SOLAR ENERGY UK BRIEFING

Everything Under the Sun

The Facts About Solar Energy

Mar 2022

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Introduction

Solar photovoltaic (PV) energy systems are affordable, reliable, low impact, and popular. In 2021 they supplied more than 4% of the UK's entire electricity demand, and this could treble by 2030.[1, 2] The many benefits of solar technology mean it can and must support the UK's transition to a net zero economy.

This briefing sets out the facts about solar and how it works, addressing some misconceptions about solar projects in the UK.

Solar cost and performance

QUESTION:
Does solar PV work well in the UK? Is it sunny enough?

Yes! Solar works well everywhere in the UK. Solar panels don't need direct sunlight to operate, and they produce power all year round.

Solar PV is an effective technology around the country. Over a million homes, businesses and landowners have installed solar panels over the past decade, which are providing electricity directly to residential and commercial premises, as well as the national grid.[3]

Solar can already produce as much as 30% of UK electricity at different points in the year, and in 2020 provided more than 4% of the UK's total supply.[4] All UK solar markets are fully subsidy-free, and with strong growth forecast for the next decade, solar's contribution to the UK's clean electricity will increase: if the UK achieves 40GW of solar capacity by 2030, solar could meet 15% of the UK's annual power needs.[5] Even in winter, the technology is powerful and effective. For example, at one point in February 2022, solar was providing more than 20% of the UK's electricity. Other countries on a similar latitude are also targeting significant solar deployment, such as Germany, which intends to set a 2030 capacity target of 200GW.[6]

The UK's residential, commercial, and utility scale solar markets are all performing extremely well, and 2021 saw huge growth, a reflection of the economic viability of solar.[7] This is true for all parts of the country, including Scotland, which has a thriving solar industry. Indeed, in 2021 more than a quarter of systems accredited by the Microgeneration Certification Scheme around the UK were installed in Scotland.[8]

On an annual basis, solar power generation is extremely reliable, because the exact time of sunrise and sunset is known for each day, and hence the number of daylight hours available. It is therefore possible to forecast the electricity generation ("yield") from a solar system very accurately. And none of the power produced goes to waste: for example, if a rooftop solar system is generating more electricity than is being consumed on site, it can be fed into the national grid. Solar technology also has few if any moving parts and is very reliable. With professional maintenance solar systems should last for more than 30 years.

As the cost of solar decreases, this means that with each passing year solar becomes even more economic, which is why there is now huge investment in solar energy. For example, the utility scale pipeline of solar power projects is 37GW, ten times the generation capacity of the planned nuclear plant at Hinkley Point.

QUESTION:
Is solar expensive?

Not at all, solar is the most affordable electricity in history and the most affordable renewable energy in the UK.

According to the International Energy Agency, in some circumstances solar PV is now the cheapest source of electricity in history.[9] This is because the price of solar has plummeted around the world – including in the UK, where the cost of solar panels has declined by as much as 60% since 2010.[10] At the same time, the efficiency of solar panels and other system components continues to improve.[11]

The combination of these factors means that solar power is a very effective way to reduce spending on energy. This is true for all types of solar system. For example, government research shows solar farms will supply the most affordable electricity to the national grid for the foreseeable future, far more cheaply than fossil fuel power plants such as gas.[12]

Commercial solar systems help businesses – for which energy bills are typically the second biggest cost after salaries – reduce their costs and their environmental impact. This is why companies up and down the country are installing rooftop solar arrays. The market is booming: 2021 saw record growth in the post-subsidy commercial rooftop sector.[13]

There is also an extremely robust investment case for residential solar. Solar Energy UK research, with modelling carried out by the University of Cambridge and sustainability consultants Think Three, shows that installing solar on a typical home could increase its value by around £2,000, and reduce running costs by more than £300 a year over the lifespan of the system.[14] The running cost figure is based on gas and electricity prices from Spring 2021: the comparative savings will have gone up significantly because of the energy price crisis caused by fossil fuels.

An important related fact is that because the primary input for a solar system – light – is free, the price of solar power is much less volatile than fossil fuels. This has been made very clear during the energy crisis which began in Autumn 2021. As the UK's energy market regulator, Ofgem, makes clear, the rising cost of energy bills has been directly caused by the price of gas.[15] Installing more solar generation capacity will therefore help the UK to become more energy self-sufficient, while bringing down bills for everyone as different technologies produce the power the UK needs at different times. The reliability of solar – with the long-term, stable returns it provides – is a key reason why homeowners, businesses, and external investors are financing new solar projects.

Solar power generated during the day can also be stored for use at night, using batteries and other energy storage technologies. This is true for all sizes of solar systems, and the aggregate potential of energy storage is huge. For example, Solar Energy UK research, with modelling carried out by the Centre for Renewable Energy Systems Technology at Loughborough University, shows that 4.4 million homes with solar PV and a battery could eliminate the winter peak in electricity demand on the national grid during cold evenings.[16]

There are also financial benefits to storage, because storing any surplus solar power produced the day, when electricity is cheaper, means that it can be sold back to the grid at other times, when it is more expensive.

The overall efficiency of solar panels themselves continues to improve, while developments in component and system design mean that more light can be captured in other ways. For example, tracking systems enable solar panels to follow the sun from east to west during the day, while bifacial (double-side) panels increase the output of the panels themselves.

Land use, landscape and the environment

QUESTION:
Are solar farms good for environment?

Yes! Solar farms provide a range of environmental and biodiversity benefits.

Ground-mounted solar projects can deliver major benefits to the environment. In addition to providing clean, affordable energy – which is good for the planet – they can improve local biodiversity by supporting new and existing plant and animal life.

Well-designed and managed solar farms contribute to a range of ecosystem services. They support sustainable agriculture, regulate air quality, mitigate flood risk, generate new habitats, and reduce carbon emissions. Solar farms that have been monitored regularly by ecologists demonstrate an increase over time in the local abundance and variety of plants, pollinators, birds, and other wildlife.

Panels themselves are set on posts, meaning there is minimal disturbance to the ground (typically around 1-2% of the total site area).[17] This means the rest of the land is available for developers to take measures that actively improve the local environment, and provide a range of ecological benefits.[18] These include:

- Establishing wildflower meadows and grasslands. Solar farms sit on land which can be used for two things at once. The areas between panels and between the edge of the site can be used to create new habitats for pollinators, butterflies, and ground nesting birds.

- Supporting hedgerow growth. Hedgerow loss is a major concern for countryside management around the country. New solar projects aim wherever possible to preserve, restore or deliver new hedgerow growth.

- Promoting wetland habitats. Effective drainage and water management systems are essential for solar farms. As part of this, they can be designed to incorporate wetland habitats. These offer a drainage solution for the site, which reduces local flood risk while supporting terrestrial and aquatic life with wetlands and ponds.

The importance of these benefits is now recognised in law. Under the 2021 Environment Act, all new developments in England for which planning permission is required, not just solar projects, must demonstrate a Biodiversity Net Gain (BNG) of at least 10%.[19] Independent evidence of BNG gains on solar farms, using metrics provided by the Department for Environment, Food & Rural Affairs, shows that solar farm BNG can range from 20% to over 100%.[20] Solar developers welcome input on other ways in which they can contribute to the local environment.

More information on the contribution solar energy makes to the natural world is available in Solar Energy UK's Natural Capital Value of Solar report, and in light of the new BNG requirements introduced in the Environmental Bill, the industry is also developing an extensive guide on natural capital best practice.[21] This will help developers to deliver high-quality land management programmes on solar farms around the country. This best practice guide will be published in Spring 2022.

Solar farms can create extensive new habitats for pollinators
© Next Energy

QUESTION:
Does land used for solar farms use reduce our food security?

Not at all. Solar farms provide valuable income for farmers, they can still be used for grazing, and they support UK farmers to continue food production on other parts of their land.

The independent National Food Strategy Review shows that solar farms do not in any way present a risk to the UK's food security.[22] Indeed, the reverse is true: the solar industry is working closely with Britain's farmers to reduce their energy costs and improve the sustainability of their operations.

Solar developments follow national planning guidance, which says clearly that non-agricultural land or land of lower agricultural quality should be prioritised. The industry has also signed up to our 10 Commitments, which includes being sensitive to protected landscapes and enhancing the ecological value of the land.[23]

Further, where a solar farm is installed on land which has been intensively farmed, it enables the ground underneath to recover, while providing income for the farming business. Solar farms also help regenerate soil quality, and so are helping to ensure the continued availability of high-quality agricultural acreage for future generations.

The solar industry is committed to supporting sustainable countryside development and is working with farming groups to develop guidelines for other dual use techniques of solar landscapes. These include, for example, collaborating with farmers and landowners to manage grasslands around solar farms through grazing sheep.

Some solar projects connect with local farmers, using sheep to control vegetation growth
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Because solar parks generate income, they provide the UK's farmers with a revenue stream to support other aspects of their agricultural business. This is vital in the context of the UK's exit from EU Common Agricultural Policy. The solar industry is helping to ensure the continued viability of UK food production.

There may also be further potential for agrivoltaic projects, directly combining solar and agriculture, with solar panels installed above crops.[24] These installations are designed to the maximise the production of renewable energy and food from the same land, by using the microclimates created under solar panels to protect crops from harsh weather patterns, promote water retention and minimise evaporation, and extend growing seasons.[25]

QUESTION:
How much space do solar farms take up?

Very little! Solar farms occupy less than 0.1% of the UK's land.

In the UK, new solar farms occupy roughly four acres of land per MW of installed capacity. All solar farms in the UK currently account for 0.08% of total land use.

To meet the government's net zero target, the Climate Change Committee estimates that we will need between 75-90GW of solar by 2050. Our analysis indicates this would mean solar farms would at most account for approximately 0.4-0.6% of UK land – less than the amount currently used for golf courses.[26]

QUESTION:
Are solar parks built with the landscape in mind?

Yes! All solar farms are designed with appearance in mind, and developers work closely with communities to design solar farms in keeping with the rural aesthetic.

The location and setting of a solar farm are major elements of the planning and approval process, as with any development.

A major concern of developers, for example, is to ensure that the visual impact of a solar farm is minimised. This is made easier because solar panels are low-profile and can be easily screened. Solar projects aim to maximise local rights of way and access to the countryside.

During the community engagement stage, which is part of the planning process, developers engage with local residents to understand and mitigate any concerns they may have. This is central to successful project development.

Some of the most common landscape management options include:[27]

- Screening sites by encouraging existing and supporting new hedgerow and tree growth. This also supports the creation of new habitats and safe travel corridors for birds and other animals.[28]

- Using the landscape itself, by considering where best to place solar panels in the context of local lines of sight.

- Creating new rights of way, footpaths, and bridleways, where possible. Developers also work hard to ensure that existing rights of way and footpaths are retained. Many sites also support the development of outdoor spaces for use by the local community, such as by providing educational visits for local schools.

Solar developments often include a planning condition that they be returned to their original use at the end of their life, and so any impact on the landscape is designed to be completely reversible.

Solar Energy UK members have developed and endorsed a list of 10 commitments to ensure high quality solar farm developments.[29]

QUESTION:
Do solar panels create glint and glare?

Barely any. Solar panels are designed to absorb light. Glint and glare are not a problem.

Solar panels are fundamentally designed to absorb as much light as possible. This stands to reason: the more light a panel absorbs, the more power it will generate. This is why the industry has developed high-tech anti-reflective coatings, and ultra-transparent glass to improve panel efficiency.

In fact, solar panels are less reflective than many common building features – such as windows.[30] Further, airports around the UK either already operate or are installing solar systems, which they would not do if glare were a concern for safety or other reasons. These include:

- Southend Airport, which has a 120kW installation on its terminal building and a 5MW solar array under its flightpath.[31]
- Edinburgh Airport, which is developing an 11-acre solar farm next to its runway.[32]
- Stansted Airport, which is planning to install a 14MW solar farm directly to the east of the airport.[33]

Glint and glare are therefore not an issue.

Local communities and the public

QUESTION:
Do solar project developers engage with the local community?

Of course! Developers work hard to engage with the community throughout the development and operation of solar farms.

Meaningful engagement with the local community is a cornerstone of all successful planning applications, and this is true for solar developments as well. The solar industry is committed to engaging with communities at all stages of the decision-making process.[34] This includes the presentation and discussion of project plans and ensuring the opportunity to provide detailed feedback on proposals.[35, 36, 37]

Typically, this involves:

- Local consultations. Developers will organise public events and exhibitions. These will explain the intended project, provide information, and plans on what it will look like, and have project staff on site to answer questions. Members of the public are encouraged to ask questions and share feedback.
- Online surveys. Developers will seek feedback through digital engagement. Key documents are made available on a dedicated web page for members of the public to familiarise themselves with and comment on plans.

- The developer will then take account of feedback in the design of the project and in the preparation of the planning application.

- If a project is over 50MW in size, the site will also need to seek approval from the Secretary of State. Feedback from residents is an important factor in this process.

Once a solar farm has been constructed, it can deliver a host of benefits for the local community. These include delivering ecosystem services and biodiversity net gain, providing recreational opportunities, and hosting educational visits from local schools to provide practical, hands-on learning opportunities. Many developments also offer a community benefit fund which can be used to support local environmental and social projects. Throughout the solar farm's life span, communities and project owners are encouraged to continue to engage with the project and the opportunities it provides.

Solar projects are developing new ways to support and engage with local communities, for example installing community beehives on sites.

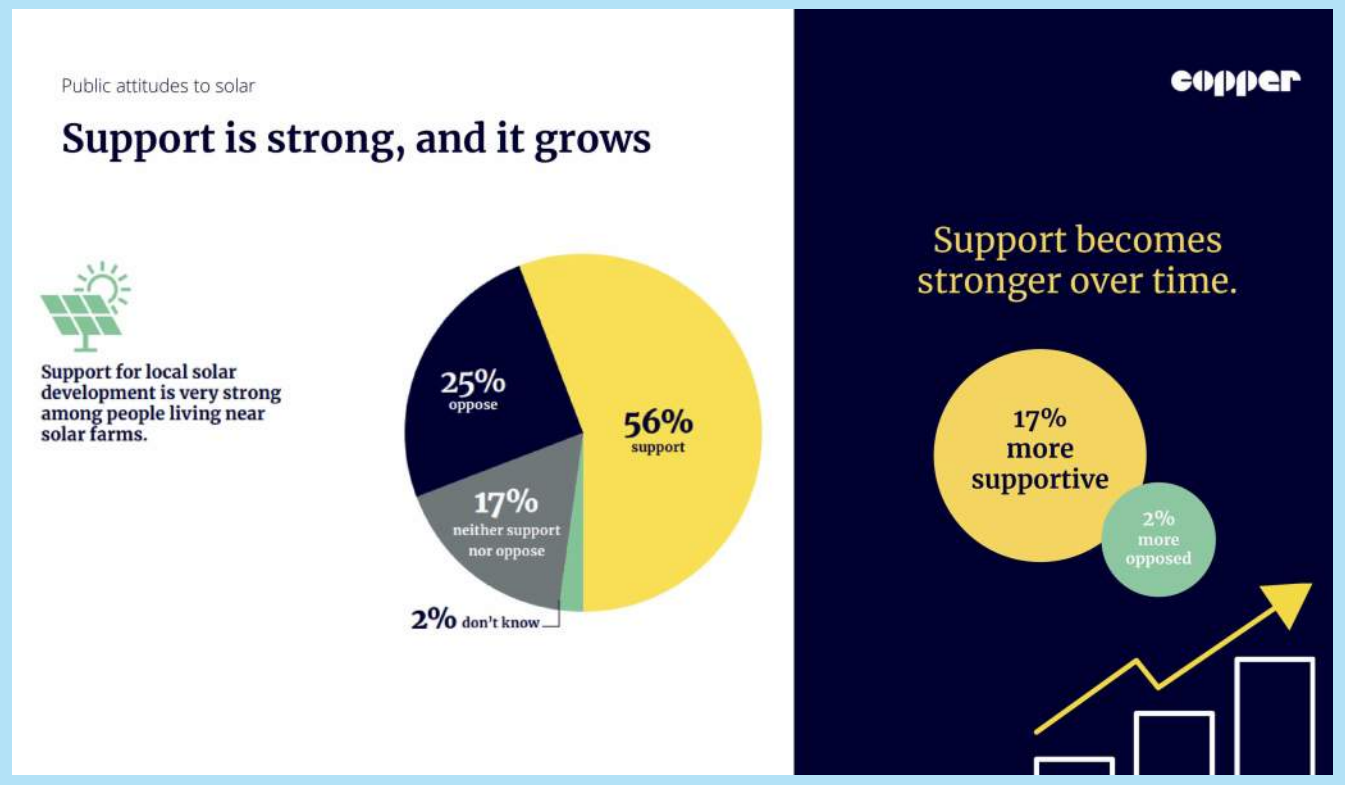
©Bluefield

QUESTION:
Is solar popular?

Yes! In fact, solar is the most popular of all renewable energy sources according to the Government's own surveys.

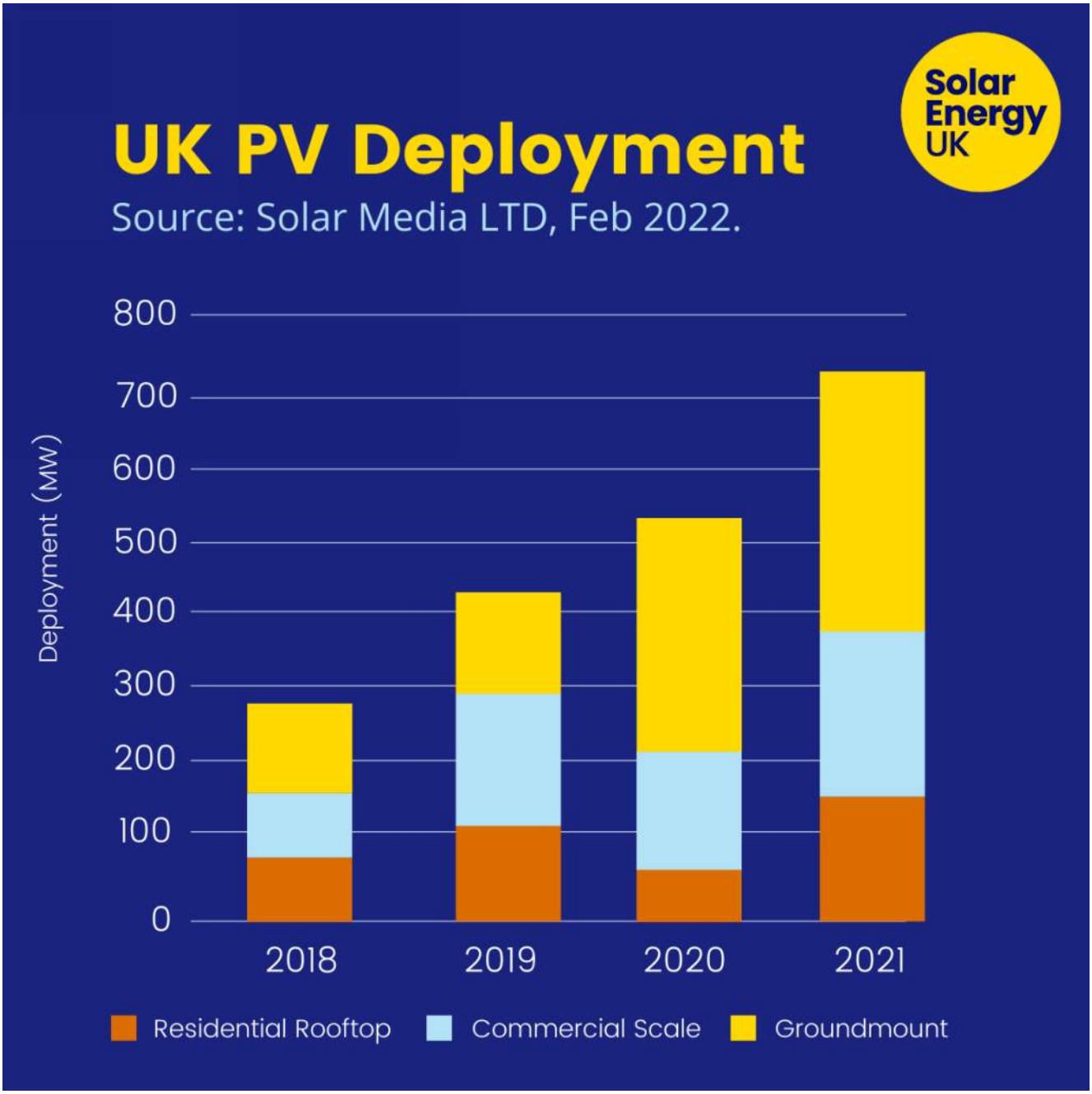
Public support for solar is extremely strong. This has been repeatedly demonstrated in a range of research. For example, the Department for Business, Energy and Industrial Strategy conducts regular polling on public attitudes towards renewable energy technology. The level of support for solar is consistently high, with the most recent survey results, published in December 2021, showing that an astonishing 90% of the public supported solar. This is the most popular of any renewable energy technology.[38]

Research carried out by Copper Consultancy on behalf of Solar Energy UK also shows that support for solar farms increases once they been built among people who live near them.[39] This is because they recognise the benefits which solar farms provide, from clean energy to local habitat and environmental improvements. The research also shows that more than half of the public wants government to do more to prioritise solar in national planning decisions.



A Bright Future for Solar – Realising the UK's potential: a study into public attitudes to solar https://solarenergyuk.org/wp-content/uploads/2022/01/Copper-Consultancy_Solar-Energy-UK_Public-attitudes-to-solar_January-2022.pdf

In rooftop solar markets, the record growth in deployment shows how popular a building upgrade both commercial and residential solar is. The graph below shows the capacity of commercial rooftop systems which have been deployed since the end of government subsidies, while consumer polling shows that installing solar panels are the third biggest home improvement priority for homeowners, after fitting a new kitchen or bathroom and windows. This is perhaps unsurprising, given that nearly three-quarters (72%) of homeowners feel that the environmental impact of their home is important.[40]



Sustainability and Recycling

QUESTION:
Does manufacturing solar panels produce carbon than they save in their lifetime?

Not at all. Solar projects save thousands of tonnes of carbon emissions over their lifetime.

As with all manufactured products, some carbon is emitted in the manufacture of solar panels. However, the claim that solar panels produce more carbon than they save is false.

Not surprisingly, there are many studies that have looked into this issue in detail, such as one recently published in Nature Energy.[41] The evidence is conclusive that solar reduces carbon emissions. Even the average residential solar project can save over a tonne of carbon emissions every year, that's about as much carbon emissions as come from burning 500 gallons of petrol.[42]

Research has shown that the average carbon payback period for solar panels is 1-4 years.[43] This means that over their lifetime, typically 40 years, each panel will generate zero-carbon and zero-pollution electricity for decades after any carbon emitted in its production has been paid back.

Many projects also include further environmental elements, such as tree or hedgerow planting, which actively remove carbon from the atmosphere. This can completely offset any carbon emissions created when manufacturing the panels.

As manufacturing processes advance, it is likely that the carbon payback period for solar will decrease further. Solar power generation is zero emission at the point of use and a key technology to help achieve a net zero global economy.

QUESTION:

Are solar panels recyclable?

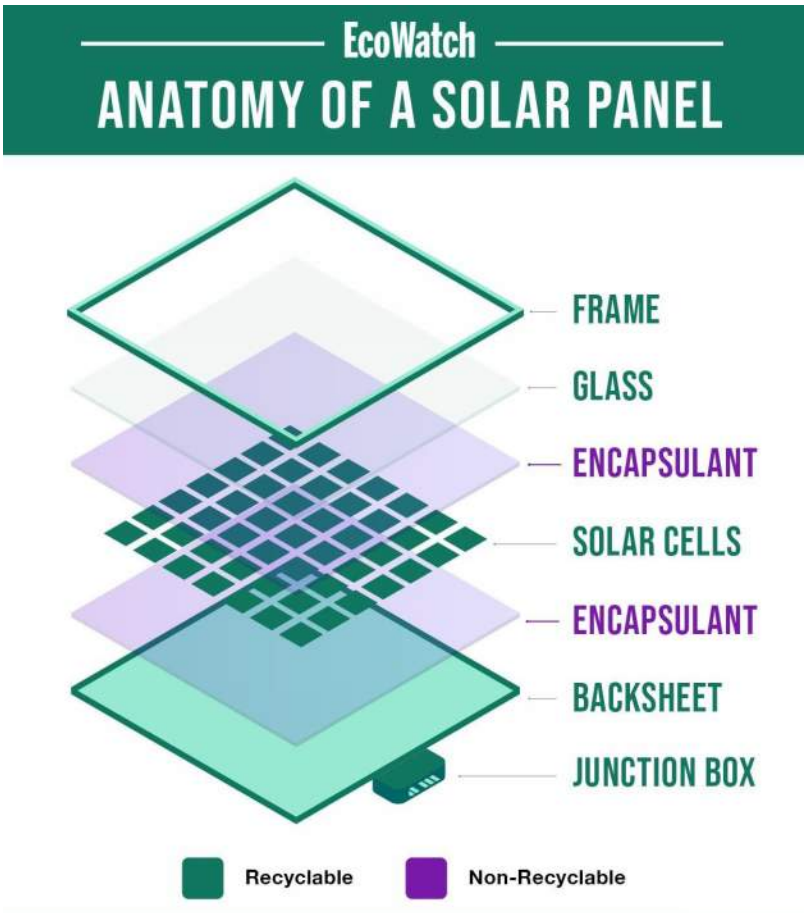
Yes! Up to 99% of materials in a solar panel are recyclable.

In most cases, 99% of a solar panel is recyclable, and there are well established industrial processes to do this.

A solar panel is made of a frame (typically aluminium), glass, crystalline silicon solar cells, and copper wiring, all of which can be extracted, separated, and recycled or reused. The remaining one percent is an encapsulant material which bonds the layers of a panel together.

There are organisations around the UK and Europe specialising in solar recycling, such as PV Cycle and the European Recycling Platform. They are working with solar developers to minimise electrical waste and recycle old panels in line with the Waste from Electrical and Electronic Equipment (WEEE) regulations.[44]

This means the environmental impact of decommissioning a solar system is minimised, in line with the solar industry's commitment to adhering to the highest possible standards of sustainability.



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Published in the United Kingdom by Solar Trade Association
Chapter House, 22 Chapter St, London, SW1P 4NP
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