South West NET ZERO HUB

Setting a net zero energy offset price for new build residential development

Evidence for B&NES Policy SCR6 (Sustainable Construction for New Build Residential Development)

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Executive Summary

The purpose of this report is to provide recommendations for an energy offset price (in £/MWh) that would be sufficient to meet a shortfall in on-site renewable generation under Policy SCR6 (Sustainable Construction for New Build Residential Development) of B&NES Local Plan Partial Update (LPPU).

Offsetting should without exception be a last resort. It will almost always be more cost effective to integrate net zero measures within new development design and construction than it will be to retrofit existing housing stock.

It has been established that an energy offset price of **£130/MWh** (in 2024 prices) is sufficient to fund the installation of east/west orientated PV systems onto existing B&NES social housing stock based on a 'central' cost. The evidence suggests that the proposed offset price is not unjustifiably high or unviable but will incentivise developers to maximise renewable generation on site before considering offsetting.

An energy offset price in £/MWh should be applied to the full development lifetime (30 years). The **offset payment** for can be calculated using the formula:

[annual *site energy demand (MWh) – annual site energy generation (MWh)] x 30 (years) x energy offset price (£/MWh)*

If costs for energy storage were incorporated in these offsetting projects, the energy offset price charged to developers would likely need to increase to £150-£200/MWh.

Regardless of the rate at which the offset price is set it is important to ensure that all prices are subject to periodic review or linked to market price inflation.

1 Introduction

This report has been prepared to provide additional evidence to support Bath and North East Somerset Council (B&NES) in taking forward recommendations set out in CSE's report 'Carbon offsetting within an energy intensity policy framing'. In the most part it is an updated version of a report prepared by South West Net Zero Hub (SWNZH) for Cornwall Council in 2022 which was successfully used as evidence to establish a renewable energy offsetting framework as part of their Climate Emergency DPD.

The purpose of this report is to provide recommendations for an energy offset price (in £/MWh) that would be sufficient to meet a shortfall in on-site renewable generation under Policy SCR6 (Sustainable Construction for New Build Residential Development) of B&NES Local Plan Partial Update (LPPU). At time of writing, it is proposed that an energy offset price will apply to major development applications (10 or more dwellings) only.

1.1 Rationale

B&NES has acknowledged the important role that net zero housing has in leading and driving the transition to a net zero local economy. This position is supported by the Committee on Climate Change (CCC) in their advice on UK housing which was subsequently adopted under the UK Government's legally binding carbon budgets.

Policy SCR6 sets out a requirement for new housing to demonstrate a **net zero *energy*** balance over an operational year. This is intentionally **not net zero *carbon*** for two reasons:

1. Performance gap: the gap between predicted and actual housing energy consumption has never been greater, leading to higher energy bills than predicted[1]. Energy is a far more familiar metric than carbon that can be more readily assessed and understood by planners and developers, and easily measured on the household energy bills post-construction.
2. UK electricity grid decarbonisation: as the UK electricity grid continues to decarbonise, the carbon factors (tCO2e) used in calculating emissions from energy use will continually change and trend towards zero[2]. Requiring net zero energy use in development considers a constant metric that helps ensure that new development doesn't avoid its climate emergency (or fuel poverty) responsibilities by hiding poorer performance behind a decarbonising grid.

1.2 Offsetting mechanisms

It is assumed that offsetting will only be acceptable to an onsite renewable energy shortfall where energy efficiency has been prioritised, renewable generation has been maximised, and the Local Planning Authority (LPA) considers that there are sufficient site constraints to deem offsetting necessary. ***This means that offsetting cannot be used as a mechanism to avoid energy efficiency or onsite renewable energy measures.***

[1] Etude et al, Making SAP and RdSAP 11 fit for Net Zero: 15-minute summary, 2021.
[2] DESNZ, Data Table 1: Electricity emissions factors to 2100, 2023.

For the avoidance of doubt, this report does not consider offsetting of embodied energy arising from construction. It relates solely to the operational energy requirement of Policy SCR6.

Whilst many different offset mechanisms are possible, the analysis in this report assumes that offsetting will take the form of cash-in-lieu payments to B&NES Council for investment into local energy projects. This is the most transparent mechanism for the purposes of setting an accurate local offset price and ensures development needs and benefits are realised locally.

2 Setting the right price

To determine a net zero offset price locally there are two main considerations: maximising renewables and not increasing the burden on existing area-based decarbonisation plans. Offsetting should without exception be a last resort. It will almost always be more cost effective to integrate net zero measures within new development design and construction than it will be to retrofit existing housing stock.

Establishing offsetting prices for planning policies has historically been based on the priority of maximising renewables. Whilst this approach has accelerated the deployment of renewables, relying on it alone often allows new housing development to offset with the most cost-effective options (e.g. offsite large-scale renewables) that were already planned for construction (i.e. no additionality provided). It can address the net zero energy balance from new development however it might reduce opportunities for others and drive up the cost of offsetting for sectors that are less able to meet net zero requirements onsite. Figure 1 illustrates the importance of considering the wider impact when setting a net zero offsetting policy.

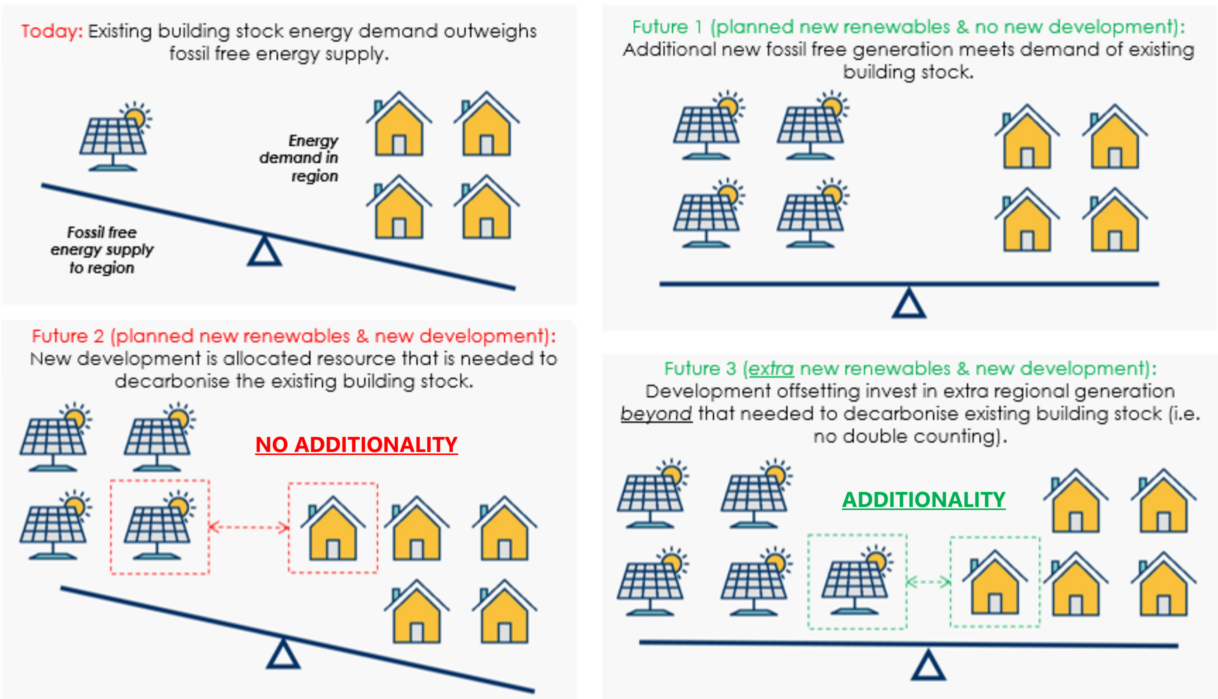

Figure 1 – Balancing net zero at a regional level

In 'Future 1', planned renewables meet the energy demand of existing building stock and no new building stock is developed. In 'Future 2', the same planned renewables are expected to meet the energy demand of both existing and new building stock. No additionality is provided and there is likely to be double counting of renewables. In 'Future 3', extra renewables are deployed to meet the energy demand of new building stock. Additionality is provided to ensure no double counting of renewables.

2.1 Rate of savings

Wider principals of carbon offsetting are not covered in this document. However, it is critical that any cash-in-lieu contributions received are invested into offsetting measures that come online at the same time as buildings start consuming energy (and emitting carbon). Failure to do so would require higher offset prices to play 'catch-up' with development emissions; ***offset payments in bank accounts do not save carbon***. Figure 2 illustrates this concept. Where offsetting measures are delayed there will be an equivalent delay in energy offset (unless additional investment is made available to increase the offsetting measure).

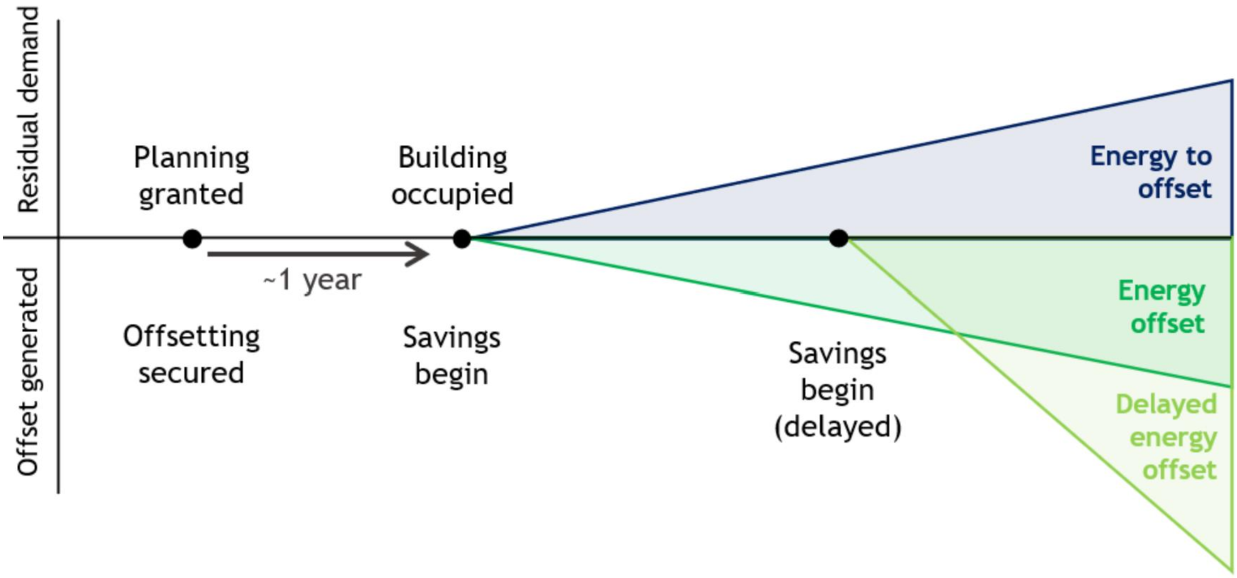

Figure 2 – Rate of savings concept

2.2 Energy & carbon imbalance

To mitigate the burden on developers and LPAs alike, the energy balance in Policy SCR6 is an oversimplification of how the energy system works in practice. Whilst the policy ensures that the total renewable energy generated equals demand over a typical year, in practise there will be a mismatch. For example, peak solar PV energy generation occurs in summer months during the day, whereas peak heating demand occurs in the morning and evenings during the winter.

In time it is important to address this mismatch both to manage the upstream balance of carbon emissions and to reduce energy bills to homeowners (when not generating, energy must be purchased from the grid). This applies equally to onsite measures and offsite measures. In a domestic setting with solar generation the addition of battery storage currently offers the most effective solution to help address this imbalance. When combined with solar PV it can help to modulate daily imbalances in supply and demand. The additional offsetting cost for battery storage is not considered in detail in this report but B&NES should be mindful that it will likely become a standard specification as consumer confidence increases and costs fall.

3 Methodology

3.1 Scenarios

A solar photovoltaic (PV) system is the most likely renewable energy generating technology to be installed onsite for new developments. This report therefore focusses on retrofitting solar PV onto existing B&NES social housing stock as a suitable method to provide an equivalent solution elsewhere. The offset fund could, however, be utilised to develop solar PV at other B&NES sites.

Three scenarios have been developed to assess the cost of a 3kW domestic PV installation (typical size for a domestic roof of this archetype) under different conditions. Each scenario includes projected costs that would likely be incurred in a counterfactual scenario over the lifetime of a system, to ensure that offsetting can be fully funded and resourced. This might include (not limited to):

- Capital cost
- Inverter replacement cost
- Other maintenance & admin costs (10%)
- Panel degradation (1% in Year 1 then 0.4% in Years 2-30)
- Energy imbalance due to delayed installations (see Figure 2)

Table 1 sets out typical costs (in 2024 prices) that might be incurred by B&NES for a 3kW domestic PV installation. The 'central' capital cost scenario (DESNZ) is the mean cost of 118,000 systems installed in 2023/24. A single inverter replacement is likely during the lifetime of a PV system and the costs provided are based on soft market testing. A cost to cover other maintenance and admin equal to 10% of capital and inverter replacement costs is included.

Table 1 – Cost scenarios for a 3kW domestic PV installation

Cost scenario		Low	Central	High
Capital cost	£	4,350[3]	7,200[4]	7,500[3]
Inverter replacement	£	500	650	800
Other maintenance & admin	£	485	785	830
Total cost	**£**	**5,335**	**8,635**	**9,130**

Solar PV performance is very predictable and there are numerous methods to forecast annual yield based on variables such as location, orientation, tilt, and shading. Perhaps the most accessible method is MCS irradiance tables[5] which provide annual yield per kW installed at a regional level across the UK. These tables have been used to determine annual yields for systems based in B&NES with different orientations, at 30° tilt, and with no shading. Table 2 sets out yield forecasts for a 3kW domestic PV installation over an expected lifetime of 30 years.

[3] Naked Solar, Home Solar Pricing Guide, 2024.
[4] DESNZ, 2023/24 0-4kW solar PV mean cost data, 2024.
[5] MCS Charitable Foundation, The Solar PV Standard MIS 3002 Issue 5, 2023.

Table 2 - Lifetime (30-year) yield forecasts for a 3kW domestic PV installation in B&NES (MWh)

Panel orientation	Lifetime (30-year) yield (MWh)
South	80.9
South East / South West	76.7
East / West	66.0

If total cost (£) for each of the three scenarios in Table 1 is divided by each of the lifetime yields (MWh) in Table 2 then costs for the PV installation per unit of energy generated over its lifetime is derived (£/MWh). These results are presented in Table 3 and illustrate the range of energy offset prices to be considered in this report.

Table 3 – Energy offset prices to develop a 3kW domestic PV installation in B&NES (£/MWh)

Panel orientation	Low cost	Central cost	High cost
South	£66	£107	£113
South East / South West	£70	£113	£119
East / West	£81	**£131**	£138

It can be observed that there is a considerable price range of £66 - £138/MWh. However, the 'low' prices are considerably less than both the 'central' and 'high' prices for each panel orientation. On this basis it is reasonable to suggest that these 'low' prices can be discounted. The 'central' and 'high' prices are similar (within £6-£9/MWh) for each of the panel orientations. The 'central' cost uses more robust (and regularly updated) market capital cost data and therefore likely represents the most appropriate prices. The 'East / West' panel orientation is the highest central cost (£131/MWh) and provides a single offset price to cover all panel orientations. A £130/MWh offset price is considered in more detail in the next section.

4 Worked example

4.1 Example house

Following the energy hierarchy, 'fabric first' developments should have a low energy demand by default. An SCR6 policy compliant home should have a total energy use[6] no greater than 40kWh/m^2 and with offsetting only permitted where this demand cannot be fully met through onsite generation due to site specific constraints, on major development applications.

Table 4 considers a home that is only just meeting the Council's energy use target and cannot install sufficient solar panels to balance this (i.e. offsetting is the last resort). Offsetting payments are requested to cover the full development life of 30 years, akin with the London Plan Carbon Offset Guidance. This aligns with the expected 30-year lifetime of the PV system used as offset.

Table 4 – Example offset calculations for a single home

Variable		Scenario			Calculation Ref.
		8 panels	***9 panels***	***10 panels***	
Building energy use	kWh/m^2/yr	40			*A*
Floor area (GIA)	m^2	95			*B*
Building energy use	kWh/yr	3,800			*C (A x B)*
PV panels (400W)	No. (kW)	8 (3.2kW)	9 (3.6kW)	10 (4.0kW)	
PV energy*	kWh/yr	2,925	3,290	3,656	*D*
Residual energy	kWh/yr	875	510	144	*E (C – D)*
Development life	years	30			*F*
Offset amount	MWh	26.3	15.3	4.3	*G (E x F ÷ 1000)*
Offset price	£/MWh	130			*H*
Offset charge	**£**	**£3,419**	**£1,989**	**£559**	J (G x H)

* *based on SE/SW facing unshaded PV panels in B&NES.*

This example passes the test of promoting onsite energy first; it should always be cheaper to increase PV than to pay the offset charge. In this case increasing PV from 8 panels to 10 panels reduces the offset charge by c.£2,900; in practise this might only cost c.£500 to implement.

At time of writing, it is proposed that an energy offset price will apply to major development applications (10 or more dwellings) only. If B&NES decided to apply this requirement to minor applications then they might want to consider only pursuing collection of offset funds over a pre-set cap, to minimise administration.

An offset price of £130/MWh is sufficient to fund the installation of east/west orientated PV systems onto existing B&NES social housing stock based on a 'central' cost (see Table 3). If B&NES had a desire or need to install systems with higher costs (e.g. including battery storage), then this would likely increase the offset price to £150 - £200/MWh. For the 8 panels scenario this would increase the offset charge from £3,419 to £3,945 - £5,260 respectively.

[6] For supporting evidence see Cornwall Council's Technical Evidence Base For Policy SEC 1 and WECA's Net Zero New Buildings: Evidence and guidance to inform planning policy.

4.2 Comparison with UK Carbon Values

A respectable comparison for offsetting values is the UK Government's Green Book Carbon Values. Documentation on how to use these figures for valuing greenhouse gas emissions in policy appraisals is available online. These values were last updated in 2022 and reflect both the UK's net zero commitments and requirements to offset within the UK's terrestrial boundaries.

This guidance is also referenced by the Greater London Authority (although prior to these updates) in their setting of the London Plan offset price. The price was matched to the DESNZ (formerly BEIS) Green Book high price in 2017. For the reasons set out in Figure 1, the 'High' carbon values (see Table 5) remain the most appropriate comparison for offsetting emission from new development so that offsetting is truly additional.

Table 5 - Carbon values and sensitivities 2020-2100 for appraisal, 2022£/tCO2e (DESNZ)

	Carbon values		
	Low	**Central**	**High**
2020	127	253	380
2021	129	257	386
2022	130	261	391
2023	132	265	397
2024	134	269	**403**
2025	137	273	410
2026	139	277	416

It is possible to use these carbon values to calculate an equivalent offset charge for the example house presented in Table 4. This is achieved with the addition of a carbon factor (carbon intensity of electricity grid) for the energy that is used/generated. Table 6 shows this calculation for the 8-panel scenario using the DESNZ 2024 high price of £403/tCO_2e (in 2022 prices).

Table 6 - Offset calculation for a single home with 8-panels using DESNZ carbon offset value

		Scenario	
Variable		***8 panels***	Calculation Ref.
Energy to offset	kWh/yr.	875	*A*
Carbon factor	$kgCO_2e$/kWh	0.210	*B*
Development life	years	30	*C*
Total emissions to offset	tCO_2/yr.	5.51	*D (A x B x C ÷1000)*
Carbon price (in 2022 prices)	£/tCO_2e	403	*E*
Offset charge	£	**£2,222**	*F (D x E)*

It can be observed in this example that the offset charge using UK carbon values is £2,222, compared to £3,419 using the methodology set out previously. The charge to offset via a £130/MWh offset price is therefore c.50% higher than using UK carbon values. Whilst this is not insignificant it does confirm that that the proposed offset price is not unjustifiably high or unviable, in this case requiring an additional c.£1,200 per new home. For the 9 and 10 panel scenario the difference is just c.£700 and c.£200 respectively.

Several other notable considerations regarding the carbon value methodology are as follows:

- It is highly dependent on the carbon factor, which will continually change and trend towards zero as the UK electricity grid continues to decarbonise.
- The methodology is inherently different, considering various offsetting mechanisms across the UK rather than local offsetting.
- It is understood to exclude ongoing maintenance costs.
- Carbon values are in 2022 prices and do not account for inflation since (c.10%).

4.3 Comparison with Cornwall Council's offsetting framework

In 2022 Cornwall Council established a renewable energy offsetting framework as part of their Climate Emergency DPD, using evidence akin to that presented in this report.

At that time the offset price was set at £100/MWh (in 2022 prices). The rate has been effective in that there has been a high degree of compliance with the plan (i.e. site energy demand ≤ site energy generation), such that negligible offset payments have been received to date.

Cornwall Council has confirmed that their offset price will increase to £117/MWh from December 2024 to reflect inflation and increases in PV installation costs[4]. The main reason why B&NES offset price is higher than Cornwall is that irradiance/ yield in B&NES is c.10% less than Cornwall (if PV costs remain fixed and irradiance/ yield reduces, then the offset price will increase).

All this combined suggests that the proposed offset rate of £130/MWh is suitably evidenced and will likely deliver the desired effect, i.e. incentivising increased onsite generation with offsetting being without exception a last resort.

5 Conclusion

The purpose of this report was to provide recommendations for an energy offset price (in £/MWh) that would be sufficient to meet a shortfall in on-site renewable generation under Policy SCR6 (Sustainable Construction for New Build Residential Development) of B&NES Local Plan Partial Update (LPPU). At time of writing, it is proposed that an energy offset price will apply to major development applications (10 or more dwellings) only.

An energy offset price of **£130/MWh** (in 2024 prices) is sufficient to fund the installation of east/west orientated PV systems onto existing B&NES social housing stock based on a 'central' cost. This is c.50% higher than using UK carbon values however the evidence suggests that the proposed offset price is not unjustifiably high or unviable. Cornwall Council established a renewable energy offsetting framework as part of their Climate Emergency DPD in 2022 with an offset price of £100/MWh (in 2022 prices), which has proved successful. From December 2024 this will increase to £117/MWh. The offset price for B&NES is justifiably higher for reasons set out in the report.

An energy offset price in £/MWh should be applied to the full development lifetime (30 years). The **offset payment** can be calculated using the formula:

[annual *site energy demand (MWh) – annual site energy generation (MWh)] x 30 (years) x energy offset price (£/MWh)*

If B&NES decided to apply this requirement to minor applications then they might want to consider only pursuing collection of offset funds over a pre-set cap, to minimise administration.

As offsetting to achieve net zero *energy* is only a proxy of net zero *carbon*, energy storage is also an important part of addressing any supply and demand imbalances that may occur. Whilst there is a preference for including energy storage onsite, this is not part of Policy SCR6. If costs for offset projects were elevated, or energy storage was incorporated in these offsetting projects, the energy offset price charged to developers would likely need to increase to £150-£200/MWh.

Regardless of the rate at which the offset price is set it is important to ensure that all prices are subject to periodic review or linked to market price inflation. Not doing so would allow market inflation to erode the impact of such measures over time meaning that payments would be insufficient to deliver the energy offsetting needed for net zero new development.