The reality of low grade UK solar: the numbers don't stack up

We are ranked one of the worst countries in the world for solar power potential.

Solar is the weakest performing form of renewable energy tech in the UK, taking up the most space. Across a year in our climate, solar installations struggle to reach a tiny proportion of their capacity – **panels perform at an astonishing average of just over 10% efficiency*** – yet thousands of acres of agricultural land are at risk of ground-mounted solar development

> The government's push to expand solar energy as part of its Net Zero goals is triggering a surge in proposals for over-scale, ground-mounted solar facilities on large tracts of agricultural land. But converting thousands of acres of farmland into solar developments offers only a fraction of the promised energy output – and fails to justify the significant impacts

> Solar has a role in transitioning away from fossil fuels in the UK, but because the actual electricity generated falls so far short of capacity, the current approach demands a rapid rethink in response to critical questions about energy returns, agricultural land-take and long term sustainability

> Unless we pivot towards more innovative, built environment-based, dual-use solar solutions, we risk locking in a model that will needlessly sacrifice valuable farmland for generations – or for good – in favour of a form of energy generation that remains intermittent and highly inefficient

*10.2% averaged over 2020–2024: Energy Trends: UK renewables, Digest of UK Energy Statistics (DUKES): renewable sources of energy

Solar numbers in reality: capacity vs actual output

2024: an average of only 1.77GW solar output from 17.8GW installed solar capacity

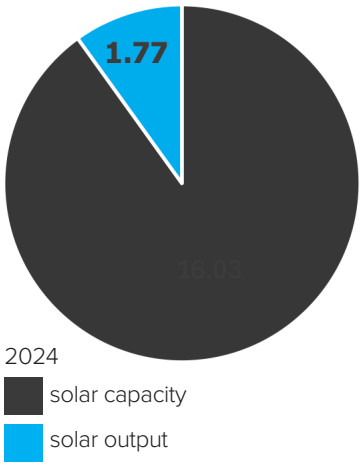
Latest figures from the Department for Energy Security and Net Zero, for 2024, show that the UK had an installed solar power capacity of **17.8GW**. DESNZ data shows that last year, this national solar power fleet delivered an average output of just **1.77GW**. In other words, across a typical year in this country, **solar panels harnessed a fraction of their potential, generating about a 10th of the electricity they are designed to produce**

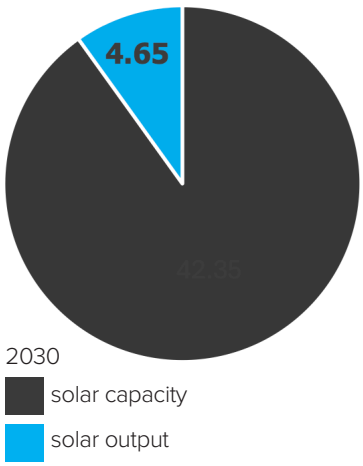
2030: an average of just 4.65GW solar output predicted from 47GW installed solar capacity

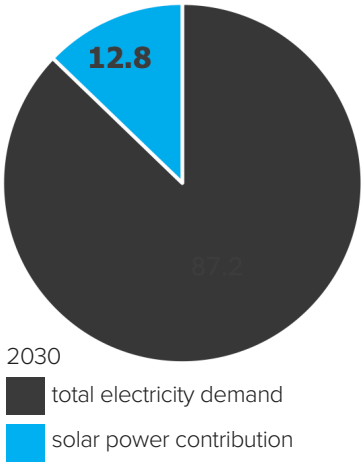
The government's 2030 target for installed solar capacity is **47GW**. Based on 2024's UK solar load factor of 9.9%*, the **actual average output would be as low as 4.65GW**. Across a decade of operational data captured by DESNZ, the average efficiency level does not even reach 11%

2030: solar output predicted to contribute less than 13% to the UK's electricity needs

If the UK solar power sector reached the 2030 installed capacity target, based on 2024's annual electricity demand of 318.7TWh it would deliver **only 12.8% of our total electricity needs**, but with dramatic seasonal variance – and a minimal contribution to energy security. Electricity demand is expected to grow by 2030 as the UK shifts to electrification of transport, heat and industry







> "Net Zero is not about how much capacity, how many gigawatts we install. It is how [much] electricity we can produce"
>
> Dr Pablo Ouro, Department of Civil Engineering and Management, University of Manchester

*The 'load factor' is an expression of efficiency, and shows the percentage of time an energy generator works at its full (installed) capacity – the lower the figure, the less efficient the energy generator

Key takeaways

Poor UK solar energy yields

- Department for Energy Security and Net Zero data reveals the stark reality: solar power generation delivers exceptionally low yields in the UK climate. On average, only around 10% of the total installed solar capacity is converted into usable electricity here – we are last but one in a global list of 230 countries for solar power potential. It is no surprise that solar also comes last in DESNZ's productivity ratings for renewables currently up and running in the UK

- In order to generate enough power to make a profit on such poor UK solar yields, developers of ground-mounted solar 'super schemes' fill vast areas of farmland with cheap imported panels in excessive numbers

- Solar developers present data in ways that mask the huge discrepancy between capacity and output, and misleadingly imply that their schemes can supply electricity to a specific number of households on a reliable, round-the-clock basis

Battery bank energy security and safety

- Battery banks built alongside solar schemes to store energy do not have enough capacity to support the UK energy balancing strategy in a meaningful way – although they do offer lucrative grid trading opportunities for solar scheme owners

- Battery banks use lithium-ion or lithium ferro-phosphate batteries, which are inherently unstable, posing risks of explosions, fires and toxic gas releases. We do not yet have UK regulations governing safety issues, including how far they should be from occupied buildings such as houses, hospitals or schools

Agricultural land-take

- DESNZ cites a figure of 0.1% of ground-mounted solar land-take – but it's a percentage of *all* UK land, when England is targeted more heavily, and only accounts for existing smaller schemes. The '0.1%' figure downplays what is planned. Added to Nationally Significant Infrastructure Project* super-scale schemes in the national planning pipelines alone, solar would cover land more than twice the area of Birmingham – or 800 farms. More is to come: schemes spanning thousands of acres are in local planning and on the National Energy System Operator's Transmission Entry Capacity register. We have limited visibility of the rising numbers of ground-mounted solar schemes in pre-planning and local authority pipelines

- Ground-mounted solar developers are industrialising farmland – around 2% of UK cropland is at risk of conversion to this poor performing form of power production. At least 23% of the farmland targeted by NSIP developers is in the top two grades of 'Best and Most Versatile' land – in addition a further 66% is classed Grade 3, a proportion of which would also be BMV land. Genuine 'agrivoltaics' is not a serious feature of many schemes

- The new Land Use Framework proposed by the Department for Environment, Food and Rural Affairs could see even more farmland lost to Net Zero schemes – a staggering 1,878,000 acres is set to be taken out of food production altogether, and a further 2,100,000 acres transferred to limited food production

*Solar power proposals with more than 50MW capacity (changing to 100MW at the end of 2025) are designated as NSIPs and apply for consent via the Planning Inspectorate, rather than local authorities

- Super-scale solar development proposals are not evenly targeted across the country. Certain counties are seeing significant volumes of over-scale solar infrastructure proposals on agricultural land – in Lincolnshire, there are 12 NSIP solar sites planned, covering farmland amounting to 2% of a county dominated by the agricultural sector

- In its rush to target farmland ahead of dual-use applications, the UK is prioritising NSIP solar super schemes of an unprecedented scale, thousands of acres each, unevenly distributed and often clustered – driven by developers maximising profitability by selecting the closest locations to ageing National Grid Electricity Transmission infrastructure. This new breed of outsize solar scheme is out of sync with solar performance in this climate, declining areas of the cropland so vital to maintaining home-grown food production, and the protection of the UK's distinctive rural landscapes

- Ground-mounted solar facilities cannot genuinely be described as 'temporary' – we are already witnessing decades-long scheme extensions. The new National Planning Policy Framework facilitates the extension of renewable site lifetimes, opening the door to permanent changes of use. Several pieces of research show previously productive soil is suffering some long term damage caused by ground-mounted solar schemes

Smarter options for UK solar rollout

- The UK is an outlier in Europe in promoting a 'fields first' model to solar rollout. Unlike other forms of renewable energy, solar panels can be sited almost anywhere and work well in the innovative dual-use installations we see in other countries, from rooftops through car parks to transport corridors – all down to smart policy levers

- In the UK, with one of the world's worst ratings for solar power efficiency, and without a coordinated plan for solar sites, we are set to install around 70% at least of the 2030 capacity target via ground-mounted solar, largely on farmland. This is despite the enormous potential for built environment dual-use solar deployment – we have hundreds of thousands of acres of available rooftop and car park space alone

Poor UK solar energy yields

Solar panels in the UK climate don't deliver enough energy

Zero energy captured every night and levels low over the long autumn and winter months – intermittent and unreliable solar power is a poor policy choice for mass-scale ground-mounted rollout in this cloudy, higher latitude country. Based on its climate, the UK is ranked by the World Bank one of the worst for photovoltaic power potential, coming in at 229 out of 230 countries.

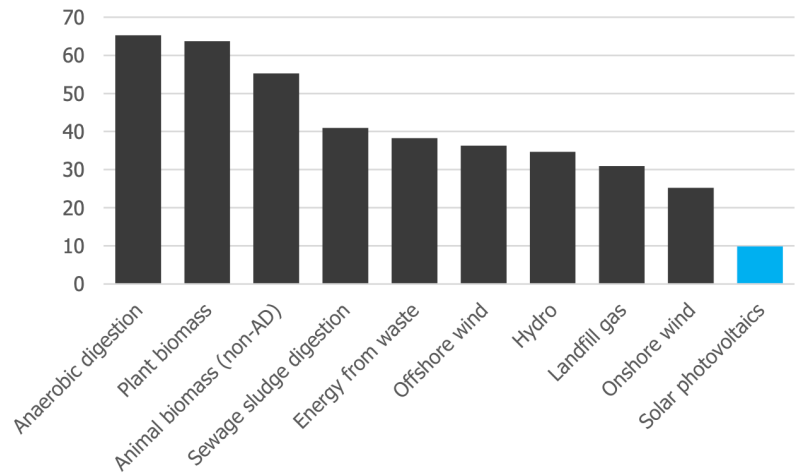
Average solar power output here is exceptionally inefficient. Over the last five years, the average output was 10.2% – and for 2024, it was just 9.9%. This isn't a theoretical assumption: the government's data demonstrates it. Solar power has the worst performance in DESNZ's list of 10 types of operational renewable electricity generation technologies.

Solar is very space intensive. Around 5 acres are needed for every installed 1MW of solar power capacity – but this so-called 'nameplate capacity', the most it can achieve in ideal conditions, is nothing like what is delivered in reality. Because of the inefficiency of solar in the UK climate, panels installed on 5 acres achieve an average equivalent to just 0.1MW of power.

Developers of NSIP ground-mounted super schemes play down the discrepancy between installed capacity and real output. They know that the best way to make solar pay here is by relying heavily on cheap solar infrastructure imports – many from China – and massively over-scaling the quantity and racking of solar panels across substantial tracts of land to make up for the inferior performance of solar power in the UK.

Low yield, high footprint: a solar super scheme example

- Sunnica is an NSIP solar scheme on a 2,500 acre site on farmland in east England
- Nameplate capacity: **500MW**
- Data presented during the planning process shows that the developer projected its solar plant of more than a **million panels** to produce an average output of only **66MW**. Even this is ambitious, especially as panel performance degrades
- Despite this, the facility has now been greenlighted for construction



DESNZ Energy Trends: UK renewables – 2024 load factors (% of time energy generators work at capacity). (Excludes liquid biofuels – insignificant installed capacity)

The ‘Homes powered by solar’ claim is a misleading metric

Ground-mounted solar developers promote their projects by suggesting how many homes their solar power facilities would be able to ‘supply’ with electricity. They use an industry-standard calculation based on the total GWh a scheme is estimated to generate across a year, divided by the electricity the average home uses. A typical claim on a solar super scheme developer’s website states that its plant would provide “enough clean, reliable energy to power approximately 115,000 homes annually”. Supporting the impression that this supply is consistent, developers often link their anticipated aggregated energy output to a specific local community – “more than the total in Bedford and St Neots”. These calculations are mathematically correct, but that doesn’t make the claims right.

At face value, these statements imply that ‘reliable energy’ will fulfill an uninterrupted energy requirement, year-round, for tens of thousands of households. But a solar scheme can’t supply electricity ‘on demand’ or continuously to any home: the long periods of no or low energy production make it impossible. This is evident from the huge mismatch in energy supply and demand which is a feature of solar’s extreme day/night and seasonal cycles, its wide fluctuations and unpredictability, and the very poor efficiency of solar in the UK climate. On-site battery banks can only store enough energy for a short time – a matter of minutes or a few hours, depending on demand and their capacity.

No solar installation – regardless of scale – can independently power a single home, let alone thousands, in a reliable, continuous way. Without colossal, costly long duration energy storage, or complementary baseload generation, these facilities can’t meet real-time electricity needs. At best, they contribute a portion of energy intermittently to the grid.

It is important for public communication and planning policy to avoid over-promising what these systems can deliver.

Solar inefficiency: a typical presentation of the numbers

Tucked away in the calculations for a super scheme, UK solar inefficiency is evident in the ‘0.11’. This one small number ultimately explains why 1,500 acres of farmland are being targeted to generate the 385GWh quoted:

“400,000kW (400MW x 1000) x 8,766 (number of hours in a year 365.25 days to account for leap years * 24hours) x 0.11 (calculated using a capacity factor sourced from DUKES averaged over five years, (DUKES 6.3, BEIS 2022)) = 385,704,000kWh”

“Solar surge threatens to throw grid off balance”

In April it emerged that NESO may have to order ‘inflexible’ power stations like solar to switch off this summer, to maintain the ‘flexible’ power supplies needed to balance the grid. The warning demonstrates the extreme seasonal imbalance of solar’s output, producing its highest levels of electricity at the very lowest point in consumer demand – summer.

NESO’s news suggests that the more solar sites that are built, the greater the summer glut. Battery banks will only be useful for a few hours: without enormous (and expensive) national energy storage, the solar energy will be disconnected from the grid and go to waste.

Battery bank energy security and safety

Batteries are not a fully reliable or risk-free backbone for the energy transition

For intermittent, non-dispatchable energy generation with very poor efficiency in the UK climate, storage is essential. Ground-mounted solar developers generally include battery energy storage systems alongside their plans for super solar schemes. But these massive battery banks, consisting of a series of shipping container-sized units typically housing hundreds of lithium-ion battery cells packed into racked modules, come with issues.

Even the very large utility systems only store energy for a few hours of demand. Batteries can't be relied on for long for all the times of low or no sunlight, nights or the many months when solar energy plummets. This technology can only play a limited role in the UK's broader energy security strategy, particularly falling short across the five or six months of the year when solar energy generation drops dramatically and demand rises.

Battery storage could introduce new safety and environmental liabilities. Lithium-ion batteries are inherently unstable. There has been a series of explosions, fires and toxic gas releases at battery energy storage installations around the world, raising concerns over public and first responder safety. The intense fires, caused by thermal runaway, are notoriously difficult to extinguish and can last for days or weeks. The millions of litres of water needed to attempt to control battery fires can lead to local ground contamination as the firewater runoff contains toxic compounds. If even small amounts of contaminated firewater reach aquifers, farming irrigation, crops, local streams or rivers it has detrimental environmental impacts for decades.

Lithium ferro-phosphate batteries, which some developers consider slightly safer as they require higher temperatures before thermal runaway occurs, can still experience thermal runaway. Lithium ferro-phosphate batteries carry a higher explosion risk and higher concentrations of fluorinated compound emissions.

Short term performance

- A typical solar scheme's **100MW** battery bank, consisting of 120 battery storage shipping container-sized units, will hold enough energy for the 108,000 houses the developer claims to be able to supply **for just 30 minutes**
- Batteries cycle between 80% and 20% charge level to preserve lifespan, so **in reality capacity is around 60%** of the rated capacity

Despite the accelerating pace of 'solar-plus-storage' proposals and installations, the UK does not yet have specific safety standards or regulations governing utility-scale battery storage – for example, there is still no regulatory standard for safe distances from occupied buildings, built-in fire suppression or controls over using 'second life' batteries. Emergency access is an additional concern in the context of the rural, off-road sites that typify farmland solar schemes. Jurisdictions such as Orange County, California, have already imposed a moratorium on new battery banks until regulatory safeguards are in place.

Battery storage offers developers lucrative arbitrage and trading opportunities. Depending on their contracts, some developers may be able to hold their caches of stored energy until there is a demand for it – and its price is higher – before releasing it to the grid. Battery banks may also be used to trade electricity by buying cheap surplus electricity from the grid and storing it at times of peak output, ready to sell back at a better price at times of high demand. These economic models prioritise commercial gain over public value, with very limited contributions to resilience or baseload generation.

Long term safety concerns

- In January, a fire erupted at the 750MW/3,000MWh facility at Moss Landing, California, sending up **plumes of toxic smoke and resulting in a local evacuation order for 1,000 people**. The fire burned for three days and continued to reignite over the next few weeks
- Even with limited battery capacity in the UK to date, we have already seen **fires at battery storage sites this year**, including in Aberdeenshire, Essex and Gloucestershire

Agricultural land-take

The DESNZ '0.1% of land for solar panels' figure belies the reality

The frequently cited DESNZ statistic of solar accounting for 0.1% of UK land refers to existing, smaller scale, ground-mounted solar installations. Repeated references by DESNZ ministers to this static figure without context or consideration of projected increases obscures the scale issue at the heart of the solar power land use debate.

The figure of 0.1%, referring to the 52,386 acres of land already taken up by ground-mounted solar facilities, is also problematic for two key reasons:

- it is expressed as a percentage of *all* UK land, including national parks, hilly terrain, watercourses and protected areas – all where solar development is unlikely or restricted
- the majority of developers' solar scheme proposals are concentrated in England – not uniformly distributed across the UK. This regional disparity is masked by the aggregated UK land figure

The 40-plus new 'super scale schemes' in the current NSIP portal alone (as at April 2025) target 101,960 acres of farmland in England. That would take out an area amounting to 0.3% of all land in England. And when combined with the solar sites already operational in the UK, we would see a total in excess of 154,346 acres of farmland replaced by solar facilities.

In Wales, a further eight NSIP-scale solar projects are planned, including Llanwern and Maen Hir, both with sites in the thousands of acres. Shotwick in Flintshire is utility-scale, but far smaller than the new solar 'super schemes', and already in operation as a private wire facility for a paper manufacturing plant. In Scotland, there are four NSIP-scale schemes planned, but none exceed 1,000 acres. Schemes in Wales and Scotland total nearly 9,000 acres.

Importantly, all these figures are substantial under-estimates. They exclude:

- small-scale ground-mounted solar projects currently under construction
- small-scale schemes in local authority planning systems
- small and super scale ground-mounted solar schemes on NESO's TEC register. The register, tracking projects with grid connection agreements, lists schemes that could cover thousands more acres. Without the relevant details on project status or timelines, the register does not give a clear picture of the national solar pipeline to those outside the sector

In excess of 163,000 acres of UK farmland set to be under poor performing solar panels

- More than **twice the size of Birmingham**, our second largest city
- Bigger than the **New Forest**
- More than **800 average UK farms**
- Much **more in the pipeline**

Farmland schemes set to make up almost 70% of the target

- If the UK meets its 47GW installed solar capacity target by 2030, it would have put **photovoltaic panels on an area of around 235,000 acres**
- We are heading towards delivering a **huge proportion of the capacity target via single-use, land-intensive ground-mounted solar developments**, with very limited contributions from dual-use installations
- Operational ground-mounted solar sites and super-scale schemes in the pipeline alone account for **nearly 70% of the 2030 capacity target**

Solar schemes could ultimately cut nearly 2% of UK cropland

Most ground-mounted solar facility proposals target cropland. Looking at the proportion of cropland earmarked for solar operations gives a far more meaningful metric than just 'UK land'. Operational and planned NSIP schemes already amount to around 1.4% of UK cropland, with yet more smaller ground-mounted solar schemes under construction or in the planning pipeline.

If the full 2030 47GW target is reached predominantly via ground-mounted solar facilities, it would take nearly 2% of all cropland – vast tracts of food-producing land – out of production. This largely arable land is currently growing key crops including wheat and vegetables.

NSIP ground-mounted solar developers are targeting 'Best and Most Versatile' farmland and are avoiding much lower quality land, despite guidance to prioritise it. Under the Agricultural Land Classification system, land categorised at Grades 1, 2 and 3a is considered BMV. Analysis using the ALC map overlaid onto NSIP plans in England shows that 23% of the farmland selected by planning applicants for solar development is the top quality Grades 1 and 2, with 66% at Grade 3, a proportion of which will be Grade 3a BMV land. Over a fifth of schemes are planned for farmland with in excess of 50% Grades 1 and 2 land.

Ground-mounted solar land-take is part of a wider DEFRA plan to take up to 9% of our farmland out of agricultural production. The Land Use Framework fails to address the serious cumulative impact of ground-mounted solar and other schemes that are being developed without any genuine coordination.

We currently import 40% of what we eat. The amount of food we are capable of producing in the UK will inevitably drop at a time when we are already experiencing vulnerabilities in the international food supply chain, leading to food shortages, food price inflation and food poverty. Home-grown food will become ever more essential as our population rises: between 2022 and 2032, the number of people living in the UK is projected to increase by 7.3% to 72.5 million.

The Land Use Framework would take out 9% of farmland for Net Zero

The Land Use Framework, under consultation until 25 April, looks set to make things worse. Heralded by the government as a 'toolkit' to protect the most productive agricultural land and boost food security, if it goes ahead as planned it is likely to achieve exactly the opposite.

It uses modelling based on data from the 1970s to justify its claim that a 9% drop in the area of land farmed would not affect food production.

The Framework sets out a plan for this enormous area of land currently used to grow food to be switched to sustainability initiatives such as woodland planting and rewilding, more bioenergy crops and renewable infrastructure developments like wind and solar facilities. Yet more land would transfer to limited food production if the proposals go ahead.

Millions of acres of agricultural land to stop producing food

- **1,878,000 acres of farmland** to be converted to sustainability initiatives
- **2,100,000 acres of farmland** to go into limited food production

Farmland in specific counties is being disproportionately targeted

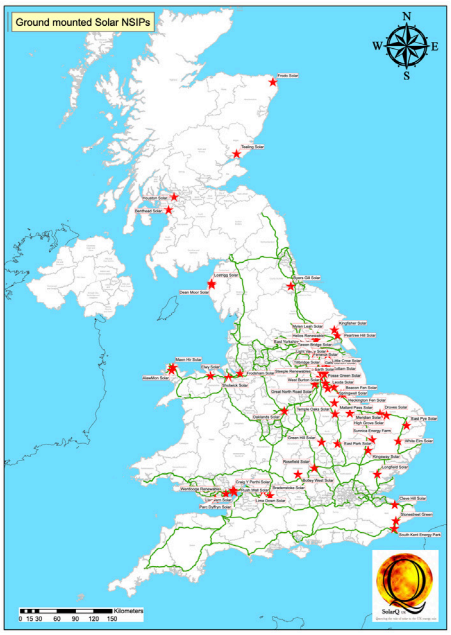
Uneven targeting of cropland across the UK means that over-simplistic claims around the total quantity of land-take for solar, and attempts to minimise its impact, are misleading. The majority of the land-intensive super solar schemes are concentrated in the East, East Midlands, North-East, South-East and South-West England. Ground-mounted solar developers are heavily targeting counties including Cambridgeshire, Norfolk, Nottinghamshire and Yorkshire.

Lincolnshire, responsible for growing 30% of the nation's vegetables, stands out. In the NSIP pipeline alone, there are 12 solar super site proposals heading for the county, five of which have been consented within less than a year. Together these NSIP schemes would cover over 31,000 acres of farmland – more than 2% of the total land area of what is often described as a 'bread basket' of England. With a combined installed capacity of 6,340MW, these 12 schemes would make up 13.5% of the UK's solar capacity target. But their collective likely average output, based on the latest load factor, would be as low as 628MW. Smaller scale schemes, either already operational or currently in planning or pre-planning, push the solar land-take total for this single county considerably higher.

The disproportionate concentration of solar development in high value food-producing counties poses a risk to the UK's agricultural productivity and regional land use balance. With no strategic oversight or an equitable distribution of renewables infrastructure, critical farming regions are facing land losses that could undermine local economies as well as national food security – especially if the Land Use Framework is delivered as set out.

Solar scheme clustering – a typical example

In one part of East Yorkshire, there are four NSIP-scale solar plans, totalling 10,785 acres, closely clustered and covering 14% of the immediate area. Added to the smaller operational and planned solar schemes in this one location creates planned solar coverage of 13,150 acres. The combined installed capacity of the NSIP schemes is 1,540MW – but they would on average deliver only 152MW, based on last year's load factor.



Courtesy Professor David Rogers

Nearly 60 utility-scale schemes planned so far, concentrated in specific regions

We risk industrialising farmland with a new breed of 1,000-acre plus super schemes

The rush to push through mass solar capacity on agricultural land threatens to deliver dramatic changes in the scale and impact of solar development. These shifts would see not only a huge scale-up in ground-mounted solar coverage and its consequences for farmland, but also rollout of the NSIP-scale pipeline of new colossal 'super schemes' which risks changing parts of our countryside beyond recognition – for decades or for good.

We are on the cusp of an unprecedented ground-mounted solar infrastructure scenario. Nothing on a super scale has yet been built and entered commercial operation in the UK. The industrial nature of the super schemes is radically different to existing installations and it is clear the scale of this new breed is beyond current comprehension. This is compounded by media labels like 'massive' or 'huge' to describe the modest solar plants – often smaller than 100 acres – we see dotted about the countryside or hear about as they go through local authority planning systems.

There are well over 40 solar super schemes planned for England in the NSIP portal. Nine have so far been given a Development Consent Order, but only one, Cleve Hill, is under construction. Thirty of the proposals are around 2,000 acres or more – the biggest is in Nottinghamshire, an astounding 7,000 acres. The super scheme plans consist of dense networks of hundreds of thousands of racked photovoltaic panels and associated infrastructure, complete with battery bank compounds, CCTV and security features. The bigger schemes have well over a million solar panels at heights of between 3 and 4.5 metres.

NSIP solar schemes are unevenly distributed across rural areas of the UK. They are often clustered with other large or small schemes across one setting as developers target land closer to existing NGET infrastructure connections – not because of technical constraints, but to keep their construction costs down and maximise profits.

This mass-scale industrialisation of the countryside, exacerbated by cumulative effects in many cases, would inevitably have detrimental implications for agricultural land availability, landscape character, rural culture, heritage assets, visual amenity and local communities across specific UK regions.

Without transparent data and a national strategy that accounts for the true scale and distribution of these developments, the UK risks allowing incremental planning approvals to permanently alter the rural environment, often without full public awareness or scrutiny.

Cleve Hill: the first in a new breed of solar super site

- The first vast ground-mounted solar scheme to be given a DCO was the Cleve Hill site, near the rural community of Graveney in Kent
- At **900 acres, the facility is dwarfed by others in the planning pipeline**, and still not complete
- Cleve Hill features **600,000 east-west oriented panels, 3.9 metres high**, in a continuous solar apex grid pattern, covering the land below almost without break
- It has taken a **Greek construction company nearly two years to build**, working 7am to 7pm on weekdays and 7am to 2pm on Saturdays. It is due to start operating in late 2025

The first solar super scheme, the 900-acre Cleve Hill site, under construction

Solar sites are not 'temporary' and it's unlikely fields will ever produce food again

The likelihood of farmland returning to meaningful food production after decades of energy generation is extremely low. Many schemes apply to operate for 40 or even 60 years – few would describe this as genuinely 'temporary'. The two to three year build times for each super scheme extend the timeframe. Some solar NSIP developers have increased their project lifetimes mid-application – for example, the developer behind the 2,600-acre West Burton scheme, which will take out farmland across the Lincolnshire and Nottinghamshire border, increased from 40 to 60 years. Smaller site investors are applying to extend their lifetimes only a few years into agreed terms – for example, the Manor Farm solar array in Bedfordshire was originally given the go ahead for 25 years, but not even 10 years into operation, the latest in a series of scheme owners achieved planning permission to extend to 40 years.

The new National Planning Policy Framework encourages 'life extension' or 'repowering' of renewable installations, setting the stage for more or less permanent loss of farmland to solar.

Solar DCOs only require the developer to remove all the power generation equipment and infrastructure as part of any decommissioning phase – they are not obliged to return the land to its previous productive agricultural use. A recent Lancaster University study of solar facilities in England and Wales shows that soil covered by solar panels suffers from the effects of decreased sunlight and the change in microclimate. Soil becomes compacted, leading to issues with water infiltration and root growth. Other negative impacts relate to nutrient cycling and soil properties, including a drop in organic carbon and particulate organic matter, essential in soil carbon storage. The findings support earlier work from Lancaster finding evidence of issues with soil, microclimate and carbon cycling changes. A 2023 ADAS report found that solar sites cause soil compaction which results in structural damage – compaction leads to reduced permeability to water and air as well as increased surface water runoff and erosion. The study concludes that reversing soil compaction could take years and in some cases may prove permanent. ADAS also calls for more research into the impacts of corroded galvanised metal piles and beams used in foundations for the panels, and associated soil contamination.

These research findings challenge the perception of ground-mounted solar as a low impact or reversible use of land. In practice, these installations may result in the long term degradation of tracts of UK farmland.

'Agrivoltaics' is not the answer

Claims that land can still be farmed alongside industrial-scale, uninterrupted banks of solar panels are problematic: the concept of 'agrivoltaics' is in its infancy and is likely to remain limited in both scope and scale.

NSIP scheme panel heights are typically designed at 3 metres or higher – if panel heights are raised even higher to allow industry-standard agricultural machinery to harvest crops below or between solar arrays, even stronger, more robust concrete foundations and support structures would be needed, increasing both environmental and landscape impacts.

Arrays spaced widely enough to allow crop cultivation bring energy yields down further.

Claims that cropland can be successfully repurposed as grazing land after it has been switched to power production are generally over-stated – livestock is usually used to keep vegetation around the panels under control rather than a serious attempt to combine genuine farming with solar power generation.

Smarter options for UK solar rollout

More haste, less speed: there are better ways to roll out UK solar power

We are currently rushing into the mass-scale adoption of a form of intermittent, unreliable renewable that performs poorly in the UK – yet we are the only European country to adopt a 'fields first' route to solar power generation, aggressively targeting farmland with ground-mounted solar while ignoring the potential of brownfield land, or more intelligent dual-use or built environment solar deployment. The UK, with our climate at the bottom of the international table for solar power potential, should be following the example of countries like Germany or France, where legislators have incentivised or mandated solar panels on industrial, commercial and residential rooftops, car parks, balconies and other smart solar installations. In Germany, which has a higher solar power potential rating than the UK, policymakers have prioritised rooftop solar – in 2024, two thirds of its new installed capacity was on rooftops or buildings.

University College London Energy Institute analysis estimates a technical potential of 117GW of solar power on 650km² of rooftops and car parks in England alone. If only part of this 'wasted space' were used for solar, the 2030 47GW target could be achieved without sacrificing further farmland or impacting rural landscapes.

Solar has a role to play in the UK energy mix. But because of the yawning gap between installed solar capacity and actual output of usable electricity in the UK climate, and the very high land use requirement, ground-mounted solar facilities on farmland are a questionable policy direction. Policymakers should rethink how the UK rolls out solar in a more considered way. We should prioritise higher-yielding renewable sources that maximise energy output per acre, not just nameplate capacity. And we should follow the example of our neighbours in Europe and elsewhere to introduce new policy levers to deliver smarter solar siting strategies that double-up use of existing and new infrastructure and the built environment. This would better align with realistic energy outputs, good land stewardship and the protection of food security and our distinctive agricultural landscapes.

How other countries are using policy levers to deliver dual-use solar

- In Germany, **financial incentives play a key role in promoting rooftop solar** with generous grants and feed-in tariffs. States have **mandatory requirements for rooftop solar** on new buildings
- In Japan, several **local authorities promote power purchasing agreements** through a 'zero yen' policy. Kyoto has a **mandatory requirement for rooftop solar** on new buildings
- In China, a whole-county solar policy is used by local authorities to **aggregate opportunities for solar developers to install solar panels on a wide range of buildings** within a local area
- Countries including Poland and Italy are delivering **process reforms aimed at streamlining and speeding up the installation of rooftop solar**. Italy has **banned solar on agricultural land**

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