Energy and Sustainability Statement
Land to the rear of the garden at 12 Berkeley Road, Bristol, BS16 3LX

For Mrs B Kendall

27 October 2023
Completed by Laura Meehan
Issue 02

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P01	10/10/2023	Preliminary draft for comment
P02	27/10/2023	Updated version

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1. Introduction

This report has been prepared by M Sustainability in consideration of the Bristol City Council Policies and the Sustainability and Practice note (November 2012) which details the relevant issues for the local authority. The application is for outline approval for a total of 1 new build dwellings.

It assesses expected energy demand for the site showing how energy and carbon dioxide emissions will be reduced through designing for minimum energy use and installing on-site renewable and low carbon energy sources.

It will outline the sustainable construction principles that will be incorporated into the design and outline the proposed developments energy requirements and subsequent CO_2 emissions

Bristol City Council BCS 15 requires residential developments of more than 10 dwellings to provide evidence of energy efficient design and that 20% of predicted energy demand is met through renewable and low carbon sources. A final energy strategy, to outline how the 20% reduction can be met can be finalised through a suitably worded condition.

The development design proposes a 20% reduction on the total CO2 emissions as outlined within Bristol's Climate Change and Sustainability Practice Note BCS14. The table on page 18 shows that there is proposed a significant improvement on the energy usage and CO2 emissions from Baseline measures.

2. National Policy Requirements

The Climate Change Act 2008

Under the Climate Change Act the UK government is committed by law to reducing greenhouse gas emission by at least 100% of 1990 levels (net zero) by 2050 compared to 1990 levels. The government has set five-yearly carbon budgets which currently run until 2032. Through Climate Change Act the government has set a target to significantly reduce UK greenhouse gas emission by 2050 and a path to get there.

The construction and operation of UK buildings account for approximately 60% of national carbon dioxide emissions. Therefore, planning legislation seeks to mitigate the impact (in particular) of new construction in order to minimise these emissions and to meet the national targets.

National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out the overarching planning policies on the delivery of sustainable development through the planning system. The NPPF was published in early 2012 – updated in early 2019, with limited changes affecting the environmental sustainability requirements. It sets out the Government's planning policies for England and how these are expected to be applied, moreover it compels planning authorities to facilitate and promote good quality and sustainable development.

Para 154

When determining planning applications for renewable and low carbon development, local planning authorities should:

(a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

(b) approve the application if its impacts are (or can be made) acceptable 49 . Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.[1]National Policy Requirements

[1]https://www.gov.uk/guidance/national-planning-policy-framework/14-meeting-the-challenge-of-climate-change-flooding-and-coastal-change

3. Bristol Core Strategy 14 - Sustainable Energy

In December 2012, Bristol City Council published their "Bristol Development Framework, Core Strategy". This Core Strategy has set out a strong commitment to promote sustainable development and high quality urban design. This publication clearly outlines the objectives and strategy for sustainable communities in Bristol, tackling the causes and effects of climate change, and maximising energy savings and energy efficiency within new buildings.

BCS14 - Sustainable Energy

This sets out the criteria for assessing new renewable energy schemes, with a presumption in favour of large-scale renewable energy installations. BCS14 requires new development to minimise its energy requirements and then incorporate an element of renewable energy to reduce its CO_2 emissions by a further 20%.

From the Bristol Core Strategy:

"Development in Bristol should include measures to reduce carbon dioxide emissions from energy use in accordance with the following energy hierarchy:

1. Minimising energy requirements;

2. Incorporating renewable energy sources;

3. Incorporating low-carbon energy sources.

Heat Hierarchy

Consistent with stage two of the above energy hierarchy, development will be expected to provide sufficient renewable energy generation to reduce carbon dioxide emissions from residual energy use in the buildings by at least 20%. An exception will only be made in the case where a development is appropriate and necessary but where it is demonstrated that meeting the required standard would not be feasible or viable. The use of combined heat and power (CHP), combined cooling, heat and power (CCHP) and district heating will be encouraged. Within Heat Priority Areas, major development will be expected to incorporate, where feasible, infrastructure for district heating, and will be expected to connect to existing systems where available. New development will be expected to demonstrate that the heating and cooling systems have been selected according to the following heat hierarchy:

1. Connection to existing CHP/CCHP distribution networks

2. Site-wide renewable CHP/CCHP

3. Site-wide gas-fired CHP/CCHP

4. Site-wide renewable community heating/cooling

5. Site-wide gas-fired community heating/cooling

6. Individual building renewable heating"

How to comply

Compliance with the requirements of Policy BCS14 can be shown through following the guidance outlined in the Bristol City Council's Climate Change and Sustainability Practice Note, dated July 2020 with addendum July 2023. The Climate Change and Sustainability Practice Note states the following requirements:

"As such, the policy has four main strands:

- *To encourage major freestanding renewable and low carbon energy installations;*
- *To reduce energy demand through the use of energy efficiency and conservation measures, including improvements in fabric efficiency and air permeability and use of passive design principles in new development;*
- *To secure at least a 20% saving in CO2 emissions from energy use in new development through on-site generation of renewable energy; and*
- *To ensure that heating and hot water systems are designed and specified in accordance with the heat hierarchy including, where appropriate, connection to a heat network. "*

In general terms, policy BCS14 aims to push developments towards energy efficiency measures, connection into district CHP systems and/or installing low and zero carbon technologies on site. An exception will only be made in cases where a development is appropriate and necessary but where it is demonstrated that meeting the required standard would not be feasible or viable.

Bristol City council are committed to achieving their goal as part of the climate emergency protocol. Currently all planning applications large or small are required to meet the heat hierarchy. In conjunction with energy efficiency in design, this will lead us towards the goal of carbon neutrality.

BCS15 - Sustainable Design and Construction

- Requires all development to engage with issues around sustainable design and construction.
- Requires larger developments to be assessed against BREEAM and super major developments to be assessed using BREEAM Communities.
- Contains additional policy content relating to refuse storage and broadband provision.

BCS16 - Flood Risk and Water Management

Principally addresses the issues around development in flood risk areas but also requires all development to include water management measures to reduce surface water run-off, including sustainable drainage systems (SUDS).

1. The Proposed Site

This report has been structured to demonstrate how the proposed development responds to both the local sustainability policies of Bristol City Council and the principles of sustainable development set out in the National Planing Policy Framework (NPFF)

Site and Surroundings

The application site comprises of proposed new building

Figure 1 Site from Axistor Design Ltd

Proposed development

The client seeks to create a two storey dwelling in existing garden, as has been done at 16 Berkeley Road.

2. Sustainability at Berkeley Road

Sustainability has been considered for the development under the following chapter headings which reflect the Sustainable Development Themes of the NPPF and the guidance of the Core Strategy from Bristol City Council.

Climate Change

One of the main challenges facing the UK and new development is the need to mitigate and adapt to a changing climate. The government is committed to tackling climate change and has an ambitious long-term goal to reduce carbon emissions by 100% by 2050.

Policies BCS13 through to 16 requires new developments to contribute to both mitigation of and adaption to the impacts of climate change and meet targets to reduce carbon dioxide emissions.

Mitigation

Climate Change Mitigation refers to efforts to reduce or prevent emission of greenhouse gases. Mitigation measures are incorporated throughout this section under various different headings as follows:

- Energy and Carbon - including outline detail on super insulated, air tight and highly efficient services including outline design measures to passively reduce energy demand and finally the use of renewable and low carbon energy systems to meet the lower demand.
- Sustainable Design and Construction - includes the efficient use of natural resources and ensuring that methods of reducing waste are identified at early stages and materials with low embodied carbon are identified
- Sustainable Transport - includes measures to encourage cycling, walking, the use of public transport and use of electric cars instead of journeys by private car.

Adaptation

Policy BCS16 states that developments should be designed to be resilient to extreme weather events including flood risk, rising temperatures and changes in rainfall. The following features will be considered:

- Spacing of the development to allow free air flow for ventilation and comfort
- Use of trees to provide shade, buffer wind and help mitigate against flooding (retaining soil and acting as a natural water retainer)
-

- Openable windows to allow for cross ventilation whilst keeping dwellings secure.
- Larger capacity building gutters, downpipes and drainage to cope with additional rainfall
- Water butts to buffer additional rainfall

3. Energy and CO_2 emissions reductions

BCS14 Reducing energy demand and CO2 emissions

Provides criteria for assessing new renewable energy schemes, with a presumption in favour of large-scale renewable energy installations. Requires development to minimise its energy requirements and then incorporate an element of renewable energy to reduce its energy by a further 20%.

The strategy will be considered in line with the energy hierarchy below considering options to demonstrate sufficient renewable energy generation to reduce energy emissions by 20%.

Baseline Energy Use and Carbon Emissions

The exact requirements of the development will be outlined at detailed design stage and then confirmed through energy modelling. The energy performance of the proposed development is therefore a pro rata calculation based on benchmark design stage Part L (SAP) data for dwellings. Therefore at this stage all elements of the energy strategy are preliminary, pending further design work prior to any reserved matters submission.

The proposed new dwellings will be designed and constructed in accordance with the energy hierarchy, aiming to minimise energy use and carbon emissions before considering low carbon energy and renewable energy technologies.

The energy baseline (Part L 2016[2]) is shown in table 1.

These figures are based on building regulations minimum standards, however the part of Bristol City Councils requirement is to provide *"designs that are energy efficient and designed to reduce their energy demands"* this is also in line with government policy to reduce residual emissions.

This approach has a number of benefits including:

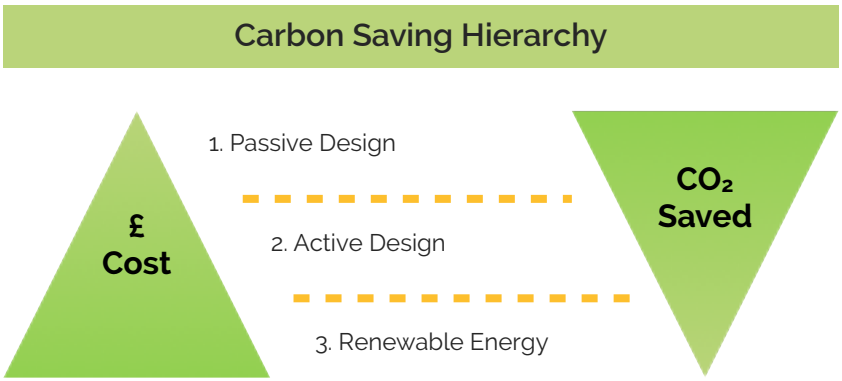
- Carbon savings delivered are 'locked-in' for the lifetime of the homes (60 years or more) rather than the much shorter lifespan (around 25 years) of a renewable energy technology;
- There are virtually no maintenance and/or replacement costs to maintain carbon reductions through improved fabric; and
- No reliance on an occupier's behaviour to deliver carbon reductions. In contrast, achieving carbon savings from renewable energy technologies requires education, awareness and often, behavioural changes from occupants.

[2] http://www.zerocarbonhub.org/zero-carbon-policy/fabric-energy-efficiency-standard

	Fabric energy efficiency (kWh/ yr)	Target Primary Energy Rate (kWh/ yr)	Energy saving (%)	Total Regulated CO_2 emissions (kg CO_2/yr)	Saving achieved on residual CO_2 emissions (%)
Baseline energy demand – "Baseline"	4925	9068	0%	770.04	0%
Baseline energy efficiency demand (kWh/ yr)			4925		
TPER			9068		
Regulated emissions (kg/yr)			770.04		

4. Reducing Energy Demand

There are two complementary parts, passive design and provision of efficient building services. The section below outlines our proposal for the measures included for the proposed development.



Passivhaus is a standard for the design and construction of comfortable, highly energy efficient buildings with set performance targets. It is the gold standard and first step towards achieving a net zero operational carbon building and some of the features are listed below:

- Free heat in winter from solar gains with predominant façades facing west and limited overshadowing
- Simple building form for the warm spaces with a low exposed surface area high levels of insulation
- An extremely airtight building fabric
- Significantly reduced thermal bridges
- High performance triple glazed windows with window proportions that are based on orientation
- Efficient background mechanical ventilation with heat recovery (MVHR) with summer bypass

Some of the benefits of this are;

- Significantly lower energy bills
- Increased thermal comfort in both winter and summer
- Higher build quality
- Internal air quality is significantly increased
- Maintenance is reduced from higher quality

If we assume that all dwellings will be built to a highly efficient fabric standard the estimated energy demand can be significantly reduced above and beyond our current calculations.

Currently to meet building regulations we assume a specification of:

- Minimal thermal bridges
- Walls at 0.15 w/m^{2}K
- Floors and roofs at 0.12 w/m^{2}K
- Windows at 1.2 w/m^{2}K
- Air pressure test at 1

Building Services

In addition to building fabric, the building services (i.e. lighting, plumbing and wiring) will be highly efficient. Building services are generally installed in buildings to provide comfort conditions. The services that provide comfort conditions are most efficient when they are accurately sized to match the load that they need to provide. Therefore both the efficiency of the items of equipment and their level of control affects overall CO_2 emissions performance.

The following items have been used to show that in conjunction with insulating building fabric, the building's energy use can be reduced by:

- Mechanical Ventilation
- Low energy lighting such as LEDs throughout
- Highly efficient Air Source Heat Pump for hot water
- Electric panel heaters
- Programmers and room thermostats

This will mean a reduction in CO2 emissions and reduced running and maintenance costs.

	Fabric Energy Efficiency (kWh/yr)	Target Primary Energy Rate (kWh/ yr)	Energy saving (%)	Total Regulated CO_2 emissions (kg CO_2/yr)	Saving achieved on residual CO_2 emissions (%)
Baseline energy demand – "Baseline"	4925	9068	0%	770.04	0%
Proposed scheme after energy efficiency measures better than Building Part L1A standards – "Residual"	4148	7541	15.77%	717.12	6.87%

Baseline energy demand (kWh/yr)		4925
Regulated emissions (kg/yr)		770.04
Energy savings from energy efficiency measures (kWh)		777
Emission savings from energy efficiency measures		6.87%
Total regulated emissions after energy efficiency measures		717.12

5. Renewable Energy Generation on Site

Of the technologies considered: (PV, Solar Thermal, Air Source Heat Pumps, Wind, District Heating and CHP), Air Source Heat Pumps were considered the most appropriate option for the site. This was due to the nature of the site in terms of planning restrictions, financial investment required.

CHP

Bristol City Council has plans for mixed use district heating and CHP schemes.

Gas-fired combined heat and power (CHP) schemes in high-density urban areas are the most popular because the costs are viable, the technology is mature and heat networks benefit many users.

CHP systems requires a significant infrastructure, and a substantial heat demand to be viable and therefore has been discounted within development, as the infrastructure is not yet available.

Wind

The first consideration for this technology is local wind speed. The Energy Saving Trust has established the wind speed at 12 Berkeley Road to be 4.5 metres per second at 10 metres above ground[3]. Wind speeds of less than 5 metres per second are unlikely to provide a cost effective source of electricity (based on current technologies) and considering the neighbouring buildings and suburban environment it may not be the best placed to provide wind power.

A solution may be to mount the turbine beyond the zone of turbulence which may be 15m or more in the air – there may be planning concerns from both an aesthetic and noise perspective. Turbines also carry high capital costs upwards of £35,000 for a 12 kW turbine.

Solar hot water systems

Solar water heating systems use the energy from the sun to heat water stored in a hot water cylinder inside the building.

Typical cost for 4m² of flat plate solar hot water is approximately £2,800 with a payback period of around 6-10 years. This could also benefit from the Renewable Heat Incentive.

There is west facing roof space so it could accommodate both PV and Solar thermal and if the buildings have a low heat demand it will be suited to solar thermal to supplement the hot water demand. This is a suitable technology.

[3] http://www.rensmart.com/Weather/BERR

Biomass heating

Biomass boilers such as Woodchip-fed systems remain very costly and the requirements for siting both the boiler and the fuel source were considered impractical for this development.

Therefore use of this technology for the main heating system was considered to be inappropriate for this development.

Heat pumps

Heat pumps take in heat at a certain temperature and release it at a higher temperature, using the same process as a refrigerator. Fluid is circulated through pipes buried in the ground and passes through a heat exchanger in the heat pump that extracts heat from the fluid.

The heat pump raises the temperature of the fluid via the compression cycle to supply hot water to the building as from a normal boiler. Air source heat pumps work in the same way but use the air as the heat source rather than the ground.

Ground-source heat pumps are used to extract heat from the ground to provide space and water heating. The ground pipe system can be horizontal or vertical.

Ground Source heat pumps have a high capital cost and would be very disruptive to install, therefore they are not advised for this site.

Air Source Heat Pumps can deliver up to four units of electricity from one unit, they can be sized to provide heating and hot water and work best with highly insulated and air tight properties with underfloor heating. They are best sited on a South or West facing wall with good air flow.

As general guidance ASHPs require:

- Ample supply of ambient (outdoor) air, enclosed courtyards or alleyways are usually unsuitable. Manufacturers vary but as a guide 350mm gap behind units, 4m space in front of unit and ample air flow at sides
- Easy access for servicing schedule
- Some drainage below outside unit (small 400mm depth soakaway sufficient) to prevent ice build up from condensation dripping in cold weather, if the unit is wall mounted a tray connected to a waste pipe may be needed.

They work very well on super low energy houses.

Photovoltaic Panels

Photovoltaic Panel systems convert energy from the sun into electricity through semi-conductor cells mounted in collector panels. The panels are connected to an inverter to turn the DC output into AC for use in the building to which they are attached and to be fed back into the grid when not required.

The current Feed in Tariff scheme yields guaranteed payments for 25 years for all electricity generated by the system and payment for electricity exported back to the grid. Typical cost for around 3kWp array is around £5,000 with a payback period of around 12 years.

Photovoltaic arrays provide a quiet and effective renewable energy source with a relatively low aesthetic impact. The major benefit of PV systems is the significant reductions they can achieve in comparison to other technologies, in terms of CO_2 and energy use.

PV are suitable in conjunction with ASHP, PV is a very complementary technology.

Air Source Heat Pump and Photovoltaics, chosen strategy

An Air Source Heat Pump for hot water heating is appropriate for dwellings with a low energy demand and these houses will be well insulated, air tight. Air Source Heat Pump can provide low temperature hot water and heating. This is well suited as it can provide highly efficient hot water heating in conjunction with around 2 kWp of Photovoltaics for each dwelling

6. Table 1, Proposed renewables and Emissions Reductions for the House[4]

	Primary Energy Rate (kWh/yr)	Energy saving (%)	Total Regulated CO_2 emissions (kg CO_2/yr)	Saving achieved on residual CO_2 emissions (%)
Baseline energy demand – "Baseline"	9068	0%	770.04	0%
Proposed scheme after energy efficiency measures to achieve pass were it required to comply with Building Part L1A standards – "Residual"	7541	16.84%	717.12	6.87%
Proposed scheme after on-site renewables (compared to strict definition of BCS14 residual)	6127	19%	528.12	26.36%
Proposed scheme offset for financial contribution or other allowable solution	N/A	N/A	N/A	N/A

Baseline energy demand (kWh/yr)	9068
Regulated emissions (kg/yr)	770.04

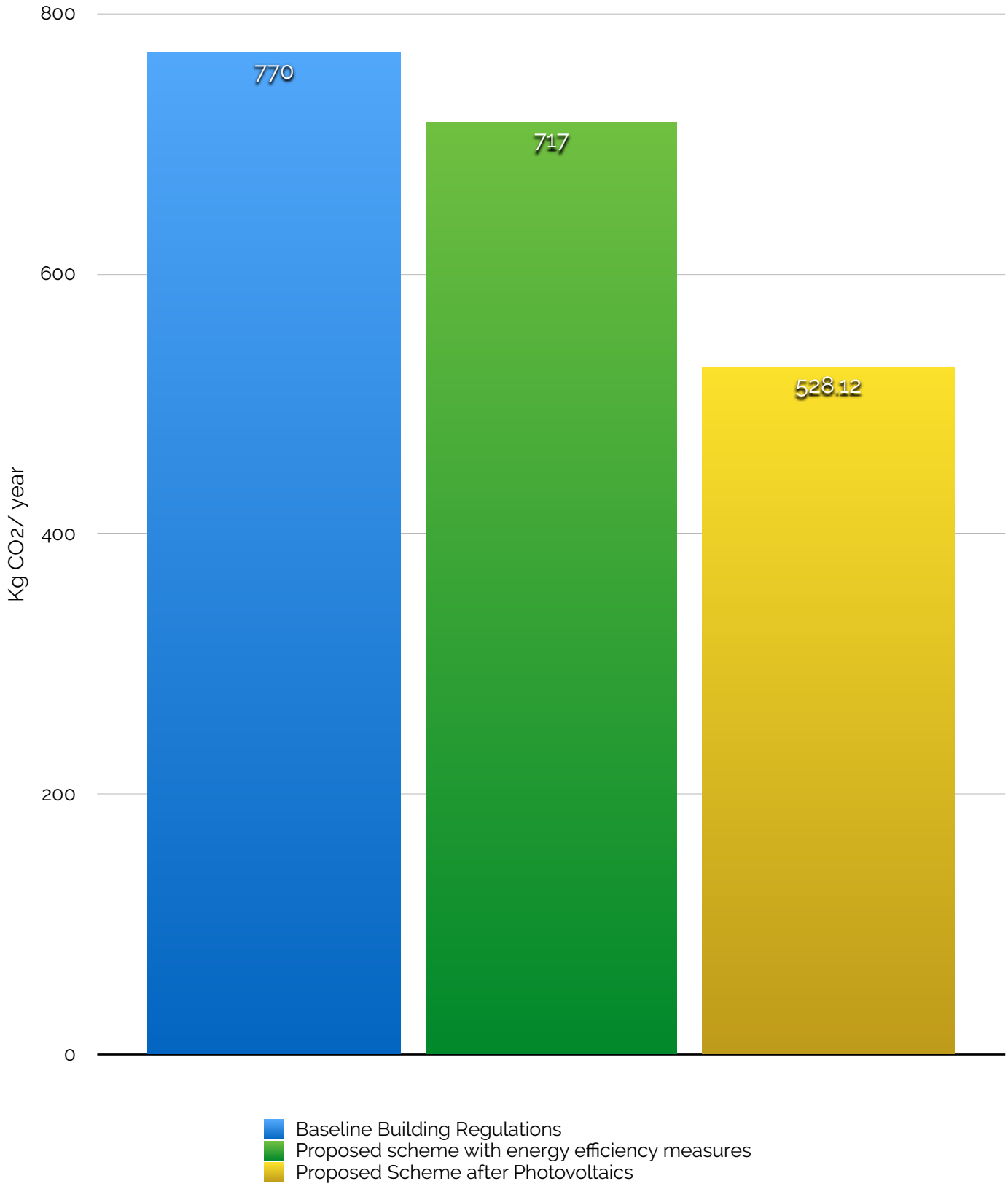
Energy savings from energy efficiency measures (kWh)	1527
Emission savings from energy efficiency measures	6.87%
Total regulated emissions after energy efficiency measures	717.12

Generated Power (kWh)	1414
Saving on residual emissions from use of renewables (kg/yr)	400.18

Saving on residual emissions from use of renewables (kg/yr)	**400.18**
Saving on residual emissions from the use of renewables (%)	**26.36%**

4 As the development has reached the 20% the financial contribution is not needed. Information on Photovoltaic generation accessed http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php

7. Graph to Show CO2 reduction in Emissions



11. Water

Water

The BCS15 states that the water resources should be conserved. The appliances onsite will be low water use in line with the requirements of planning and Part G, full calculations in appendix A.

The potable water demand will be designed to be less than 125l/person/day as prescribed by Part G of the Building Regulations, this could be achieved by:

Dual flush toilets (6 full flush and 3 part flush)

Basin taps with 5 l/minute flow

Bath capacity of approximately 240 litres

Flow restrictors to bathroom taps of 3 litres per minute

Eco shower heads for up to 9 litres per minute

Lower water usage dishwashers and washing machines

Water butts will be fitted to drainpipes for watering plants onsite.

Water Efficiency Measures on site

Water is a valuable resource and water conservation is key to environmental and sustainable design. It is proposed that low water usage fittings will be utilised throughout the development to minimise water consumption as well as within the site cabins. This will assist with keeping low usage throughout the construction phase.

Monitoring of water consumption through water metering will take place. Any inefficiency in the water distribution system should be detected in the unlikely event of leakage.

It would be recommended that the site workforce will have tool box talks to cover 'Energy and Fuel Efficiency' as well as being made aware of the standard Environment Agency PPGs for pollution prevention guidance and groundwater pollution prevention. Whilst on site, energy and water consumption could be recorded and monitored.

12. Materials use

Materials will be considered for embodied impact and preferred materials will be locally and responsibly sourced, such as FSC timber, and BES certified roof tiles. Any replaced materials will be increasing efficiency overall for the lifecycle of the building.

Proposed Measures

A number of methods for maximising green infrastructure and procuring responsibly sourced materials will assist with the overall design. A number of methods are being used to assist with having minimal environment impacts including:

- Materials Specification - The building fabric and materials specified will have a low environmental impact. Where appropriate materials may be reviewed using the BRE 'Green Guide to Specification' aiming to maximise the proportion of A+ or A rated materials. Materials may include reclaimed or recycled materials where appropriate.
- Maximise Recycled Content of Materials – A number of materials used commercially in the UK construction industry are manufactured using materials recycled from post consumer waste. A detailed analysis of the materials available in the UK is outlined on the government WRAP website and the National Building Specification (NBS) Greenspec website. The proposed development will be designed to give preference to natural materials and materials with a high percentage of recycled content.
- Responsible Sourcing of Materials: Where possible materials will be responsibly sourced. The green guide will also assist with the materials selection. 100% of the timber used including the timber products will be legally and responsibly sourced.
- FSC Certified Timber – Certain timber products and materials available in the UK use tropical hardwoods from endangered or illegal sources. The development will endeavour to use timber from a temperate, well-managed source or manufactured from recycled timber waste. Timber will as far as possible be certified by the Forest Stewardship Council (FSC), which provides a product- specific chain of custody number confirming that the timber used in the manufacture of the product originates from a sustainably managed source.
- Low solvent / low VOC paints – Certain paints contain high levels of solvents or Volatile Organic Compounds (VOCs). High VOC paints emit the chemical contained in the paint into the internal air of a building, long after the building has been completed. These chemicals that are inhaled by the building occupants are considered to be a contributing factor in sick building syndrome. Low VOC products also have a benefit to construction workers in terms of health and safety. As far as reasonably possible, internal paints which have a low solvent / low VOC content will be used.
- Zero Formaldehyde MDF – Medium Density Fibreboard (MDF) is a timber panel product, which can be manufactured with new or recycled timber. Typically MDF is manufactured using formaldehyde, which is hazardous to health and is emitted into the internal air of a building, long after the building has been completed. MDF can be manufactured without the use of formaldehyde. The proposed development will seek to use zero formaldehyde MDF for internal skirting within the building. The potential for the use of MDF manufactured using recycled materials will also be assessed.
- Zero ODP and GWP Insulation – Certain foamed plastic insulation materials available in the UK are manufactured with substances, which deplete the ozone layer and/or contribute to global warming. The proposed development will give preference to insulation materials such as rock wool and mineral wool, which are manufactured with no ozone depletion potential (ODP) and low global warming

potential (GWP), while still giving consideration to thermal performance and fitness for purpose.

- Flexibility – the internal partitions should allow for adaptation which allows for alternative layout and reconfiguration should any future occupants wish to make changes. This would be subject to the practicalities associated with the choice of building material.
- Construction Site Impacts - The main contractor will have an environmental material policy used for sourcing of construction materials to be used on site.

13. Waste

Waste and recycling

The development will follow the waste management hierarchy (England Waste Strategy 2007 at www.defra.gov.uk), above.

This site will implement measures during the construction phase which aim to reduce substantial environmental impacts as advised in the NPPF (National Planning Policy Framework). Waste impacts will be mitigated through the following means:

Site Waste Management Plan

A SWMP will be used to help benchmarking, procedures and commitments for the minimising of and diversion of the site waste from landfill, as well as target benchmarks for resource efficiency, procedures and commitments to minimise non-hazardous construction waste and procedures for minimising hazardous waste as applicable

There are many opportunities to reduce waste on the site, such as careful storage of site materials, offsite construction where possible, consideration given to sizing in the design stage such as using manufacturers set sizes to reduce waste, take back systems such as those offered by plasterboard manufacturers, and re use of materials where appropriate.

14. Pollution

On site and during construction, the following measures have been recommended:

- Pollution prevention measures and environmental controls to be included in the site specific induction, as well as delivery of relevant tool box talks
- Provision of site specific inductions
- Controls in place to control construction dust

Air Quality Management

During the construction phase of the development there is the potential for air quality impacts as a result of fugitive dust emissions from the site. Good practice dust control measures will be implemented and therefore the residual significance of potential air quality impacts from dust generated by demolition, earthworks, construction and track out activities is predicted to be negligible.

Internal and External Lighting

All fluorescent and compact fluorescent lamps will be fitted with high frequency ballasts to reduce the risk of health problems related to the flicker of fluorescent lighting. All internal fittings will be energy efficient (e.g. LED), and all external fittings will be low energy and controlled to avoid their use during hours throughout the day. The use of time clocks and PIR sensors may be considered where appropriate.

During construction works, any lighting will be kept to a minimum. Task specific lighting will be reviewed and detailed within a Construction Management Plan and monitored accordingly.

Flooding and Surface Water Runoff

The government's flood map shows that there is a high risk of flooding due to surface water build up.

However, there is no history of flooding within the client's occupation of the site – over 40 years.

It should be noted that permission was given in 2020 for construction of a house in the garden of 16 Berkeley Road (20/01096/F).

Soakaways will be utilised wherever ground conditions allow.

ICT/Broadband

Broadband is available locally and the house will be designed to incorporate necessary wiring.

Appendix A PV

M Sustainability

Proposal for B Kendall

Prepared by:
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07852802823
laura@msustainability.co.uk

For: B
12 Berkeley Road, Bristol

Quote #: 3130203
Valid until: 10th November 2023

Solar Energy System Proposal

Dear B,

Thank you for the opportunity to present your Solar Energy System Proposal.

Best Regards,
laura@msustainability.co.uk
M Sustainability

Recommended System Option

2.345 kW	21 %	105	0.00 %
System Size	Grid Independence	Trees planted	Performance Ratio

Your Solution

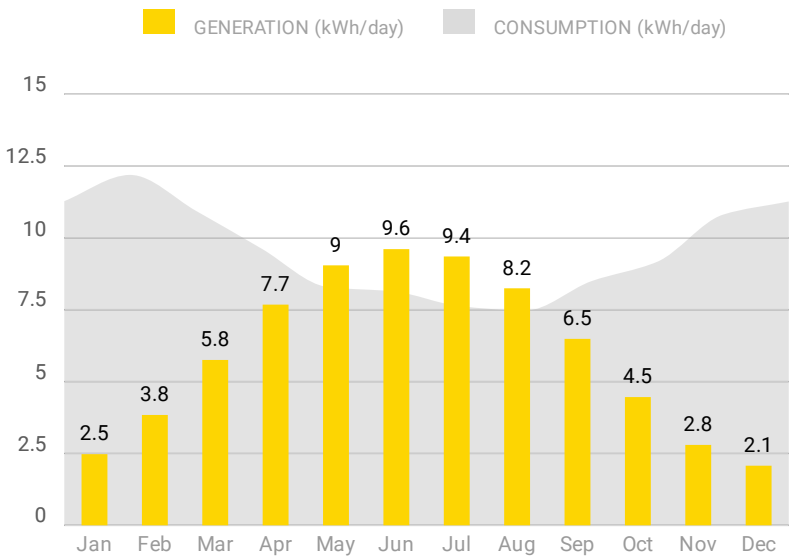
Solar Panels

SunPower
2.345 kW Total Solar Power
7 x 335 Watt Panels (SPR-P3-335-BLK)
2,188 kWh per year

Warranties: 25 Year Panel Product Warranty, 25 Year Panel Performance Warranty

System Performance

63%
Energy From Solar



33%	67%
Self-consumption	Export to grid

System Performance Assumptions: System Total losses: 0%, Inverter losses: 0%, Optimizer losses: 0%, Shading losses: 0%, Performance Adjustment: 0%, Output Calculator: MCS. Panel Orientations: 7 panels with Azimuth 188 and Slope 20.

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 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 the most relevant methodology for your system. There are a number of external factors that can have a significant effect on the amount of energy that will be self-consumed.

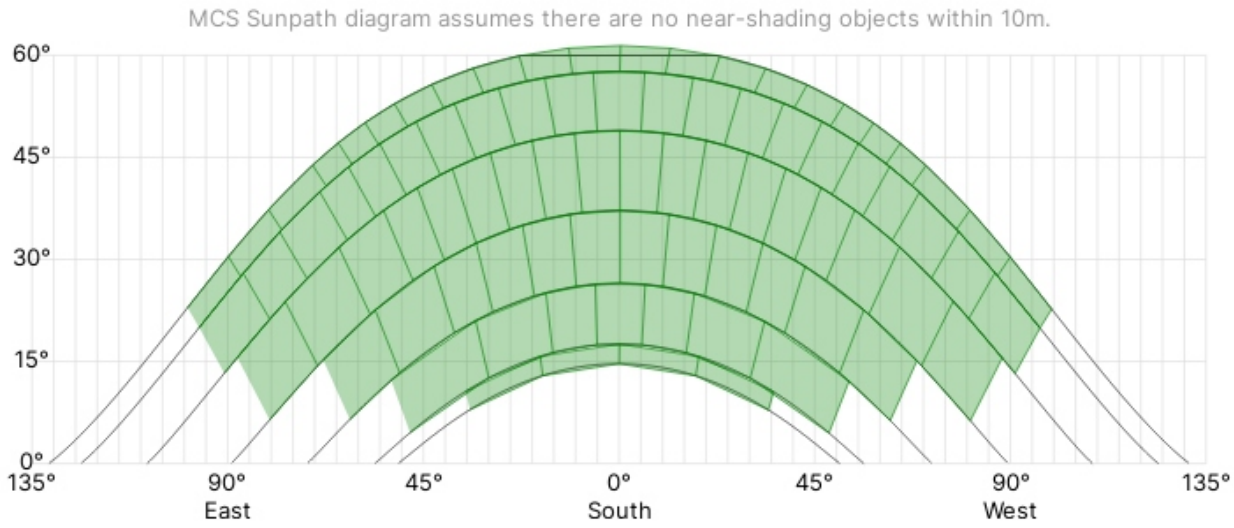
This system performance calculation has been undertaken using estimated values for array orientation, inclination, or shading. Actual performance may be significantly lower or higher if the characteristics of the installed system vary from the estimated values.

A. Installation data		
Installed capacity of PV system - kWp (stc)	2.34	kWp
Orientation of the PV system - degrees from South	Group 1: 7 panels with Orientation: 10 °	°
Inclination of system - degrees from horizontal	Group 1: 7 panels with Tilt: 20°	°
Postcode region	5E	
B. Performance calculations		
kWh/kWp (Kk) from table	Group 1: 933	kWh/kWp

Shade Factor (SF)	1.00	
Estimated annual output (kWp x Kk x SF)	2,188	kWh
C. Estimated PV self-consumption - PV Only		
Assumed occupancy archetype	In Half Day	
Assumed annual electricity consumption, kWh	3,500.00	kWh
Assumed annual electricity generation from solar PV system, kWh	2,188	kWh
Expected solar PV self-consumption (PV Only)	722.05	kWh
Grid electricity independence / Self-sufficiency (PV Only)	20.63	%

Sunpath Diagram

Disclaimer: The shade mask mapped onto the sunpath diagram is based off the field of view from a point in the center of the array. This means that the shade mask shown will only capture the shading experienced at the array center point, and will not reflect the shading casted onto other locations on the array.



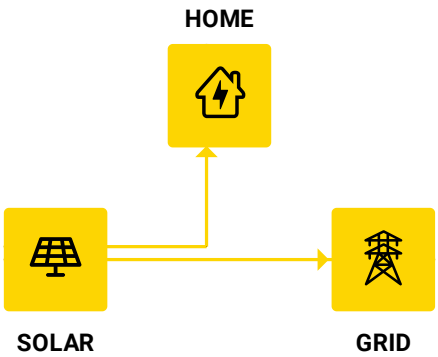
Environmental Benefits

Solar has no emissions. It just silently generates pure, clean energy.

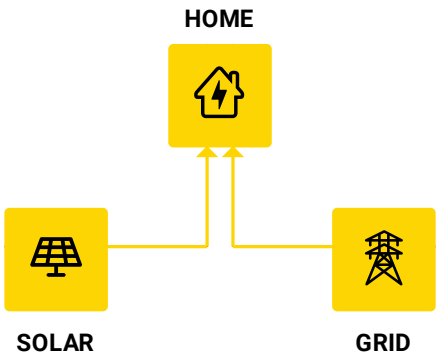
Each Year		Over System Lifetime		
63%	554 kg	16,408	105	12
Of CO_2, SO_x & NO_x	Avoided CO_2 per year	Car km avoided	Trees planted	Long haul flights avoided

How your system works

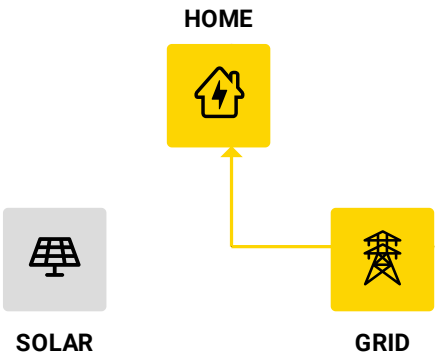
Generating Excess Solar



Partially Offset Usage

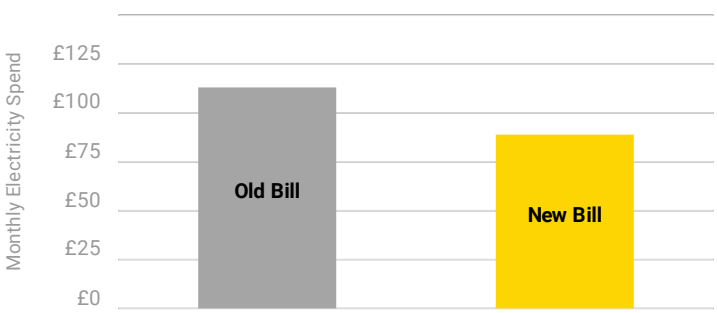


Night

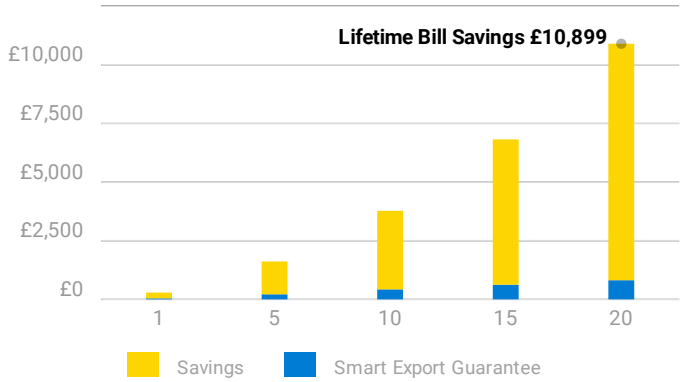


Electricity Bill Savings

First Year Monthly Bill Savings



Lifetime Bill Savings



Month	Solar Generation (kWh)	Electricity Consumption before solar (kWh)	Electricity Imported after solar (kWh)	Electricity Exported after solar (kWh)	Export Credit (£)	Utility Bill before solar (£)	Utility Bill after solar (£)	Estimated Savings (£)
Jan	77	350	302	29	1	133	116	17
Feb	107	341	285	51	2	130	109	21
Mar	178	339	269	109	3	129	102	27
Apr	230	289	216	158	5	112	83	29
May	280	257	185	208	6	101	70	31
Jun	288	244	171	215	6	97	66	31
Jul	290	236	166	219	7	94	64	31
Aug	256	232	170	194	6	93	66	27
Sep	195	255	197	137	4	100	77	24
Oct	138	284	232	87	3	110	90	20
Nov	84	324	278	38	1	124	107	17
Dec	64	349	305	20	1	133	117	16

Rate not specified specified, using Electricity based on location.

Your projected energy cost is calculated by considering a 7.0% increase in energy cost each year, due to trends in the raising cost of energy. This estimate is based on your selected preferences, current energy costs and the position and orientation of your roof to calculate the efficiency of the system. Projections are based on estimated usage of 3500 kWh per year, assuming Electricity Electricity Tariff.

Your electricity tariff rates may change as a result of installing the system. You should contact your electricity retailer for further information.

Proposed Tariff Details - E.ON Electricity (England)	
Energy Charges	
Usage Charge *All Day*	£0.34 / kWh
Feed-in Tariff	

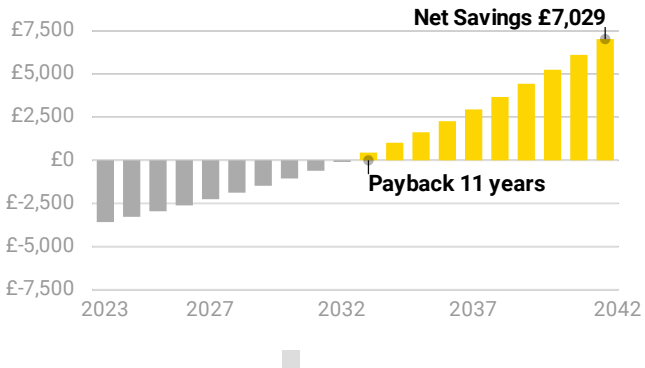
Feed-In Credit *All Day*	£0.03 / kWh
Fixed Charges	
Fixed Charge	£13.89 / month

Net Financial Impact Cash

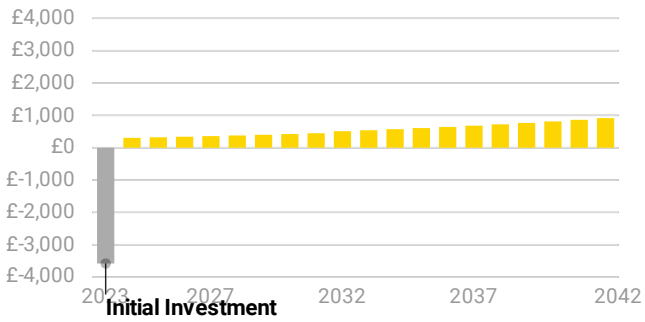
£10,899 - £3,869 = £7,029

Utility Bill Savings | Net System Cost | Estimated Net Savings

Cumulative Savings From Going Solar



Annual Savings From Going Solar



£1,282
Net Present Value

14 Years 11 Months
Discounted Payback Period

182%
Total Return on Investment

9.9%
Rate of Return on Investment

Year	Electricity Consumption (kWh)	Solar Generation (kWh)	Utility Bill (before solar) (£)	Utility Bill (after solar) (£)	Annual Savings (from solar) (£)	System Costs (Net of Dealer Incentives) (£)	Customer Incentives (Upfront) (£)	Net Savings (£)	Cumulative Impacts (£)
2023	3,500	2,188	1,357	1,067	290	3,869	0	(3579)	(3579)
2024	3,500	2,177	1,452	1,146	305	0	0	305	(3274)
2025	3,500	2,166	1,553	1,231	322	0	0	322	(2951)
2026	3,500	2,155	1,662	1,322	340	0	0	339	(2611)
2027	3,500	2,144	1,778	1,420	359	0	0	358	(2253)
2028	3,500	2,133	1,903	1,524	379	0	0	378	(1874)
2029	3,500	2,122	2,036	1,636	400	0	0	400	(1474)
2030	3,500	2,111	2,179	1,756	423	0	0	422	(1051)
2031	3,500	2,100	2,331	1,884	447	0	0	447	(604)
2032	3,500	2,090	2,494	1,984	510	0	0	510	(93)
2033	3,500	2,079	2,669	2,128	541	0	0	540	446
2034	3,500	2,068	2,856	2,283	573	0	0	572	1019
2035	3,500	2,057	3,056	2,449	607	0	0	606	1626
2036	3,500	2,046	3,269	2,626	643	0	0	642	2268

Year	Electricity Consumption (kWh)	Solar Generation (kWh)	Utility Bill (before solar) (£)	Utility Bill (after solar) (£)	Annual Savings (from solar) (£)	System Costs (Net of Dealer Incentives) (£)	Customer Incentives (Upfront) (£)	Net Savings (£)	Cumulative Impacts (£)
2037	3,500	2,035	3,498	2,817	682	0	0	681	2950
2038	3,500	2,024	3,743	3,021	723	0	0	722	3673
2039	3,500	2,013	4,005	3,239	766	0	0	766	4439
2040	3,500	2,002	4,286	3,473	813	0	0	812	5252
2041	3,500	1,991	4,585	3,723	862	0	0	862	6114
2042	3,500	1,980	4,906	3,992	915	0	0	914	7029

Estimates do not include replacement costs of equipment not covered by a warranty. Components may need replacement after their warranty period. Financial discount rate assumed: 6.75%

Quotation

Payment Option: Cash

7 x SPR-P3-335-BLK 335 Watt Panels (SunPower)	
Total System Price	£3,869.25 Excluding £0.00 VAT
Purchase Price	**£3,869.25** Including £0.00 VAT

Price excludes Retailer Smart Meter should you want us to install your Smart Meter it will be an additional cost.
This proposal is valid until 10th November 2023.

Quote Acceptance

I have read & accept the terms and conditions.

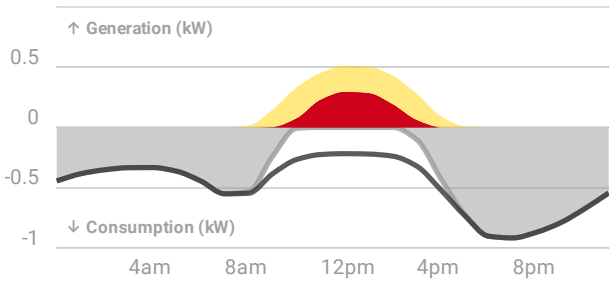
Signature _____

Name _____ Date _____

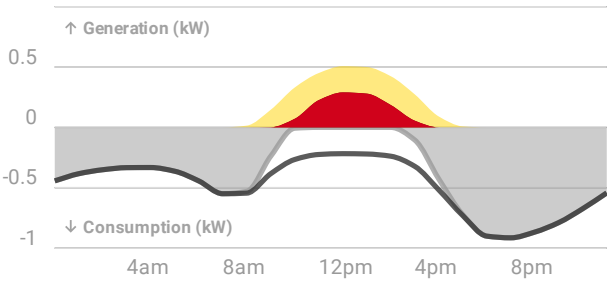
Daily Energy Flows

CONSUMPTION (kWh) GENERATION (kWh) NET CONSUMPTION (kWh) EXPORT TO GRID (kWh)

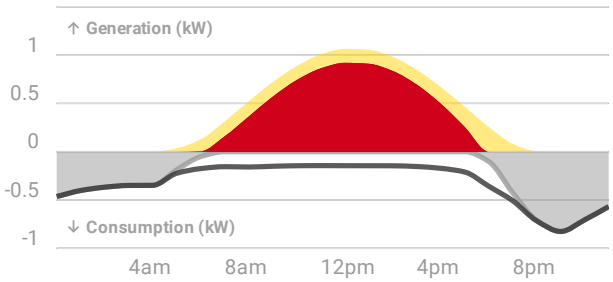
Winter Weekday



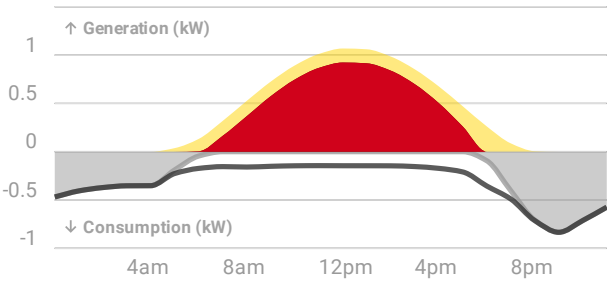
Winter Weekend



Summer Weekday



Summer Weekend



OpenSolar

This proposal has been prepared by M Sustainability using tools from OpenSolar. Please visit www.opensolar.com/proposal-disclaimer for additional disclosures from OpenSolar.

Appendix B Flood Risk

Learn more about this area's flood risk

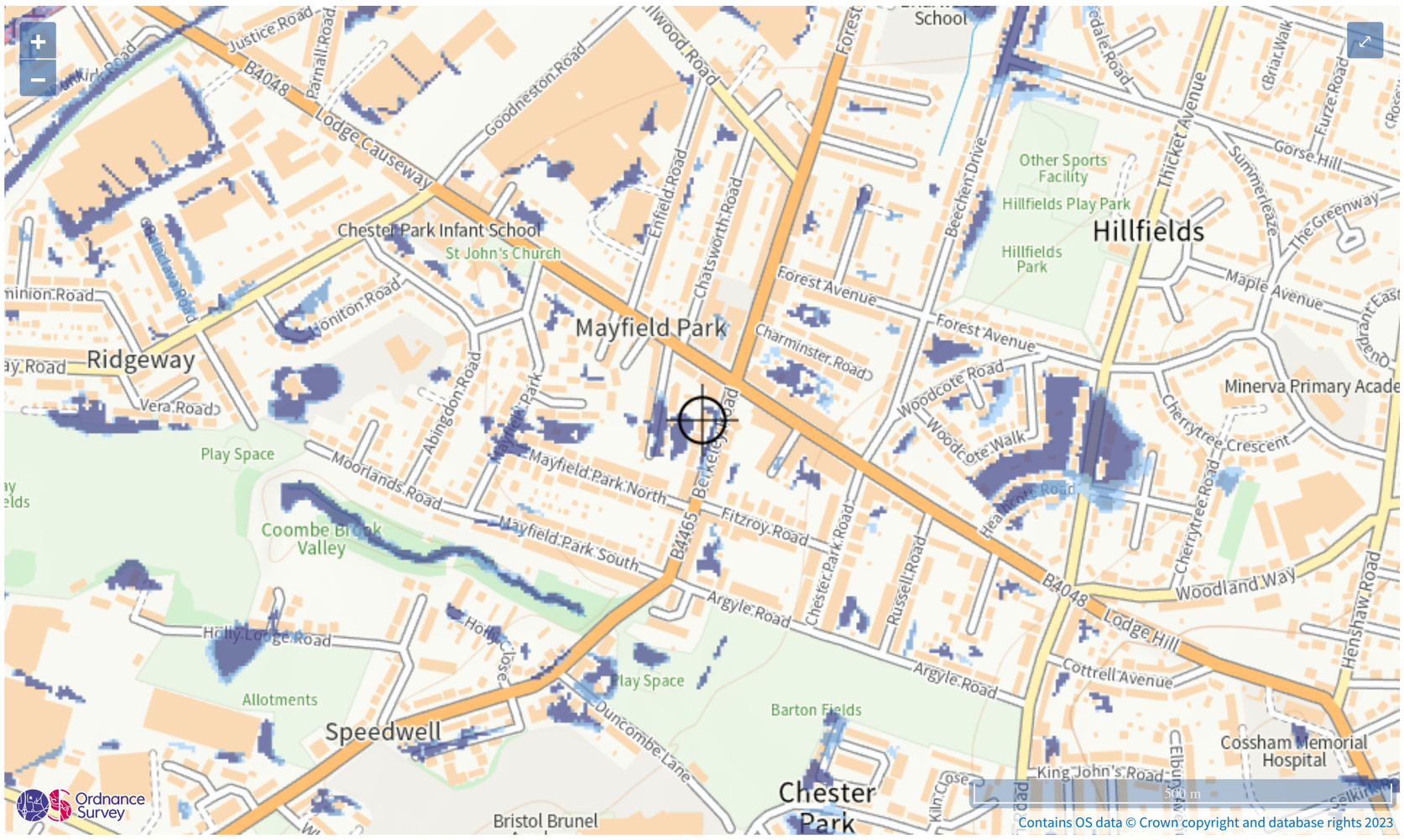
Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

Enter a place or postcode



Extent of flooding from surface water

High Medium Low Very low Location you selected

View the flood risk information for another location

Appendix C Broadband

Your broadband results

We've searched through our deals to find the right ones for you
Check your results below:

Your address: **12 Berkeley Road, Fishponds, Bristol, City of Bristol, BS16 3LX**

Your provider: **BT**

Edit details

11 of 51 results

Sort by

- Uswitch rated
- Cost (low to high)
- Contract length
- Speed (high to low)
- Speed (low to high)

Filter by

Special offers

- Uswitch exclusives (4)

Package

- Broadband (31)
- Broadband + TV (19)

Average speed

- 0-30 Mbps (7)
- 30-100 Mbps (27)
- 100-300 Mbps (9)
- 300-900 Mbps (5)
- 900+ Mbps (2)

Broadband type

Virgin Media Gig1 Fibre broadband only

1130 Mbps
average UK speed*

£46.00 a month
no setup cost
18 month contract

Most Popular Broadband Provider

More info Buy now

Virgin Media Gig1 Fibre Broadband + Phone

1130 Mbps
average UK speed*

£58.00 a month
no setup cost
18 month contract

Most Popular Broadband Provider

More info Buy now

Uswitch Exclusive

Virgin Media M500 Ultrafast Fibre broadband only

516 Mbps
average UK speed*

£38.50 a month
no setup cost
18 month contract

£100 bill credit Most Popular Broadband Provider

Broadband type

- [ ] Fibre broadband (44)
- [ ] Copper ADSL broadband (6)

Provider

- [ ] BT (0)
- [ ] Plusnet (2)
- [ ] Sky (5)
- [ ] TalkTalk (3)
- [ ] Virgin Media (16)
- [ ] Vodafone (4)
- [ ] Direct Save Telecom (3)

Show 3 more

Contract length

- [ ] 12 months (15)
- [ ] 18 months (29)
- [ ] 24 months (6)

Monthly cost

- [ ] £0-£25 (11)
- [ ] £25-£40 (25)
- [ ] £40+ (14)

Inclusive calls

- [ ] Weekend calls (9)
- [ ] Anytime calls (1)
- [ ] Evening & weekend calls (1)
- [ ] No calls included (39)

More info Buy now

Uswitch Exclusive Sponsored

Virgin Media M250 Ultrafast Fibre broadband only

264 Mbps
average UK speed*

£30.50 a month
no setup cost

18 month contract

£90 bill credit | Most Popular Broadband Provider

More info Buy now

Virgin Media Mega Volt Bundle, Lightning Fast Fibre Broadband, Phone + O2 Sim

516 Mbps
average UK speed*

£85.00 a month
no setup cost

230+ channels

18 month contract

Most Popular Broadband Provider

More info Buy now

Virgin Media M500 Ultrafast Fibre Broadband + Phone

516 Mbps
average UK speed*

£52.00 a month
no setup cost

18 month contract

Most Popular Broadband Provider

More info Buy now

Virgin Media M350 Ultrafast Fibre Broadband + Phone

362 Mbps
average UK speed*

£46.00 a month
no setup cost

18 month contract

Most Popular Broadband Provider

More info Buy now