PPG Note SW001

Solar PV – regional variance

SOUTH WEST ENERGY HUB

September 2021

The SW Energy Hub is supporting a number of Local Planning Authorities in developing and aligning evidence in support of net zero planning policies. This guidance note is to be read in conjunction with Cornwall Council's Climate Emergency DPD evidence[1] for new housing, to inform the relevance of this work in other regions with less solar irradiance than Cornwall.

Solar irradiance

Whilst the majority of the Cornwall DPD evidence is independent of geography, solar irradiance and therefore the energy generated from solar PV panels can vary significantly across the UK. This note assesses whether this variance would impact the ability of housing elsewhere in the country to meet the targets set out in the DPD evidence.

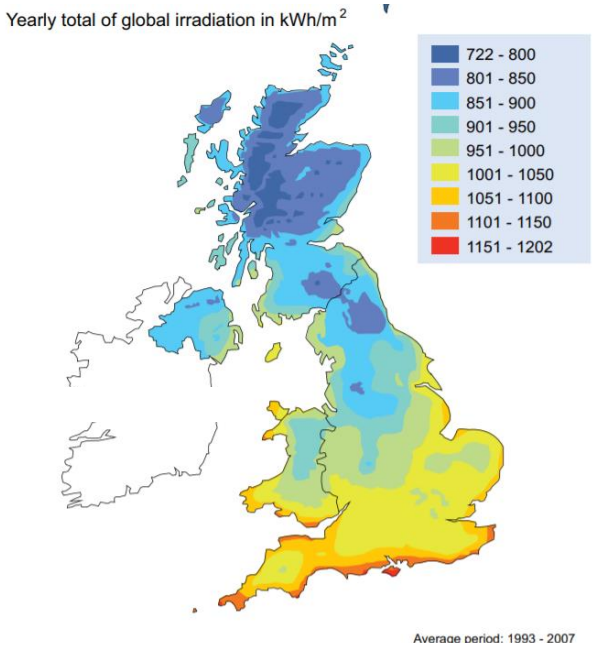

Figure 1 UK solar radiation map

Energy Use Intensity (EUI) targets

The Cornwall DPD net zero target is focussed on achieving net zero onsite energy by balancing energy demand over a year with equivalent zero carbon generation. Six housing typologies were tested against an EUI target of 35 and 40kWh/m^2/year. All cases aside from the mid-rise flats were able to achieve an energy consumption below 35kWh/m^2/year, with their consumption matched by onsite solar PV generation.

Policy viability

For the findings of this evidence to resonate beyond Cornwall, sufficient roof space must be available to make up for any shortfall in PV generation. Whilst a further reduction in demand is also possible (or generation from another source), this note does not consider demands below those modelled in the Etude report (red bars overleaf), instead it compares the output should the same sized array be located in different areas of the country.

Findings

- Cornwall DPD results (red bars overleaf) are not intended to be compared directly to any one building example – orientation, architecture and shading vary on a case by case basis.
- Predicted generation from equivalent arrays at other locations are shown for south, south-east/south-west and east/west orientations (yellow bars overleaf) based on generation assumptions from MCS[2].
- The DPD maximum roof capacity assumptions are generous and allow for optimised layout and orientation. Despite this, spare capacity far exceeds any regional shortfall for all results except flats, suggesting a lack of additional roof space for houses is unlikely to be the largest constraint when considering applying the DPD policy in other regions.

[1] Etude (2021). *Technical Evidence Base for Policy SEC 1 – New Housing*. Available at: https://bit.ly/3C5xDH9 [accessed 13/09/21].
[2] MSC (2012). *Guide to the Installation of Photovoltaic Systems*. Available at: https://bit.ly/3hrzJt9 [accessed 13/09/21].

- For flats, achieving a net zero on-site balance becomes harder as insolation reduces and would require building to target an EUI lower than the policy requirement (the case in the Cornwall DPD modelled examples), greater roof areas than the test cases modelled and/or a limited use of offsetting credits.
- Regional variance is not expected to reduce supply by more than 7kWh/m²/year for any modelled scenario, approximately equivalent to a maximum of three additional PV panels (based on 380W panels in NE England).
- Cost uplifts may be negligible where different panels are specified. Where additional panels are required, net costs may increase up to ~£600 in Bristol, and ~£1,000 in Manchester (detached house example). Other examples are given overleaf. These costs are conservative as they assume a degree of linear spend – in practice, fixed costs (scaffolding, inverters etc) may not increase.

Results – outline

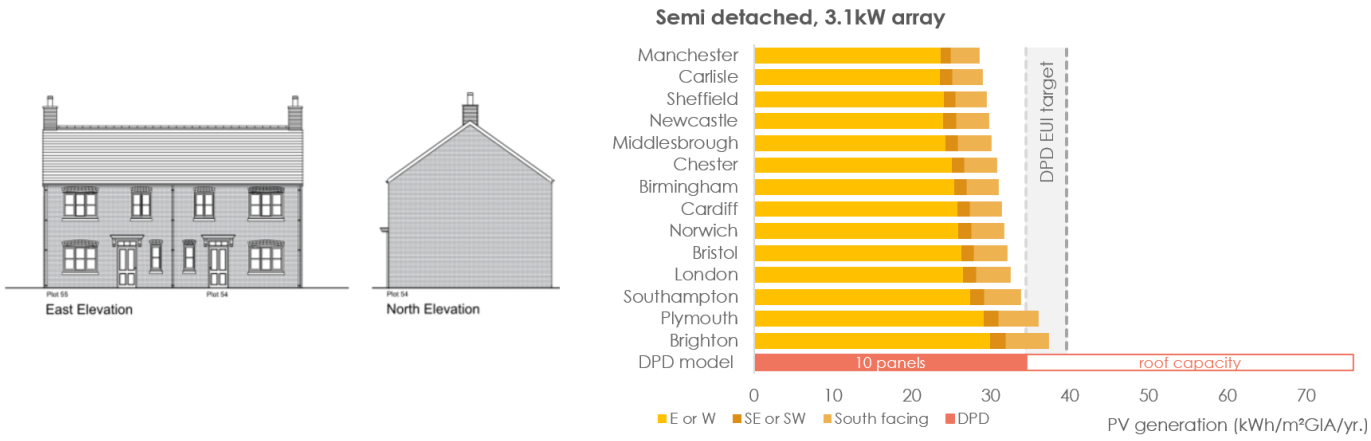

Figure 2 Test case: semi-detached house, 3.1kW PV array

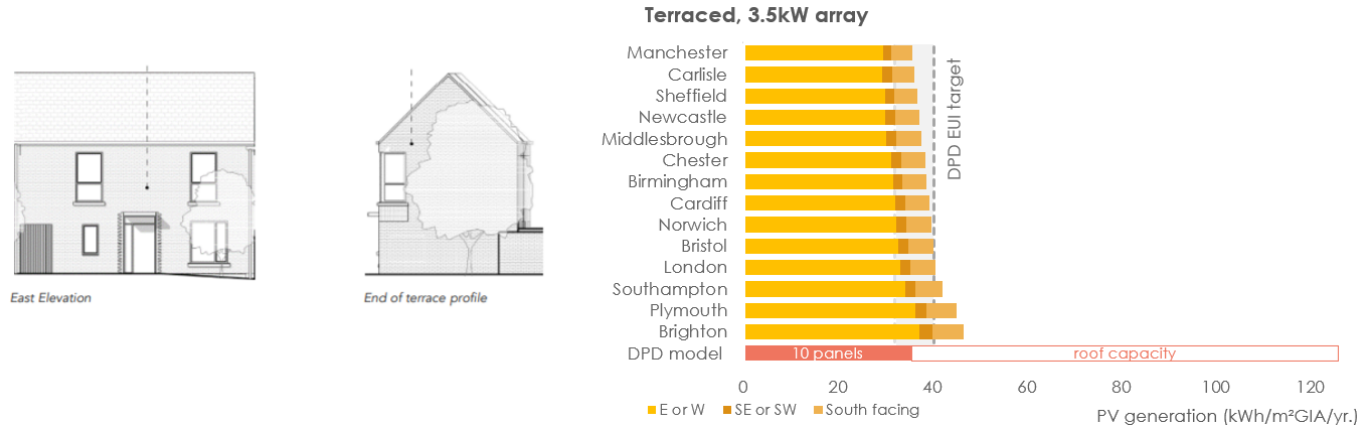

Figure 3 Test case: terraced house, 3.5kW PV array

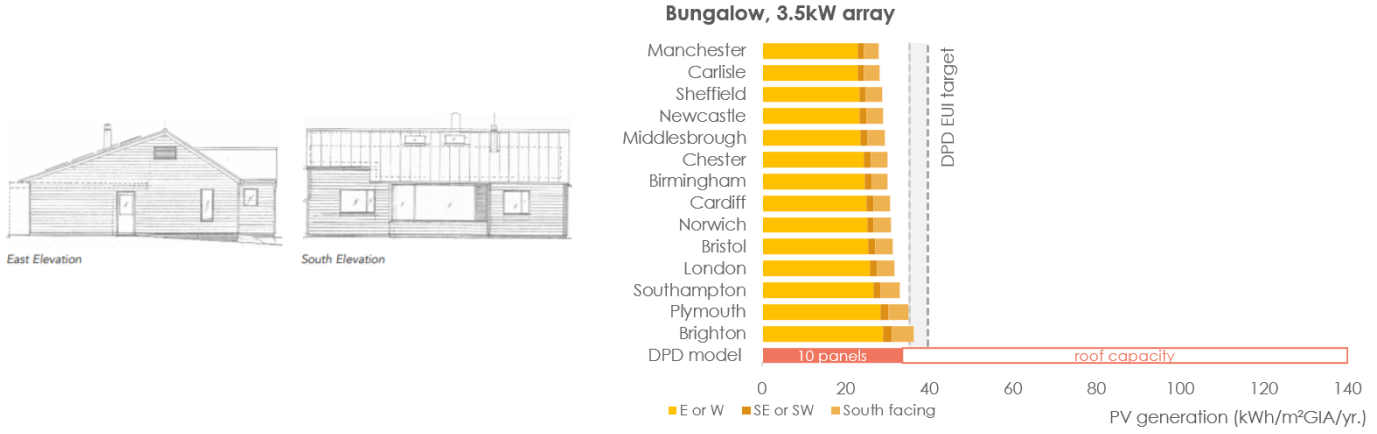

Figure 4 Test case: bungalow, 3.5kW PV array

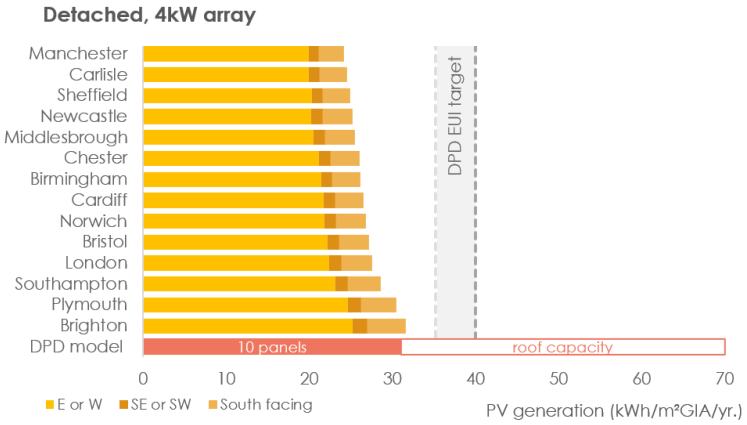

Figure 5 Test case: detached house, 4kW PV array

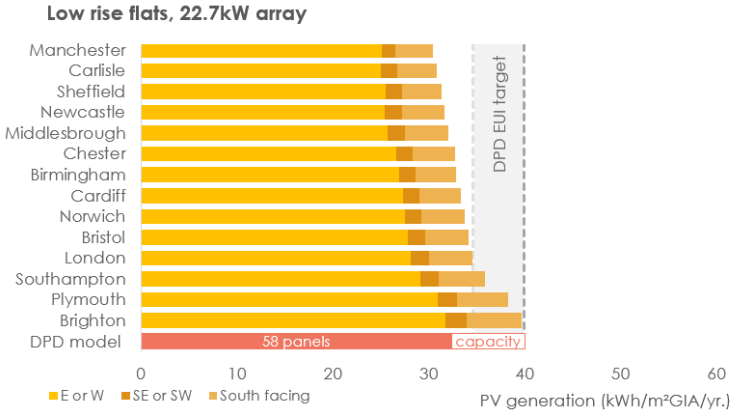

Figure 6 Test case: low rise flats, 22.7kW PV array

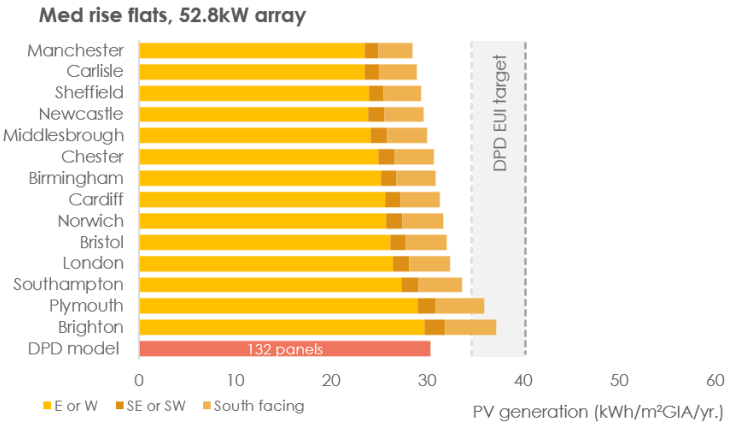

Figure 7 Test case: medium rise flats, 52.8kW array

Results – detailed

Table 1 Indicative estimates for additional requirement to match DPD scenario generation (south facing roof example)

		Additional requirements to match kWh PV generation of DPD example buildings													
		Brighton	Plymouth	Southampton	London	Bristol	Norwich	Cardiff	Birmingham	Chester	Middlesbrough	Newcastle	Sheffield	Carlisle	Manchester
Semi detached, 3.1kW array	kW	-0.1	0.0	0.2	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.7	0.8	0.8
	Panels	-0.2	0.1	0.6	0.9	1.0	1.1	1.2	1.4	1.4	1.6	1.8	1.8	2.0	2.1
	£ high	-£100	£0	+£200	+£400	+£400	+£400	+£500	+£500	+£500	+£600	+£700	+£700	+£800	+£800
	£ low	-£50	£0	+£100	+£200	+£200	+£200	+£250	+£250	+£250	+£300	+£350	+£350	+£400	+£400
Terraced, 3.5kW array	kW	-0.8	-0.7	-0.6	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.2	-0.2	-0.1	-0.1	0.0
	Panels	-2.2	-1.9	-1.5	-1.2	-1.1	-1.0	-0.9	-0.7	-0.7	-0.5	-0.4	-0.3	-0.2	-0.1
	£ high	-£800	-£700	-£600	-£400	-£400	-£400	-£300	-£300	-£300	-£200	-£200	-£100	-£100	£0
	£ low	-£400	-£350	-£300	-£200	-£200	-£200	-£150	-£150	-£150	-£100	-£100	-£50	-£50	£0
Bungalow, 3.5kW array	kW	-0.4	-0.2	0.1	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	0.9
	Panels	-0.9	-0.5	0.3	0.7	0.9	1.1	1.2	1.4	1.5	1.8	1.9	2.1	2.3	2.5
	£ high	-£400	-£200	+£100	+£300	+£300	+£400	+£500	+£500	+£600	+£700	+£700	+£800	+£900	+£900
	£ low	-£200	-£100	+£50	+£150	+£150	+£200	+£250	+£250	+£300	+£350	+£350	+£400	+£450	+£450
Detached, 4kW array	kW	-0.1	0.1	0.3	0.5	0.6	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.1	1.1
	Panels	-0.2	0.2	0.9	1.3	1.5	1.6	1.8	2.0	2.0	2.3	2.5	2.6	2.8	3.0
	£ high	-£100	+£100	+£300	+£500	+£600	+£600	+£700	+£700	+£800	+£900	+£900	+£1,000	+£1,100	+£1,100
	£ low	-£50	+£50	+£150	+£250	+£300	+£300	+£350	+£350	+£400	+£450	+£450	+£500	+£550	+£550
Low rise flats, 22.7kW array	kW	-4.2	-3.5	-2.2	-1.5	-1.2	-0.9	-0.7	-0.4	-0.2	0.3	0.5	0.8	1.2	1.5
	Panels	-11.0	-9.2	-5.9	-3.8	-3.1	-2.4	-1.8	-0.9	-0.6	0.7	1.4	2.0	3.1	3.9
	£ high	-£4,200	-£3,500	-£2,200	-£1,500	-£1,200	-£900	-£700	-£400	-£200	+£300	+£500	+£800	+£1,200	+£1,500
	£ low	-£2,100	-£1,750	-£1,100	-£750	-£600	-£450	-£350	-£200	-£100	+£150	+£250	+£400	+£600	+£750
Med rise flats, 52.8kW array	kW	-9.7	-8.1	-5.2	-3.3	-2.7	-2.1	-1.6	-0.8	-0.5	0.6	1.2	1.8	2.7	3.4
	Panels	-25.5	-21.4	-13.6	-8.8	-7.1	-5.5	-4.1	-2.1	-1.3	1.7	3.3	4.7	7.2	9.1
	£ high	-£9,700	-£8,100	-£5,200	-£3,300	-£2,700	-£2,100	-£1,600	-£800	-£500	+£600	+£1,200	+£1,800	+£2,700	+£3,400
	£ low	-£4,850	-£4,050	-£2,600	-£1,650	-£1,350	-£1,050	-£800	-£400	-£250	+£300	+£600	+£900	+£1,350	+£1,700

Assumptions

- All building drawings and energy generation estimates relating to the DPD scenario are reproduced from the Etude[1] report submitted as evidence for Cornwall Council's 2021 Climate Emergency Development Plan Document (DPD)[3].
- All energy generations estimate for the regional locations are based on MSC[2] data and an assumption that all panels are installed at a 30-degree incline.
- Cost uplift estimates are based on a typical value of £1,000/kWp. This is marginally less than small scale solar costs reported on by BEIS[4], acknowledging that including full costs in uplift calculations would double count some fixed elements. The low scenario reduces this cost by 50% to allow for less additional fixed costs and general efficiencies.
- All results are estimates only – generation can vary significantly based on weather, shading etc. Capacity, additional capacity and maximum capacity estimates are all highly dependent on building architecture and orientation.
- Sub regional estimates have not been provided; interpreting such results would overstate the accuracy for which indicative calculations can be undertaken without knowing individual building details.
- Reliance on any recommendations provided by the Energy Hub shall be taken entirely at the readers own risk.

[3] Cornwall Council (2021). *Climate Emergency Development Plan Document Pre-Submission Consultation*. Available at: https://bit.ly/2XctKI7 [accessed 13/09/21].

[4] BEIS (2021). *Annual Cost of Small-Scale Solar Technology Summary*. Available at: https://bit.ly/2YGLvsT [accessed 13/09/21].