

Bellway

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NHC Guide to Photovoltaic Panels (PV Panels)

**A guide to the benefits, design and planning stages,
installation and registration of a PV Panel system**

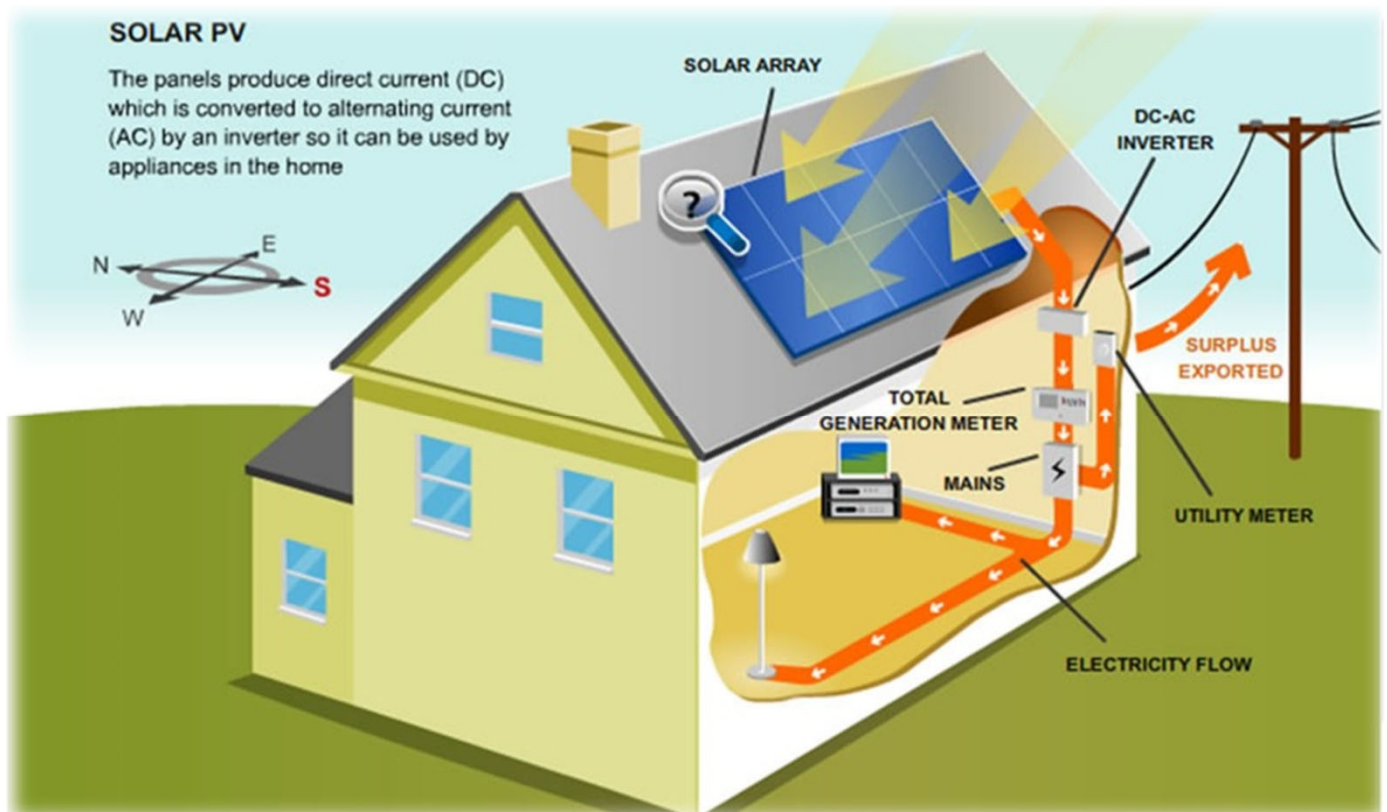


What are Solar PV panels?

Solar electricity panels, also known as photovoltaics (PV), capture the sun’s energy and convert it into electricity that you can use in your home.

Sunlight is free. By installing solar panels, you can generate your own renewable electricity whilst also reducing your carbon footprint. A typical PV installation will save around 1 tonne of CO₂ per year, depending on where you live in the UK.

How do PV panels work?



Typical System Components

Solar Thermal

A PV panel is **not the same** as a solar thermal water panel, which is designed to pre-heat water to improve boiler efficiency, commonly used over the past 20 years.



Flush PV Panel Installation



Solar Thermal Water Panel

Battery storage and other technologies

PV panels can be used in conjunction with battery storage to enable the electricity generated to be stored and used at a time to suit the homeowner.

PV panels can also be used in conjunction with air source heat pumps and immersion heaters. These are very much future technologies and is not currently provided on Bellway NHC developments. Customers should contact the PV provider to establish if their system enables future adaptation with these technologies.

What does the homeowner need to do when they move in?

- ✓ Read the PV user guide and keep it safe
- ✓ Register their details with the PV supplier to activate their warranty. They may also wish to consider additional warranty cover
- ✓ Find an energy supplier offering SEG payments and the rate they offer
- ✓ Complete a SEG application form, which is typically available online from the electricity provider
- ✓ Try to align EV charging, washing or tumble drying with peak daylight hours
- ✓ Ensure panels are kept clean and free of debris. Most window cleaning companies have the equipment to clean them from the ground
- ✓ Provide meter readings as specified by electricity supplier
- ✓ Ensure the Inverter panel, typically in their loft space is clear and unobstructed.

How do homeowners save money by having PV panels installed?

Homeowners benefit from energy savings by using the electricity at time of generation in their home. They may also receive export payments under the Smart Export Guarantee (SEG) scheme. This is a replacement for the Feed In Tariff (FIT) which closed for new applications in April 2019. SEG and FIT are covered in more detail later in the guide.

As of July 2022, the export price paid by the grid (what they pay the homeowner per kWh units of electricity) is significantly less than what a homeowner would pay their domestic electricity supplier. On this basis, using the electricity at time of generation is the most efficient approach, where possible.

Customers should be encouraged to time the operation of energy intensive appliances, such as electric car charging, washing machines, tumble dryers and dishwashers, to align with peak energy generation, which would typically be when the sun is at its strongest.

How much energy do PV panels generate?

A 4kWp solar PV system, on a 40 degree pitched roof, facing due south has an estimated output of 3,932kWh per year. This figure depends on the size of the array, roof slope, orientation and whether the PV panels are clean and debris free.

Expected output (by month) of a 4kw system is shown below.

Monthly Energy Output of a 4kW Solar Panel System



What happens when the weather is cloudy or cold?

Solar PV Panels use light to generate electricity, so the modules still work when it is cloudy, although when it is overcast they are less efficient at producing solar energy. When it is slightly overcast, the panels may produce as much as half the power they would in sunny conditions. When the sky is heavily overcast, this could reduce further. Temperature is less important than how much light there is. What's more, a clear cold day is perfect, because Solar PV modules operate better at cooler temperatures.



How does a PV panel work?

A Solar PV module is made up of mono-crystalline cells which consist of two or more thin layers of semi-conducting chemically treated silicon materials. The chemicals react when light hits the cell, creating an electric field across the layers, producing a direct current.

The greater the light intensity, the greater the flow of electricity. This direct current (DC) is then fed into an inverter which changes it into a usable alternating current (AC) producing solar energy which can be used in your home.

Who owns the PV panels?

Freehold ownership of the PV panels is typically granted to the homeowner when purchasing their property. This may differ for a flat, flat or apartment so in all instances, **please check with the solicitors for the site**. Where PV panels are leased, ownership is retained by the building owner.

Selling the surplus electricity (exporting) via the Smart Export Guarantee (SEG)

With any domestic PV system, there may be times when the electricity generated is more than homeowners can use, so the surplus will be exported to the grid to be used by somebody else.

Homeowners may be familiar with the 'feed in tariff' scheme, however this was closed for new applications in March 2019 and replaced with the Smart Export Guarantee (SEG) scheme. If the homeowner wants to be paid for exporting, they need to register their installation and request export payment. The scheme is backed by OFGEM, a government organisation.

Not all energy suppliers offer a SEG payment and the amount paid can vary. As of July 2022, of those offering the scheme, the payments can vary between 2p and 5.6p per kWh of electricity generated. Whether or not an energy provider offers a SEG payment and how much they pay should be a consideration in choosing their energy supplier. Payment frequencies can vary between 3 monthly to annually.

Bearing in mind the most customers will be on a price capped electricity tariff of 28.34p per kWh (as of July 2022) and due to increase on 30/9/22, it makes sense to use the energy where possible over exporting via SEG.

How does the new Smart Export Guarantee (SEG) scheme differ from the old Feed in Tariff (FIT) scheme?

The new SEG scheme offers far lower export payments (2 - 5.5p kWh) than legacy FIT payments of up to 40p kWh. On this basis any customers signed up to FIT should remain on this scheme. Below is a table comparing the other differences between the schemes.

	Feed-in Tariff	Smart Export Guarantee
Payment tariffs	Same tariff for all applicants, regardless of electricity supplier, set by Ofgem.	Different tariffs depending on which electricity supplier you choose.
Fixed tariff?	Tariff received fixed for 20-25 years after installation.	Suppliers can change tariff and offer multiple options such as fixed or flexible.
Electricity bought under the scheme	Two payments: generated electricity and estimated exported electricity.	A single payment for exported electricity only.
How payments are calculated	Generated electricity is metered but exported electricity usually estimated at 50% of generation.	Exported electricity metered by a smart meter capable of 30 minute readings.
Solar panel certification required	MCS certification required	MCS or equivalent, e.g. Flexi-Orb
Funding for the scheme	The FIT was paid for by a levy on all customers' energy bills.	The SEG is paid by energy companies who buy the power.

How to register for the Smart Export Guarantee (SEG)

As of July 2022, British Gas are the incumbent energy supplier when a homeowner moves in. If the customer decides to remain with British Gas, they should fill out the SEG application form on the British Gas website and provide their proof of ownership document, MCS installation certificate (provided at handover) and their EPC. Guidance is available online for frequency of payments and obligations for the homeowner in providing meter readings.

If the homeowner decides to switch suppliers, they should contact the new provider and request details of their SEG payment rate and application process.

Ongoing Maintenance & Operation

Solar PV systems need little maintenance. Keep an eye on nearby trees to ensure they don't begin to overshadow your system.

Solar PV modules are self cleaning when mounted at an angle of at least 15°. The amount of dirt on the modules depends on their location. If the modules are in a heavily silted area (e.g. under trees) the build up of dirt may reduce the power the panel generates by around 10%. Debris is more likely to build up if you have ground-mounted panels, or if you live in an area with more dust in the air. In these cases, you might need to have the panels cleaned occasionally.



Solar PV modules should be expected to last at least 25 years, since there are no moving parts. The Solar PV modules have a twenty-five year performance guarantee.

Once fitted, your installer should leave written details of any maintenance checks that you should carry out to ensure everything is working properly. This should include details of the main inverter fault signals and key troubleshooting guidance.

Keeping a close eye on your system and the amount of electricity it's generating (alongside the weather conditions) will help you understand what to expect and alert you to when something might be wrong.

The panels should last 25 years or more, but the inverter is likely to need replacing sometime during this period, at a cost of around £800 (depending on system size and the manufacturer). Some inverters have online monitoring functions and can warn you by email if the system fails.

Technical Aspects – Design & System

Bellway currently specify 335w Veridian PV Panels, measuring 1000mm x 1686mm per individual panel. These can be installed in either landscape or portrait orientation.

The Bellway limit for a single house is 12 panels, which keeps the system within the straightforward G98 regulations for connecting to the grid. More than 12 panels takes the system into G99 regulations, which are more onerous in terms of permission and other administration. So we should be specifying a **maximum** 12x335w or 4.02kWp (peak) system. The panels can be installed in a grid configuration if preferred.



Flush fitted



Over Tiles or 'On Roof'

The PV panel array can be installed either on top of tiles, or flush with the roof plane with PV panels replacing the tiles locally. The flush design is preferred as it delivers a saving on roof tiles, has a greater aesthetic appeal and is lighter overall. Typically with a roof truss system, the flush option does not require any roof truss strengthening although **a check must be carried out** on all designs with the relevant suppliers.

See below examples of on roof and flush installations.

Design and Siting

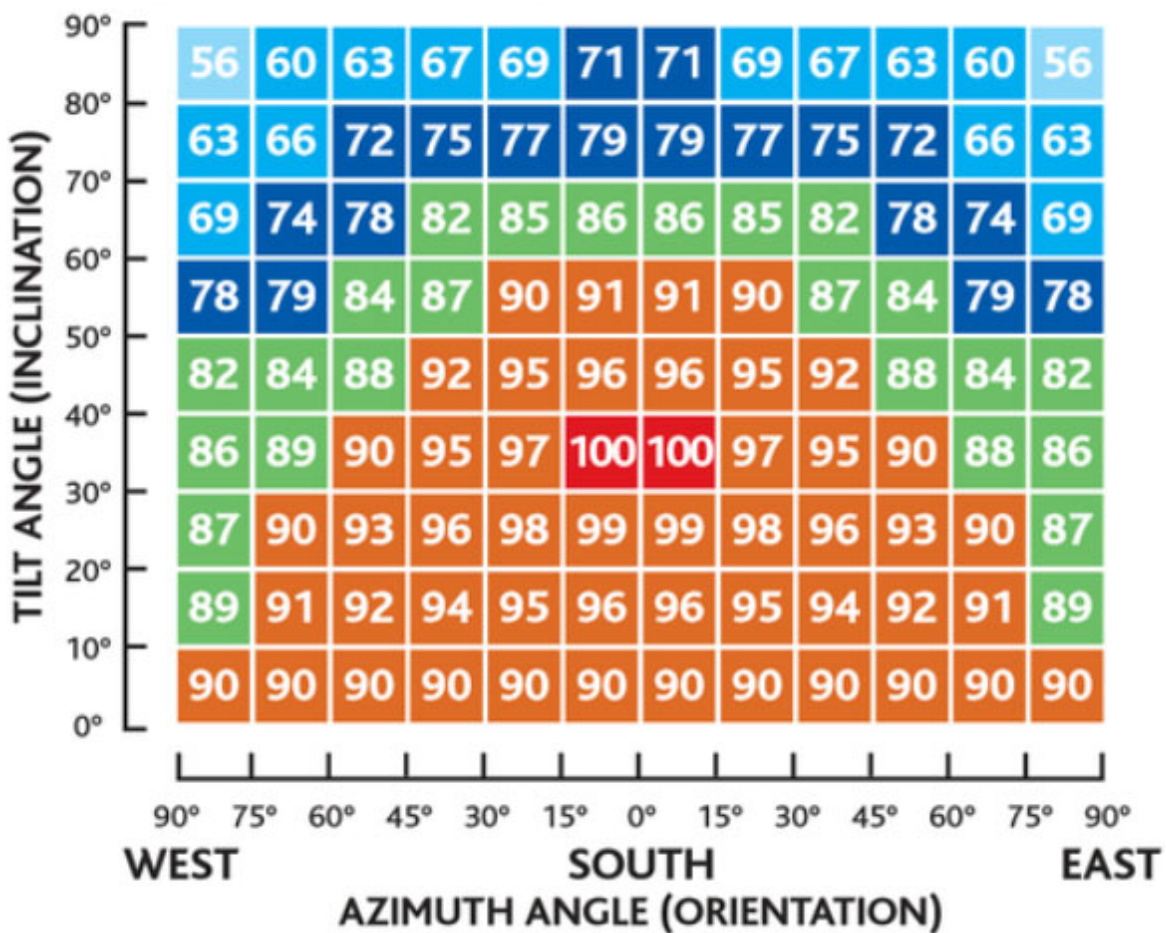
- ✓ Specify a flush fitting system, considering alternative routes for roof vents
- ✓ Face the panels South, on a 35-40 degree roof
- ✓ Limit the PV array to 4kWp to enable easy registration under G98
- ✓ Provide a suitable home for the PV inverter panel
- ✓ Advise customers on registration process for SEG
- ✗ Don't ignore PV suppliers details and preparation requirements

Location of PV Panels

The location of the Solar PV is vitally important. The modules must receive the maximum amount of day light possible, so it is not advised to install the modules in situations where surrounding buildings or trees may cast shadows. The best location for a Solar PV module is on a **south facing roof**. There are various mounting arrangements including on-roof, in-roof and flat roof kits, both landscape and portrait.

PV Panels can be installed on East or West facing elevations but output is significantly reduced.

SOLAR ENERGY CAPTURE vs ARRAY ORIENTATION & TILT



Graph showing expected output as tilt angle and orientation changes

Planning and On Site Pre-Start

To ensure smooth delivery of the PV panel installation, a pre-start meeting should be held. The PV supplier will issue a document outlining 1st / 2nd fix requirements. It would however be wise to invite the carpenter, electrician and roof tiler into a pre-start meeting to fully coordinate the installation to ensure all prerequisite aspects. The below list is not intended to be exhaustive but outlines some of the typical requirements. In all cases, the PV supplier's installation guide must be followed.

Prior to work commencing the electrical contractor will have received,

- A site plan indicating PV locations and number of panels
- Drawings for each housetype specifying locations
- Specification of works and cabling requirements

Call-Off

- Call off periods vary and should be checked with the project surveyor and supplier
- Site manager to quote unique Site PV reference when calling off plots. This reference should be provided to site team upon placement of order
- Installation prerequisites must be provided, as detailed in this guide and the suppliers documentations

Registration of the installation with DNO

- On every site, the PV supplier should make a Distribution Network Operator (DNO) application to request that the load generated from the PV systems can be connected to the grid.
- PV supplier will submit this application to the DNO on Bellway's behalf.
- In order to submit this application, Bellway needs to provide the PV supplier with postal addresses, MPANs and a signed letter of authority for the site. Without this information, the PV supplier cannot submit the application.
- The DNO approval process can take up to 60 days from receipt of application therefore we need to submit the DNO application at least 60 days before the first plot is due to be completed.
- The DNO may issue a network study fee to allow connection. This cost will be requested from Bellway. Note that PV arrays cannot be connected to the grid without payment of these charges.

Note that the solar PV system needs to be fully installed, tested and commissioned by the PV suppliers' professional engineers

Technical Aspects - Roof Structure, Tiling and Flashing

1st Fix

For standard In Roof Viridian and GSE installs, the roof needs to be at felt and batten stage.

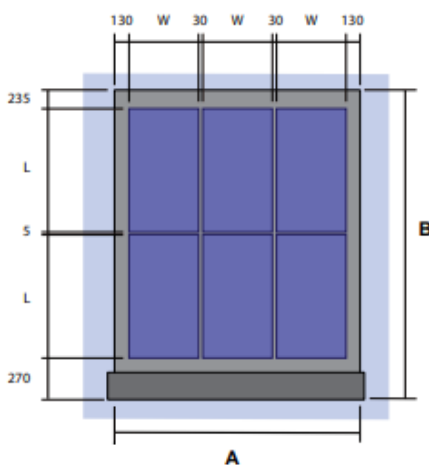
2nd Fix

- There must be permanent, live mains power to the plot
- 2 meter working platform next to loft hatch
- A fixed structure of 2 x vertical timber upstands within a meter of the loft hatch 600mm apart to allow us to fix the fireproof board/inverters to
- A cable (as specified by the PV supplier) running from the consumer unit to the inverter location for domestic installations under 4kw. Any systems above 4kw will require a bespoke schematic and cable specification
- A CAT5/6 shielded twisted pair (STP) will run from the DNO utility meter (service head) to the inverter location
- A high integrity consumer unit fitted with a 16A type A RCBO, in accordance with BS 7671 amendment 2 March 2022

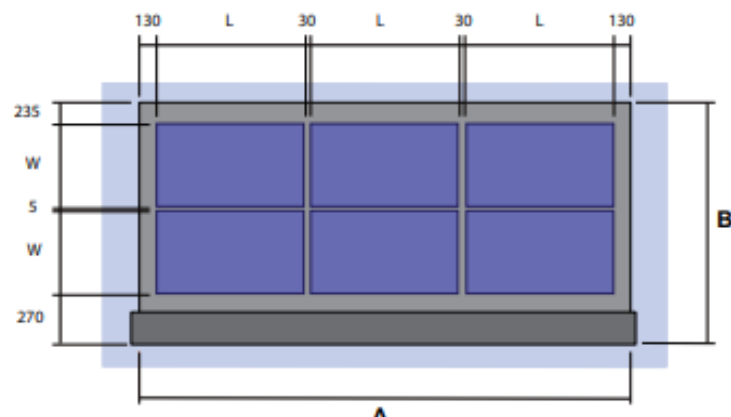
Roofing Contractor (for Viridian Systems)

Once the installation of the array is complete the following items are to be noted

- To fit the bottom flashing ensure that the tiles are CLEAN AND DRY, remove the paper strip on the underside of the flashing and dress the flashing down onto the tiles. Ensure that the bitumen strip is well bonded to the tiles.
- For some tile types it may be necessary to chamfer the high points of the tiles under the bottom flashing.
- The outside edge of the side flashings can be flattened over.
- The foam strip on the side flashing can be trimmed to within 10mm of its base, however not completely removed.
- The tiles will need to be cut in as close as possible around the array.



Portrait Installation



Landscape Installation

Technical Aspects – Inverter

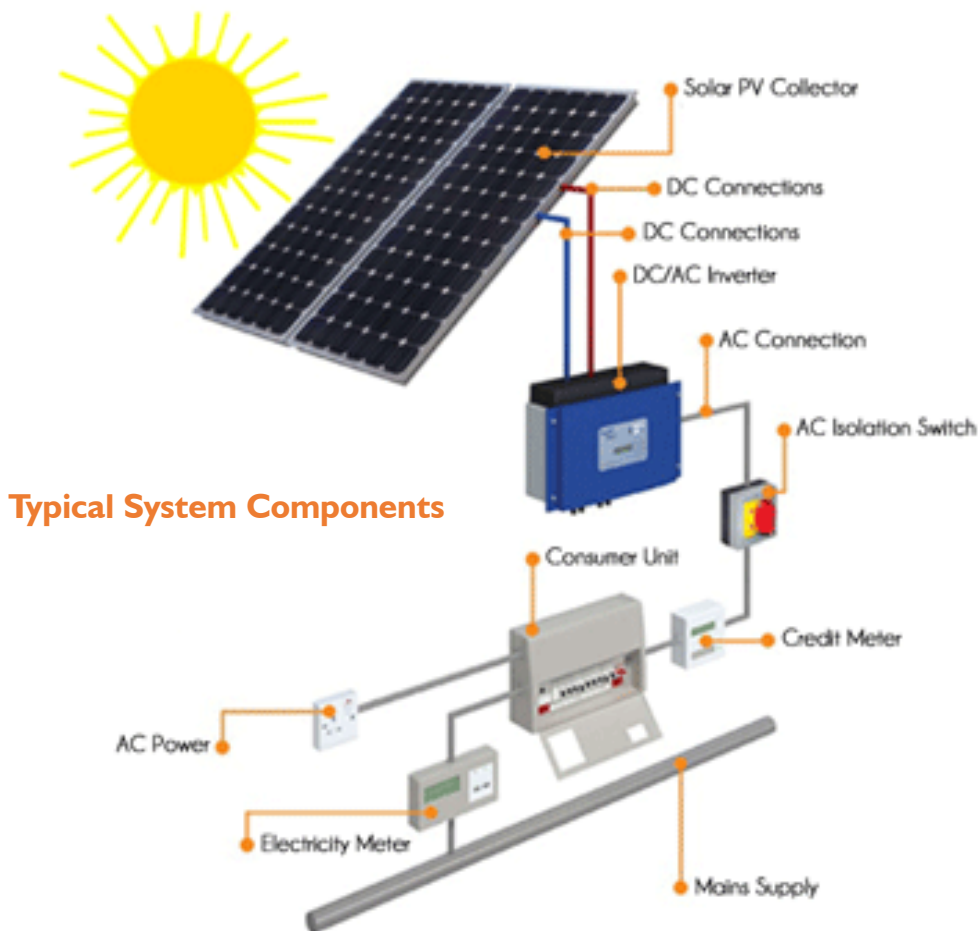
To ensure compliance with BS771 and the Electricity at Work Regulations 1989 (HSR25) the following shall be observed:

- The inverter should be installed as close to the loft hatch as possible, without impending operation of the loft ladder
- 2 meter working platform provided to allow safe access & egress for the electrician, homeowner and maintenance personnel in the future
- Install 2 vertical upright posts 600mm apart. This structure is used to fix fire-retardant board and inverter to.
- The site electrical contractor shall provide cabling as specified by the PV supplier, from the consumer via a (local) loop and then to the loft space near the loft hatch. Cables to be clipped up from the ceiling plasterboard to prevent it being lost or buried by the rockwool insulation.
- The supply cable shall be selected and erected to comply with the latest requirements of BS 7671
- The PV system shall be installed on its own dedicated circuit where no other current using equipment is permitted
- Consumer Unit – leave approximately 300mm inside the consumer unit, unterminated for the PV supplier to connect
- The local loop needs to project out 300mm so PV electricians can install the AC isolator and Generation Meter
- In the loft space, leave approximately 2000mm of cable near the loft hatch and clipped at least 300mm above the insulation
- A shielded 4 pair CAT5/6 cable from the inverter location to the DNO service head / cut out fuse may be required, installed by the site electrical contractor



Technical Aspects - Consumer Unit & Protective Device

- Site to provide a high integrity consumer unit or similar fitted with a 16A type A RCBO ready for the PV Supplier second fix. The installation of a high integrity consumer unit complies with BS 7161 Amendment 2 March 2022 (32 & 531.3.2) and the MCS/ECA guidance (2.3.1). Regulations state that every installation shall be divide circuits to reduce the risk of unwanted tripping and to minimise any inconvenience.
- RCBO Type AC shall not be used where a load current contains DC components (531.3.3) i.e. Solar PV, EV charging.
- A high integrity consumer unit will also future proof the installation should an EV charge point be required.



Technical Aspects – Post Commissioning

Once a plot has been commissioned, PV supplier should supply the nominated contact at Bellway with the following plot level information;

- MCS Certificate
- User Manual
- Installation Detail Sheet
- G98 Commissioning Certificate
- PV supplier to notify the DNO of plot commissioning within 28 days from connection