Resolution Foundation
BRIEFING

Sunny day savings

Assessing Government support for solar panels

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Summary

The new Government's plan to decarbonise the electricity system brings with it the lofty aim of tripling total solar capacity by the end of the decade. Although much of this will be driven by large-scale installations, ministers are also hoping for a "rooftop revolution" that could see millions more homes topped with solar panels by 2030. As well as providing carbon-free electricity, domestic solar can deliver significant reductions in energy spending – an average of £440 per year – to the households that get them. This means policy makers should think about rooftop solar like other ways of permanently reducing household energy spending, such as improving insulation. So in this briefing note we take a closer look at the case for installing more solar panels, discuss progress so far, and consider what, if any, policy might be needed to maximise the benefits.

Although they have received less attention than other bill cutting measures, solar panels are a cost-effective way to cut bills. Indeed, they offer bigger savings than insulating walls: 7p-a-year per pound spent, a third more than cavity-wall insulation. But fewer than one-in-ten (8 per cent of) roofs have solar panels installed, compared with 72 per cent of cavity walls that are filled, and 97 per cent of lofts that have at least some insulation. The high level of savings and untapped potential make rooftop solar an attractive option to cut bills and thereby improve living standards.

As with any measure to cut energy bills, households on lower incomes have proportionally more to gain. Energy spending makes up a tenth of monthly spending for the poorest households, twice that of the richest fifth, and a solar panel could reduce this by almost a quarter (24 per cent), equivalent to a 3 per cent rise in disposable income. But most poorer families are locked out from these benefits: three-in-five of the poorest fifth households have less than £1,000 in non-pension savings, so the £6,500 bill for a solar panel is surely out of reach for most, while credit markets aren't accessible for many poorer households and landlords have little incentive to fork out.

So for many poorer households, the reality is that support is needed to access the energy savings that installing solar panels bring. However, the past decade has seen outcomes move in the opposite direction. In 2015, the proportion of solar panels going to the richest third of local areas was similar to that for the poorest third (31 to 35 per cent). But, by 2023, there were over twice as many going into the richest places (45 to 21 per cent). The timing of this change suggests it was driven by the reduction in the feed in tariff rate in 2016, which reduced the subsidy to solar panel recipients by almost two-thirds overnight. This led to a collapse in take up of solar panels by poorer consumers.

Reversing these trends and broadening access to such an effective way of reducing households' energy spending should be a priority of any new era of solar policy. This need is brought into sharp relief by currently elevated levels of energy spending and binding

targets to reduce the energy costs of fuel-poor homes by 2030. Solar can help with these problems: we estimate that almost one-in-three (33 per cent) of the 3.6 million households that would be in a position to fit solar panels and are in fuel poverty (that is, spend more than a tenth of their disposable incomes on energy bills), would no longer be in that position with solar panels on their home. On average, fitting solar panels would get suitable households halfway towards the energy spend reduction needed to alleviate fuel poverty.

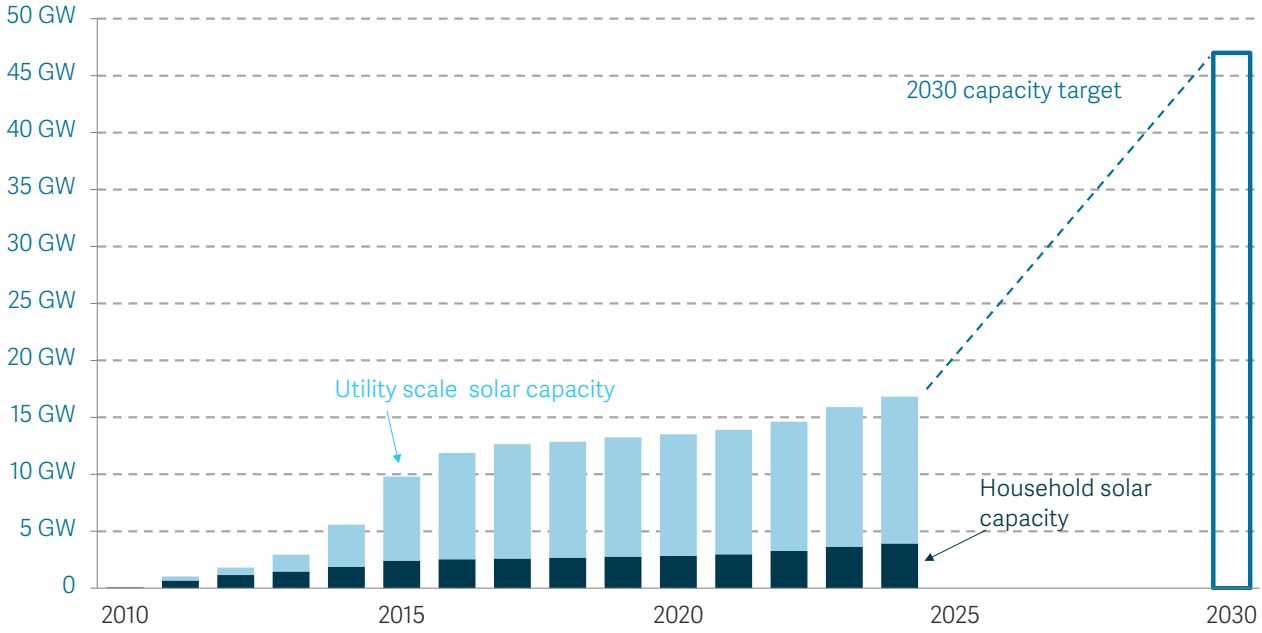
To achieve this, the Government should consider a means-tested scheme for subsidising the cost of borrowing and more grant funding to help poorer households overcome up-front cost barriers. That would help policy makers spark a "rooftop revolution" that reaches beyond just families that can afford it.

The Government has big plans for solar power

The Government's plan to decarbonise the electricity system brings with it lofty ambitions for solar energy. Its *Clean Power 2030 Action Plan* sets out the electricity mix needed to meet 2030 targets and finds that total solar capacity needs to triple by the end of the decade.[1] This means a step change increase in the pace of solar capacity installation: solar buildout will need to be over five-times faster than it has been since 2020, something that would push solar from 5 to 13 per cent of generation (see Figure 1).[2]

FIGURE 1: **The Government is aiming for a huge increase in solar-power capacity**

Installed solar generation capacity, actual and target: GB



SOURCE: RF analysis of Department of Energy Security and Net Zero, Solar photovoltaics deployment by capacity.

1 Department of Energy Security and Net Zero, Clean Power 2030 Action Plan, December 2024.
2 NESO, Clean Power 2030 Data workbook, November 2024.

The bulk of this will – and should – be delivered by large-scale installations, which provide cheaper energy than their smaller rooftop counterparts: the capital cost of a solar installation of less than four kilowatts was 64 per cent higher than one of 10-50 kilowatts in 2023-24, and the levelised cost of electricity (LCOE) – which includes all lifetime generation costs – was estimated to be 52 per cent higher for rooftop solar than utility-scale in 2018.[3]

Despite this, ministers also have set out hopes for a "rooftop revolution".[4] The Distribution Network Operators told Government that 9-10 gigawatts of rooftop solar projects could be installed by 2030, which would be a substantial revolution indeed – that could mean over 3 million more roofs with solar panels by 2030.[5]

The reason to do this isn't to speed up clean power or reduce electricity prices. Roofs may play a part in that, but we're better off focusing on utility-scale renewables with bigger capacities and lower costs that can reduce bills a bit for everyone. Instead, what's important about rooftop solar is it can deliver significant reductions in energy spending to the families that get them. We estimate that typical savings could be as high as £440 a year for a family with a small 3 kilowatt installation under typical assumptions about generation, electricity consumption, and prices.[6] This means policy makers should think about rooftop solar predominantly as a way of permanently reducing household-energy spending.

Rooftop solar is an excellent way of cutting household bills – and should be treated as such

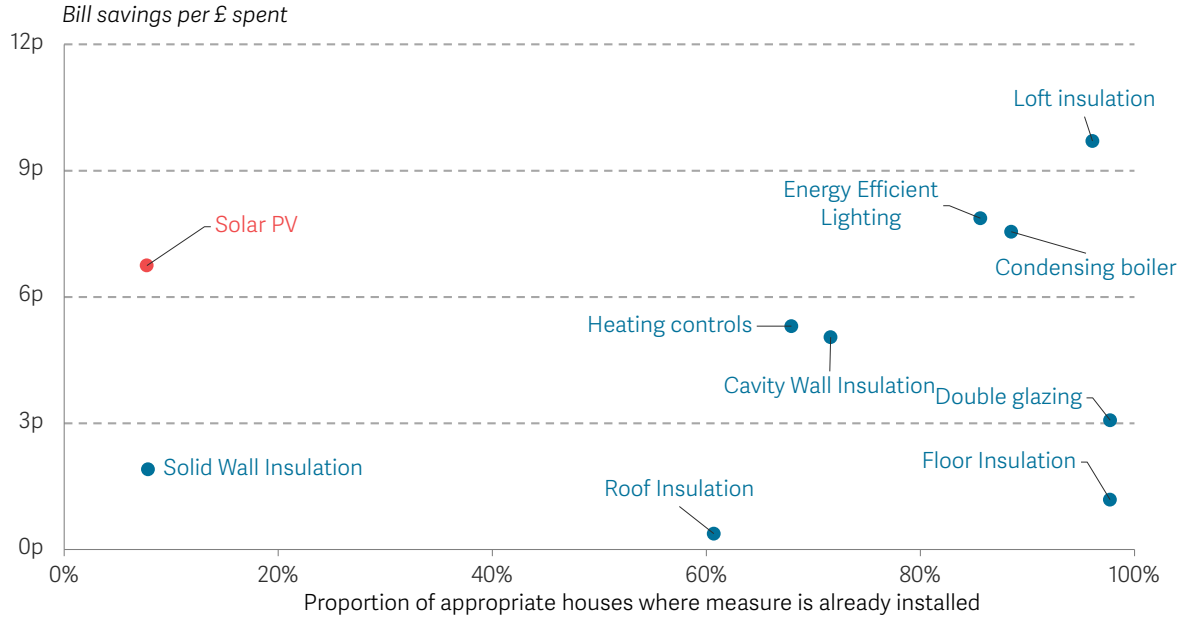
Rooftop solar reduces bills for households in two ways: most obviously, its generation means households have less need to use costly electricity from the grid, and it can also be a source of income when generation exceeds household electricity use or storage. As such, its comparator is not utility scale solar or wind power, but rather home upgrades like insulation and efficient heating systems. And compared to these other bill reduction measures, solar is fairly cost effective, as shown by Figure 2. At current prices (£6,500 for a 3 kilowatt solar panel) every pound spent cuts bills by around 7p-a-year, a third more than cavity wall insulation and over double what is saved by solid wall insulation.[7] But, despite their efficiency, solar panels have only been fitted to a small minority of

3 Department of Energy Security and Net Zero, Solar photovoltaic (PV) cost data, May 2024; European Commission – DG Energy, Cost of Energy (LCOE), July 2020.
4 T Helm and R McKie, Labour's 'rooftop revolution' to deliver solar power to millions of UK homes, 13 July 2024.
5 This is an upper limit assuming that all new rooftop solar is delivered on residential properties, and that installations are on average 3 kilowatts.
6 This savings figure assumes a 3 kilowatt installation operates with a load factor (the proportion of maximum possible generation produced by a solar panel over the course of a year, dependent on factors like sunlight hours) of 10.1 per cent, the feed-in tariff average over the last five years. Self-consumed energy is valued at the current electricity price of 24.5p/kwh, while exported energy is sold at 13.7p/kwh, the mean Smart Export Guarantee tariff rate in 2024, weighted by take-up. The assumed self-consumption rate is 25 per cent, which MCS research found was average for a typical household at home for half the day without a battery.
7 RF analysis of DESNZ, Green Homes Grant Local Authority Delivery release, January 2025

houses: fewer than one-in-ten (8 per cent) roofs have solar panels installed, while 72 per cent of cavity walls are filled and 97 per cent of lofts have at least some insulation. This combination of high savings and potential for growth makes rooftop solar an attractive option for policy makers concerned about household bills.

FIGURE 2: **For many, solar panels are the low hanging fruit of household bill reduction**

Bill savings per £ spent, and proportion of appropriate houses where measure is installed, by bill-cutting measure: England, 2024-25



NOTES: Calculations of bill savings are based on 2024-25 electricity and gas prices but based on 2020-21 English Housing Survey. The impact of installing insulation was calculated through a regression of energy spending on installation of insulation measures, controlling for other physical characteristics. Loft insulation represents the bill savings for increasing insulation thickness from under 50mm to 200mm – households topping up loft insulation from a higher thickness will typically receive less savings but should also pay lower costs. Solar Photovoltaic (Solar PV) savings assume a 3 kilowatt installation with a 10.1 per cent load factor where 75 per cent of generated electricity is exported using a typical Smart Export Guarantee tariff of 13.7p/kwh. See Footnote 6 for more details.
SOURCE: Measure costs based on average cost of installations in the Local Authority Delivery scheme, or Checkatrade where not available. Bill savings for insulation measures are based on the English Housing Survey. Proportion of appropriate houses where measure is installed based on a combination of data from Energy Performance Certificates, English Housing Survey, and MCS installation data.

It doesn't have to be a competition between insulation and solar, as the best measure will differ across households. Solar panels are more expensive and sometimes more disruptive interventions than many of these measures, and, of course, these averages hide variation across households for all the options.[8] There are also more considerations than just average savings. Insulation reduces the marginal cost of heating the home to higher temperatures – as well as lowering bills – making it particularly compelling

8 Several factors could drive lower or higher solar savings – such as lower savings for those in rainier areas or north facing roofs, and higher savings for those using more of their generation. Savings from insulation also vary, for example they are likely to be bigger for houses starting from a lower level of thermal efficiency.

for those living in homes too leaky to heat to comfortable temperatures. But for most households with roofs, solar is likely to be an attractive option.

And just as is the case for insulation, it is households on lower incomes that have the most to gain. Energy spending makes up a tenth of total household spending for the poorest households, twice that of the richest fifth.[9] A solar panel could reduce energy spending by almost a quarter, on average, for the poorest fifth of households (24 per cent), from £1,820 to £1,380 a year, equivalent to a 3 per cent boost to disposable income.[10]

But poorer families are particularly unable to access the benefits that solar panels bring, as they are capital intensive measures with big up-front costs. Three-in-five of the poorest fifth in households have less than £1,000 in non-pension savings, making the £6,500 bill for a solar panel a significant barrier for most.[11] This means that most poorer households would be dependent on private sources of credit that they may not be willing, or able, to access if they want to join in the rooftop revolution.[12] And for the two-thirds of the poorest fifth of households living in rented properties, there is (as with insulation) very little incentive for landlords to invest.[13] So for most poorer households, policy support is a necessity if they are to access the benefits that solar brings.

A new dawn of solar policy is needed to improve distributional outcomes

But policy decisions over the past decade appear to have driven outcomes in the wrong direction. From 2010 to 2016 the solar market was stoked by generous payments to early adopters called 'feed-in tariffs' – a per-kilowatt-hour subsidy to solar generators, which boosted demand for a new and unfamiliar product.[14] But after these were cut by almost two-thirds (64 per cent) in 2016, installations collapsed by 80 per cent from the 2015 peak to just 30,000 in 2017.[15] Feed in tariffs were eventually ended in 2019, replaced since by the 'Smart Export Guarantee', which requires energy suppliers to pay solar panel owners for their unused electricity but guarantees only that the price is above zero, a significantly weaker policy framework.[16]

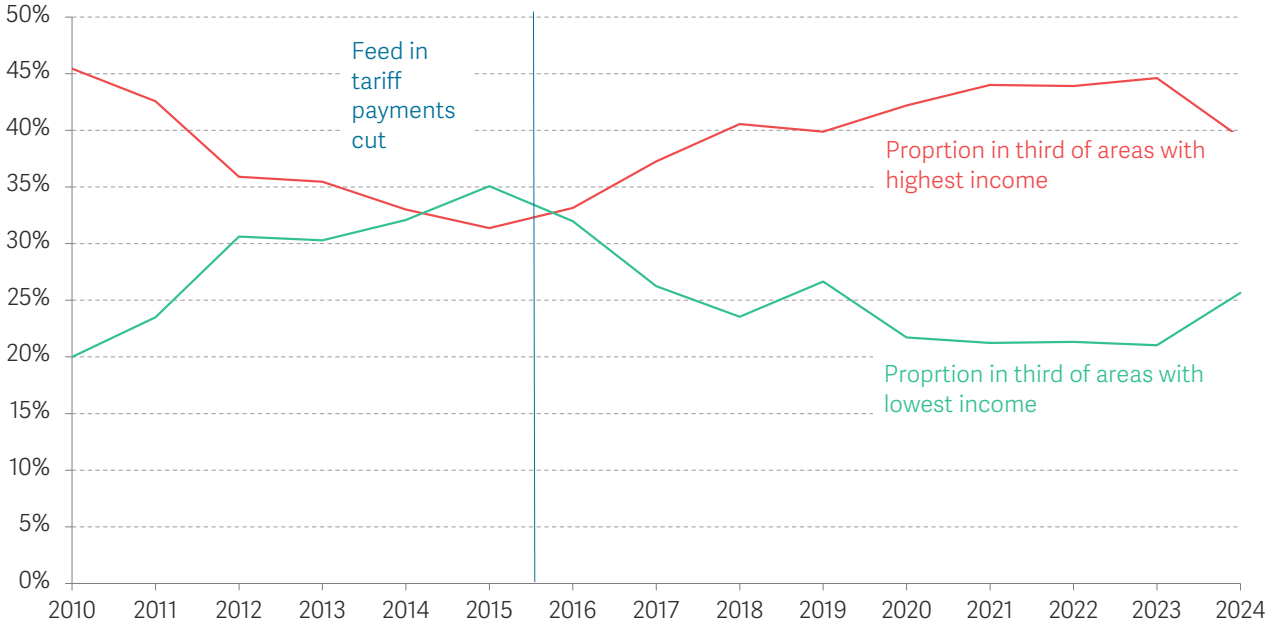
And demand for solar panels appears to have fallen furthest among poorer households. In 2015, the proportion of solar panels going to the richest third of lower layer super

9 RF analysis of ONS, Living Costs and Food Survey.
10 RF analysis of ONS, Living Costs and Food Survey and ONS, Households Below Average Income.
11 RF analysis of ONS, Wealth and Assets Survey.
12 RF analysis of University of Essex, Understanding Society. For more on debt issues facing poorer households, see Resolution Foundation, In too deep? The impact of the cost of living crisis on household debt, February 2024.
13 RF analysis of DESNZ, English Housing Survey.
14 Ofgem, Feed in tariffs, accessed 22 January 2025.
15 RF analysis of DESNZ, Solar photovoltaics deployment, December 2024; and Ofgem, Feed-in Tariff: Tariff Table 1 April 2024, January 2024.
16 Ofgem, Smart Export Guarantee, accessed 22 January 2025.

output areas (LSOAs, small geographical units with 400-1200 houses) was 31 per cent, lower than the 35 per cent going to the poorest third.[17] But by 2023 over twice as many were installed in richer LSOAs (45 per cent to 21 per cent), shown by Figure 3. Only in 2010, when solar panels were expensive and unfamiliar, were solar panels distributed more unequally.

FIGURE 3: **Since feed in tariff payments were cut, solar panel installations have become more concentrated in richer areas**

Portion of solar panel installations in the third most and least income-deprived LSOAs: England and Wales



NOTES: Feed in tariff payments were cut from 12.5 p/kwh to 4.4 p/kwh for deemed generation in January 2016.
SOURCE: MCS, Installations dataset; MHCLG, English Index of Multiple Deprivation 2019; Statistics for Wales, Welsh Index of Multiple Deprivation 2019.

The key reason for this appears to be the reduction in feed in tariff rates in January 2016. Installations fell disproportionately in poorer areas, and then didn't return when the market recovered (by 2023, installation numbers had recovered to 91 per cent of the 2015 peak). Box 1 further explores the implications of low prices for unused generation.

There has been welcome improvement during 2024, possibly driven by the inclusion of solar panels in government-funded energy-efficiency policies such as the Energy Company Obligation (ECO) and Local Authority Delivery schemes.[18] This is very welcome, and such schemes have delivered 62,000 solar panels to eligible households since 2019.[19]

17 RF analysis of MCS, Installation Data, January 2025.
18 Ofgem, Energy Company Obligation, accessed 3 February 2025; DESNZ, Green Homes Grant, accessed 3 February 2025
19 RF analysis of DESNZ, Household Energy Efficiency Statistics, December 2024; DESNZ, Green Homes Grant LAD and HUG release, December 2024.

But these schemes are a small part of the solar market, accounting for just 12 per cent of total installations since 2019, and have not been enough to reverse the trends of the past decade.[20]

BOX 1: Ensuring households are paid well for their generation is also important

Better take up of solar panels in poorer areas when feed-in tariff rates were high (see Figure 3) suggests that adequate and certain payoffs are important to broadening access to solar panels. Export rates are particularly important for households with lower electricity consumption that can consume less of their generation themselves.

At present, the Smart Export Guarantee (SEG) leaves export rates to the market, guaranteeing only that prices stay above zero. At first look the SEG seems to be doing the job – the average export rate is 13.7p per kilowatt-hour, over half the electricity price.[21] The most common SEG tariff is Octopus' fixed price 15p per kilowatt-hour tariff, which accounts for 40 per cent of all those on SEG tariffs.[22]

But these healthy prices mask problems for many solar panel owners, particularly for the 20 per cent still on 'unbundled' tariffs in 2023-24.[23]

Unlike the more popular 'bundled' tariffs, these don't require exporters to import electricity from the same company they export to.[24] The trade-off for easier access is very low export prices: on average, a household on an unbundled tariff is paid just 4.1 p per kilowatt-hour, 73 per cent less than the median unbundled tariff. Selling energy this cheaply reduces typical annual solar savings from £440 to £240.[25] Households less able to switch supplier –such as those in arrears, a problem affecting 1.9 million electricity accounts – are particularly likely to be underpaid for their generation, as they may be locked out of the most lucrative 'bundled' tariffs.[26]

So policy makers should consider helping those facing low export prices as well as support with upfront costs, to ensure poorer households can benefit from solar panels as well as afford them. This could involve either stronger price regulation that prevents households

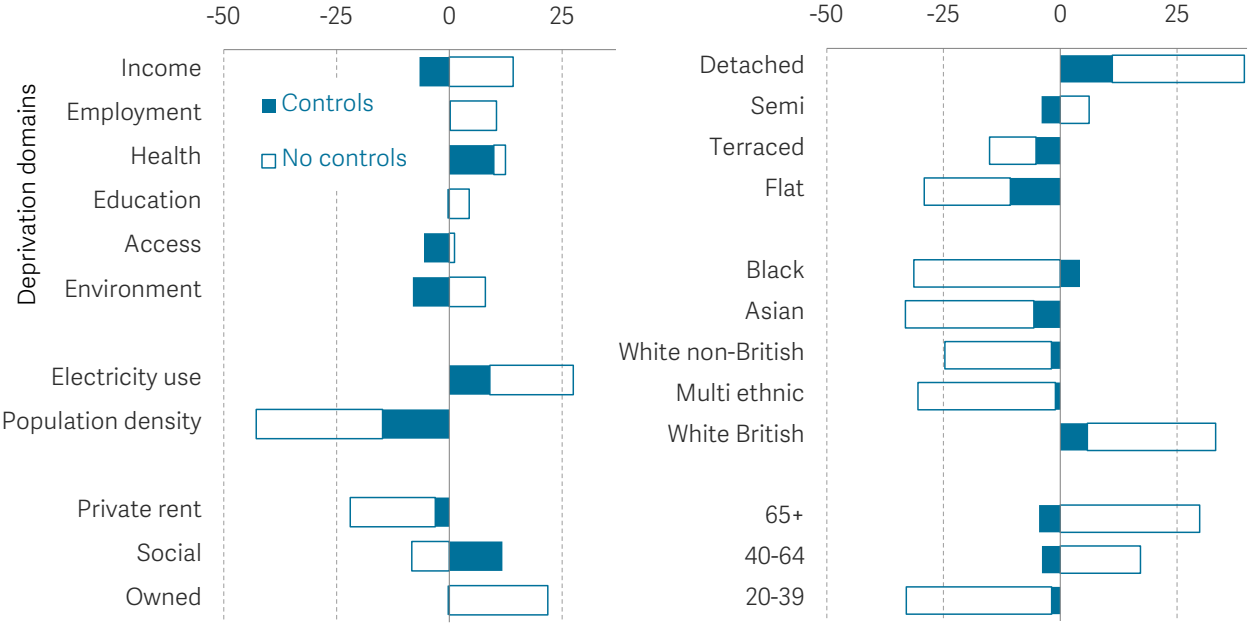
20 RF analysis of DESNZ, Solar photovoltaics deployment; Household Energy Efficiency Statistics; Green Homes Grant LAD and HUG release; Social Housing Decarbonisation Fund, December 2024.
21 RF analysis of Ofgem, Smart Export Guarantee Annual Report, October 2024. This is the average tariff across all individuals with tariffs not the average of available rates.
22 RF analysis of Ofgem, Smart Export Guarantee Annual Report, October 2024.
23 RF analysis of Ofgem, Smart Export Guarantee Annual Report, October 2024.
24 Some bundled tariffs also have other requirements, such as EV or battery ownership.
25 Based on the same assumptions except a 4.1p/kwh export price. See Footnote 6 for more details.
26 RF analysis of Ofgem, Debt and Arrears Indicators Q3 2024, December 2024. This includes both accounts with a consumer repaying an energy debt, and accounts in arrears where there is no arrangement to repay the debt.

from being stuck on very low tariffs, or higher take-up of batteries, which increase the proportion of electricity that solar-generating households are able to consume themselves.

Digging deeper, Figure 4 shows how well an LSOA's ranking on various characteristics – such as population density, or the concentration of detached houses – predicts its take-up of solar panels. We do this by showing how many additional houses have a solar panel in places at the 75th percentile (of the characteristic in question) compared with areas at the 25th. For example, this analysis suggests that an LSOA in the 75th percentile of electricity use has 27 more solar panels per 1,000 houses (or 9 more when controlling for other factors) than one at the 25th percentile of electricity use – a significant amount given the average number of solar panels per 1,000 houses across the country is 56. The unshaded bars show the raw relationship, and the darker blue bars show the results when controlling for local authority and the other displayed characteristics.

Figure 4. Demographic factors play an important role in where solar panels are going

Increase in solar panels per 1,000 houses in LSOAs at the 75th percentile of various characteristics, compared to the 25th percentile: England and Wales, 2010 to 2024



NOTES: Regressions controls include local authority region and measures of the presented characteristics. Regressions assume the relationship between solar panel take-up and other characteristics are linear.
SOURCE: Census data; and MCS, Installation Data.

Figure 4 shows that it is rural places, places with bigger detached houses and places with older, whiter populations that are more likely to have solar panels. Rich households are almost four times as likely to be in a detached house than a poor household, suggesting

concentration of solar panels in these areas isn't representative of those who need the energy savings most.[27] Similarly, private renters are missing out even accounting for the concentration of renters in denser areas with more flats: over three-in-five low-income renters live in houses with roofs, not flats, so with the right policy support there is scope to get solar into a much wider variety of places and houses.[28]

Support for solar installation should be targeted at reducing fuel poverty

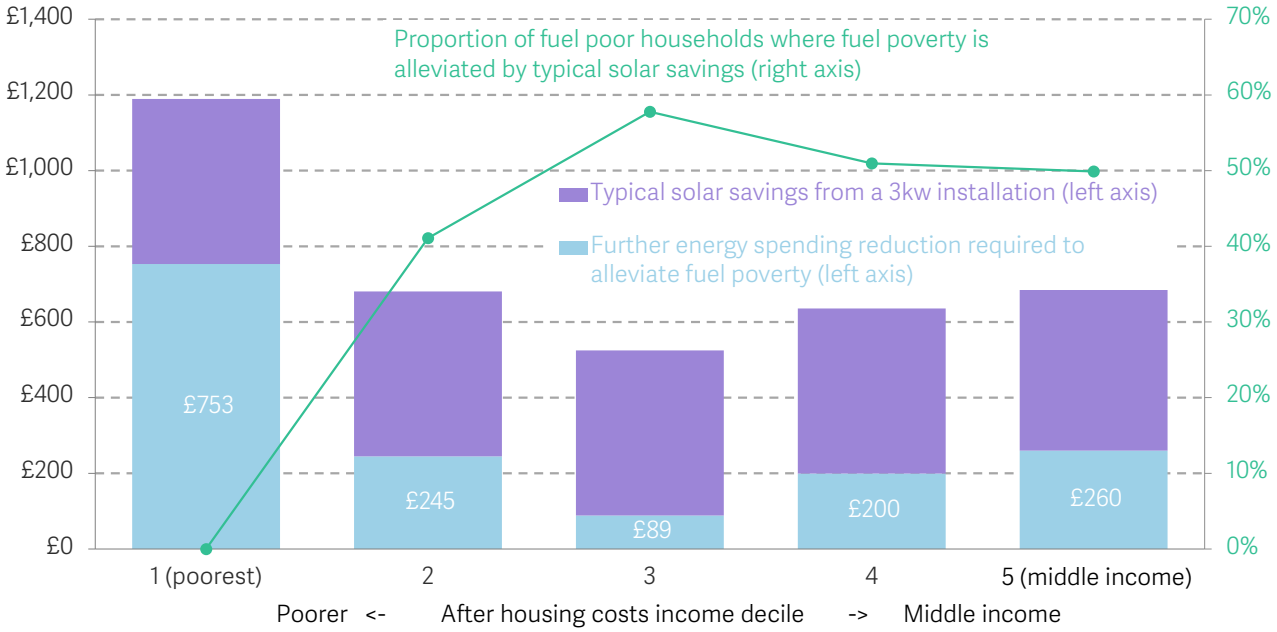
Reversing these trends and broadening access to a key means of reducing energy spending should be a priority of any new era of solar policy. The distribution of solar panels is less equal than it has been, but history shows it is possible to sustain a solar market that many can engage in. But this requires policy support that caters for the barriers facing some households.

This need is brought into sharp relief by the currently elevated levels of energy spending and binding fuel poverty targets set to bite later this decade. One-in-three (33 per cent) of the 3.6 million low-to-middle income households that could install solar panels and which spend more than a tenth of their disposable incomes on energy bills would no longer do so with a solar panel on their home.[29] As Figure 5 shows, while the very poorest need significant support with energy spending to alleviate fuel poverty, a solar panel can go a long way towards getting all but the poorest out of fuel poverty. On average, a solar panel would get suitable fuel poor households over halfway (53 per cent) towards the reduction in energy spending they need to move out of fuel poverty.[30]

27 RF analysis of DESNZ, English Housing Survey.
28 RF analysis of DESNZ, English Housing Survey.
29 RF analysis of DESNZ, English Housing Survey. Fuel poverty is defined here as households that have below median equivalised income after housing costs and spend more than 10 per cent of disposable income on energy. This differs from the Government's preferred definition, which excludes households living in energy efficient homes.
30 RF analysis of DESNZ, English Housing Survey.

FIGURE 5: **Solar can make a big dent in fuel poverty for lower income households**

Contribution of typical solar panel savings to energy spending reduction needed to alleviate fuel poverty, by after housing costs income decile, below median income households only: England, 2024-25



NOTES: Households are classed as fuel poor if they spend more than 10 per cent of their income on energy, and have an after-housing-costs income below the median. Solar savings assume a load factor of 10.1 per cent, an average self-consumption rate of 25 per cent, and an average export price of 13.7/kwh. Self-consumption rates are higher for high electricity users and battery owners, who could receive significantly higher savings than assumed here. Households are assumed to be able to install solar panels if they live in a non-flat house.
SOURCE: RF analysis of DESNZ, English Housing Survey; Energy Savings Trust, and Ofgem, SEG annual report.

With the new Fuel Poverty Strategy due this year and policies under the Warm Homes Plan yet to be announced, it is very much worth considering what role rooftop solar should play. Policy makers should think ambitiously about what can be done to achieve this. It is good that the Government wants to continue including solar in energy-efficiency schemes and funding for these schemes should be expanded under the Warm Homes Plan. The Government should also ensure that its minimum energy-efficiency standards for renters incentivise landlords to turn to solar where that's the best option. But the Government should also cast the net wider and consider providing some form of means-tested subsidised credit for those that are ineligible for grant support schemes. Means-testing based on both incomes and assets (including property value) is the fairest way to target support for home upgrades towards those least able to access credit markets.[31] And, although help with upfront costs is vital, the Government should also consider ways to prevent unfairly low export rates for some consumers. Getting policy right in this area would help policy makers spark a "rooftop revolution" that reaches beyond those households with the means to afford it.

31 For an example of how to take into account capital and income in means testing, see: A Anis-Alavi, L Judge, J Marshall, C McCurdy & D Tomlinson, Hitting a brick wall: Low the UK can upgrade its housing stock to reduce energy bills and cut carbon, Resolution Foundation, December 2022.

Annex 1

Data Citations

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