RETROFIT HOW-TO GUIDES

THREE

How to retrofit Solar Panels

March 2024

ZERO CARBON 2040
Westminster Climate Action

City of Westminster

Contents

Introduction

Solar panels use the energy of the sun to generate both hot water or electricity.

Installing solar panels can save money on your energy bills and reduce your carbon footprint, and will help us on our journey towards a net zero future.

This guide provides an overview of how solar panels work, their potential benefits and practical considerations to help you decide if solar panels are right for your home. It also provides information on where to install panels without the need for planning permission and where permission is required, sets out how to make a successful planning application. With this information, you can confidently explore the benefits of solar energy and make an informed decision that is right for you and your household.

Solar Panels at a glance[1]

Solar thermal panels

What is it?

Solar thermal panels generate hot water for heating and taps.

Cost £ £[2]

Average cost to purchase and install a solar thermal system for a 4 person household is between £3,000 to £8,000.

How effective is it?

Can typically produce up to 3,000 kWh of energy per year (see energy metrics at a glance). This can meet c. 60% of annual hot water demand for a household of 4 people.

Consents required

- Planning permission not normally required - subject to certain conditions.
- If you live in a listed building, listed building consent is required.
- Check the rules at Section 5.

Issues to consider

- 35-degree angle panel installation produces more energy per year
- South, Southeast, and Southwest orientations best for maximum energy production.
- Efficient panels require less space but are more expensive.

The Energy Savings Trust website can provide you with an initial figure in terms of savings that the installation of photovoltaics panels might achieve for your property. You can use their **Home Renewables Selector** to decide which technologies are best for your home.

1 The data presented in this table should be considered a rough estimate and reflects the information accessible at the time of writing. For precise and reliable figures and calculations, it is recommended you engage a certified expert in the field

2 The cost of solar panels may be subject to fluctuations due to various factors, such as materials availability and logistical issues.

Solar Panels at a glance[1]

Photovoltaic Panels

What is it?

Photovoltaic panels generate electricity for the home.

Cost £[2]

Average cost of solar panel system (including installation) is around £4,000-£6,000.

How effective is it?

A 3-4 kWp system would produce circa 3,400-4,200 kWh and would require between 24-32 m2. In London, a 1 kWp system can produce around 950 kWh of electricity per year.

Consents required

- Planning permission not normally required - subject to certain conditions.
- If you live in a listed building, listed building consent is required.
- Check the rules at Section 5.

Issues to consider

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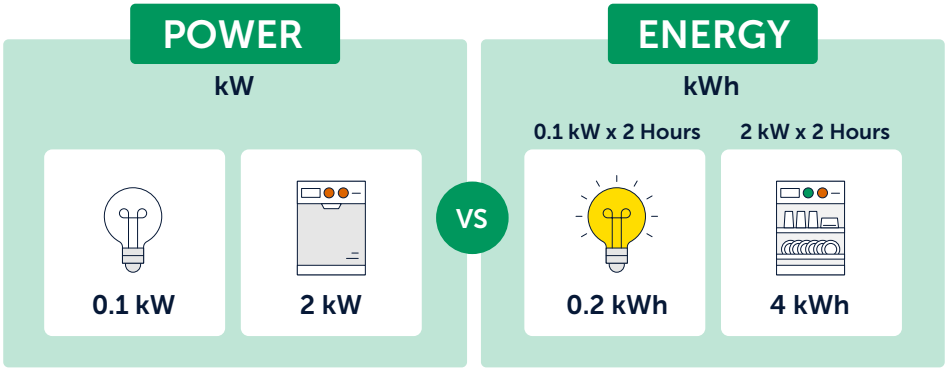
Energy metrics at a glance

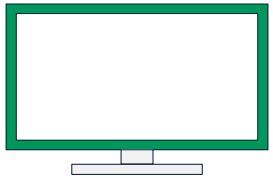
A Watt is a unit that measures the amount of power an electrical device or system produces or uses at any given moment.

A kilowatt-hour, on the other hand, measures the total amount of energy used or produced over time. For example, if you have a 100-Watt light bulb that is turned on for 10 hours, it will use 1,000 Watt-hours (or 1 kilowatt-hour) of energy. In summary, Watts describe power usage or production at any given moment, while kilowatt-hours describe the total amount of energy used or produced over time.

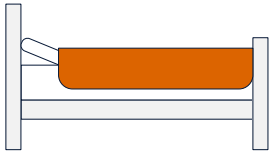
kW vs kWh



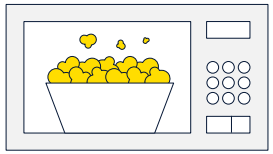
With 1kWh of Electricity you can



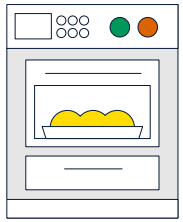
Binge-watch your favourite show for
33 hours and **20 minutes**
on a 30-Watt LED TV



Stay warm and cozy for
5 hours with a **200-Watt**
electric blanket



Make 30 bags of popcorn in
1 hour with a
1000-Watt microwave

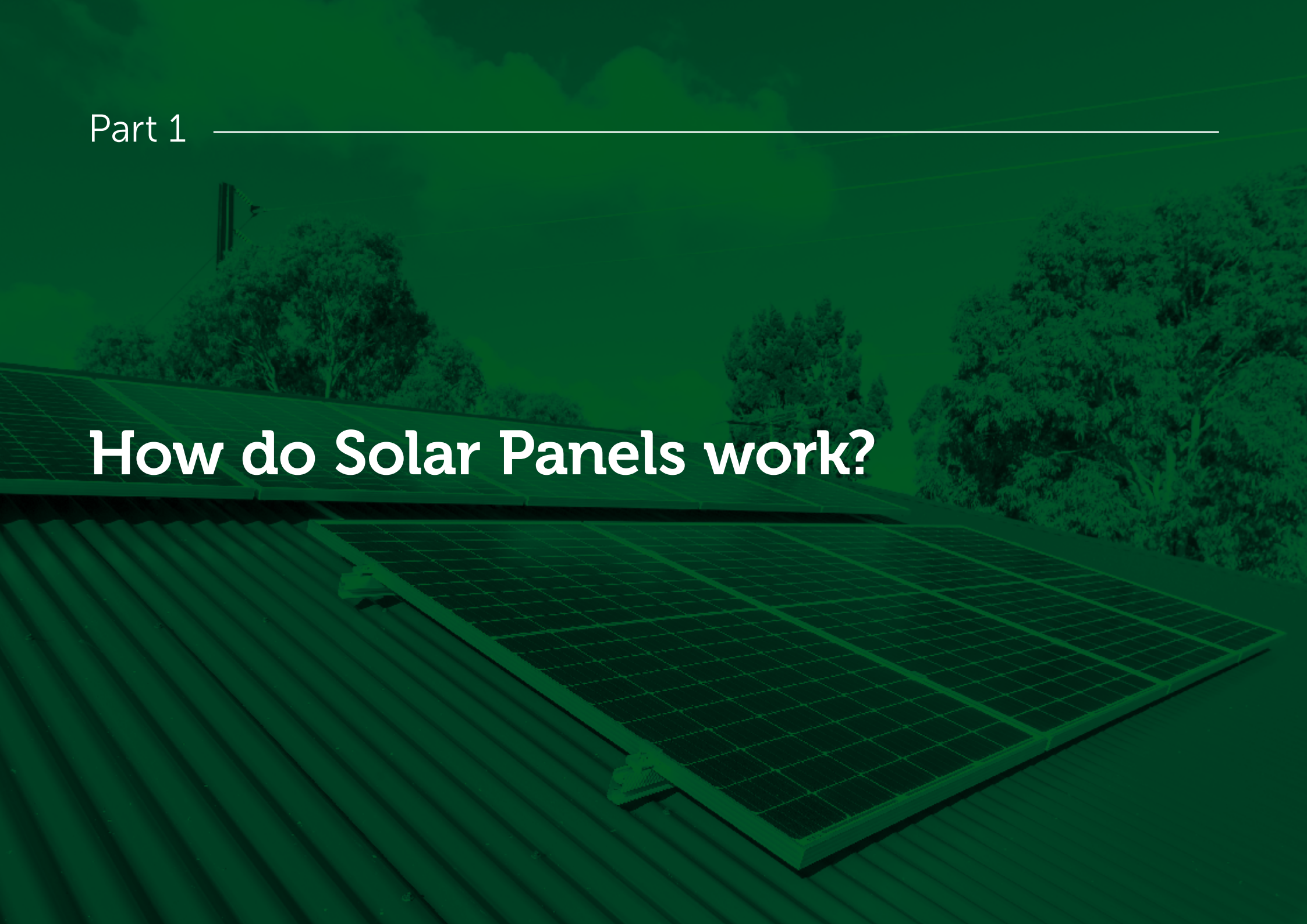


Roast a delicious sheet-pan dinner in
30 minutes with a
2000-Watt oven

Enjoy cool air for
12 minutes with a **5000-Watt**
air conditioner

Part 1

How do Solar Panels work?



What is the difference between a solar thermal panel and photovoltaics?

While both solar thermal and photovoltaic panels use solar radiation to produce energy, it is important to distinguish between these two technologies and their differences.

Solar thermal panels, also known as solar thermal collectors, are designed to absorb sunlight and convert it into heat. Photovoltaics convert sunlight directly into electricity. The following table illustrates the characteristics and differences between the two types of solar panels:

Feature	Solar thermal	Photovoltaic
What it produces	Hot water	Electricity
Made from	Metals like Copper and Glass	Silicon, Glass, Metals
Cost to start	Medium	Medium to High
How well it works (a.k.a Efficiency*)	Very Good (about 80% effective)	Good (about 17-22% effective)

*defined as the amount of sun energy converted in useful energy.

Solar Thermal Panels

Photovoltaic Panels

How do they work?

Brief explanation

These types of low and zero carbon technologies produce renewable energy in the form of heat (solar thermal) and electricity (photovoltaic).

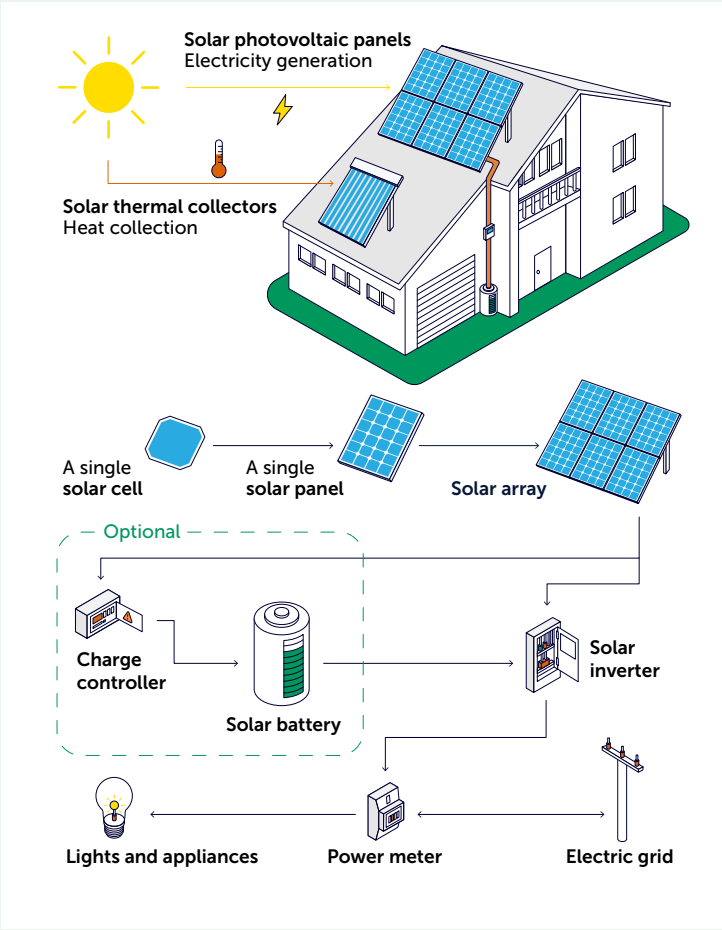
Energy generated at home can be used to provide hot water and to power electrical appliances and vehicles reducing the amount of gas and electricity drawn from the grid, lowering bills and carbon emissions. Energy produced and used locally is only partially affected by transmission losses which normally occurs when energy is transported across long distances. Click the buttons opposite to see the diagrams which illustrate how the different systems work. For more detail read the technical information in the appendices.

How do they work?

Photovoltaic Panels

Photovoltaic Panels

1. Solar Energy is captured by the photovoltaics panels (array) and it is converted into direct current (DC).
2. Direct Current is converted into Alternate Current by the Inverter and used to meet the electrical loads of the dwellings (e.g. heat pumps, lighting, dishwasher, washing machine, computer and appliances).
3. If the system is provided with a battery, the solar energy can be stored and used at a later stage.
4. If more generated than required, the electricity can be sold to the National Grid.

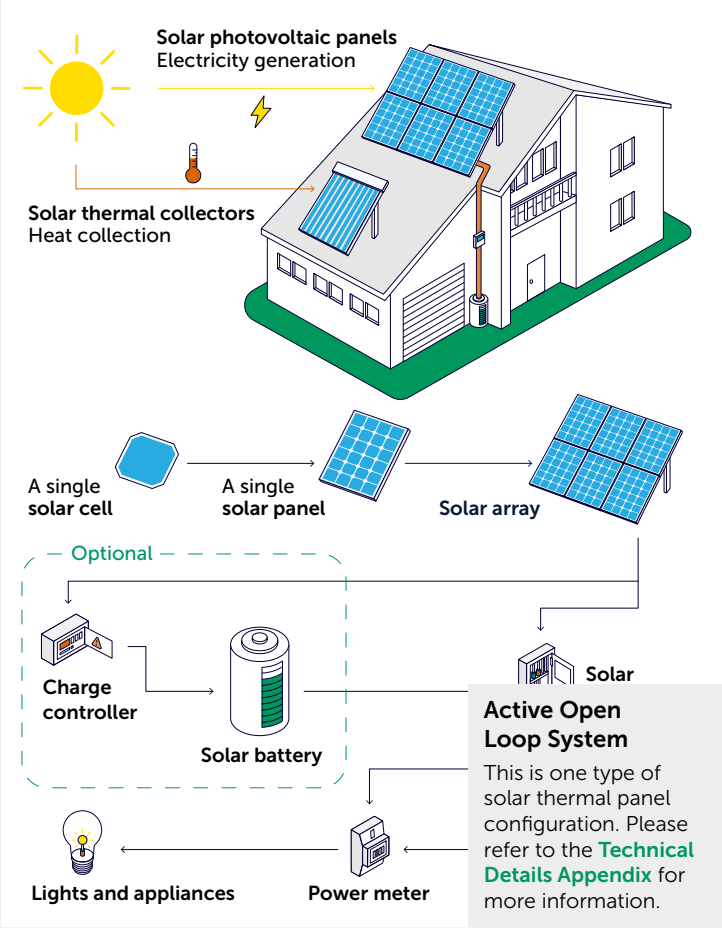


How do they work?

Solar thermal panels

Solar thermal panels

1. Solar Energy is captured by the solar thermal panels and the working fluid (a mixture of anti-freeze and water).
2. The working fluid is then directed (through gravity or a pump) to the water cylinder where it exchanges the solar energy captured with mains cold water to heat it up.
3. The working fluid is re-directed to the solar panels to restart the cycle and hot water is stored into the cylinder to be used when needed.



Active Open Loop System

This is one type of solar thermal panel configuration. Please refer to the **Technical Details Appendix** for more information.

How effective are solar thermal panels and PV systems?

In London, the efficiency of solar thermal panels can be high, often around 70-80%, because they are designed to capture both direct and diffuse solar radiation, which is beneficial given the UK's often overcast conditions.

However, this can vary depending on the season, the specific technology used, such as flat-plate collectors or evacuated tubes, and the integration with the building's heating system (you can find out more in the Appendix – Technical Details).

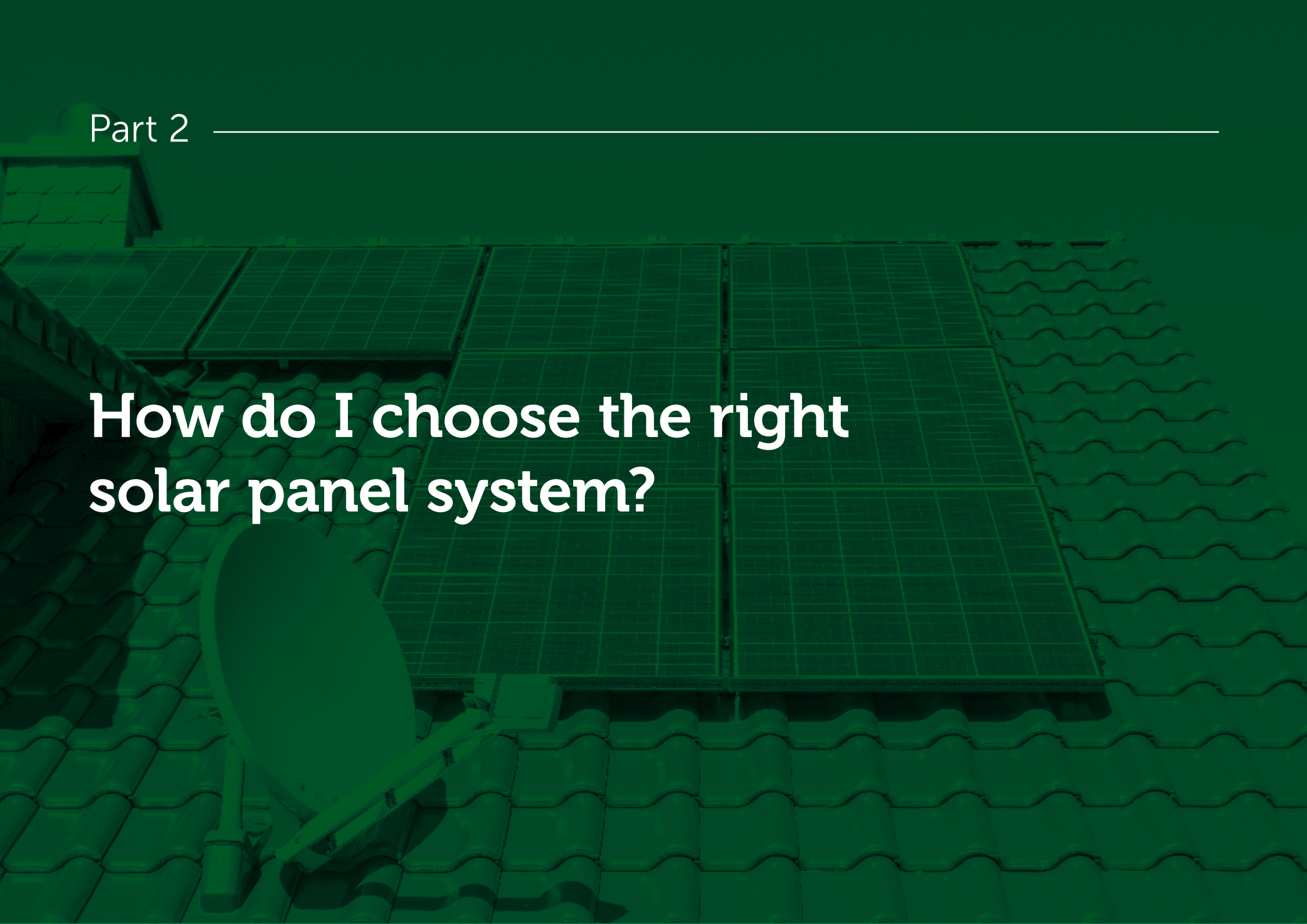
The efficiency of PV panels is generally lower than that of solar thermal technology, with most commercial systems having efficiencies between 15-20%. However, advances in technology are steadily improving these figures, with some high-efficiency modules exceeding 22%. The efficiency of PV panels can be affected by factors such as cloud cover, day length, and the angle of the panels, which ideally should be optimized to match the latitude to maximize the solar irradiance they receive throughout the year (refer to the Appendix – Technical Details for more information).

A 3-4 kWp system would produce circa 3,400-4,200 kWh of electricity per year and would require between 24-32 m2. In London, the latest estimates, show that

Mid terraces and flats use the least electricity, both around 2,800kWh per year. End terraces use slightly more, with semi-detached homes next, followed by bungalows and detached houses at 4,153kWh per year.

In London, a 1 kWp system can produce around 950 kWh of electricity per year.

Part 2



How do I choose the right solar panel system?

This section sets out some practical and technical issues to consider in assessing whether your property is suitable for solar panels and which type to choose.

Is my property suitable for solar panels?

Solar panels are typically installed on roofs (both flat and pitched), but can also be positioned vertically on buildings. For flat roofs they are mounted on frames and angled.

They will work best if you locate them in an unshaded area facing south, southwest, or southeast, with a slope close to 35 degrees from horizontal, if possible. This will result in higher energy output for both solar thermal and photovoltaic systems. Although freestanding panels mounted on the ground are less common in areas like Westminster, this is also a viable option if you have the space.

The roof orientation can affect the system's output. This table shows that areas in green achieve the best performance (100% or close to it).

Orientation from North							
	W			S			E
Tilt	**270°**	**240°**	**210°**	**180°**	**150°**	**120°**	**90°**
0°	84	84	84	84	84	84	84
10°	84	87	90	91	90	87	84
20°	82	89	94	96	94	89	82
30°	81	90	97	100	97	90	81
40°	78	89	97	100	97	89	78
50°	74	87	95	98	95	87	74
60°	69	82	92	95	92	82	69
70°	64	77	86	89	86	77	64
80°	57	69	78	81	78	69	57
90°	50	61	68	71	68	61	50

The map opposite provides an overview of where solar panels will work best in Westminster. This can help you to figure out the best places to set up solar panels to produce clean energy.

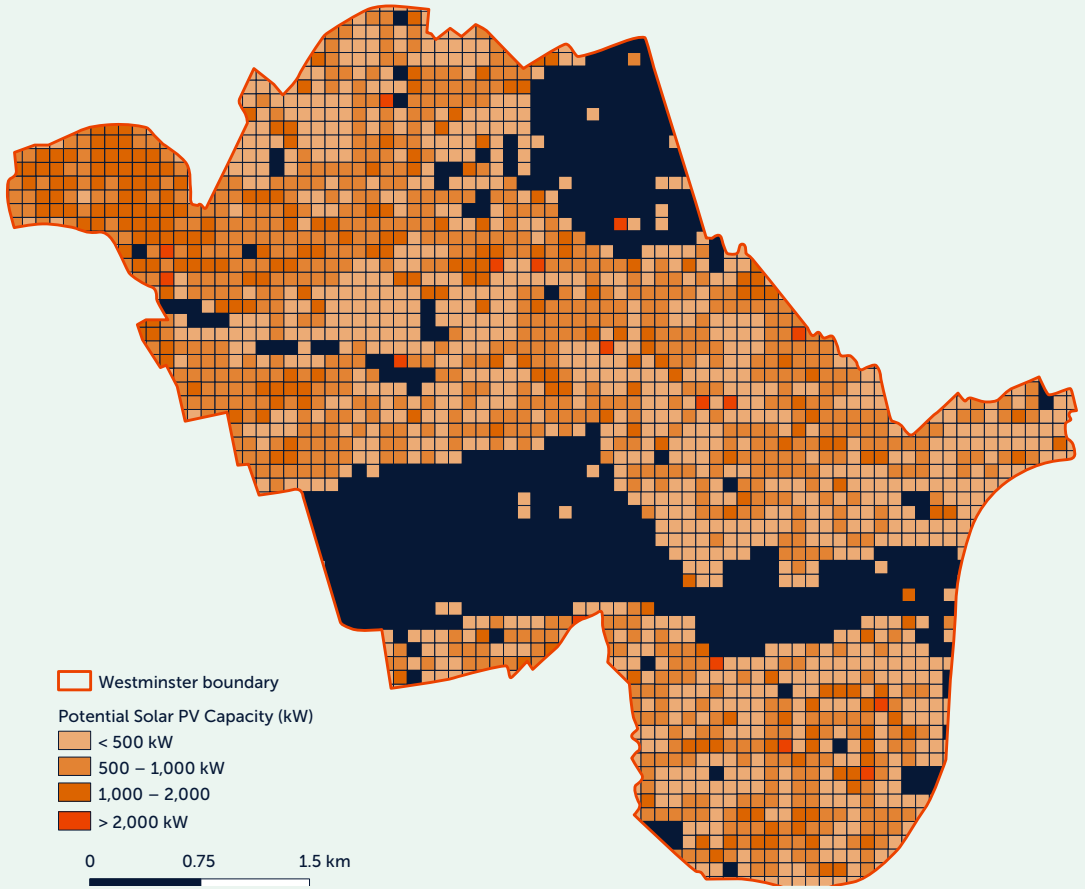
You can also use the London Solar Opportunity Map developed by the Greater London Authority to help you identify the solar potential of your home.

Enter your address or postcode, to access detailed information about the solar potential of your rooftop, including the estimated energy output, the size and orientation of the roof, and the suitability for solar panel installation.

Click the button below to access the London Solar Opportunity Map.

London Solar Opportunity Map

Solar PV Capacity Map



How do I decide which type of solar panel system is right for my property?

When deciding which size and type of solar panel system is most suitable for your property, you need to consider the available space, and your energy goals, the costs and appearance.

Assess your monthly energy usage, which can be found on your utility bills, to understand your typical consumption. If your primary need is to cut down on gas bills and your household consumes a lot of hot water, solar thermal panels could be the answer. They can use sunlight to heat your water directly and can be more cost-effective upfront. Solar thermal systems can contribute around 50-60% of the annual domestic hot water heating energy requirements, meaning that they can provide about half of the energy needed to heat water.

If your electricity bills are high and you're looking to reduce those then PV panels might be the ideal choice. It should also be noted that with some adaptation, PV panels can produce hot water too, but this typically involves using excess electricity to heat water, which can be less efficient than direct solar thermal systems. Budget constraints and the potential for future changes in energy use (such as the installation of Electric Vehicle chargers) should be factored into your decision. If scaffolding is required for installation, the costs could be considerably higher.

When choosing a supplier, we encourage the selection of solar panels from companies that offer take-back programs for recycling at the end of their lifecycle and also prioritise the design of panels for easier disassembly. This ensures that the panels contribute minimally to waste, as their components can be efficiently reused or recycled. Opting for this type of product supports environmental sustainability by encouraging the industry to adopt practices that reduce waste and enhance the recyclability of materials.

What should I consider when choosing solar thermal systems?

There are two main types of solar thermal panels in the U.K – Flat plate collectors and Evacuated tubes. Evacuated tube solar thermal systems are more visible than flat-plate panels but do require less space. You can find more on the pros and cons of these in the **Technical appendices**.

The initial costs of solar thermal systems can vary. For example, plumbing costs may be higher if your home has a complicated or outdated water system. The size of the system required, which includes the number of collectors and water cylinder capacity, depends on the hot water demand. As a rule of thumb, 1m^2 of solar system is needed for each occupant. Solar thermal collectors are typically 2-3m^2 in size, so an average 3–4-bedroom house will require 2 collectors. As the average person uses around 50 litres of hot water each day, a typical 4-bedroom house will require a 200-litre tank. The hot water cylinder will need to be compatible with a solar system design.

What should I consider when choosing Photovoltaic Panel Systems?

The selection of photovoltaic panels, like solar thermal panels, depends on several factors such as the available area for installation, the amount of energy required, costs, and appearance. However, the desired electrical output is also an important consideration for photovoltaic panels. It's worth noting that inclination and orientation can have a significant impact on the energy output of a photovoltaic system.

As a general rule of thumb, 1 **kWp** of photovoltaic panels requires 6-8 m2 of space. The more efficient the panel, the less area it will require to produce the same output. In London, a 1 kWp system typically yields around 950 kWh per year. According to the Energy Saving Trust, the average three-bedroom home in the UK uses just over 3,000 kWh per year, which suggests that a 4 kWp photovoltaic system could meet this requirement.

It's important to note that the Energy Saving Trust's estimate is only an average, and the actual energy usage of a home can vary based on several factors such as the number of occupants, the type of appliances used, and the level of insulation in the home.

The following table summarise the key points listed above:

Type	Monocrystalline	Polycrystalline	Thin-film amorphous	Solar tiles
Efficiency	High (18%-22%)	Medium (14%-18%)	Low (6%-8%)	Varies (10%-20%+)
Space needed per kWp	6/8m^2	8/10m^2	10/12m^2	Depends on efficiency
Performance in Sunlight	Better yield in direct sunlight	Constant yield even in diffuse light	Constant yield even in diffuse light	Generally lower yield
Cost range per kWp	£1,750 - £2,500/kWp	£1,500 - £2,250/kWp	£1,000 - £1,750/kWp	£2,500 - £5,000/kWp
What they look like				

More information about the different type of PV panels can be found in the **Appendix – Technical Details**.

How do materials and roof structure affect Solar Panel installation?

The existing roof structure and materials affect the suitability and installation methods for retrofitting solar panels. Different roof types have distinct characteristics that affect their compatibility with solar installations, as set out below:

Roof material type	Suitability	Installation method
Metal Roof	Suitable	Metal seams can be used to anchor the panels without drilling.
Clay & Concrete Tile	Suitable	Installation on clay tiles is more expensive than on concrete tiles; a supporting structure is required.
Composite Roofing / Asphalt	Suitable	Typically flat, allowing for a ballast system with no roof penetration.
Slate	Suitable	Avoid drilling through slate tiles due to their brittleness. Use roof anchors to fix to the rafters beneath as per **Historic England (HE)** advice.
Wood / Shingles	Not suitable	Discouraged due to fire safety concerns.
Transparent PV Panels (for Glazing and Pergolas)	Suitable	Can be integrated into glass surfaces or pergola structures; requires careful planning for optimal energy production and aesthetic integration.
Biosolar	Suitable	Combines green roofing with solar panels; requires a supportive structure that can bear the weight of vegetation and solar equipment, and adequate water management systems.

The roof's structural capacity is also crucial; it must be able to support the weight of the solar panels. Additionally, local climate and solar insolation (the amount of solar energy received over a given area) will influence the efficiency and size of the system needed.

What Factors Affect the Efficiency and Quality of Solar Panels?

When selecting a solar panel, it is essential to recognise that its efficiency – the measure of how effectively it converts sunlight into electricity – is not the sole indicator of its quality. Things like what it's made of, how it's made, and the technology behind it also matter. It's best to consider all these things, not just efficiency. For more comprehensive guidance and specific advice, please refer to the technical appendices.

What might the installation of solar panels involve?

Firstly, when considering the installation of solar panels, it is crucial to address the ownership of the roof. If the roof is under shared ownership or owned by a freeholder, you will need to secure their agreement. This includes discussions around ownership rights, funding options, and obtaining the necessary permissions (See **Section 5** for more information on permissions).

For the most common installations in Westminster, typically work begins with preparing the location and access to it if needed (scaffolding). Any necessary roof repairs or reinforcements must be addressed to support the new system and subsequently, the mounting system is installed and the solar panels are fixed to this. After these steps, electrical components are installed, connecting the solar panels to an inverter, and integrating the system with your home's existing electrical panel. Upon completion, the system is tested to verify proper operation and grid integration.

The duration of the installation process can vary significantly. It is influenced by the complexity of the project, the size of the solar array, the condition of the existing roof, and the scheduling of necessary inspections. Scaffolding can be expensive and may require a license, so if you are planning other works to your property which require a scaffold, this is good time to consider solar panels.

Read about getting your job done safely **here**.

Part 3

Will I need permission to retrofit solar panels?

Do I need planning permission?

In many circumstances installing solar panels (both solar PV and solar thermal) is what is known as 'permitted development'[3].

This means you do not need to apply for planning permission if you meet conditions set out on the next pages. There are however circumstances where you would need to apply for planning permission. If you are proposing to attach solar panels to a flat or house, please follow the **chart on the next page** to see if you need to make an application.

Whether or not planning permission is required you should ensure that you have the permission of the freeholder or check that permission from the freeholder is not required.

3 Permitted development rights are regularly reviewed and may be subject to change. This guide will be updated accordingly.

For solar panels fixed to a building

Use our online map to check if your building is **listed** or in a **conservation area**.

Conditions

Remember that even if you do not need planning permission, for work to be permitted development you also need to comply with the following conditions:

- Solar PV or solar thermal equipment must so far as practicable, be sited so as to minimise its effect on the external appearance of the building and on the amenity of the area see advice on siting and design in Part 4 for how to achieve this); and
- Solar PV or solar thermal equipment must be removed as soon as reasonably practicable when it is no longer needed.
- For solar panels on a flat roof in a conservation area you must still apply for prior approval. See our **website** for how to apply.

Do I need planning permission?

Is the property in the grounds of a listed building (a curtilage structure)?
- Yes → Yes you will need planning permission. See **part 5** for how to apply.
- No ↓

Is it in a conservation area and on a wall that fronts the highway?
- Yes → Yes you will need planning permission. See **part 5** for how to apply.
- No ↓

Will any part of the panel protrude more than 60cm from a flat roof?
- Yes → Yes you will need planning permission. See **part 5** for how to apply.
- No ↓

Will any part of the panel protrude more than 20cm from a wall or a pitched roof slope?
- Yes → Yes you will need planning permission. See **part 5** for how to apply.
- No ↓

Will any part of the proposed solar panel(s) protrude higher than the highest part of the roof (this excludes the chimney)?
- Yes → Yes you will need planning permission. See **part 5** for how to apply.
- No → Planning permission not needed – conditions opposite apply.

If you are in a listed building or in the grounds of a listed building you will need an application for listed building consent.

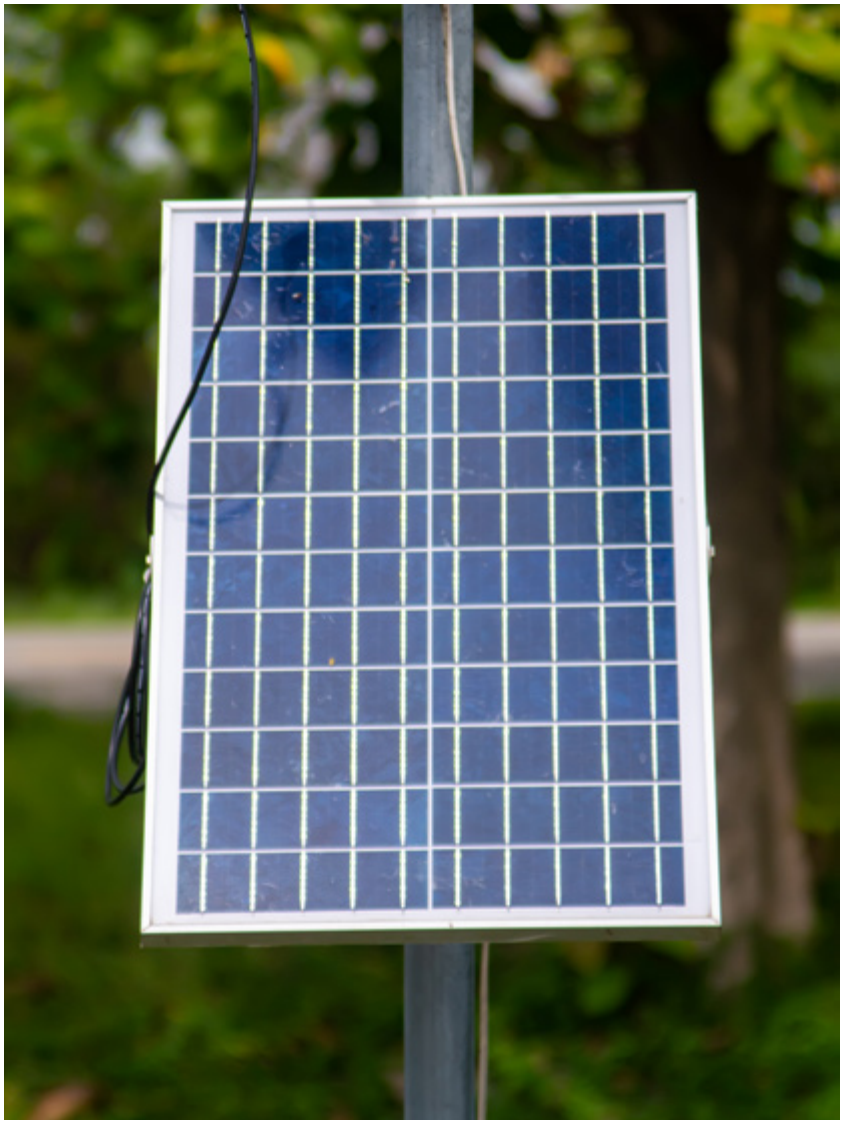
For a stand-alone solar panel on domestic premises, not fixed to a building.

You need only apply for planning permission when any of the following apply:

- more than one stand-alone solar panel would be installed.
- it would exceed 4 metres in height.
- it would be located 5 metres within the boundary of the property.
- it would be installed within the curtilage of a **listed building**, curtilage refers to the garden or grounds.
- it would be located in a **conservation area**, and any part of the solar installation would exceed 2m in height and be closer to a highway than any part of the property, this includes roads, patch and public rights of way.*
- the surface area of any stand-alone solar panel will exceed 9 square metres or 3m wide by 3m deep.

Even if you don't need planning permission, for stand-alone panels you will also need to ensure panels are sited to minimise effect on the amenity of the area (see advice in **Part 4**); and removed when no longer needed.

*Where the stand-alone solar equipment is within the grounds of a building in a conservation area and nearer to the highway than the building, before work commences you must apply to establish whether prior approval is required.



Can I get advice before I submit a planning application?

Yes, you can apply for pre-planning application advice. This is a paid for service. However, we offer a discounted pre-application advice fee for householder environmental performance improvements.

You can apply on our website.

Request pre-application planning advice

See **Part 5** for advice on how to make your application.

Can I get written confirmation that I do not need planning permission and/or listed building consent?

You can apply for a **Certificate of Lawfulness** to prove that you do not need to make a planning application. In the case of listed buildings, you can apply for a Certificate of Lawfulness for Proposed Works to a Listed Building – this certificate has to be applied for and obtained before the works take place.

More information about the costs associated to the Certificate of Lawfulness can be found **here**.

Will I need Building regulations approval?

If you're planning to install a solar panel on your roof, the rules set out in building regulations will apply. The key areas are structural safety of a building (Part A) and electrical safety of a building (Part P).

The strength of the existing roof will need assessing to ensure it can carry the weight of the panel. You may need to do some work to strengthen the roof. Additionally, compliance with building regulations extends to other elements including the electrical setup.

As for any other electrical equipment, it should be installed by the qualified professionals who adhere to all necessary fire safety regulations and guidelines during the installation process.

Key considerations include, but are not limited to:

- Ensuring the roofing materials are suitable for the addition of a Solar Panel;
- Ensuring Installation does not compromise the structural integrity of the building;
- Provide easy access for the fire brigade.

You should use an installer who can provide the necessary advice and who can self-certify their work by being a member of the relevant **Competent Person Scheme**[4]. Should you not have that certification you will need to make a Building Control Application. You can see advice on the **building control** pages on our website.

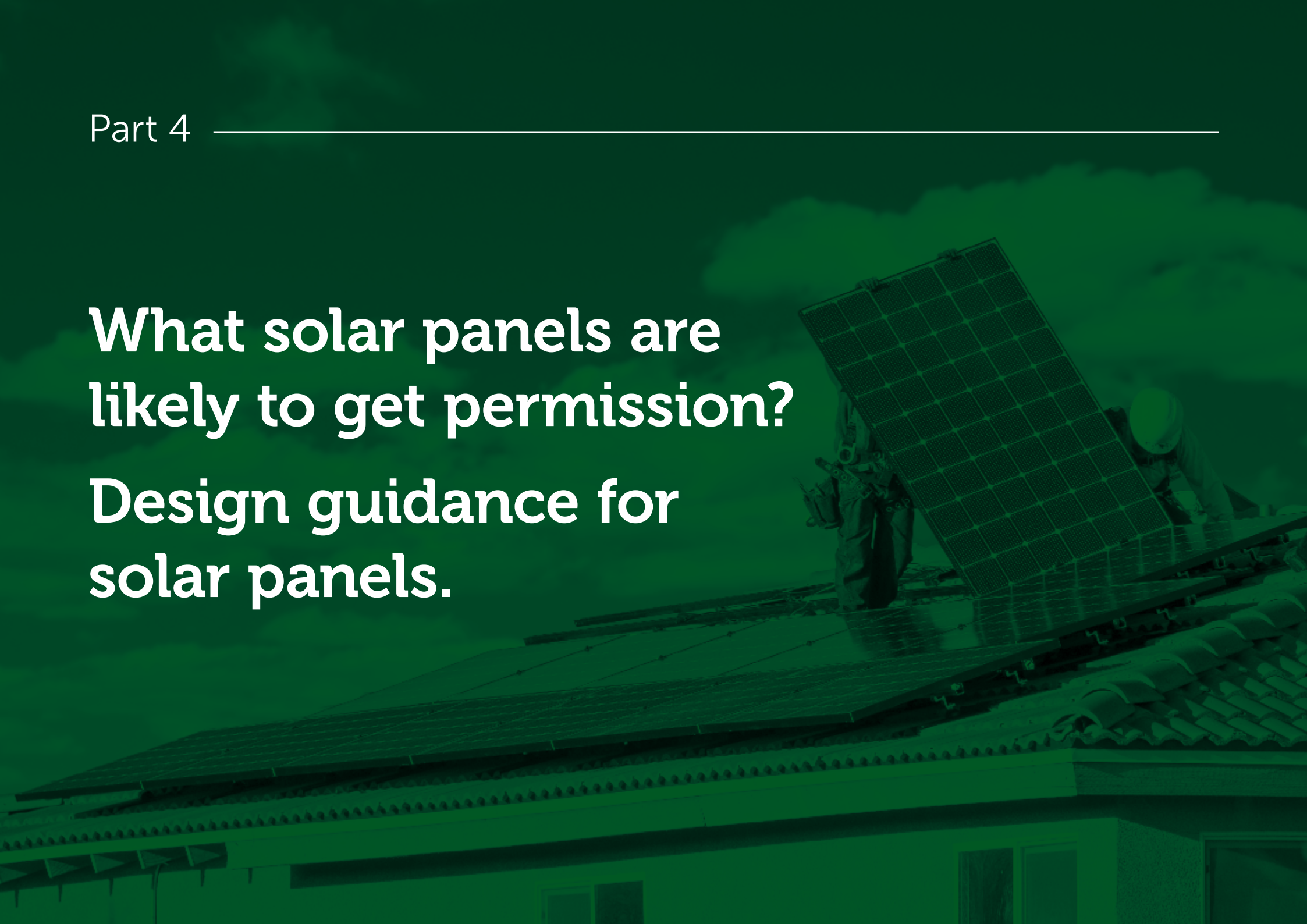
Building Regulations

4 **Building regulations approval:** Use a competent person scheme - GOV.UK (www.gov.uk)

Part 4

What solar panels are likely to get permission?

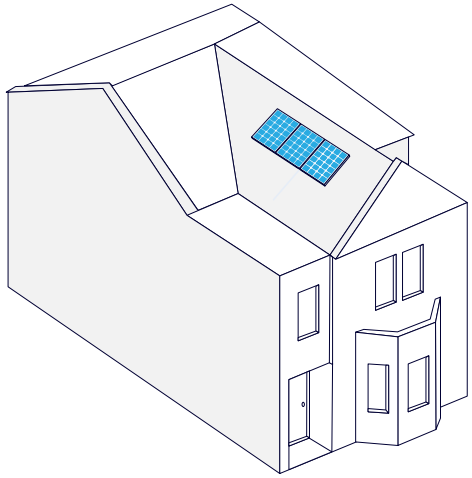
Design guidance for solar panels.



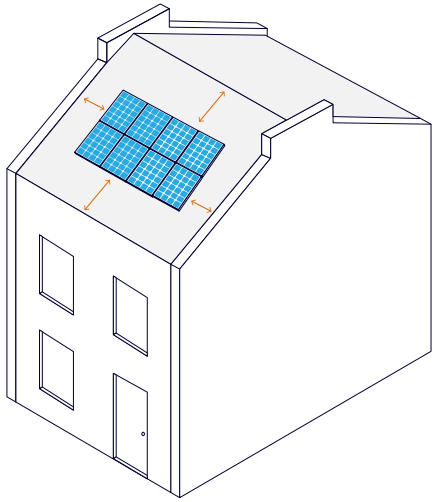
This section provides advice on siting and design issues to consider if you are installing a solar panel system, and what is likely to get permission.

How can solar panels be designed and located to reduce their impact on the street and your neighbours?

Of suitable locations identified, you should choose the most discreet location. Visual impact will be most significant when panels positioned on pitched roofs slopes visible from public locations. Wherever possible, place panels on rear roof slopes, behind parapets, on concealed valley roofs or set back on flat roofed areas.



Where possible locate panels on rear or valley roofs.

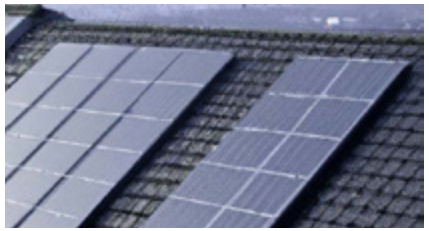


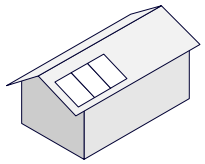
Group panels where possible and follow design guidance on the next page.

All cabling associated with the solar panels should ideally be routed internally but if externally routed then should run to the rear of the property.

You can also reduce the impact on the street scene through detailed design, positioning and colour of panels. Consider these design tips to integrate the solar panels system as seamlessly as possible with the existing roof design:

- Ensure panels are sited for optimum efficiency and aligned with roof pitch (planarity).
- Ensure the panels are installed within the roof boundaries and retain even distances to the roof margins (respect roof ridge lines and edges).
- Ensure panels are spaced evenly and cluster together to create uniform shapes (shape and grouping).
- Select colours based on the existing building characteristics and to complement the appearance of the original roof covering where possible. Careful selection and design of the colour, framing and size, can reduce the visual impact.
- Consider the use of solar roof tiles where appropriate (limited or irregular roof space, roof being replaced).
- In some circumstances, to reduce visibility it may be possible for panels to be mounted at lower pitch angles or concealed behind features such as chimneys, where this does not create shading issues.
- Consider use of a green roof which is compatible with solar PV.





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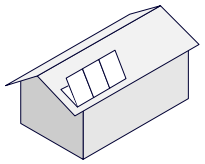

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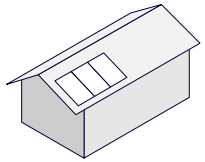
In Line with Roof Slope



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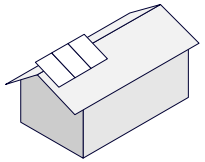

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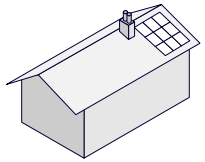
Respect roof ridge lines and edges



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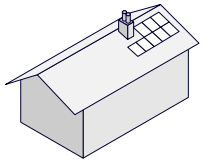

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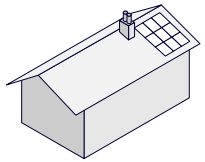
Shape



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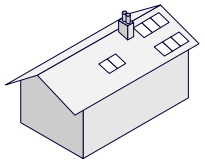

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Grouping

How to protect your neighbour's amenity and address glare concerns

When designing and installing solar panel systems, it is important to consider the impact on your neighbours and minimise the impacts of glare and you should discuss the position and siting of the panel with your neighbour. You can minimise glare impacts by adjusting the siting, panel orientation and tilt, using anti-reflective coatings, incorporating screening and landscaping measures, and utilising non-reflective framing and mounting materials.

How to design for maintenance

You should also consider access for maintenance when designing solar panels, ensuring the system can be maintained efficiently and safely throughout its lifespan. Railings and other safety features may be needed for safety; but can be designed to minimise visual impact by considering:

- Retractable railings or collapsible railings: can be installed and easily retracted or folded down when not in use.
- Low-profile railings: may include slim, minimalist railings or even cable-based systems that are less noticeable from a distance.
- Temporary railings: can be installed only during maintenance activities and removed once the work is completed. Any associated cabling or fixtures should be positioned and designed to minimise visibility as well.

I live in a conservation area. How can I ensure my solar panel installation preserves or enhances the character of the local area?

On unlisted buildings in conservation areas, the installation of photovltaic and thermal panels is supported but where located on the front of the building, you may need planning permission and you should ensure these are sensitively designed and sited in keeping with the character of the local area, following the tips on design set out above.

Careful selection and design of the colour, contrast, framing, size, and symmetry of panels can reduce their visual impact and in highly visible or sensitive locations, you could consider customized design solutions tailored to the specific needs of the building, selecting solar panels that match the color, texture, or shape of existing roof materials. Where no historic fabric is affected, you could opt for 'Building-Integrated Photovoltaics' BIPV solutions – these can include solar roof tiles, solar window glass, or facade-integrated photovoltaics that blend seamlessly with traditional building materials.

What do I need to consider on Listed Buildings?

On listed buildings, solar panels are supported where they are sensitively sited and designed, in a way that will protect the special architectural and historic interest of the building, including any historic or characteristic roofscapes. In addition to taking into account the impact on the appearance of the building, following advice set out above, you should consider the potential for work to cause damage to or loss of historic fabric for example original roof slates or tiles.

Where significant or original roof fabric remains, the best solution may be for panels to be fixed over the existing roof covering, to sit above the existing tiles or slates. Recessed panels should be avoided where this will result in the loss of historic or significant roof coverings.

Fixings should not damage significant historic fabric and you should also consider the weight of solar panels and an assessment of the roof structure by a structural engineer may be required.

As works to listed buildings can be more complicated, and consent will almost always be needed, we strongly recommend you **seek pre-application advice** before submitting your application.

We will work with you to help you find the most suitable locations for solar panels.

We offer a discounted advice service for homeowners who wish to install solar panels on listed buildings.

For further advice on solar panels in listed and historic buildings, you can read **Historic England's Guidance** – Energy Efficiency and Historic Buildings: Solar Electric (Photovoltaics)

Part 5

How do I make an application to retrofit solar panels?

You can apply online via the **national planning portal website**.
You can find advice on our website on **'making a planning application'**.

What does my application need to include?

You will need drawings and information to explain the location, design and appearance of the solar panels.

Your application should include the following:

Completed application form	Signed and dated. Make sure you complete the ownership certificate at the end of the form. For most people this is likely to mean completing either Certificate A – where you own all the property affected; or Certificate B where there are other interested parties e.g., where you are a flat owner/occupier in a larger building.
A location and site plan	This is to clearly identify the building affected. Your location plan needs to be a scaled plan of the site at 1:1250 or 1:2500 scale, which outlines in red the boundary of the application site. You can read this national guide on **how to prepare a site plan** and you can **buy a plan online**.
Elevations, plans and section drawings	These will be scaled drawings which show what the building looks like from the outside. Only those roof plans and elevations showing the location of panels need to be included. You should also provide plans and sections showing any associated equipment, fixings, wires and pipes, including details of internal works for listed buildings.
FEE	Listed Building Consent has no fee. See the fee schedule on our website - **Fees** for Householder and full planning permission application. A full application applies if you live in a flat/apartment. For example, if you live in a mansion block.
For applications located within a conservation area or a listed building	
A Design and Access and/ or Heritage Statement	This is to explain your reasoning for the choice of installation, its position, the energy benefits it delivers and how it will impact on the heritage significance of the building. Both a Design and Access and Heritage Statement are required for listed buildings, but this can be one document. There is guidance and a template you can use on our website, see **heritage statements and heritage statement template**.

If your application includes other works, for example if you are also building an extension, other documents may be required, and you should check the guidance on our website. To find out more about information needed with your application, you can review the information on **validation requirements** as this explains what documents you have to include.

How long does it take to get permission and/or consent?

For both planning applications and listed building consent for retrofit measures, decisions are usually completed within 8 weeks from the date of validation (this is the date we confirm all the required information has been submitted).

Can I get any planning advice before I submit my application?

To find out whether your proposal is likely to be accepted, you can also **apply for pre-planning application advice**. We now offer a **discounted pre-application advice fee** for householder environmental performance improvements, including solar panels.

Part 6

Where can I find out more information?

Planning Portal Advice on Greener Homes

www.planningportal.co.uk/info/200140/greener_homes

Energy Saving Trust Advice

Energy advice for your home - Energy Saving Trust

Historic England Advice

Energy Efficiency and Historic Buildings: Solar Electric (Photovoltaics) | Historic England

Advice on Grants

Visit our Home Energy Saving webpages for the most up to date information on grants and support schemes.

www.westminster.gov.uk/home-energy-savings

Microgeneration Certification Scheme – (MCS)

Find a registered contractor to install your solar panels.

mcscertified.com

Feedback

We will continue to add to and improve this document to make it as useful as possible for you. If you have any feedback, please send this to planningreception@westminster.gov.uk

Appendix – technical details

Solar Thermal

Solar thermal systems can be used to produce hot water for both domestic and space heating purposes. However, this guide focuses on the production of domestic hot water, which is the most common use for solar thermal systems in the UK due to its weather conditions.

A typical solar thermal panel system for domestic hot water production and storage includes the following components:

- Solar panels (also known as collectors)
- Circulation pump (for mechanical circulation systems only)
- Water storage system (usually a cylinder)
- Back-up heat source (such as a direct electric immersion heater)

These components work together to collect and store solar energy, which can then be used to heat water for household use.

Such a system is based on the principle that the solar panel surface absorbs solar energy and transfers it to cold water stored in a cylinder. The medium used to capture the sun's energy (called thermal fluid) can be water (direct exchange) or a mixture of water and anti-freeze (indirect exchange). In this case, the thermal fluid is circulated within the system and by a heat exchanging process transfers its energy to the stored cold water.

The most common solar thermal panels in the U.K. are:

Flat plate collectors

These are the most used and are made of a sheet of black metal that absorbs the sun's energy and transfers it to the thermal fluid circulating in copper tubes located within the panels case. This system, called the absorber, is covered by a glass panel which lets solar radiation in and at the same time limits heat losses from the absorber itself. The back and the sides of the collector are provided with insulating material as well to reduce further heat losses. All these components are held together by a metal frame.

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The most common solar thermal panels in the U.K. are:

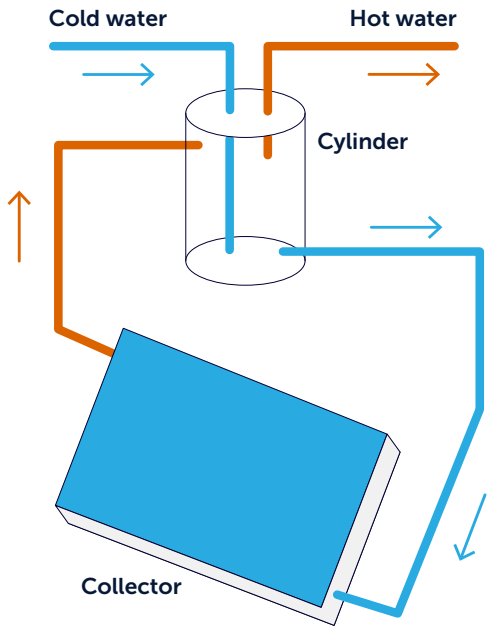
Evacuated tubes

These are made of a series of parallel glass heat tubes grouped together. Each tube contains an absorber which captures solar radiation transferring heat to the thermal fluid flowing through the tube. The tubes are evacuated to reduce the heat loss while allowing solar radiation to fall onto the absorber.

Furthermore, a solar thermal system can be classified based on the circulation of its thermal fluid:

Natural (passive) circulation

The transfer of solar energy is achieved by gravity and the change of density of the thermal fluid circulating within the solar panels. In this configuration the water cylinder is generally installed close to the panels and above the collector level.



In the U.K. most of the solar thermal domestic hot water systems are based on indirect exchange and mechanical circulation.

The advantages of such a configuration are:

- Integral protection against freezing
- Overheat control.
- Greater choice of collector and pipe layout
- Reduction in heat loss through pipes
- Renewable and environmentally friendly source of energy
- Lower energy bills and reduced carbon emissions
- Can provide up to 60% of a household's hot water needs.

However, there are disadvantages as well:

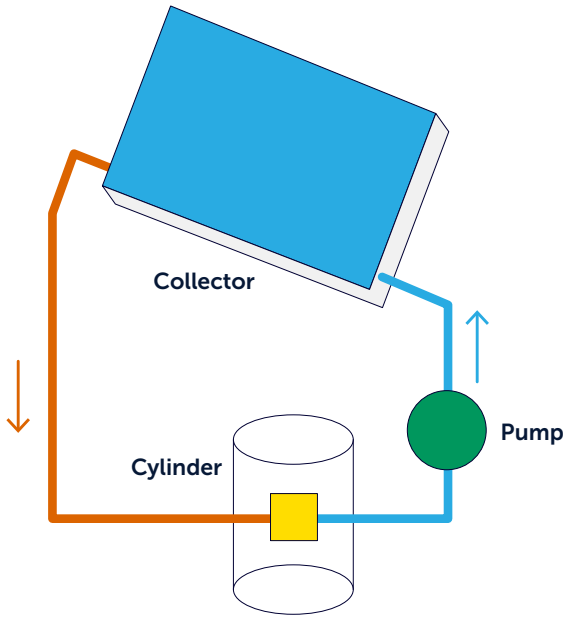
- Increased complexity compared to traditional hot water systems.
- Need for electricity to run the circulation pump.
- Higher installation costs compared to traditional hot water systems.
- Dependent on sunlight and weather conditions
- Require additional backup heating source for periods of low sunlight.
- Can be affected by shading or obstructions on the roof or surrounding area.

Regardless of the type of panels or circulation, a solar thermal system needs to store the solar energy collected for when it is required. In domestic applications, the thermal store is generally the hot water cylinder where mains cold water is heated by the energy collected by the panels. Because solar radiation varies with the weather and the season, a secondary heat source must be provided to ensure that the stored cold water can be always heated; typically, this is achieved using a direct electric immersion heater.

Furthermore, a solar thermal system can be classified based on the circulation of its thermal fluid:

Mechanical (active) circulation

A pump moves the thermal fluid within the system to achieve heat transfer from the panels to the cylinder cold water. In this configuration the water cylinder is installed in an appropriate location inside the dwelling.



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Solar Photovoltaic

Photovoltaic panels are used to transform solar radiation into electricity (direct current, DC). A typical photovoltaic panel system generally comprises the following elements:

- Photovoltaic panels (also called generators).
- An inverter (which converts direct into alternating current).
- A battery and a diverter (not always present).
- A dedicated meter.

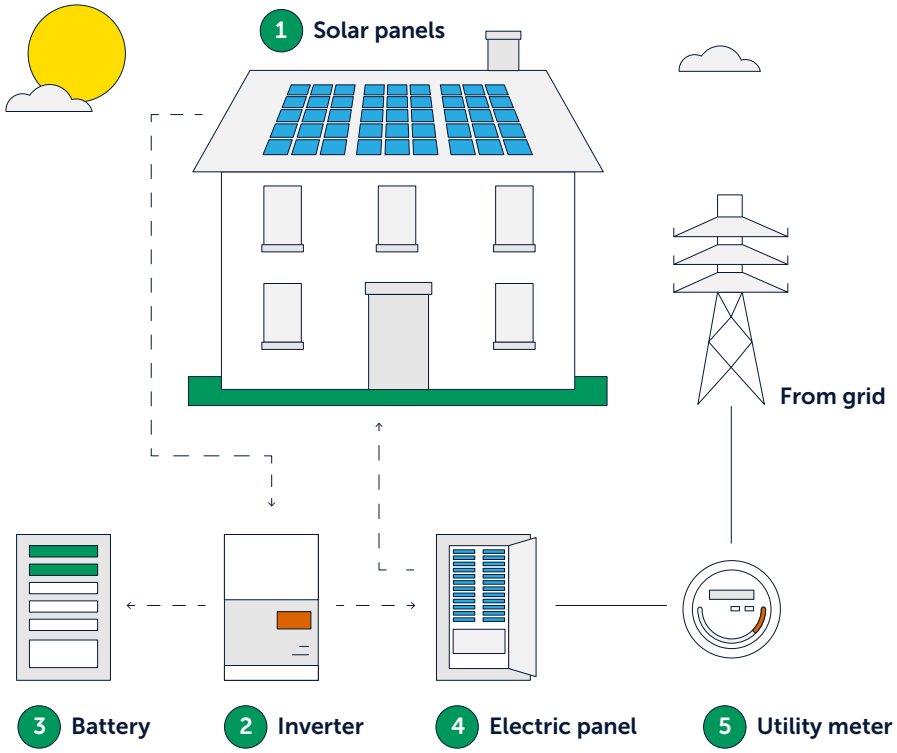
Monocrystalline solar panels are known for their high efficiency, ranging from 18% to 22%. They are made from a single crystal structure, giving them their characteristic uniform, dark appearance. Monocrystalline panels perform better in direct sunlight and require a smaller area for installation compared to other panel types. However, they come with a higher price tag, making them a more expensive option.

Polycrystalline solar panels have medium efficiency, ranging from 14% to 18%. They are composed of multiple silicon crystal fragments, resulting in a distinctive blue, speckled appearance. These panels require slightly more area for installation compared to monocrystalline panels, but they are more cost-effective. Polycrystalline panels provide a constant yield even in diffuse sunlight, making them a popular choice for many installations.

Thin-film amorphous solar panels are the most economical option but have the lowest efficiency, ranging from 6% to 8%. They are made by depositing a thin layer of amorphous silicon onto a substrate. Their flexibility allows for easier integration with existing structures, and they can perform well even in diffuse sunlight. However, their lower efficiency means that a larger area is required for installation to achieve the same power output as other panel types.

Solar tiles, also known as solar shingles or photovoltaic tiles, are an aesthetically pleasing alternative to traditional solar panels. Their efficiency varies greatly, usually between 10% and 20%, with some advanced models reaching up to 22%. Solar tiles are designed to seamlessly integrate into a building's roof, providing a discreet solution for harnessing solar energy while maintaining the architectural aesthetics. They can be installed on various roof types and pitches and can be easily integrated with other roofing materials. However, solar tiles come with a higher price tag and generally have a lower energy yield compared to traditional solar panels. Durability can also be a concern for some solar tiles, particularly those made from less robust materials. While solar tiles are designed to withstand the elements, they may be more prone to damage or wear compared to conventional solar panels. This could result in higher maintenance costs and a shorter lifespan for the solar tiles.

How battery storage works with a Solar Array



The generation of electricity depends on the intensity of the incident solar radiation which peaks on sunny summer days, but electricity is still produced on overcast and winter days. Photovoltaic panels are rated based on the Kilowatts peak (kWp); this is the rate at which they produce power at peak conditions, and it is evaluated under the Standard Test Conditions. When the panels are operating, they produce electricity which is measured in kilowatt hours (kWh). For instance, PV panels with a peak power of 100 kWp which work at maximum capacity for one hour will produce 100 kWh. However, photovoltaic panels do not always work at peak conditions as these depends on some variables such as weather, air and panels temperature and soiling factor, which is the accumulation of snow, dirt, dust, leaves, pollen on PV panels.

When Photovoltaic panels are exposed to solar radiation, they produce DC which is subsequentially converted into alternating current (AC) by the inverter. This transformation is needed as most appliances can only use AC. Photovoltaics panels can produce an electricity surplus which can be stored into a battery. Furthermore, surplus electricity can be used to produce hot water through the installation of a diverter, or it can be exported to the grid. The landscape of grants is ever-evolving; thus, it is advisable for readers to consult the Westminster website at **www.westminster.gov.uk/home-energy-savings** or to conduct independent research for the most current information.

Glossary

Glossary

Alternating current (AC) – Electric current in which the direction of flow is reversed at frequent intervals of 50 or 60 cycles per second, or 50 or 60 hertz (Hz).

Array – Any number of photovoltaic modules connected to provide a single electrical output.

Battery – A device used to storing energy that can be converted into electrical power

Carbon footprint – A carbon footprint is the total greenhouse gas (GHG) emissions caused by an individual, event, organization, service, place or product, expressed as carbon dioxide equivalent (CO2e)

Direct current (DC) – Electric current in which electrons flow in one direction only. This type of current is produced by the photovoltaic panels.

Electrical distribution system – Cabling, distribution board and such like, needed to get the electricity generated to where we want to use it.

Greenhouse effect – A process that occurs when gases in Earth's atmosphere trap the Sun's heat.

Greenhouse gas (GHG) – is a gas that absorbs and emits radiant energy causing the greenhouse effect.

Grid-connected system – A solar electric or photovoltaic (PV) system in which the electricity produced by the PV is exported to the grid.

Inverter – An inverter converts the energy from the PV panel from direct current (DC) into useable alternating current (AC).

Kilowatt (kW) – The kW is the unit of power.

Kilowatt-hour (kWh)– The kWh is a unit of energy.

Kilowatt-peak (kWp) – The 'rated' amount of power a solar panel will produce in optimum conditions.

Microgeneration Certification Scheme – (MCS) A scheme to accredit installers and designers of solar panel systems to prove they are competent.

Orientation – Placement with respect to the cardinal directions, north (N), south (S), east (E), and west (W).

Standard Test Conditions – they are defined as the solar irradiation of one kilowatt (kW) per square metre, a module temperature of 25 degrees Celsius and a solar irradiation angle of 45 degrees.

Tilt – The angle at which a photovoltaic array is set to face the sun relative to a horizontal position