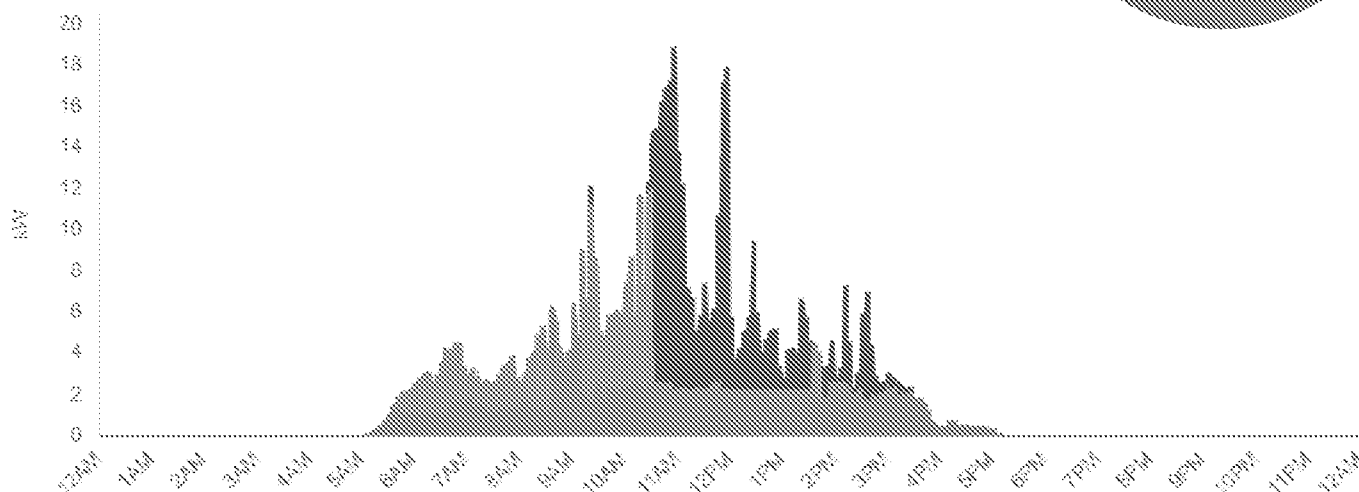
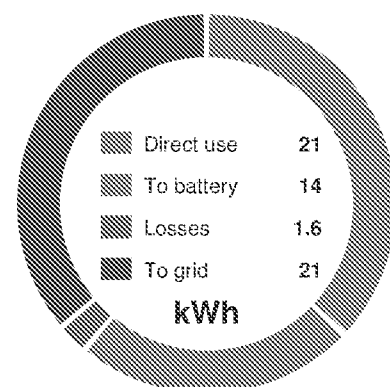
The solar PV array is expected to generate 20507 kWh over a typical year. The graph shows whether the generated energy is used directly in the house, used to charge the storage battery, or exported to the grid.

30% (6103 kWh) of the electricity generated is expected to be used directly in the property. 19% (4023 kWh) is directed to the battery for later use, although 406 kWh of this is lost during battery charging and discharging. The remaining generation (10381 kWh, or 51% of the total) is exported to the grid.



On a typical spring day

This graph shows the modelled profile of electricity generated by the PV array on a selected day (March 27th). On this day the PV system is expected to generate 57.9 kWh. Of this, 21.4 kWh (37%) is used directly in the property, 16 kWh (28%) is stored in the battery for later re-use, and 21 kWh (36%) is exported to the grid.

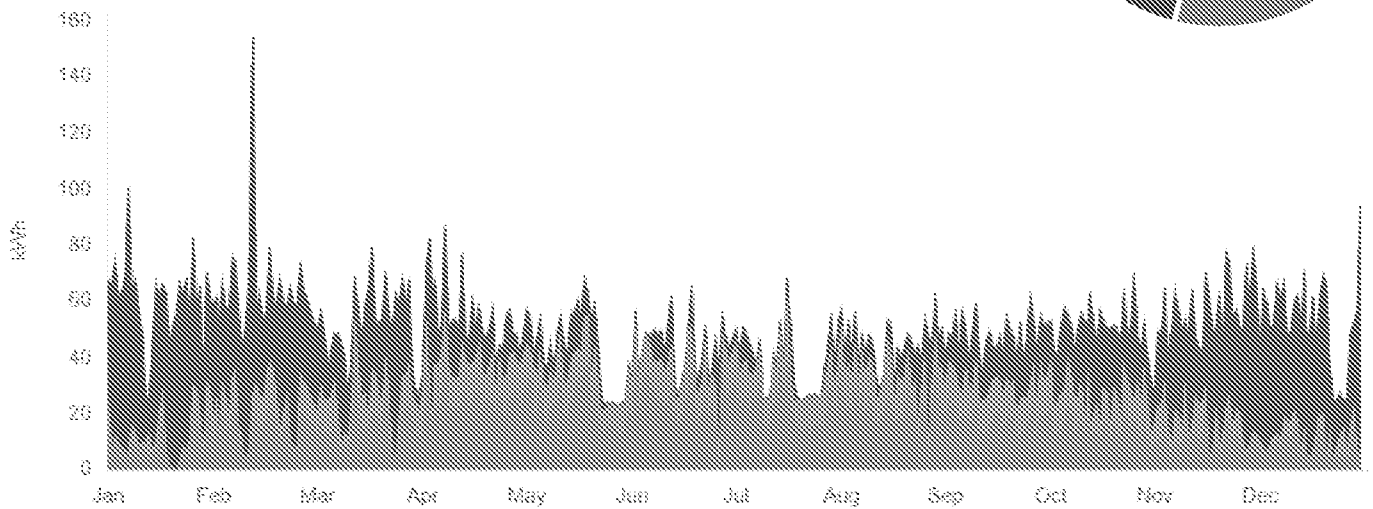
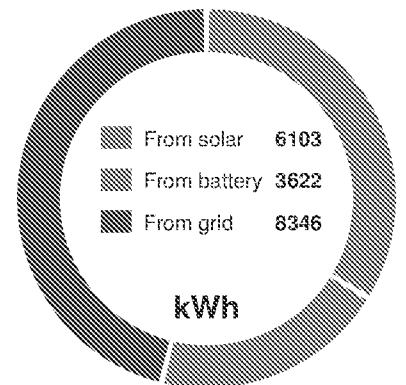


Consumption projections

Yearly

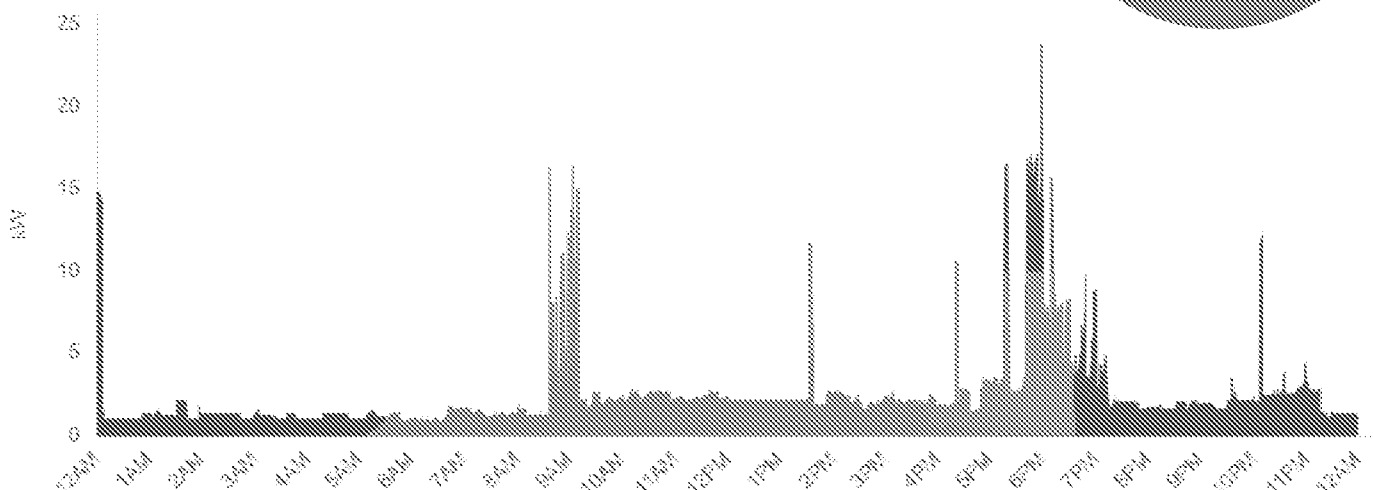
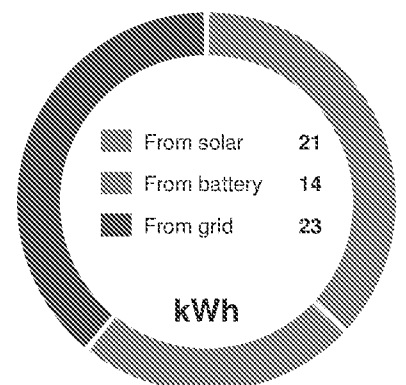
The property is expected to consume 18000kWh of electricity each year. Around 34% of this (6103 kWh) is expected to be supplied directly by the solar array. Another 20% (3622 kWh) is supplied from the storage battery. The remaining 46% (8346 kWh) is supplied from the grid.

The total self-consumption is expected to be 54% (9725 kWh) with the battery storage system. Without battery storage it would be 34% (6103 kWh).



On a typical spring day

This graph shows modelled consumption data over the course of the selected day (March 27th). Total electricity consumption on this day was 58.4 kWh, of which 21.4 kWh (37%) is expected to be supplied directly by the solar array, and a further 13.9 kWh (24%) drawn from the battery storage system. The remaining 22.7 kWh (39%) is imported from the grid.

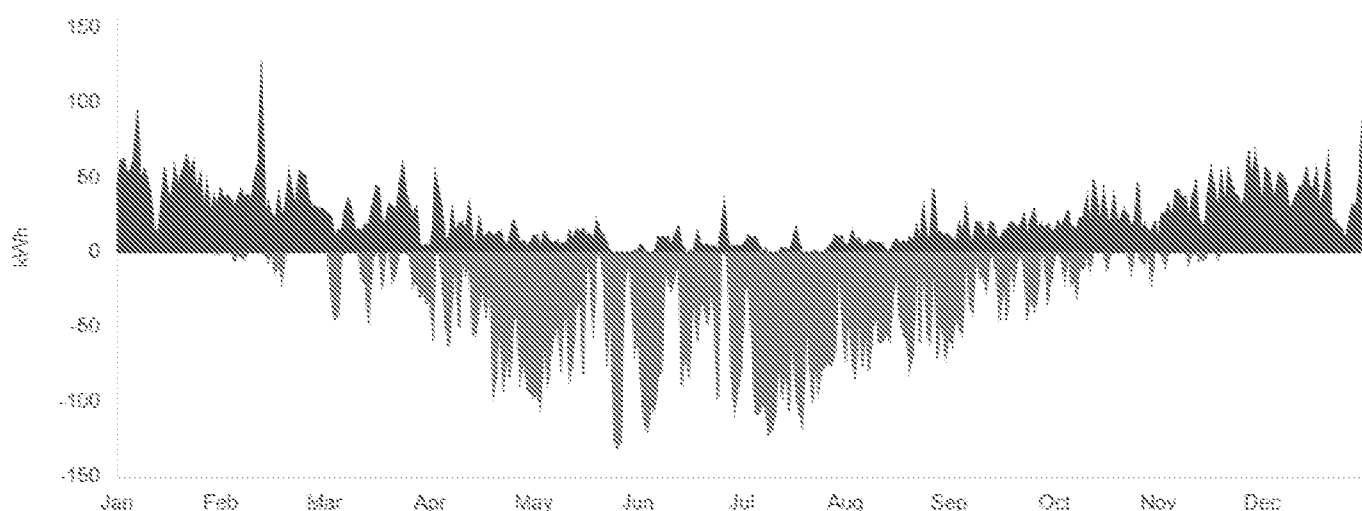
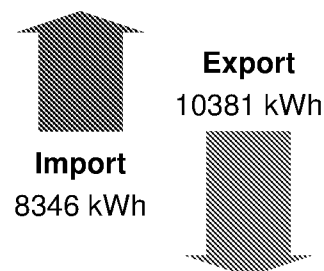


Import / export

Yearly

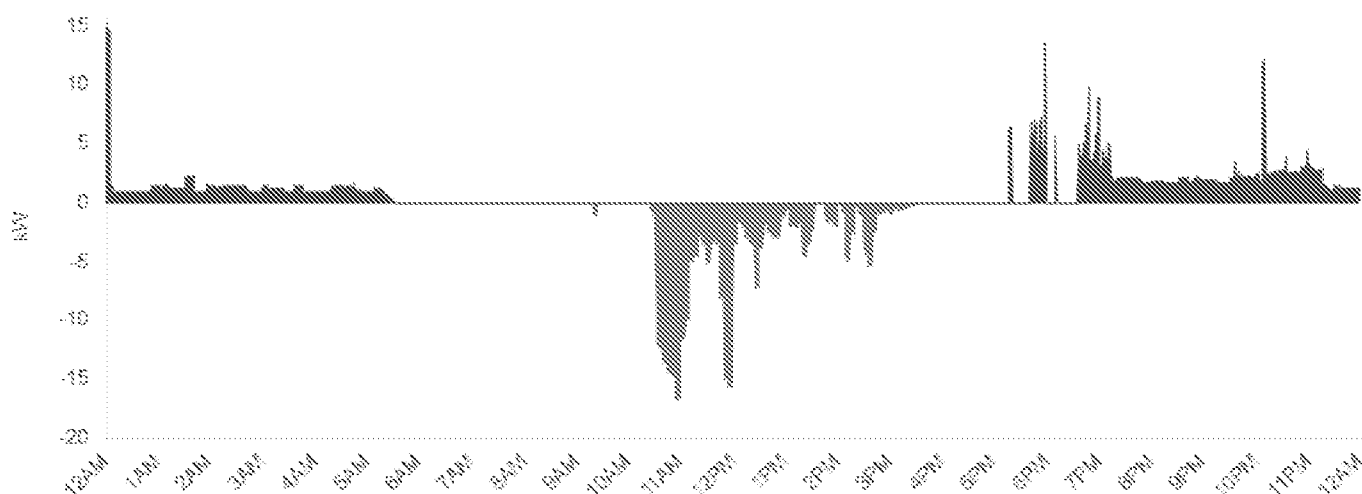
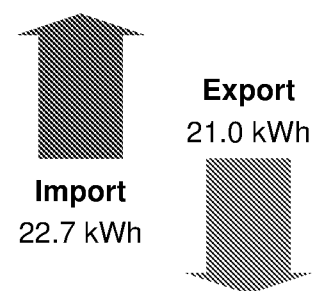
This graph shows modelled profiles of electricity imported and exported to and from the grid over the course of a year. The red area above the horizontal axis represents imported electricity, and the green area beneath the axis exported electricity.

Over the course of the year, a total of 8346 kWh is expected to be imported by the property, and 10381 kWh exported back to the grid.



On a typical spring day

This graph shows the modelled import and export of electricity over a selected day (March 27th). On this day 22.70 kWh is expected to be imported from the grid, and 21.0 kWh exported. At times when no import or export is shown the battery storage system is charging or discharging.

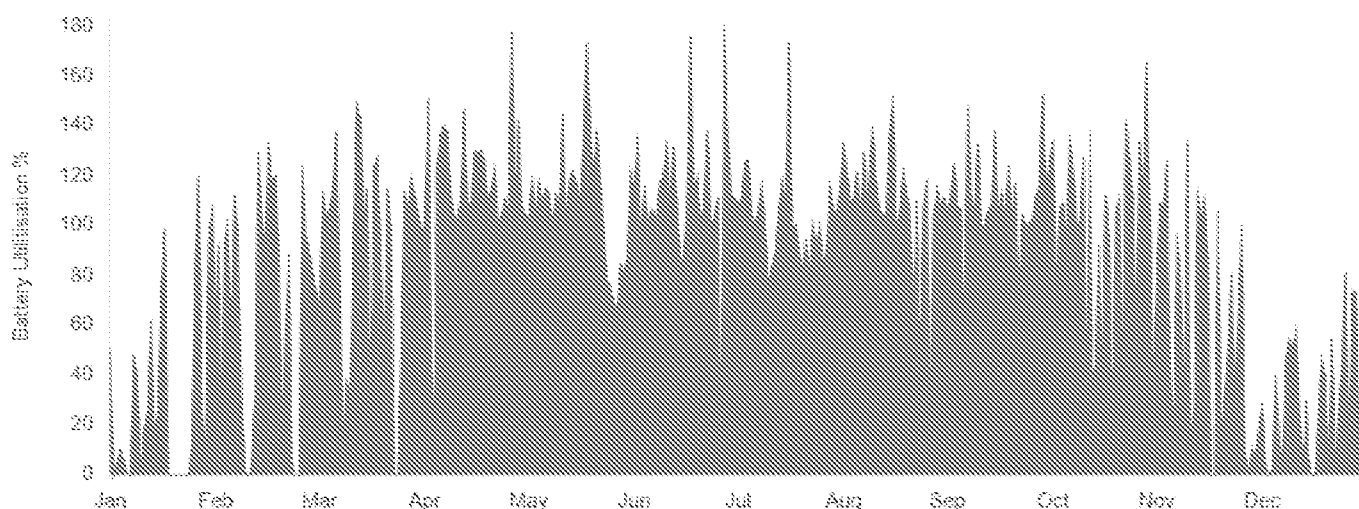


Battery Utilisation

Yearly

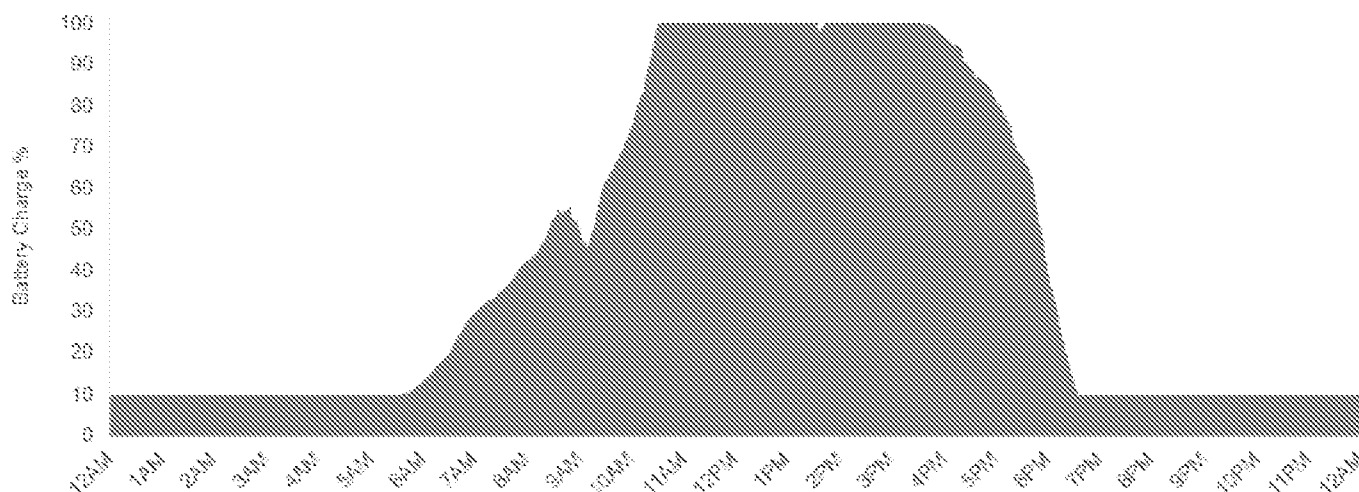
The graph shows the modelled utilisation of the battery over the course of the year - the fraction of the available battery capacity that is actually charged and discharged each day. Utilisation of over 100% is possible at times where a battery is charged and discharged more than once during a day.

Low battery utilisation can be due to either insufficient spare PV generation to charge the battery (often the case in winter, or on cloudy days), or because loads are small overnight and the battery does not fully discharge.



On a typical spring day

The state of charge of the battery over a selected day (March 27th) is shown in the graph below. The battery discharges overnight or when there is heavy demand during the day, and charges when there is excess solar PV generation during the day. On this day, 120% of the battery capacity was utilised.



Financial projections

The expected system cost excluding £4,236 VAT is £25,398. The total cost including VAT is expected to be £29,634.

The system is expected to generate 20436 kWh per year initially, decreasing gradually as the solar cells degrade. It is anticipated that 80% of the generated power will be consumed in the property, and the remaining 20% exported. Over the 25 year term of this financial projection the total generation is expected to be 480,186 kwh, of which 384,153 kWh will be consumed on site and 96,032kWh exported.

After adjusting projected costs and benefits for inflation where appropriate, and applying a discount rate of 4%, the initial system cost of £29,634 is expected to be recouped after 11 years.

Income and savings

The projected income from the system over the project lifetime in payments for generated and exported electricity, along with electricity savings, are shown below.

These figures assume an inflation rate of 2 percent.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Export payments	206	209	212	215	218	222	225	228	232	235	239	242	246	250	253	257	261	265	269	273	277	281	285	289	294
Electricity savings	3.0k	3.0k	3.1k	3.1k	3.1k	3.2k	3.2k	3.3k	3.3k	3.4k	3.4k	3.5k	3.5k	3.6k	3.6k	3.7k	3.8k	3.8k	3.9k	3.9k	4.0k	4.0k	4.1k	4.2k	4.2k
Total benefit	3.2k	3.2k	3.3k	3.3k	3.4k	3.4k	3.5k	3.5k	3.6k	3.6k	3.7k	3.7k	3.8k	3.8k	3.9k	4.0k	4.0k	4.1k	4.1k	4.2k	4.3k	4.3k	4.4k	4.5k	4.5k

Bottom line

Net Present Value

The total present value of future benefits and costs, using a discount rate of 4% per year, is £57,847. The cost of the PV system is £29,634. The net present value of the project is therefore £28,213. A positive net present value is a good indication that the project is financially worthwhile.

Internal Rate of Return

The projected internal rate of return is 10.6%.

Payback Period

The table and graph below show the discounted costs for the project (including the initial capital required for the installation), against the total discounted benefits from income and savings on electricity bills.

The cumulative discounted benefits become higher than the cumulative discounted costs after approximately 11 years.

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Discounted benefits		3.1k	3.0k	2.9k	2.9k	2.8k	2.7k	2.7k	2.6k	2.5k	2.5k	2.4k	2.3k	2.3k	2.2k	2.2k	2.1k	2.0k	2.0k	1.9k	1.9k	1.8k	1.8k	1.8k	1.7k	1.7k
Cumulative benefits		3.1k	6.1k	9.1k	12k	15k	17k	20k	23k	25k	28k	30k	32k	35k	37k	39k	41k	43k	45k	47k	49k	51k	53k	54k	56k	58k
Discounted costs	30k																									
Cumulative costs	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k	30k
Cashflow	-30k	-27k	-23k	-21k	-18k	-15k	-12k	-9.5k	-6.9k	-4.4k	-1.9k	477	2,87	5,15	7,38	9,58	11,76	13,93	16,10	18,27	20,44	22,61	24,78	26,95	29,12	31,29

