Warwick District Council

Net Zero Carbon Supplementary Planning Document

Warwick District
Prepared for: Warwick District Council
May 2024

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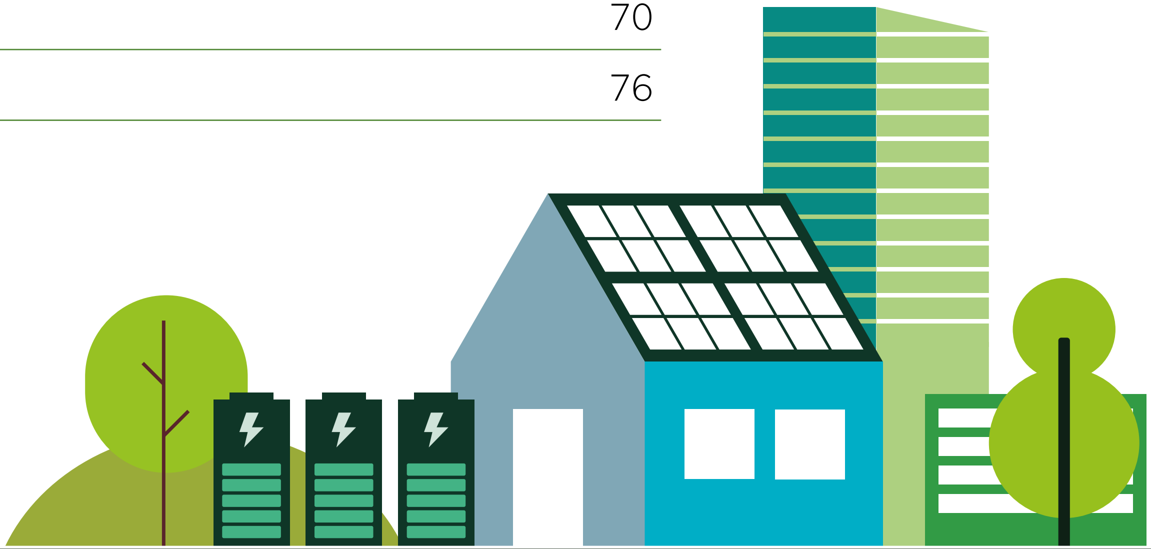


1.

Introduction

1.1

In June 2019 Warwick District Council declared a climate emergency. Following this declaration, the Council made the commitment to reduce total carbon emissions to as close to zero as possible by 2030.

1.2

The Council's Climate Emergency Action Plan recognised the importance of the built environment in reducing carbon emissions and have implemented the Net Zero Carbon Development Plan Document (NZC DPD).

1.3

The NZC DPD aims to minimise carbon emissions from existing and new buildings within the District to support the achievement of national and local carbon reduction targets. From adoption, the DPD will aim to ensure new development should be net zero carbon in operation. For the purposes of this DPD net zero carbon relates to regulated operational energy, which results from fixed building services and fittings (space heating, cooling, hot water, ventilation and lighting).

1.4

To work towards this aim, the DPD is designed to ensure that new development's contribution to the District's carbon deficit is minimised and that new homes do not add to the significant number of existing buildings in the District that will need costly and disruptive retrofit as part of the local and national transition to achieve net zero carbon.

1.5

The purpose of this Supplementary Planning Document (SPD) is to assist applicants in implementing the policies of the NZC DPD by providing technical guidance to inform the design of developments, and to illustrate what measures applicants need to consider in the preparation of an Energy Statement. Furthermore, an Energy Pro-Forma has been prepared, and is annexed to this SPD, which outlines the technical calculations required to be submitted by applicants in compliance with the NZC DPD policies.

1.6

This document is being prepared as a Supplementary Planning Document (SPD) under Regulation 14 of the Town & Country Planning Regulations (Local Plan) 2012, as amended.

1.7

The SPD has been subject to consultation during October–November 2023. The SPD has been revised considering the comments received during the consultation. Upon adoption this guidance will be a material consideration in deciding planning applications within Warwick District.

1.8

The format of this SPD provides supplementary information and technical guidance relating to the six NZC DPD policies and follows the energy hierarchy to identify how applicants can: reduce energy demands through fabric efficiency, utilise zero or low carbon energy sources, and offset any remaining carbon emissions. The SPD also provides guidance on embodied carbon assessments and how existing buildings can be retrofitted to reduce carbon emissions.

2.

Validation Checklist

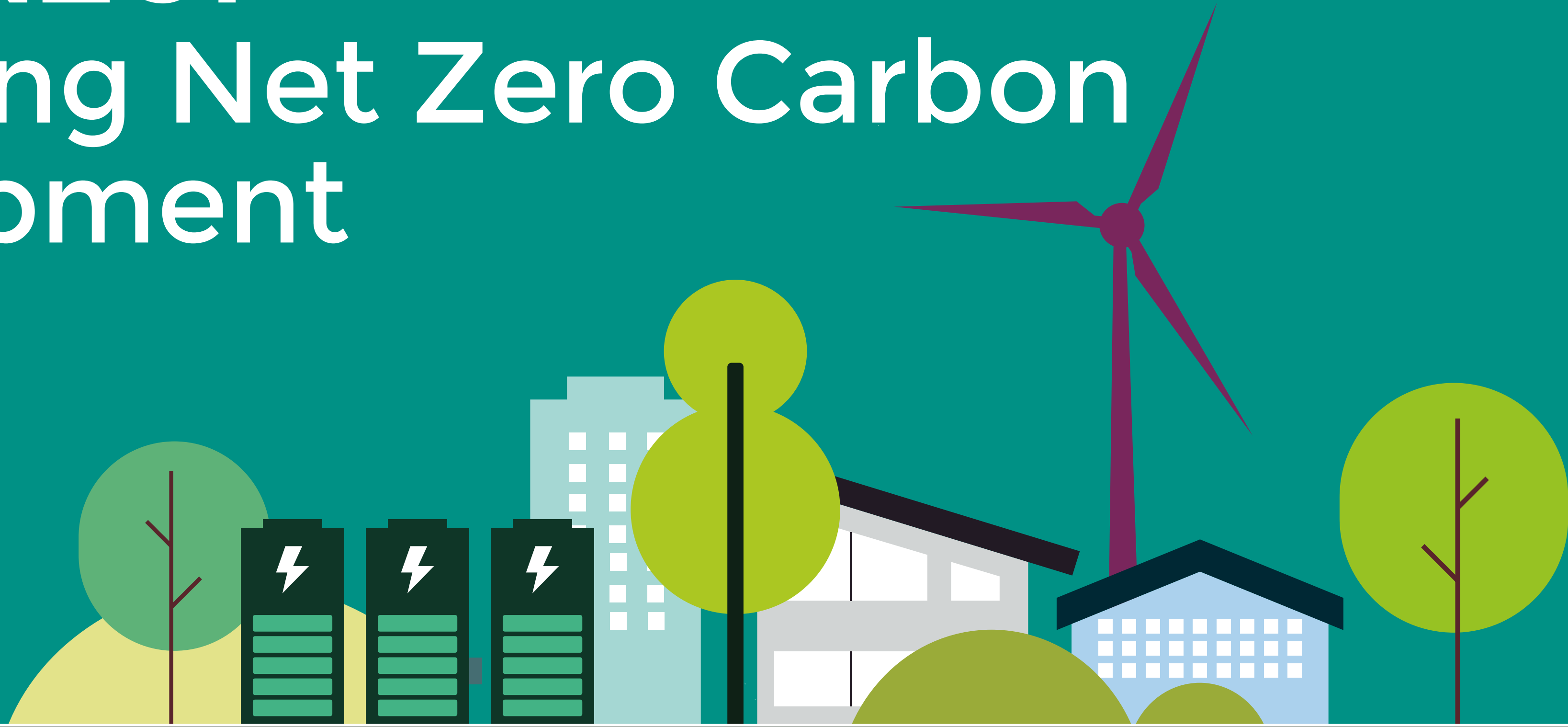
2.1

To demonstrate compliance with the NZC DPD policies the following documentation will be required to be submitted with planning applications of the relevant type and size. On adoption of this guidance these requirements will be added to the Council's Local Validation List that sets out the information required for validation, assessment and determination of planning applications.

What Document?	When/What needed
Energy Statement	New development of one or more dwellings (C3 or C4 use class) and/or 1,000sqm or more of new non-domestic floorspace – Gross Internal Area (GIA) including non-residential floorspace, hotels (C1 use class) or residential institutions (C2 use class). A statement should be submitted which outlines technical information relating to the compliance with energy efficiency and carbon emissions reduction requirements of the Net Zero Carbon DPD. Applicants should provide within their Energy Statement: 1. A completed Energy Pro-Forma – see Annex of this SPD. This includes the calculation of the Building Regulations Part L Target Emission Rate (TER) for the building type, the % reductions achieved against this TER, and if required a carbon offset calculation. 2. Description of the proposed energy efficiency measures (including passive measures), their suitability and effectiveness for the development proposed, and the energy efficiency benefits they impart to the design to comply with Policy NZC2A. 3. Description of the proposed zero- or low-carbon energy sources, their suitability and effectiveness for the development proposed and carbon emission reductions they impart to the design to comply with Policy NZC2B and achieve on site net zero regulated carbon. 4. Where Policies NZC2(A), NZC2(B) and on-site net zero regulated carbon are not achieved, justification for why this is not feasible having regard to the development proposed. More information on how to demonstrate compliance against each of the NZC DPD policies is provided throughout this SPD.
Embodied Carbon Assessment	New major development should demonstrate in the energy statement how the embodied carbon of the proposed materials to be used in the development has been considered and reduced where possible, including with regard to the type, life cycle and source of materials to be used. Proposals for development of 50 or more new dwellings and/or 5,000sqm or more of new non-residential floorspace should be accompanied by a whole-life embodied carbon assessment of the construction.
Existing Buildings	Existing Buildings (householder, extensions and conversions) to demonstrate compliance with Policy NZC4 using Energy Proforma – see SPD Annex Part 2.

3.

Policy NZC1 Achieving Net Zero Carbon Development



3.1

Policy NZC1 expresses the overarching approach to 'net zero carbon' development. This definition refers only to ***operational, regulated carbon***.

- *Operational* means only the carbon emitted during the in-use phase of the building;
- *Regulated* means only the share of those operational carbon emissions that are from an energy use that is regulated by Building Regulations, for example heating and hot water systems, or fixed lighting circuits.

Policy NZC1: Achieving Net Zero Carbon Development

New development of one or more new dwellings (C3 or C4 use class) and/or 1,000sqm or more of new non-residential floorspace, hotels (C1 use class) or residential institutions (C2 use class) should achieve net zero operational regulated carbon emissions by implementing the energy hierarchy.

Proposals should demonstrate application of the energy hierarchy through submission of an energy statement which identifies:

i. For new dwellings, a minimum 63% reduction in carbon emissions is achieved by on-site measures, as compared to the baseline emission rate set by Building Regulations Part L 2021 (SAP 10.2).

ii. In non-residential buildings, hotels and residential institutions at least a 35% reduction in carbon emissions through on-site measures compared to the rate set by Building Regulations 2013 (or equivalent percentage reduction on Building Regulations 2021).

iii. Compliance with the energy efficiency and renewable energy provisions set by policies policy NZC2(A) & (B) and by presenting the carbon savings achieved across each step of the energy hierarchy (demand reduction, efficient supply, renewable and other low-carbon technology).

iv. Any residual operational regulated carbon emissions (over the course of 30 years) will be calculated and offset to zero in accordance with policy NZC2(C). Offsetting will only be considered an acceptable solution to net zero carbon requirements if it can be demonstrated that carbon reductions achieved via on-site measures (and near-site renewables) are demonstrably unfeasible or unviable.

Where full compliance is not feasible or viable, proposals must demonstrate through the energy statement that carbon reductions to the greatest extent feasible have been considered and incorporated through applying the energy hierarchy. In applying the energy hierarchy, proposals are expected to implement fabric energy efficiency and low carbon heating before incorporating renewable electricity generation and then offsetting.

A condition will be applied to planning permissions requiring as built SAP or SBEM calculations to be submitted prior to occupation and demonstrating that the finished building meets the standard set in Policy NZC1.

Alternatively, applications may demonstrate the requirements of Policy NZC1 are met through the Passivhaus standard with accompanying PHPP calculations submitted within the energy statement (without the use of fossil fuels on site including gas). A condition will be applied requiring Passivhaus certification prior to occupation.

3.2

The net zero carbon requirements of Policy NZC1 are applicable to development that creates one or more dwelling (C3 or C4), or $1,000m^2$ (GIA) of non-domestic floor space (including C1 hotels, C2 residential institutions and other non-residential development).

3.3

Applicants are required to reach net zero carbon by following the Energy Hierarchy as shown in Figure 1.

3.4

These requirements are also summarised overleaf in Table 1: Summary of Policy NZC1 requirements by building type.

Figure 1: Energy Hierarchy

Overall emissions reduction target to achieve net zero carbon buildings (NCZ1)

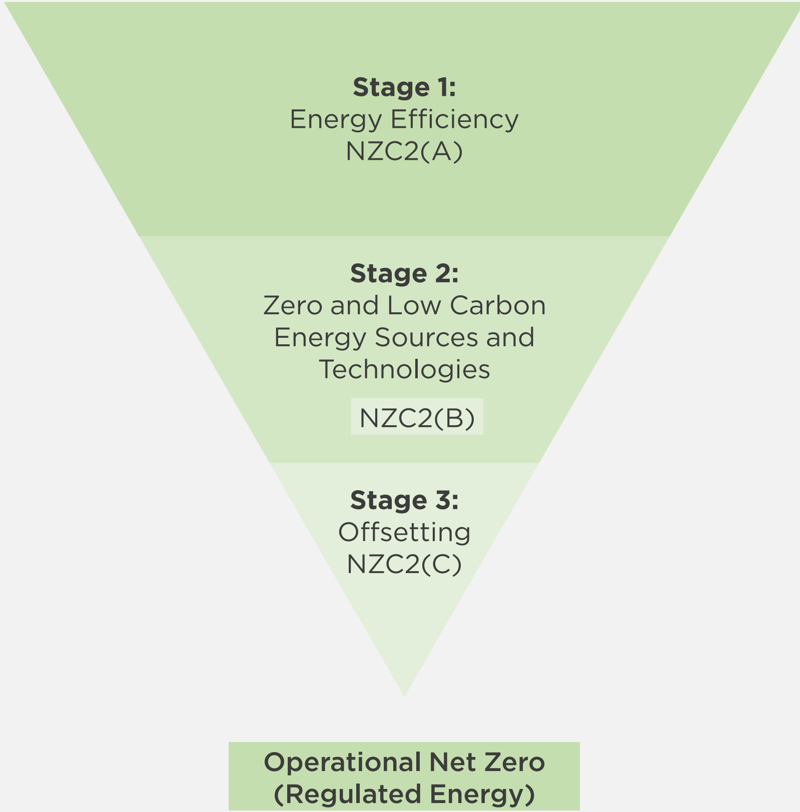


Table 1: Summary of Policy NZC1 requirements by building type.

Use type	Baseline measure	Minimum on-site improvement on baseline required by Policy NZC1	Further information
Residential (one or more dwellings)	Part L 2021 Target Emissions Rate (notional dwelling, with gas boiler)	63% reduction compared to a baseline of Part L of the Building Regulations 2021. Dwelling Emissions Rate ≤ (Target Emissions Rate -63%)]	Equivalent to the carbon reduction anticipated to be achieved by the Future Homes Standard (2021 specification), which is expected to become the new national minimum requirement from 2025.
	OR: Achieve Passivhaus certification and not use fossil fuels on site for the operation of the building.		Passivhaus certified homes represent a significant improvement in energy performance even beyond the Future Homes Standard. For compatibility with national and local carbon budgets, fossil fuel must still not be used.
Non-domestic (of 1,000m² GIA or more)	Part L 2013 Target Emission Rate (notional building, with gas boiler)	35% reduction compared to a baseline of Part L of the Building Regulations 2013. [Building Emissions Rate ≤ (Target Emissions Rate -35%)]	Small improvement beyond Part L 2021 (which delivers ~27% carbon improvement on 2013[1]).
	OR: Achieve Passivhaus certification and not use fossil fuels on site for the operation of the building.		Passivhaus certified buildings represent a major improvement in energy performance even beyond Part L 2021. For compatibility with national and local carbon budgets, fossil fuel must still not be used.
All	Deliver required energy efficiency (NZC2(A)) and low-carbon/renewable energy supply (NZC2(B))		See separate guidance for NZC2(A) and NZC2(B) in sections 4 and 5 below.
All	Where it is not possible to meet the applicable target noted above and/or where the feasible efforts towards NZC2(A) and (B) do not deliver a building without any regulated carbon emissions, proposals must: • **Demonstrate** that carbon reductions to the **greatest extent feasible and viable** have been pursued following the steps of the energy hierarchy in order (prioritising fabric improvements and low carbon heating – not gas – before renewable energy), AND • **Make a contribution to carbon offsetting** as per the stipulations of the guidance under Policy NZC2(C) (see Section 6)		The 'offsetting' route to net zero is permitted in recognition that there may be some sites where it is not feasible to achieve a building with net zero regulated carbon through on-site measures. The Council's offsetting fund will deliver interventions elsewhere in the local area that are a necessary part of local/national carbon budgets and net zero, but currently unfunded or underfunded.

1 HM Government Department for Levelling Up, Housing and Communities (2021), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1040925/Future_Buildings_Standard_response.pdf

Meeting the requirements in proposals for 1 or more new dwellings

3.5

The required minimum on-site reduction is a 63% reduction in regulated carbon emissions compared to a baseline of Part L of the Building Regulations 2021.

3.6

For the avoidance of doubt, this is the Part L 2021 notional building baseline specification, which has a gas boiler. See Table 1.1 of Part L for dwellings[2] for a summary, or Table R1 Appendix R in SAP 10.2[3] for the full baseline specification.

3.7

This required minimum 63% on-site carbon reduction on Part L 2021 is approximately equivalent to a 75% reduction on Part L 2013. This target reflects the Future Homes Standard[4] (FHS).

3.8

Therefore, it is anticipated that most new residential developments will be able to meet the on-site minimum requirement of Policy NZC1 by meeting the notional building specification of the Future Homes Standard.

3.9

Compared to the Part L 2021 notional dwelling, the Future Homes Standard notional dwelling has the following improvements:

- Improving thermal insulation and resistance (U values) of floors, roofs, walls, doors and glazing (See Guidance for Policy NZC2(A) Section 4, Table 3)
- Including a heat pump as the primary heat source instead of a gas boiler (See Guidance for Policy NZC2B Section 5, Tables 7-8)

3.10

Policy NZC1 does not require new homes to be built precisely to the indicative Future Homes Standard (FHS) specification. For example, where it is unfeasible or unviable to match the FHS specification for certain building elements, applicants may compensate for this by making improvements to other elements to achieve the required Dwelling Emission Rate.

2 HM Government (2023), Conservation of fuel and power: Approved Document L, Volume 1: Dwellings. 2021 edition incorporating 2023 amendments.

3 Building Research Establishment, SAP10 – Standard Assessment Procedure. See 'specification' link on this page, and find the table . This document is periodically updated as frequently as every few months, therefore readers should refer to the latest available version for the fully up to date version of the notional building specification. However, for convenience, the latest available version at the time of writing this SPD was SAP 10.2 of 11th April 2023, and we here provide a link to the relevant page for the specification table (Appendix R, Table R1) in that version: https://files.bregroup.com/SAP/SAP%2010.2%20-%2011-04-2023.pdf#page=118

4 HM Government Ministry of Housing, Communities and Local Government (2019/2021), The Future Homes Standard: changes to Part L and Part F of the Building Regulations for new dwellings. Summary of responses [to consultation], and Government response.

3.11

We note that it has already been proven feasible to design homes that perform at this standard in Warwick District – see Gallows Hill case study. Commenced in 2020, this social housing project achieves a ≥77% improvement on Part L 2013 (which means it would meet or outperform the minimum on-site standard required by Policy NZC1). This was achieved through fabric improvements, air-source heat pumps, and solar panels.

3.12

Proposals are unlikely to be able to meet the required on-site improvement without a heat pump or similarly efficient and low carbon heat source.

- **Proposals with gas boilers will not be considered acceptable**. Nor will 'hydrogen-ready' gas boilers because there is not yet a credible, guaranteed time-bound source for the conversion of the gas grid to hydrogen, and at present the production of hydrogen either uses fossil fuel or uses several units of electricity to produce the equivalent unit of hydrogen energy.
- **Proposals with direct electric heating** are unlikely to be able to achieve the required minimum on-site improvements unless significant further improvements are made to the fabric U-values and airtightness, and/or an extensive solar PV array.

Case study: Europa Way/North of Gallows Hill, Warwick

This is a development of 54 council homes. Construction by Countryside Partnership (formerly Vistry Partnership) commenced on site in late 2020. The homes range from 1- to 3-bed, all for rent or shared ownership.

Key facts

- The homes were designed to achieve a 100% reduction in carbon emissions compared to the target set by Part L 2013.
- This is better than the DPD Policy NZC1 required minimum on-site improvement (a 63% reduction on Part L 2021, equivalent to ~75% reduction on Part L 2013).
- The features used to achieve this include:
  - Air-source heat pumps (not gas boilers)
  - Better insulation (U-values), airtightness, and thermal bridging (psi values)
  - Solar panels of an average 3kWp/home
  - Heat-recovering ventilation (MVHR)
- Embodied carbon was also reduced by changing from masonry to timber frame.
- For specification details, see developer's sustainability web page and sustainability consultant's case study.

Meeting the requirements in non-domestic developments

3.13

The required minimum on-site reduction is a 35% reduction in regulated carbon emissions compared to the baseline compliant development under *Part L 2013*, including the notional systems as determined by the final proposed building specification[5].

3.14

It should be noted that Part L 2021 is now a minimum requirement and itself delivers a ~27% carbon improvement on Part L 2013. The minimum policy requirement of a 35% carbon reduction is therefore a small improvement on Part L 2021.

3.15

However, as all development during the DPD's lifespan will have to do calculations against more recent Part L baselines (2021 or later) for building control purposes, the Council will also accept proposals that demonstrate an on-site ≥35% reduction against a *Part L 2021* baseline[6]. This will be afforded weight in favour, as the Council recognises that the 2021 baseline is already lower-carbon than the 2013 baseline.

3.16

The 35% reduction is expected to be achieved through a passively-led specification that improves on that of the Part L notional building.

3.17

According to the energy hierarchy, applicants should firstly pursue the requirement for energy efficiency specification to achieve a 19% (or greater) improvement on the 2013 building regulations by energy efficiency measures alone (as established separately in Policy NZC2(A)).

3.18

Selection of more efficient products is one way to achieve part of the required Part L regulated carbon reductions. For example, for a heat pump, the notional Coefficient of Performance (COP) performance values in Part L 2021[7] are 2.86 seasonal generator efficiency for hot water and 2.64 seasonal system coefficient of performance for space heating (or in Part L 2013[8], these were 2.565 for hot water and 2.43 for space heating). Modern heat pump systems can significantly improve on these performance values through good design, system selection and commissioning For example, industry articles [9,10,11] in 2023 reference 'average' efficiencies of 300% for air-source heat pumps (this would be a COP of 3), 350% for ground-source (a COP of 3.5) and 450% for water-source (a COP of 4.5). These articles also cite efficiencies of up to 500% or even 600% for the most advanced products on the market.

5 HM This mirrors approaches taken in other Planning Authority areas – for example, see point 7.9 of the GLA energy assessment guidance.

6 The Council notes that while ambitious, this 35% reduction on the 2021 baseline is not thought to be unfeasible given that it is now required through the latest London Plan energy guidance, as a progressive improvement from the previous London Plan requirement for a 35% improvement on the 2013 baseline.

7 National Calculation Method Modelling Guide (for buildings other than dwellings in England): 2021 edition. For efficiencies of different heating technologies in the notional building, see Tables 7 and 8. www.uk-ncm.org.uk/filelibrary/NCM_Modelling_Guide_2021_Edition_England_26Sep2022.pdf

8 National Calculation Method Modelling Guide (for buildings other than dwellings in England): 2013 edition. For efficiencies of different heating technologies in the notional building, see Tables 7 and 8. www.uk-ncm.org.uk/filelibrary/NCM_Modelling_Guide_2013_Edition_20November2017.pdf

9 The Eco Experts (2023), The Complete Guide to Heat Pump Efficiency. www.theecoexperts.co.uk/heat-pumps/air-source-heat-pump-efficiency

10 Federation of Master Builders (2023), Best air source heat pumps in the UK 2023. www.fmb.org.uk/homepicks/heat-pumps/best-air-source-heat-pumps

11 Green Match (2024), Heat Pumps in 2023: What, How & Why? + Pros And Cons. www.greenmatch.co.uk/heat-pump

3.19

In general, it should be feasible to achieve most if not all of the required 35% improvement on 2013 TER primarily through a combination of fabric measures (e.g., insulation), other building services efficiencies (e.g., lighting and fittings), and use of modern heat systems with greater efficiencies (such as heat pumps).

3.20

As per the energy hierarchy, after initial priority is given to fabric and system measures to reduce energy demand, further progress in achieving or going beyond the 35% reduction can be made through maximising the installation of onsite renewable systems such as photovoltaic panels.

3.21

Table 2 summarises various carbon and energy saving measures and their potential contribution to the policy requirements of the NZC DPD.

Table 2: Carbon- and energy-saving measures categorised by their contribution to different parts of the NZC1 policy requirements by development type

Contribution to policy requirements for dwellings	Measure	Contribution to policy requirements for non-domestic development
Recommended to support general approach to energy efficiency. Does not result in NZC DPD % improvements on Part L. See chapter 4.	Orientation	Recommended to support general approach to energy efficiency. Does not demonstrate NZC DPD % improvements on Part L.
	Building form factor	
	Efficient unregulated energy (appliances etc)	
Contributes to required 10% improvement on Part L Target Fabric Energy Efficiency(TFEE) under Policy NZC2(A)	Fabric: U-values (insulation effect)	Contributes to required 19% improvement on Part L TER 2013 from energy efficiency measures under Policy NZC2(A)
	Fabric: Glazing ratio, and G-value	
	Fabric: Airtightness	
Contributes to the required overarching on-site TER 2021 improvement on Part L 2021 63% absolute minimum; 100% expected under Policy NZC1	Efficient building services (fans, pumps, ventilation, lighting, controls)	
	Wastewater heat recovery/exhaust air heat recovery/efficient heat storage	
	Direct electric heating	Contributes towards required 19% TER improvement from energy efficiency, or if the 19% is already otherwise achieved then these measures contribute towards the required overarching TER 2013 improvement (35% minimum; 100% expected)
	Networked heat efficiencies (district heating)	
	Heat pumps (air, ground, water)	
	Biomass	Contributes towards the required overarching on-site TER 2013 improvement (35% absolute minimum; 100% expected)
	Solar electricity or solar thermal	
	Wind	
	Hydro	

Energy Statements – How and when to evidence the proposal's compliance with the requirements

3.22

Applicants must submit within their Energy Statement (see also Pro Forma in Annex):

- The Target Emission Rate (TER) that represents the baseline (i.e., the emission rate of the notional building for Part L 2021 for dwellings, or either Part L 2013 or 2021 non-domestic development).
- The Dwelling Emission Rate (DER) or Building Emission Rate (BER) (as applicable to the proposal type) with all proposed improvements applied.
- The % reduction on the TER that is achieved by this DER or BER (as applicable to the proposal type).
- The proposed building specification for all elements (U-values, airtightness, glazing ratio, heat recovery if applicable, lighting, ventilation, heating fuel, heating system, hot water system, cooling system if applicable, renewable energy, any other energy-using system efficiencies) laid out alongside that of Part L 2021 (or 2013 as applicable to your baseline), to demonstrate how your proposed improvement in carbon emissions has been achieved.
- Commentary on energy efficiency measures including passive measures such as solar gain and resulting energy efficiency improvements to fulfil the requirements of Policy NZC2(A) (see guidance in Section 4 of this SPD, pp. 20–31) including:
  - For non-residential applications, this should include confirmation of which of the proposed building element improvements are counted towards 'improvement from energy efficiency measures' as per the definition in guidance for Policy NZC2(A) and what % of TER reduction these deliver.
- For residential dwellings, the % improvement on Target Fabric Energy Efficiency.
- Commentary on proposed zero or low carbon energy sources their suitability and effectiveness for the development proposed and carbon emission reductions they impart to the design to comply with Policy NZC2(B) (Section 5, pp. 32-49) and achieve on site net zero regulated carbon.
- A calculation of the proposed development's total annual residual emissions, showing your workings as the DER or BER multiplied by the amount of floor space created in each building typology.

A calculation of the required offsetting amount (tonnes of CO_2, and £amount) as per the contribution calculation detailed in guidance for Policy NZC2(C) in Section 6, pp. 50–53.

3.23

The same carbon factors must be used for both the baseline and the proposed emissions rate (DER or BER) to ensure that the two indicators are comparable.

3.24

The carbon factors used should be those of the latest available version of Standard Assessment Procedure (SAP) or Simplified Building Energy Model (SBEM) (as applicable to building type) to ensure that these factors are as close as possible to the contemporary grid carbon factor (recognising that the electricity grid has been, and is expected to continue decarbonising).

3.25

All proposed building elements in the planning application energy statement (U-values, system efficiencies etc) should reflect the same specification that is separately submitted to and confirmed by Building Control.

3.26

For larger proposals (10+ homes) that consist of a small number of repeated home types, the calculation does not need to be repeated individually for every home but can instead present a sample of 20% of all homes including at least one of each home type[12], present within the development. The total development carbon emissions can then be calculated by multiplying these sample results up to reflect the full development area, with a weighted figure that represents the GIA created in each typology and orientation.

3.27

The calculations should be made and submitted at the following times:

- **For Outline Planning applications:** Applicants should identify the expected building specification in their Energy Statement and Pro-Forma.
- **For Full Planning applications and Reserved Matters:** Applicants' calculations in their Energy Statement and Pro-Forma must reflect the specified building design.
- **For Section 73 applications:** Applicant's calculations in their Energy Statement and Pro-Forma must reflect any changes to the specified building design.
- **For discharge of conditions:** Applicants must re-calculate and submit these figures on completion of the building, before occupation, using the actual as-built specification. Again, this must reflect any as-built information given to Building Control.

3.28

The as-built recalculation should capture and confirm any changes in building element specification or build quality that often arise in the construction process. It should be informed by:

- **The measured air-permeability**, tested in accordance with the procedures set out in CIBSE TM23 guidance, and reported as statutory compliance in Section 7 Part L. The air-tightness building control reports are to be included.
- **The as-built Building Regulations England Part L (BREL) report** produced for building control, containing photographs as specified in Appendix B of Approved Document Part L 2021.
- **An infrared thermographic survey**, if the building is completed within the central heating season (October to March).
- **Any findings generated by the building control surveyor** during site inspections.

12 For example, top-floor apartment, mid- or ground-floor apartment, maisonette, mid-terrace, semi-detached, detached, bungalow. The reason for this is that the building form dramatically affects the space heating demand. Similar differentiation of non-domestic typologies should be undertaken, which may additionally need to be differentiated by uses (e.g., school, office, retail, hotel), as these can have dramatically different total energy use and carbon emissions.

Measures towards enhancement of building quality and energy performance

3.29

In addition to the statutory checks required within Approved Document Part L 2021, it is recommended that applicants follow an accredited quality assurance process to ensure "as built" performance is as close to design predictions as possible. Passivhaus certification is one process which can assure build quality, alongside the Assured Performance Process from the Good Homes Alliance.

3.30

Evaluating building performance following occupancy is highly recommended to assess the effectiveness of design choices, and potentially address any commissioning or building design short comings. Applicants should consider using "BS40101 Building performance evaluation of occupied and operational buildings 2022" to guide the process of evaluating the performance of buildings in operation.

3.31

Developers will also be required, by way of a condition, to produce a home user guide for occupiers.

3.32

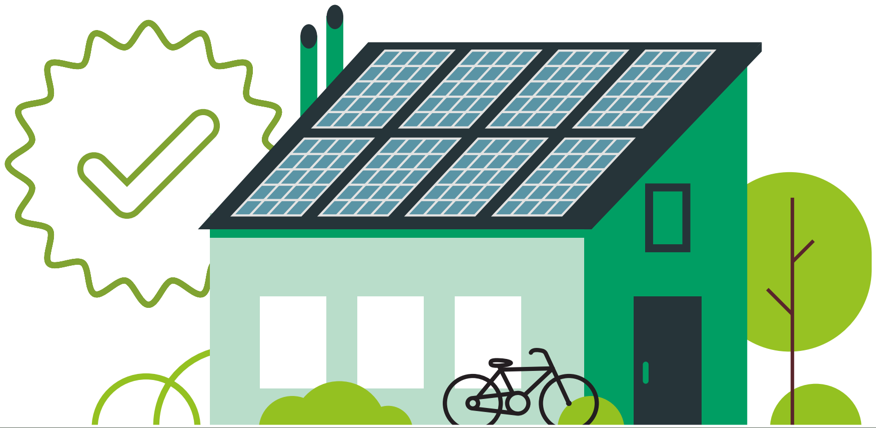
Where evidence can be provided within the application and/or discharge of conditions to show that any of the aforementioned quality assurance processes have been followed, this will be looked upon favourably as a measure towards enhanced credibility of the building's proposed performance.

Alternative route to compliance: Passivhaus certification

3.33

Policy NZC1 also establishes that a certified Passivhaus building will also be considered to have complied with Policy NZC1 provided that it does not use on-site fossil fuels of any sort-

- To take this route to compliance with Policy NZC1, the applicant must submit Passive House Planning Package (PHPP) calculations to demonstrate compliance with NZC1.
- Applications would also then be required to submit the finished Passivhaus certification to the Council for discharge of conditions prior to occupation.
- Where a proposal includes one or more buildings that are Passivhaus certified, but also other new buildings that are not certified, the buildings that are not certified will still be subject to the standard route to compliance with Policy NZC1 and the subsequent energy hierarchy policies (NZC2A, B,C).



3.34

Passivhaus certification requires the achievement of certain stringent energy efficiency targets, including[13]:

- 15kWh/m²/year limit on space heating demand.
- 15kWh/m²/year limit on space cooling demand.
- 0.6 limit on air changes per hour (to help deliver the space heating and cooling limits noted above).
- 60kWh/m²/year limit on total energy use intensity (termed 'primary energy renewable').
- 135kWh/m²/year limit on total primary energy demand.

3.35

The above cited targets are for Passivhaus 'Classic'. Optional enhanced Passivhaus certifications are also available (Plus and Premium) which require even tighter targets on total energy use intensity, and additional targets for renewable energy generation in kWh per square metre of building *footprint*.

3.36

The Passivhaus certification system requires that the above targets must use the calculation method 'Passivhaus Planning Package' (PHPP) which is a highly accurate method to predict a building's energy use. The certification process also involves verifying certain performance parameters after completion of the building. As a result, Passivhaus buildings avoid the 'performance gap' and it is deemed that this certification represents such a significant improvement in actual on-site energy performance (compared to a building using the conventional building regulations energy calculations – see Figure 2).

13 Passivhaus Trust (no date), What is Passivhaus?: Performance targets for a European climate. https://passivhaustrust.org.uk/what_is_passivhaus.php#How%20to

Figure 2:

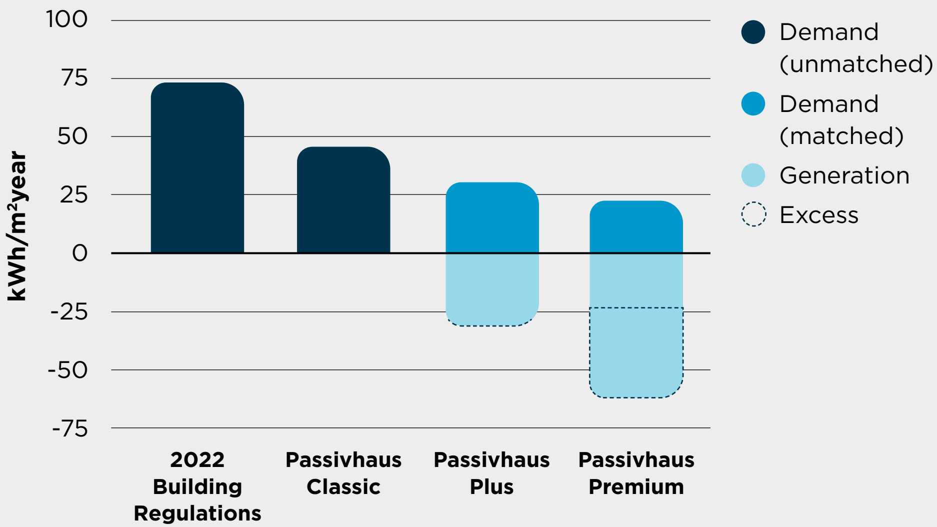


Diagram of total energy demand (regulated + unregulated), and whether matched by renewable energy on-site, in Passivhaus compared to building regulations.

Adapted from: www.passivhaustrust.org.uk/competitions_and_campaigns/passivhaus-and-zero-carbon

3.37

Although Passivhaus Classic certification does not require the inclusion of any renewable energy on site and therefore would not be 'net zero carbon', the increased quality and effort involved in achieving this certification is regarded as sufficient to address the requirements of policy NZC1 and no further renewable energy or offsetting will be required for such development.

3.38

Proposals that further achieve Passivhaus Plus or Premium will be afforded significant weight in their favour as this represents not only the achievement of actual in-use energy performance to exemplary levels, but also the delivery of renewable energy to meet or exceed the home's energy demand (thus achieving true net zero operational carbon, or even becoming carbon negative in operation; see Figure 2).

3.39

Please note that even in a Passivhaus certified scheme, direct electric heating should still be avoided especially in dwellings, due to the probability of excessive energy bills and risk of fuel poverty. Although Passivhaus certification does not directly prohibit the use of direct electric heat, the Passivhaus Trust emphasises[14] that the use of direct electric heat will make it difficult to achieve the Passivhaus required limit on primary energy demand.

14 Passivhaus trust, How to build a Passivhaus: Chapters 5 to 9. www.passivhaustrust.org.uk/UserFiles/File/Technical%20Papers/ROT/How%20to%20build%20a%20Passivhaus_Chapters%205%20to%209(3).pdf

4.

Policy NZC2(A) – Making Buildings Energy Efficient

Policy NZC2(A): Making buildings energy efficient

New development of one or more new dwellings (C3 or C4 use) are expected to demonstrate a 10% improvement on the Part L 2021 Target for Fabric Energy Efficiency.

New developments of 1,000sqm or more of new non-residential floorspace, hotels, (C1 use class) or residential institutions (C2 use class) are expected to demonstrate that they achieve a 19% reduction in carbon emissions compared to Part L 2013 through energy efficiency measures (fabric efficiency, efficient services and efficient energy supply; steps 1 and 2 of the energy hierarchy).

Where full compliance is not feasible or viable having regard to the type of development involved and its design, proposals must demonstrate through the energy statement that carbon reductions to the greatest extent feasible through energy efficiency measures have been considered and incorporated.

All energy statements must also lay out the U-values and airtightness of the proposed building in comparison to the notional values in the Future Homes Standard or Future Building Standard (indicative specification, or final, as available at time of application).

4.1

Policy NZC2(A) represents the first step in the energy hierarchy: **energy efficiency**. This refers to the design of buildings to minimise the demand for energy, regardless of the source of that energy.

4.2

This is a vital step towards the DPD's expressed objective to ensure new buildings are planned and constructed to be net zero regulated carbon in operation. High fabric efficiency in new buildings ensures that new buildings do not add to the significant number of existing buildings in the District that will need costly and disruptive retrofit in order to play their necessary role in meeting the locally committed or nationally legislated net zero carbon transition. It has been shown that to retrofit a home to a net zero carbon performance standard costs three to five times more than it does to build to that standard in a new build[15].

15 Currie & Brown on behalf of Committee on Climate Change (2019), The costs and benefits of tighter standards for new buildings. www.theccc.org.uk/wp-content/uploads/2019/07/The-costs-and-benefits-of-tighter-standards-for-new-buildings-Currie-Brown-and-AECOM.pdf

4.3

The energy efficiency targets set by Policy NZC2(A) for new buildings is summarised in Table 3.

4.4

The key ways in which energy demand can be minimised are:

- **Orientation and solar gain:** Designing the building's layout and glazing so that the building gains the optimal benefit of light and heat from the sun, to minimise the need for artificial heat and lighting *while avoiding the risk of overheating from sunlight.* See Figure 3 for an illustration.
- **Building form:** Having a more compact, simple building shape rather than an extensive, complicated building shape reduces the ratio of external surface compared to the area of internal space, and reduces the number of joins between different parts of the wall or roof. Together, this reduces the points where heat is likely to be lost to the outside. See also Figure 4 illustration of what different residential form factors could look like.
- **Fabric:** Improving the insulation value of walls, windows, floors and roofs, improving the air-tightness of the whole building, and reducing 'thermal bridges' (points where a more heat-conductive element of the building forms a bridge from inside to outside allowing heat to be lost).
- **Efficient energy supply:** Using types and sources of energy that minimise losses in the generation and distribution process, and/or which use waste heat (see Section 5).
- **Efficient services and appliances:** Ensuring that the heating system, ventilation, lighting, appliances and other energy-using devices installed within the home are able to deliver the maximum function for the minimum amount of energy input.

Table 3: Summary of Policy NZC2(A) requirements by building type, and rationale.

Use type	Baseline measure	Baseline edition of Building Regs	Required improvement on baseline
New development of one or more dwellings (C3 or C4 use class)	Part L Target Fabric Energy Efficiency (TFEE)	Part L 2021	-10%
New development of 1,000sqm or more of new non-residential floorspace, hotels (C1 use class) or residential institutions (C2 use class).	Part L Target Emission Rate	Part L 2013	-19%
Where it is not feasible to meet the applicable target noted above, proposals must demonstrate that carbon reductions to the greatest extent feasible have been pursued. This should be identified in the Energy Statement.			

Figure 3:

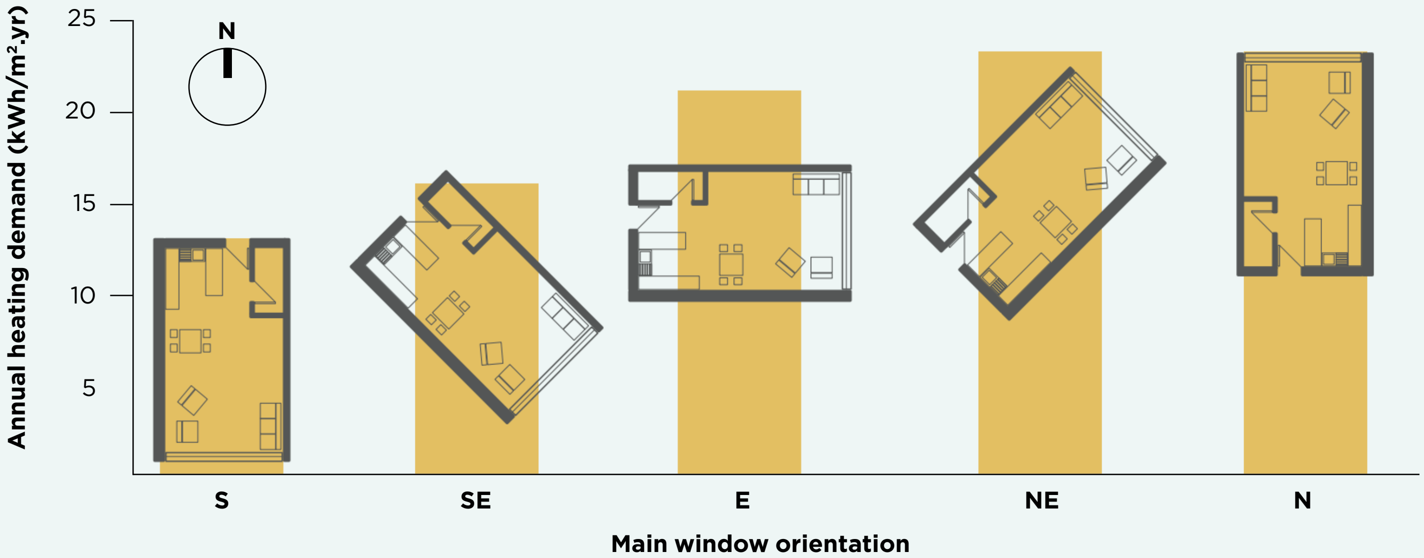


Chart showing how a well-insulated building's space heat demand increases as the main window turns further away from the south. Please note: The yellow bar denotes heat demand, not sun coverage, as the north-facing window has no direct sun. Credit: LETI.

Please also note that the higher solar gain from south-facing windows is also a risk factor for overheating in highly insulated and airtight buildings; therefore it is important to ensure that designs are balanced so as to maximise the benefit reduced heating demand while also avoiding triggering the need for active cooling, whose energy consumption could negate the energy savings of the reduced heat demand. Overhead shading of south- and west-facing glazing, using deep insets or brise-soleil, can help avoid this problem by blocking summer sun (which comes at a high angle) while still allowing the building to receive winter sun (which comes at a low angle). The GHA has guidance on this matter.

4.5

All of the above measures are encouraged and applicants should provide narrative on these within the Energy Statement and a general indication of the energy efficiency benefits they impart to the design.

4.6

To comply with Policy NZC(A) and demonstrate an improvement on the Part L baseline, **improved fabric, efficient energy supply, and efficient hot water, fixed lighting, heating and cooling services will be required** (please see the full Part L document and SAP for full list of regulated services within Part L).

4.7

Please note: the addition of renewable energy technologies (like solar panels, etc) does **not** count towards 'energy efficiency' requirement in most cases. Instead, these would contribute towards the separate requirements of Policy NZC2(B) Zero or Low Carbon Energy Sources and Zero Carbon Ready Technology. However, in **non-domestic development** only, there is some overlap between an 'energy efficiency' measure and a 'low carbon energy supply' measure. This overlap and how to handle it is detailed under 'meeting the requirements in proposals of 1,000 sqm or more of non-domestic development', below on page 27.

Figure 4:

	Type	Form Factor	Efficiency
	End mid-floor apartment	0.8	Most efficient
	Mid-terrace	1.7	
	Semi-detached house	2.1	
	Detached house	2.5	
	Bungalow	3.0	Least efficient

Diagram illustrating what different form factor numbers look like in practice, and their relative impact on space heat demand. Credit: NHBC, 2016.

Meeting the requirements in proposals for 1 or more new dwellings

4.8

Policy NZC2(A)'s new dwelling requirement for a **10%** improvement on the Part L 2021 TFEE (Target Fabric Energy Efficiency) is based on the expected fabric specification for the Future Homes Standard (Part L 2025)[17]. Thus it is anticipated that most new dwellings follow the FHS notional building fabric specification. This FHS notional building specification is replicated below as it was laid out in the Government's FHS Consultation Response.

4.9

The 'U-value' of each element represents how heat-transmissive that element is. A lower U-value means less energy loss and greater energy efficiency.

4.10

A lower 'air permeability' number means less energy loss via air moving in and out of the building. Thus, a lower 'air permeability' score represents greater energy efficiency.

Table 4: Dwelling fabric specification baseline and recommended improvement.

Building fabric element	Part L 2021 notional dwelling[16] (BASELINE)	RECOMMENDED TO MEET POLICY NZC2(A) based on the Future Homes Standard Part L 2025 notional dwelling[17]
External walls (including semi-exposed walls)	U value 0.18 W/(m².K)	U value 0.15 W/(m².K)
Floors	U value 0.13 W/(m².K)	U value 0.11 W/(m².K)
Roofs	U value 0.11 W/(m².K)	U value 0.11 W/(m².K) [no change]
Doors* (*whether opaque or up to 60% glazed)	U value 1.0 W/(m².K)	U value 1.0 W/(m².K) [no change]
Windows and glazed doors (>60% glazed)	U value 1.2 W/(m².K)	U value 0.8 W/(m².K)
Roof windows** (**If vertical. If not vertical, see conversions in SAP Appendix R)	U value 1.2 W/(m².K)	[Not separately specified in the FHS consultation response; presume same as other windows as above, i.e. 0.8 W/(m2.K) if vertical]
Rooflights*** (***If horizontal. If not horizontal, see conversions in SAP Appendix R)	U value 1.7 W/(m².K)	[Not separately specified in the FHS consultation response]
Air permeability (airtightness)	5 $m^3/(h{\cdot}m^2)$ at 50	5 $m^3/(h{\cdot}m^2)$ at 50 Pa [no change]

Please note: For all elements shown here, a *lower* number means a *lower* amount of energy lost via this element. Therefore, *lower* numbers equal *greater energy* efficiency.

16 HM Government Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2023) Building Regulations Part L ("Conservation of Fuel and Power Approved Document L) 2021 edition incorporating 2023 amendments. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1133079/Approved_Document_L__Conservation_of_fuel_and_power__Volume_1_Dwellings__2021_edition_incorporating_2023_amendments.pdf

17 HM Government Ministry of Housing, Communities and Local Government (2021), Future Homes Standard consultation response. ("Summary of consultation responses and Government response"). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956094/Government_response_to_Future_Homes_Standard_consultation.pdf

4.11

Applicants are required to lay out their proposed building fabric specification alongside that of Part L 2021 and FHS 2025, in their Energy Statement and Energy Pro Forma.

4.12

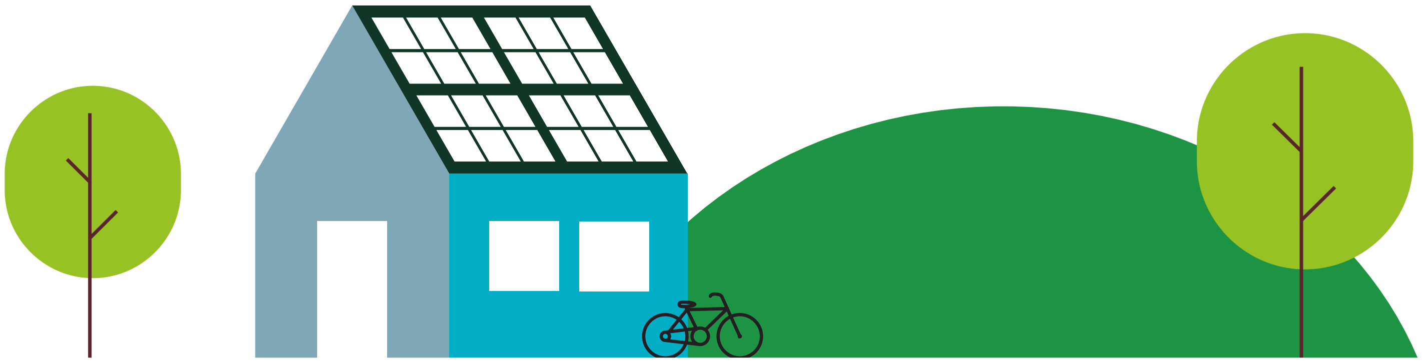
Applicants are not required to build precisely to the specification described above; considering that a lower performance in one building element (e.g., windows) may be able to be balanced out by better-than-notional performance in another (e.g. airtightness).

4.13

If the applicant has applied all of the above measures and these do not deliver the required 10% improvement on the TFEE, the applicant is recommended to pursue air tightness improvements as there is no pre-existing improvement in air tightness between the 2021 and 2025 fabric spec and airtightness can contribute a great deal to energy saving. Please note that a greater airtightness may, beyond a certain level, trigger a need for mechanical ventilation and heat recovery (MVHR).

4.14

Please note: TFEE includes any demand for active cooling as well as heating. Therefore it is important to ensure that dwelling designs are carefully balanced so as to avoid the need for active cooling as far as possible, by ensuring that the building is not subject to excessive heat gains (for example, designs should carefully optimise the amount of solar heat gain from sunlight entering via glazing, so that the optimal winter gains are achieved to reduce heating demand while avoiding excessive gains in summer). Where it is unavoidable to use some active cooling, it is recommended to provide this with heat recovery for hot water uses, and to provide any active cooling through a reversible heat pump system (as the home is likely to need a heat pump anyway, to meet the overarching carbon reduction required by Policy NZC1).



Meeting the requirements in proposals of 1000sqm or more of non-domestic development

4.15

The requirement for non-domestic buildings is a **19%** improvement on the Part L 2013 Target carbon Emission Rate **(TER)** delivered by ***energy efficiency measures***.

4.16

The selected Part L 2013 baseline should reflect the same type of building as the proposal.

4.17

For the purposes of this policy, 'energy efficiency measures' in non-domestic proposals shall be defined as:

- Fabric efficiency measures, i.e., improvements to insulating value of external building element insulating properties (U-values) and air-tightness.
- Efficient regulated energy-using fittings and services, such as cooling, ventilation, lighting, fans and pumps.
- Waste heat recycling systems such as wastewater heat recycling or heat sharing loops that capture heat rejected to active cooling systems and reuse this in other forms.
- Selection of proposed heat system with a greater efficiency than that specified for that respective heating type in the Part L notional building specification.
- Other efficient energy supply and distribution systems that are not proposed to be counted under the separate required contribution from 'renewable energy' measures (see guidance for Policy NZC2(B)).

4.18

In the case of non-domestic development, some guidance may be needed regarding whether certain heat system measures should be classed as 'energy efficiency' measures or 'renewable and low carbon energy' measures. It is recognised that some heat delivery technologies can include elements of both efficiency and low carbon/renewable energy supply. To allow flexibility, this SPD will allow that any of the **following hybrid 'efficiency/energy supply' measures in non-domestic development may be classed as 'efficiency measures'** contributing towards the initial 19% TER improvement:

- **Heat pumps:** These provide an excellent 'efficiency' to the user in terms of the amount of metered electricity they draw from the grid, as they deliver approximate three kWh of heat for every kWh of electricity they use (although this is achieved because the heat they deliver is partially 'renewable' in that it is borrowed from outdoor ambient heat in the air, water or ground, this shows up as an 'efficiency' saving to the user).
- **Heat networks** that, by economies of scale, have an improved ratio of fuel input to heat delivered in the home, compared to a gas boiler. However, in general, gas-fired Combined Heat and Power (CHP) should still be avoided as this is still a fossil fuel use even if sometimes more efficient than individual gas boilers – for more detail, see guidance relating to Policy NZC2(B). Heat network (or 'district heat') CO_2 factors per kWh are laid out in the National Calculation Methodology Guidance (see 2013 or 2021 version as applicable to your baseline); improvements on these notional factors can be counted as energy efficiency measures contributing to Policy NZC2(A).

4.19

Please note that this flexibility in classification of these heating measures as energy efficiency measures applies **only** to non-domestic development. If your scheme includes any dwellings, those dwellings should still meet the required 10% improvement in building Fabric Energy Efficiency regardless of whether your scheme also uses some of the 'energy efficient supply' measures above.

4.20

If your proposal is a mixed-use scheme that includes dwellings and non-domestic buildings which share any parts of their energy system – for example a heat network – the above measures would count towards the overarching requirements set by Policy NZC1 for minimum total regulated carbon emissions reduction in each respective use type.

4.21

In general, it should be feasible to achieve the required 19% improvement on 2013 TER primarily through a combination of fabric measures, other building services efficiencies, and use of modern heat systems with greater efficiencies. Much commercial development is likely to pursue a heat pump system, especially as reversible heat pumps can also meet the need for summer cooling. Modest improvements to fabric and services would further assist, especially in cases where it is not feasible or viable to use a heat pump system.

4.22

In fulfilling the energy efficiency improvements requirement of Policy NZC2(A) in non-domestic developments, applicants are required in their Energy Proforma to lay out their proposed building specification for all elements that are proposed as 'energy efficiency measures', alongside the respective equivalent elements of the notional building of Part L 2013, 2021, and 2025 (where available); see Annex.

4.23

Justification should also be provided in the Energy Statement on the reasons for the selected measures in respect to their suitability and effectiveness for the type of development proposed and (where relevant) the site characteristics.

Where full compliance is not feasible or viable having regard to the type of development involved, proposals must demonstrate through the energy statement that carbon reductions to the greatest extent feasible through energy efficiency measures have been considered and incorporated.

4.24

Overleaf (Table 5) provides general guidance on the range of energy efficiency measures that are likely to be suitable and effective in key prevalent types of non-domestic development.

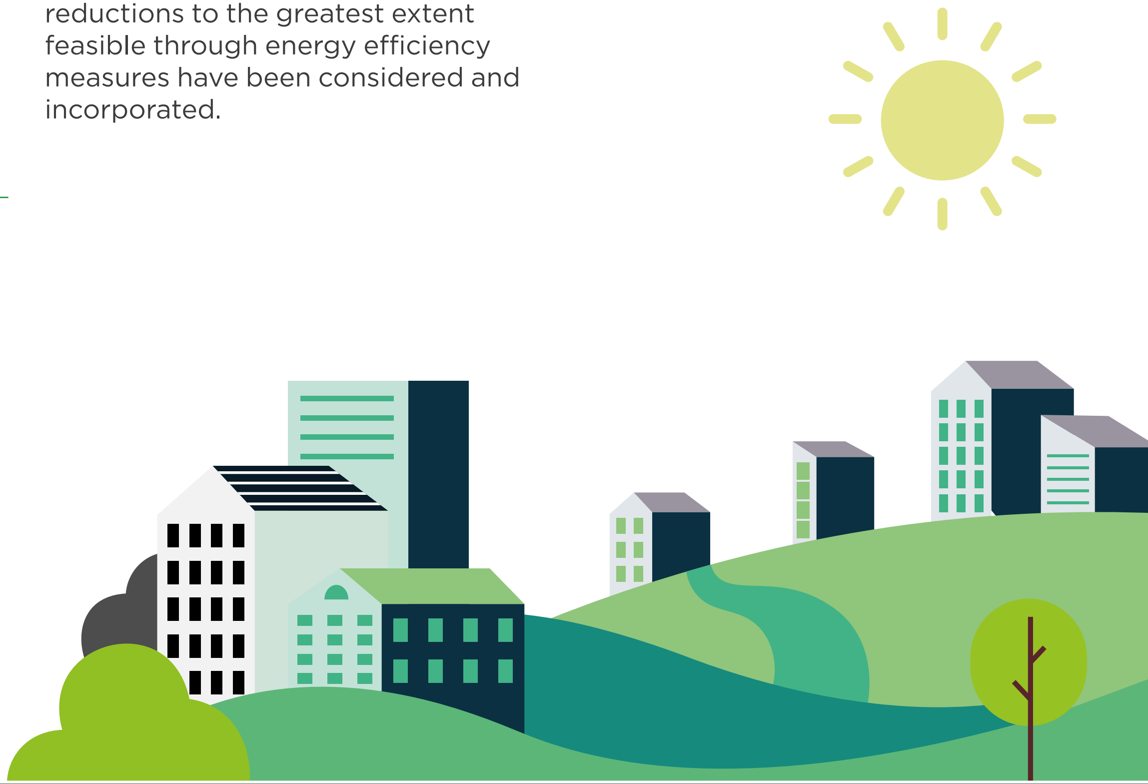


Table 5: Recommended energy efficiency measures in non-domestic development

Measure	Contributes to Part L TER improvement?	Description and rationale
Orientation	No, (but see 'glazing ratio' below) – but commentary on this topic is strongly encouraged and will be considered in assessing your energy statement	Non-domestic buildings tend to have a higher occupancy of people and electrical equipment. This can bring a higher risk of overheating which can be worsened by excessive solar gain in summer. This is especially the case where the glazing is south-facing, east- or west-facing. To avoid this problem, you could: • Orient your windows differently (north-facing windows provide more consistent light as well as avoiding solar gain, but are subject to more heat loss) • Shade the window: – South-facing windows shaded from above (e.g. with deep window reveal or brise-soleil) so that low-angle winter sun can enter but high-angle summer sun is blocked – East- and west-facing windows may need lower-angle shading as they catch sun in the morning or evening when it is at a lower angle. The design process should explore what is the optimal level of solar gain for your building's anticipated occupancy so that there is a balance between minimising the need for mains heating in winter while avoiding overheating in summer so as to avoid or minimise the need for active cooling, which consumes energy. See also 'glazing ratio and G-value'.
Improve glazing ratio and G-value	Yes Indirectly, by avoiding the need for active cooling systems (if reducing solar gain) or heating (if increasing solar gain)	These measures can help address the risk of overheating due to solar gain (the importance of which in non-residential is described above). • **Changing the ratio of glazing** from the notional glazing ratio set by SBEM: The SBEM notional 'reference building' has a set amount of glazed windows ('opening areas') as a percentage of walls and roofs. Increasing or decreasing glazing will respectively increase or decrease the amount of solar gain, thus either reducing the need for heating systems (if the glazing is also sufficiently insulated) or reducing the need for active cooling systems. The appropriate ratio will depend on the building's occupancy, uses and orientation. • **Reduce the G-value of the glazing** (amount of sunlight energy that is transmitted through the glass): This can help to mitigate overheating and thus reduce the need for cooling.
Building form factor	No, because of how Part L works – but commentary on this topic is encouraged and will be considered in assessing your energy statement	Simpler building shapes lose less of their space heating to surface area and draughts. Recommended form factors for non-domestic are here noted, replicated from LETI Climate Emergency Design Guide: • Commercial offices: Form factor of 1–2. • Schools: Form factor of 1–3.

Table 5: Recommended energy efficiency measures in non-domestic development continued

Measure	Contributes to Part L TER improvement?	Description and rationale
Fabric: U value improvements and air-tightness.	Yes	Reduces the amount of heating energy needed by: • improving the insulation values of walls, roofs, floors, doors and windows • reducing the amount of heat that is lost to draughts. An improvement on the notional building U-values laid out in the National Calculation Methodology (NCM) Modelling Guide[18] would help to deliver the required improvement. As the current NCM Modelling Guide is for the 2021 Building Regulations, the values laid out in that NCM Guide are already an improvement on the Part L 2013 regulations against which the DPD policy requirement is set. Therefore, following the 2021 notional specification will already deliver some improvement on the 2013 TER, but an even greater improvement to these fabric and airtightness values is encouraged. Part L 2021's limiting value for air permeability is $\leq 8\ m^3/(h \cdot m^2)$. This is not very high airtightness. Instead, the Council's recommended air permeability for non-domestic development is $<5\ m^3/(h \cdot m^2)$, and its preferred value is $<3\ m^3/(h \cdot m^2)$. These reflect notional building airtightness values of Part L 2021 depending on the type of activity undertaken in the building.
Lighting	Yes	Low-energy lighting is an investment that tends to pay itself back very swiftly through operational energy savings. LED lighting is far more durable than Compact Fluorescent Lamp (CFL) or incandescent bulbs, allowing savings in cost and embodied carbon during their lifetime through delaying the need to replace them. Low-energy LED lighting throughout all non-domestic buildings is recommended.
Ventilation and cooling	Yes	Where the building's use allows, natural ventilation (with opening windows located to enable cross-ventilation) or mixed-mode ventilation with an element of natural ventilation is preferable. When combined with appropriate shading, this can avoid the need for active cooling. Where it is unavoidable to use some active cooling, it is recommended to provide this with heat recovery (most likely for hot water uses), and to provide any active cooling through a reversible heat pump system so that the building also benefits from the most efficient available heating option.

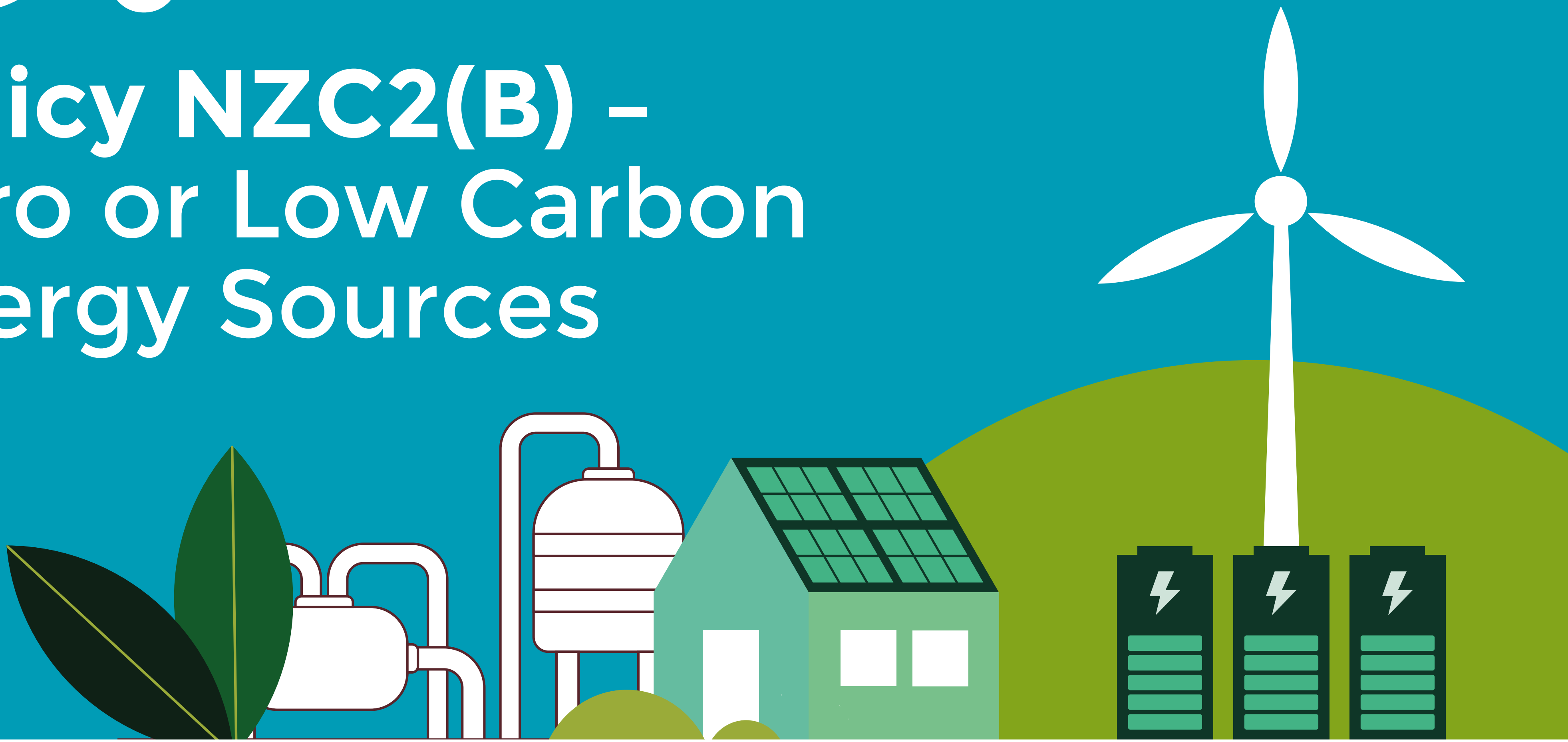
18 BRE (2022), England NCM Modelling Guide 2021 edition (Sep 2022). Available from UK National Calculation Methodologies website. www.uk-ncm.org.uk/download.jsp?id=35

Table 5: Recommended energy efficiency measures in non-domestic development continued

Measure	Contributes to Part L TER improvement?	Description and rationale
Heat recovery and heat recycling	✓ Yes	Where there is active ventilation and/or active cooling, there is potential to recover heat from the outgoing air and to reuse this to heat either incoming fresh air or hot water, thus reducing the need for mains energy for these. The typical method is MVHR (mechanical ventilation with heat recovery). Wastewater heat recovery (WWHR) systems can also have great potential in non-domestic buildings that have a significant hot water load, such as from showers, laundries, frequent hand washing, etc. These are likely to include hotels, gyms, healthcare, schools, and offices/places of work if these have showers. Mixed-use schemes may bring opportunities to recycle heat rejected by active cooling (e.g., in offices/server rooms) as domestic hot water elsewhere in the development.
Heating (for space heat and hot water)	✓ Yes	The efficiency assumption for a gas boiler in Part L 2021 for non-domestic is circa 86% to 93%. Air-source heat pumps can achieve efficiencies of >300% and ground-source heat pumps can achieve 300- 400%. This is achieved by taking heat from natural ambient outdoor sources, using a smaller amount of electricity to transfer this into the home. The efficiency is termed the ‘SCoP’ (Seasonal Coefficient of Performance) or SPF (Seasonal Performance Factor). This refers to the average efficiency across the year, as heat pumps run more efficiently when the ‘source’ is warmer (typically summer). Heat pumps can be reversible, allowing the development to have cooling in summer as well as benefitting from the excellent heating efficiencies in winter.

5.

Policy NZC2(B) – Zero or Low Carbon Energy Sources



5.1

All measures that relate to an improvement in the carbon intensity of the supply of energy are covered under Policy NZC2(B): Zero or Low Carbon Energy Sources and Zero Carbon Ready Technology.

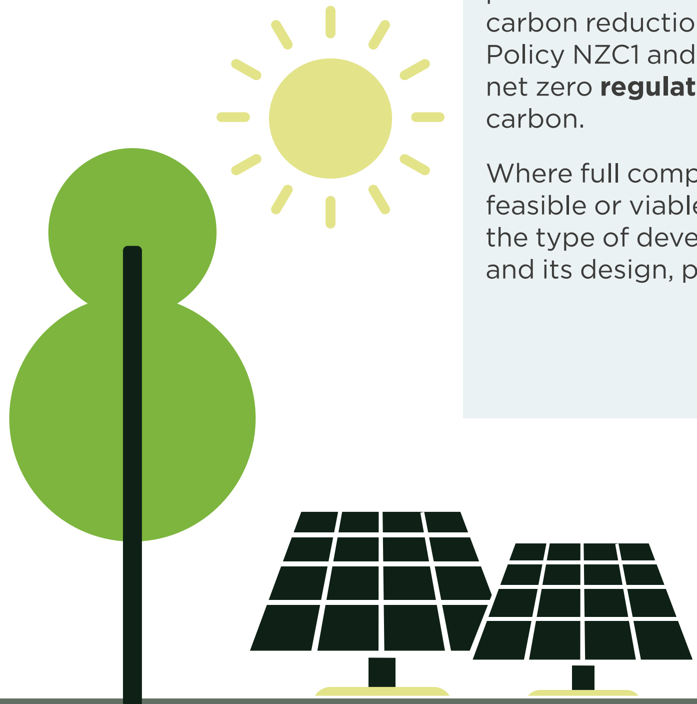
Policy NZC2(B): Zero or Low Carbon Energy Sources and Zero Carbon Ready Technology

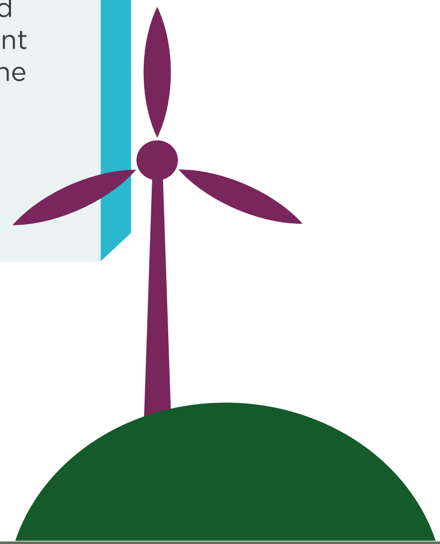
New development of one or more new dwellings (C3 or C4 use class) and/or 1,000sqm or more of new non-residential floorspace, hotels (C1 use class), or residential institutions (C2 use class) should demonstrate through an energy statement that additional renewable, zero and low carbon energy technologies have been provided on-site* to achieve the carbon reductions required by Policy NZC1 and achieve on-site net zero **regulated** operational carbon.

Where full compliance is not feasible or viable having regard to the type of development involved and its design, proposals must:

- demonstrate through the energy statement that additional renewable, zero and low carbon energy technologies have been provided to the greatest extent feasible and viable.
- incorporate ‘zero carbon ready’ (as opposed to immediately providing ‘low/zero carbon’) technologies.

*this may include off site existing or planned zero, low carbon or renewable energy generation or heat network provision where there is a direct off-grid connection to the development which has capacity to serve the development.



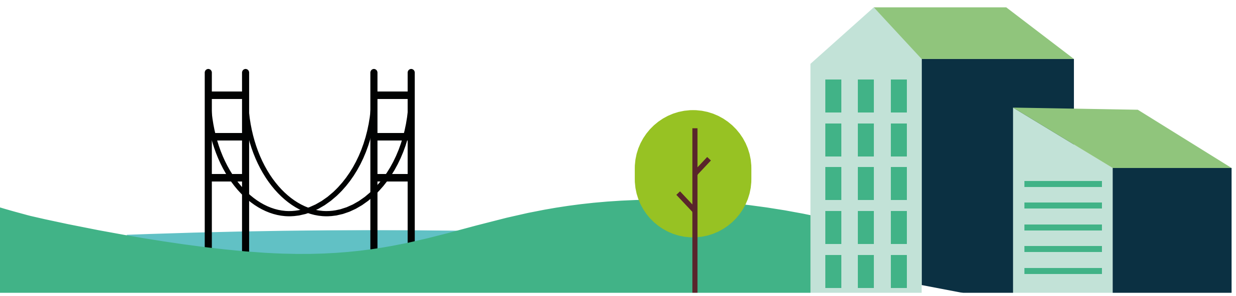


5.2

The policy requires the following provision of low-carbon and renewable energy sources to achieve the required improvements on the baseline:

Table 6: Summary of Policy NZC2(B) requirements for low-carbon energy supply by building type, and rationale.

Use type	Baseline measure	Baseline edition of Building Regs	Required improvement on baseline
New development of one or more dwellings (C3 or C4 use class)	Part L 2021 Target Emission Rate (TER)	Part L 2021	**63% minimum** **100% where feasible** in combination with the fabric efficiency improvements already achieved under Policy NZC2(A).
New development of 1,000sqm or more of new non-residential floorspace, hotels (C1 use class) or residential institutions (C2 use class).	Part L 2013 Target Emission Rate	Part L 2013	**35% minimum** **100% where feasible** in combination with the fabric efficiency improvements already achieved under Policy NZC2(A).
Where it is not feasible to meet the applicable target noted above, proposals must demonstrate that carbon reductions to the greatest extent feasible have been pursued. This should be identified in the Energy Statement.			



5.3

Measures that can be considered to contribute towards the requirements of Policy NZC2(B) include any measure that is low-carbon in comparison to the Building Regulations baseline for that type of energy use, such as:

- **Direct electric heating**, as grid electricity has a lower carbon factor per kWh than fossil gas (but only recommended currently alongside an additional renewable energy source such as solar panels or a heat pump).
- **Heat networks** supplied by fossil fuel free sources, including waste heat.
- **Solar, hydro or wind energy** generated on site, as this is zero-carbon and thus lower-carbon than grid electricity.
- **Biomass or biogas**, within strict criteria whereby the fuel source is sustainably managed and/or is a waste product that would otherwise create CO_2 in its decay if otherwise disposed.
- **Heat pumps**, as these deliver approximately 2.5–4 units of renewable heat for every 1 unit they consume in grid electricity (depending on the Coefficient of Performance that is achieved which varies by type and quality of heat pump).
- **Energy storage** (electrical or thermal), as this can, when combined with clean energy generation, increase the proportion of the clean energy generated on-site that is consumed at the development. Without energy storage, developments with large amounts of renewable energy generation on site may have to import higher-carbon energy from the grid at times of low generation, and either discard or export lower-carbon energy to the grid at times of high generation and low usage, whereby some of that exported energy would be lost in distribution before that energy can be consumed by another user).

5.4

Please note that some of the low carbon energy supply measures noted above have an element of 'energy efficiency' and therefore can, in non-domestic applications be categorised as 'energy efficiency' measures, as previously noted in the guidance for Policy NZC2(A) and Table 3.

5.5

Tables 7–18 below provide a summary of the available types of renewable and low-carbon energy supply measures and their general suitability to different situations.

Note, the following tables provide broad considerations. The application of each technology will need to take into account location specific contexts including, but not restricted to, heritage conservation, visual impact and locational requirements.

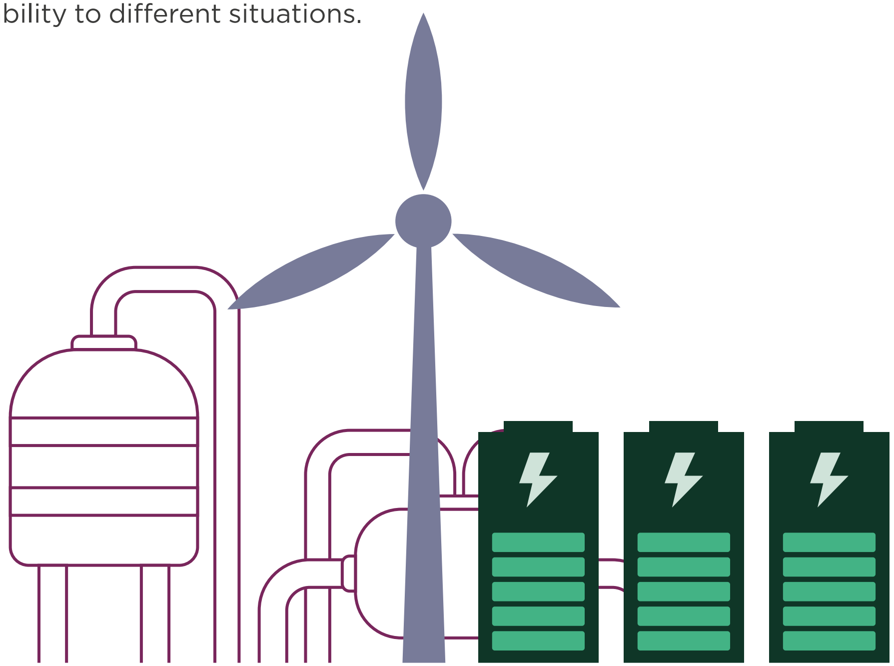


Table 7:

Air source heat pumps

What is it?

An air source heat pump (ASHP) is able to heat and cool a building through recycling heat. Similar to a fridge but in reverse, an ASHP takes heat from outside air and transfers it to an internal heating system. This can be used for heating and hot water. Some heat pumps can reverse the system to provide a cooling function. Heat pumps provide heat efficiently at lower temperatures, meaning they are paired effectively with low temperature heating systems such as underfloor heating systems, which usually have a flow temperature of 35°C compared to <70°C demanded by gas boiler fed radiators – if underfloor heating is not possible then large radiators should be installed. Since ASHPs provide heat at low temperatures, it is important the building is well insulated so that less heat is required and can be retained.

How efficient is it?

Heat pumps are significantly more efficient than direct electric or combustion-based systems because for one unit of electricity used, multiple units of heat are generated. ASHPs typically have a coefficient of performance (COP) above 3, meaning they are > 300% efficient. The efficiency of the technology will decrease as the disparity between outdoor temperature and desired indoor temperature increases, however, the seasonal efficiencies of modern domestic units when properly installed, typically exceed 350%. Installing an ASHP will make compliance with Policy NZC2(B) easier to achieve than less efficient heating systems.

Location and space requirements

The most important element for the location of an ASHP is to ensure steady air flow. To enable this any plants, walls or objects should be placed at least 1 metre away and refer to relevant product installation guidance. The unit should be located immediately outside your home and ideally at the back of the building where easy access is available for maintenance. Placing the unit in a location that requires minimal insulated pipework is important to mitigate heat loss. Where there is insufficient outdoor ground space, ASHPs can be mounted on flat roofs, which can also reduce noise pollution to neighbouring buildings.

Things to be aware of (e.g. noise and visual impact)

Without appropriate acoustic measures, some ASHPs can create noise pollution, for which mitigation could be required for planning compliance. Noise should be a consideration in the design process and can be addressed by selecting a quieter model, siting the ASHP unit away from noise-sensitive receptors such as bedroom windows or addressing the noise at the receptor such as enhanced acoustically rated windows. Encasing an ASHP with an acoustic enclosure can also mitigate noise pollution risks, whilst retaining air flow and not requiring much more additional outdoor space.

Appropriate maintenance of all heat pump units should be carried out to ensure that debris and dust does not build up in filters and the fan, which would subsequently limit efficiency.

Suitability/applicability across schemes

For new build development that must comply with Policy NZC2(B), ASHPs are suitable for the majority of building typologies, since they can be mounted outside the building on the ground or a roof. For most 2- and 3-storey residential typologies, sufficient ground space should be available for ground-mounted units, whilst flatted blocks should be able to install units on the roof. However, roof-mounted units may reduce roof space available for on-site solar PV electricity generation.

In some cases, such as large-scale new schemes, a heat network of heat pumps may be more suitable than individual units. This is explained in the 'District heating' section.

Table 8:

Ground/water source heat pumps

What is it?

A ground source heat pump (GSHP) and a water source heat pump (WSHP) will operate in the same way as an ASHP in terms of heat transfer from outside to inside. However, a GSHP extracts heat from the ground through boreholes and pipework, whereas a WSHP takes heat from bodies of water such as rivers, boreholes and lakes. Flow temperatures are low and similar to ASHP is effectively paired with underfloor heating or requires larger radiators. Both types of heat pump are also able to provide cooling.

How efficient is it?

The efficiency of a GSHP and WSHP is likely to be superior to that of most ASHP units over the course of a year, up to a COP of 4. This is because ground temperatures are more consistent due to higher heat retention, whereas an ASHP is vulnerable to fluctuations in air temperature.

A WSHP is even more efficient than a GSHP since water is an excellent thermal conductor and temperatures tend to be more stable than both air and ground temperatures.

Location and space requirements

A GSHP often requires a large outdoor space for horizontal channels or a deep vertical borehole.

GSHP can also be integrated with structural foundations, e.g., 'thermal piling'. Where a building already needs to invest in extensive foundations or deep piling, this may present an opportunity to maximise the benefits of this investment by integrating GSHP to these.

A WSHP requires a large body of water to extract sufficient heat (which can be surface water, or groundwater again via a borehole). If a WSHP is installed in a body of water too small, excessive heat could be removed and reduce the temperature to a level where freezing may occur.

The main units of a GSHP and WSHP can be located inside the building since the pipework collects the heat and therefore does not require air flow like an ASHP.

Applicants may find it helpful to refer to guidance from the GSHP Association which offers standards for vertical boreholes, horizontal exchanges, thermal piles and other guidance.

Things to be aware of (e.g. noise and visual impact)

Environmental constraints may limit where WSHPs can be installed. The same applies for GSHP as boreholes can have a negative impact on archaeology. The impact on ecology should be considered for both types of heat pumps.

Suitability/applicability across schemes

The suitability and applicability of GSHPs and WSHPs is not as widespread as of ASHPs because they both require specific settings to be feasible.

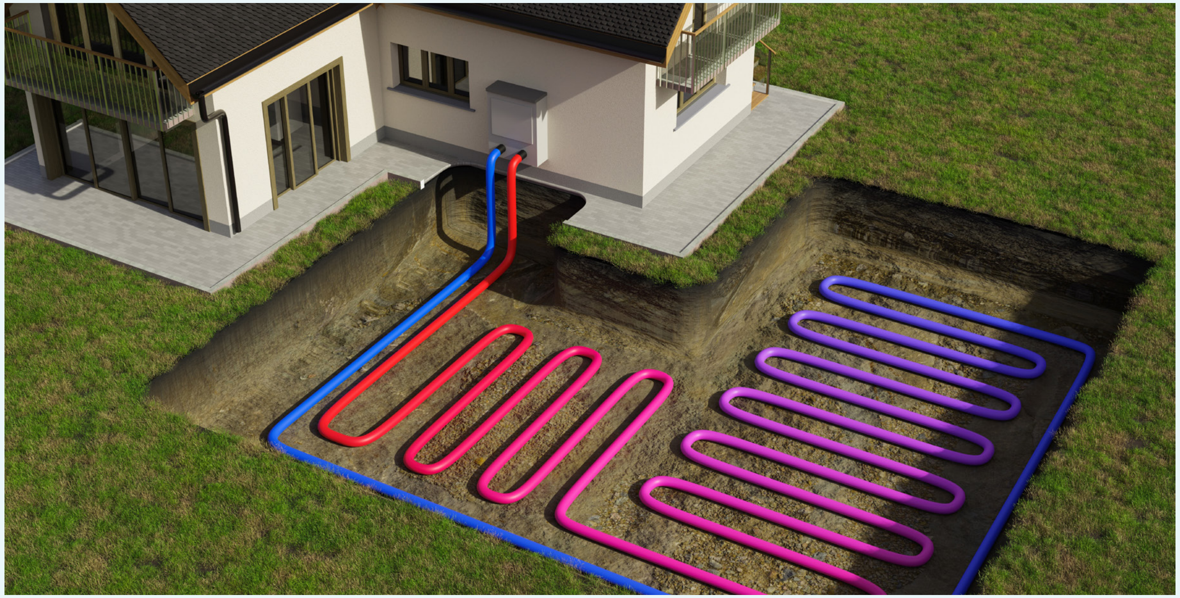


Table 9:

Domestic hot water storage

What is it?

Domestic hot water storage generally consists of a cylinder that stores pre-heated water for instant use throughout a house. Cylinder sizes can range from 50 – 500 litres, but 200 litres should be sufficient for an average four-person family. Heat pumps need cylinders with heat exchangers to deliver hot water.

How efficient is it?

The technology increases overall heating efficiency as excess heated water is stored in the tank for later use. Storage tanks reduce water wastage, whilst ensuring hot water is immediately available at all times.

Combining storage tanks with solar thermal energy generation is an efficient combination, whereby the heated water goes straight into the storage tank. This storage of solar renewable energy as hot water improves overall efficiency.

Location and space requirements

Suitable location required, such as an airing cupboard. Significant space around the unit is not necessary but flats may struggle to accommodate sufficient space.

Things to be aware of (e.g. noise and visual impact)

Sufficient insulation of the hot water tank and pipework is essentially for efficiency maximisation, particularly for piping that travels long distances through the building. This is also an important measure to avoid increasing the risk of space overheating in summer.

In accordance with the UK Health and Safety Executive, domestic hot water must be heated to and stored at a temperature of >60°C (amongst other storage and control measures) in order to prevent risk of exposure to Legionnaire's disease in residential and non-residential buildings. Heat pumps typically maintain a temperature of up to 55°C but comply with the requirement through a cleansing cycle that reaches 60°C.

Suitability/applicability across schemes

More suitable for larger homes where there is more demand for hot water but remain suitable in flatted schemes too, although issues could be apparent for space and location requirements.

Combined with heat pump technology, hot water storage will be required to store hot water, this can be provided by a hot water cylinder. The size of this cylinder depends on the amount of hot water the house/building requires. If there are spaces or other constraints that limit the ability for hot water storage, there are hybrid heat pump systems available to produce heating and hot water.

Table 10:

Heat recovery

What is it?

The two primary mechanisms for heat recovery in buildings are Mechanical Ventilation with Heat Recovery (MVHR) and Waste Water Heat Recovery (WWHR).

MVHR uses a heat exchanger to recover heat from 'used' or extracted air to pre-heat 'fresh' air to be supplied to the dwelling. Additionally, these systems improve indoor air quality by maintaining fresh air and removing stagnant air. WWHR operates in a similar way, with heat from wastewater (e.g. used shower or bath water) being used to pre-heat water entering a boiler/water tank in order to reduce demand to heat water to a set temperature.

Recognised to be simple and effective ways to reduce energy demand heating, developers should consider both heat recovery options, especially in buildings predicted to have high heat demand.

How efficient is it?

Efficient MVHR units will operate at 88 – 90% heat recovery rates but are capable of recovering up to 95% of the heat in a building. MVHR is more efficient than natural ventilation and can be used for dwellings where noise and air pollution concerns exist, meaning windows cannot be opened. WWHR units are less efficient than MVHR units but are still approximately 55–60% efficient at recovering waste water heat.

Location and space requirements

It is essential that MVHR are accessible to carry out maintenance checks and to replace filters. The total height of the unit, sound-attenuating elements, manifolds and ducts will usually not exceed 2 metres. Throughout an average medium-sized house, ducts will not exceed 10cm and therefore do not require a significantly large space. Duct routing should however be carefully thought out to limit intrusion of ducts. Duct length should be as short as possible to mitigate heat loss risks.

WWHR units do not have any significant location or space requirements.

Things to be aware of (e.g. noise and visual impact)

MVHR can be noisy if not correctly installed, so appropriate acoustic treatment should be integrated. Systems should be designed into new buildings from the beginning, as the system should be present in every room in order to balance the ventilation requirements. Homes must be well insulated otherwise the efficiency losses could become costly.

Suitability/applicability across schemes

For both types of heat recovery, assuming the home is well insulated and has sufficient unit and duct space, suitability and applicability should be high. It will be increasingly difficult to integrate heat recovery systems the later they are considered in the design process.

Table 11:

Direct electric heating

What is it?

Direct electric heating uses panel heaters to heat internal spaces. It can also heat hot water being incorporated in the water fitting (e.g. instant hot water shower) and/or in an immersion hot water tank.

How efficient is it?

Direct electric heating is roughly three times less efficient than any heat pump technology, making it relatively inefficient compared to alternative technologies in addition to potentially higher energy costs for occupants. This should be carefully considered for occupants who are vulnerable to high energy costs.

Location and space requirements

Direct electric heating panels will typically be located in the same way as a traditional radiator. Direct electric hot water can be incorporated in the water fitting (e.g. instant hot water shower) and/or in an immersion hot water tank. No major space requirements.

Things to be aware of (e.g. noise and visual impact)

Direct electric heating has minimal noise or visual negative impacts but these benefits are outweighed by high running costs and relatively low heating efficiency compared to heat pumps.

Direct electric heating is not generally desirable unless the building fabric thermal efficiency is exemplary and solar electricity generation is also provided to offset some of the running cost.

Suitability/applicability across schemes

Technically achievable for the majority of schemes but direct electric heating installations would make compliance with Policy NZC2(B) significantly more challenging due to the inferior efficiency compared to heat pumps. Due to the potentially high costs of operating direct electric heating, it should be avoided in developments where the occupants may be vulnerable to energy costs, such as social housing.

Table 12:

Energy storage

What is it?

An energy storage system allows heat or electricity to be captured when it is readily available, typically from a renewable energy system, storing it for use later. The most common energy storage systems include electric batteries, heat batteries and thermal stores.

Electricity can be stored in electrical batteries, or it can be converted into heat and stored in a heat battery. Heat batteries store spare electricity or heat by containing material which capture this energy by changing from liquid to solid. Heat can also be stored in a hot water cylinder as thermal storage. (See 'Domestic hot water storage'). Domestic-scale hot water storage is most common; however, larger communal hot water storage is also possible and can be effective in developments with large solar arrays or a shared heat network. When well-designed these can even deliver cross-seasonal heat storage, e.g. in an underground insulated tank.

Energy storage is useful for buildings that generate their own renewable energy, as it allows them to use more of their low carbon energy. Energy storage is seen as key to supporting the renewable transition, making best use of local energy resources, and supporting grid modernisation.

How efficient is it?

A typical residential solar system without a battery will cover about 30%-50% of household power consumption. With a battery system, this can be increased to 80%, 90% or potentially even 100% of household power consumption, by bridging the time gap between when solar energy is generated and when energy is used.

Location and space requirements

Battery storage units need to be in well-ventilated areas and away from sources of heat, including direct sunlight.

Units should be easily accessible for maintenance and should be enclosed and have suitable warning signs indicating that a large amount of energy is stored within.

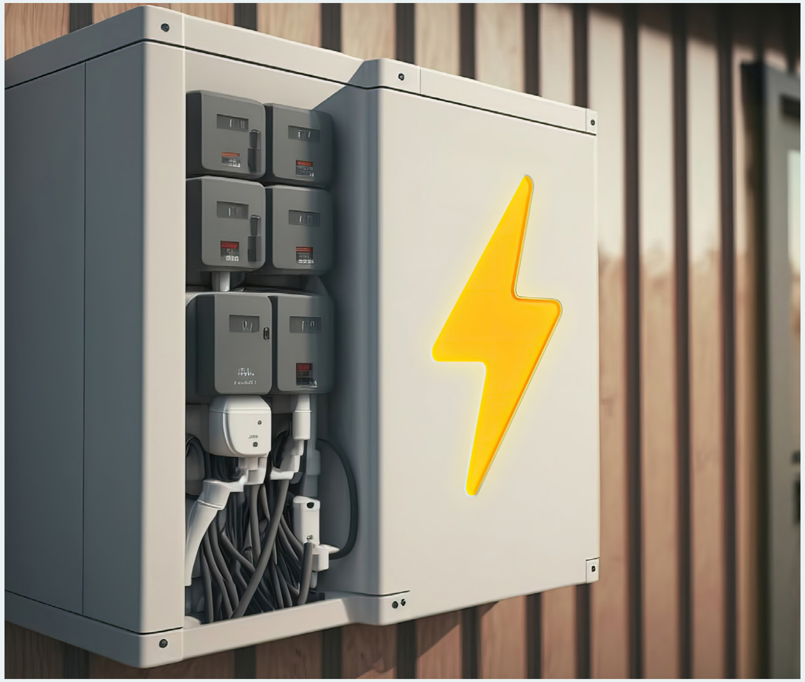
In addition, batteries need to be able to be quickly isolated from the electricity network in the case of an emergency.

Batteries can be quite heavy so a structural engineer may be needed to review the storage location and recommend appropriate fittings to meet building regulations.

Things to be aware of (e.g. noise and visual impact)

Residential installations must be placed with consideration of proximity to sleeping and living areas and proximity to neighbouring buildings so it does not pose a risk to residents should the battery fail or catch fire.

Systems should be in an exterior location or in a garage or outbuilding. If placed on the exterior of the building they should be sensitively placed so as not to impact the visual amenity.



Suitability/applicability across schemes

Most suitable for homes that have installed Solar PV systems as they can help store excess generation and maximise the use of renewable energy.

Communal thermal storage is likely to be most effective in a development with a large solar PV array or shared networked heat.

Table 13:

Solar photovoltaic panels

What is it?

Solar photovoltaic (PV) installations produce electricity from sunlight and can be mounted or integrated into the roofs or façades of buildings or may be installed on the ground. They are a common form of renewable energy that is considered mainstream within the building industry.

PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that can be used on conservatories. PVs can be used to provide extra power for buildings already connected to the national grid or can also provide the only source of electricity for a building. They can be combined with green roofs.

How efficient is it?

The majority of solar panels on domestic systems in the UK are around 10-20% efficient although some types of solar panels can reach an efficiency level of up to 25%.

However, note that this efficiency tells you how effective a solar panel is at converting sunlight into electricity. Whilst this might sound like a low figure, a solar panel system can generate enough electricity to dramatically reduce energy bills and carbon emissions.

Location and space requirements

Space is a key consideration. The average system size is around 3.5kWp and this will typically take up around 20m2 roof area.

An unshaded, South facing roof is ideal for maximum electrical output. East or West facing roofs could still be considered, but North facing roofs are not recommended. A system facing East or West will yield around 15-20% less energy than one facing directly South.

Roof structures and features including dormer windows and rooflights should be carefully designed as to maximise the available space for PV panels.

However, a 'concertina' pattern (with panels alternating between east and west facing) enables a greater total area of PV panels to fit within the given area of roof, and therefore a greater concentration of total kW generation per square metre of roof space. This kind of configuration can help buildings with a small ratio of roof area to floor area (that is, taller buildings) to achieve the targeted renewable energy generation.

Any nearby buildings, trees or chimneys can shade roofs and have a negative impact on the performance.

Things to be aware of (e.g. noise and visual impact)

There are visual impacts to consider – rooftop solar PV installations may not be appropriate and heritage and conservation designations must be considered. For ground mounted solar installations, the historic environment, landscape impact and short- and long-range views will need to be considered.

Generally, solar panels should not make noise, unless there is a structural defect or a problem with the installation.

Solar Panels can provide a space for birds, in particular pigeons to nest under. Consideration should be given to netting or mesh to avoid unwanted nuisance.

Suitability/applicability across schemes

Solar PV panels are considered 'permitted developments' and often don't require planning permission. However, exceptions apply e.g. listed buildings and conservation areas.

Solar PV should be considered standard for new developments and the design of buildings should incorporate them. However, across the district care must be taken to ensure the visual impact is not adverse and there may be instances where they may not be appropriate.

Table 14:

Solar thermal

What is it?

Solar thermal uses the energy from solar radiation to heat a fluid within a collector (either a panel or tubes). The fluid can be water or a water-glycerol mix, which is then used in a hot water cylinder or thermal store to pre-heat domestic hot water. A boiler or immersion heater is often used to further heat the water or to top up the quantity of supply to meet demand.

How efficient is it?

Solar thermal system is considered to have efficiencies of between 70% and 80%[19].

Variations in sunlight hours and solar radiation levels lead to seasonal variations in efficiency of these systems.

Often requires a top-up system as above and is required in addition to a space heating system.

The energy savings can lead to paying off the system within 12-20 years.

Location and space requirements

Most commonly installed on roofs, these can be installed anywhere (e.g.: at ground level, or on a garage roof) as the equipment is not heavy and not requiring additional structural/support requirements.

The main consideration is overshadowing, as the time the panels spend under direct solar radiation determines the efficiency of the system. Panels or tubes should be orientated between south east and south west to ensure that the most sunlight hits the panels/tubes.

Things to be aware of (e.g. noise and visual impact)

There are visual impacts to consider – rooftop solar thermal installations may not be possible and heritage and conservation designations must be considered.

Items for consideration also include ensuring systems are fully sealed and resistance to moisture and other weather, electrical safety, wind uplift and suitable fixings and structural loading (eg: snow collection).

You may require a larger hot water cylinder for the immersion heater top-up.

Suitability/applicability across schemes

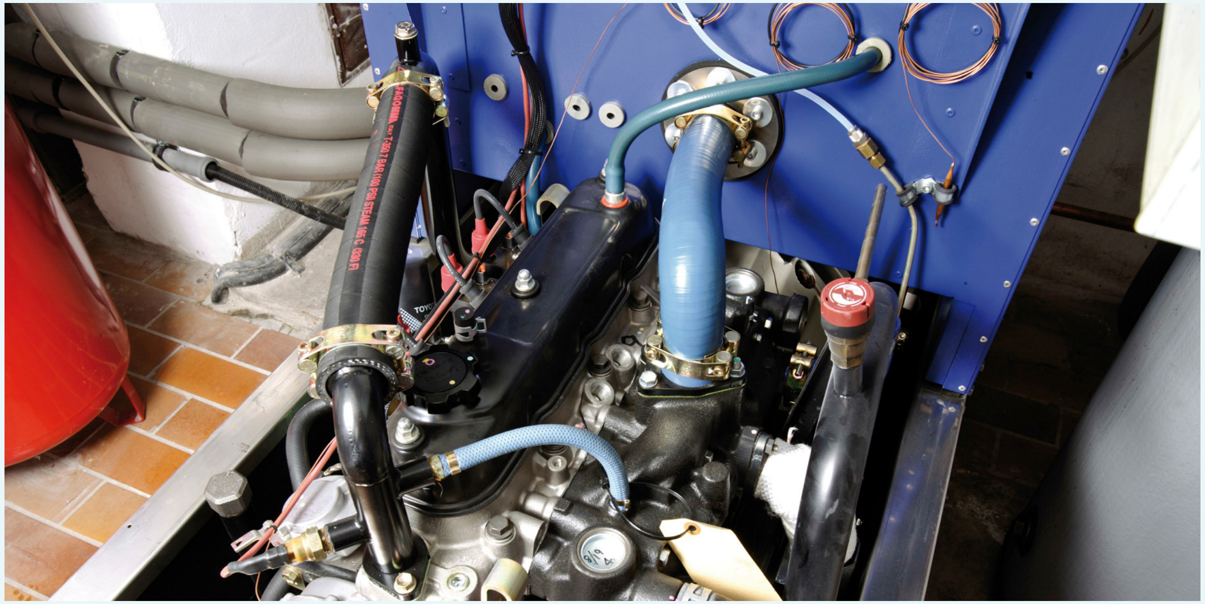
In most cases, the system would be acceptable under permitted development, however restrictions may apply where a building is listed or in a conservation area.

It is most suitable for developments with high domestic hot water demand such as residential and hotel buildings.

19 www.open.ac.uk/blogs/design/what-is-the-problem-with-solar-thermal-panels

Table 15:

Combined Heat & Power engines (CHP)



What is it?

An engine (gas, biomass or biogas powered) that creates electricity and also captures the heat energy created in the process. Therefore, simultaneously creates both heat and power.

When additionally providing cooling, the systems are known as CCHP (combined cooling heat and power) and would include absorption chillers.

It is thought that in future, hydrogen-fired CHP may also emerge.

How efficient is it?

Most efficient when there is a significant heat demand – the heat load typically requires a development with a minimum of 50 homes before CHP systems are considered to be efficient.

They must also be used constantly in order to be most efficient, so the CHP should be sized to meet the annual base heating demand. CHPs over-sized will be less efficient and produce higher emissions, so peaking plant to avoid these should also be considered.

The choice of prime mover that creates the outputs has an impact on the emissions created: commonly these are internal combustion engines and gas turbines. Gas turbines produce lower emissions and are more electrically efficient

Location and space requirements

Systems require a centralised energy centre with space for the engine, in addition to hot water tanks, distribution pipework also has to buried.

Things to be aware of (e.g. noise and visual impact)

Local air quality considerations – burning any fuel locally can impact the quality of local air, especially when the fuel is burned on site, for example in a centralised energy centre or boiler room.

CHP systems supplied with fossil gas should be avoided as these lock the development into fossil fuel use for longer.

Where CHP systems are proposed, these should be low emission versions by up to date standards and benchmarks.

Where CHP is proposed, the long term trajectory to reduce carbon emissions to zero must be considered, using SAP 10 carbon factors (or more recent versions).

Although hydrogen CHP may emerge in future, hydrogen is not yet a truly sustainable fuel, as its production currently either uses fossil fuel or takes multiple units of electricity to produce each unit of hydrogen, making it less efficient than simply using that electricity in its original state. However, technological innovation may solve this problem in future. Should hydrogen CHP proposals come forward, it will only be considered acceptable if it can be guaranteed that the hydrogen supply is not from fossil fuel (unless the resulting carbon is guaranteed to be captured and stored permanently) or produced more efficiently and sustainably than if the required electricity were instead used directly at the site.

Suitability/applicability across schemes

Can be installed in centralised energy centres as part of a district-wide strategy. Best suited to new build non-residential schemes with consideration of the technology from the outset and where there is a high heat and electricity demand.

Can use same heat distribution system as gas boilers – hot water >60 degrees with radiators.

Can be considered complex systems because of the need to balance the generation of heat and electricity, and as such systems must be designed and installed in accordance with best practice guidance and by specialist engineers.

Could potentially lead to higher energy bills for residents, therefore not a viable option where fuel poverty is a risk.

Table 16:

Biomass

What is it?

Using plant-based fuels or waste organic matter as a fuel within a boiler. Considered a renewable energy technology where the fuel source can be rapidly replenished.

Biomass fuel sources can include logs, woodchips, agricultural waste, industrial biological residues, or specially created wood pellets. Typical household systems tend to use logs, woodchip or pellets. These may heat a single room via a stove, or can heat multiple spaces and appliances via a biomass boiler.

How efficient is it?

Efficiency is dependent on the fuel used for combustion and the moisture content of the fuel, which can range between 94% (pellets) and 80% (wet woodchips)[20]. Therefore, systems can offer a similar efficiency to gas boilers.

Although burning biomass releases CO_2 to the atmosphere, this can be offset by the CO_2 absorbed in the original growth of the biomass and/ or the growth of new biomass to replace it (e.g. replanting commercial woodland after logging). Where this sequestration is taken into account, biomass boilers sometimes claim emissions ~70% lower than those of conventional gas boilers. However, see caveats about responsible fuel sourcing.

Location and space requirements

Siting of the boiler flue has to be considered and therefore biomass is often not appropriate on small spaces.

Space is required for storage of the biomass feed fuel - the size of store required depends on both the size of the biomass boiler and the frequency of deliveries of the fuel/distance to the fuel source. For example, a garage-sized store may be required for a large house so the store required may not be insubstantial.

In addition, the store should be able to accommodate the required fuel for a worst-case-scenario winter, which would have higher demand.

Local transport networks must be considered, for their capacity to accommodate transport vehicles such as trucks/lorries for fuel deliveries.

In addition, the carbon emissions and particulate matter from deliveries (as well as the biomass combustion itself) should be part of the feasibility considerations for this technology.

For this reason, on-site solutions such as heat pumps are often more favourable, both in terms of local emissions affecting air quality, and also the associated carbon emissions.

Things to be aware of (e.g. noise and visual impact)

Local air quality considerations – burning any fuel locally can impact the quality of local air, especially when the fuel is burned on site in a centralised energy centre or boiler room.

Carbon emissions and particulate matter are released both in the fuel transport and operation of biomass boiler.

In the Warwick District Air Quality Management Areas (AQMAs) a limit has been set for annual and hourly nitrogen dioxide limits[21].

Biodiesel can also be used in some biomass systems but this is not recommended due to air quality implications as it composed of animal oils and fats.

The presence of and impact on local protected habitats and species (including birds and bats nesting/roosting in chimneys/ roofs/sheds) must be fully investigated prior to installation of any biomass plant.

Responsible sourcing of biomass woodchip/pellets must also be demonstrated in order to certify this will not be associated with deforestation or forestry systems that fail to replant logged areas. Preference should be given to fuels that are a by-product of other processes and are produced in the UK.

If external flues are required, there may be additional considerations around visual impact on any surrounding areas designated for natural or manmade heritage protection.

Further information on open fires and stoves Defra have produced the following guide. You can also visit the HETAS website for help. (www.hetas.co.uk)

Suitability/applicability across schemes

Can be retrofitted into existing buildings which have fireplaces and/or gas boilers and use radiators as the heat distribution system.

Can be installed in centralised energy centres as part of a district-wide strategy, or can be designed to heat a single room or dwelling.

Pellets are easier to use and can run automatically with fuel feeders which refill the boiler when the fuel runs low. Log-burning boilers must be filled by hand and therefore require more maintenance and intervention.

Unlikely to be suitable for schemes in urban areas due to air quality impacts.

20 https://usewoodfuel.co.uk/guidance-for-biomass-users/planning-a-biomass-installation/understanding-efficiency/biomass-boiler-efficiency/#:~:text=Manufacturers%20often%20state%20the%20combustion,%25%20(for%20wet%20chips).

21 https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=296

Table 17:

Wind

What is it?

Wind turbine blades are rotated in low to medium level wind, and this movement is used to generate electricity.

For electricity generation, small-scale wind generation is often considered a less viable solution than a PV array (so wind is more likely to be considered where large scale generation is possible).

<5kW micro turbines are most suitable at a building scale (with blade diameters up to 3m), whereas macro turbines can have a capacity up to 5MW.

How efficient is it?

In suburban areas for turbines at 10m in height and working at 10 metres/second, annual efficiency ranged between 20% and 40%.

Most useful in rural locations where electrical grid connection is/ less reliable or not available, where obstacles and availability of most suited wind conditions can improve the efficiency of standalone turbines.

Location and space requirements

Site context is crucial for deciding whether wind turbines are feasible, both for the siting of the turbines themselves and if the conditions are suitable.

Average wind speeds, required separation distances from neighbours, grid connection, site access and environmental and/or landscape designations all need to be considered.

Predominant winds and average wind speed to be analysed. The UK Wind Speed (NOABL) Database should be used as a baseline, but calculations should be modified to incorporate local geographical context (terrain and obstacles).

Separation distances from neighbours, and between turbines, where necessary, to be calculated. Best suited to rural locations due to the need to have undisturbed wind pathway to the turbines.

Can be operated in an off-grid manner or connected to local/ UK-wide electrical grids. Where operated off-grid will need to be installed in collaboration with electrical battery storage to store electricity when it is generated but not used, and also to stabilise supply and demand. Where connected to the grid, battery storage can also aid in the demand side response system.

Adequate and appropriate grid connection is required.

Site access for wind turbine construction and maintenance. Similarly, rooftop/facade access route and space is required where turbines are building-integrated.

Things to be aware of (e.g. noise and visual impact)

Considered to have potential noise impacts[22], as turbine design develops, the noise concerns are becoming less of a barrier. Blade design has created low-noise options, in addition to vibration isolators, sound absorbing materials used for the gearbox and generator components can help reduce and minimise noise generation. Environmental Health may need to be consulted with regards to noise nuisance for neighbours.

Landscape and environmental designations will need to be fully considered and any impacts investigated. This includes local ecology and trees, local habitats (especially considering bird populations).

Historic environment and heritage views will also need to be considered.

Suitability/applicability across schemes

Building-integrated turbines can be used within new and existing developments.

Consideration must be given to wind speed and direction as these will impact the level of wind generation, and the number of hours the turbines can be operating at full capacity. For example, wind is strongest at night but local context will inform the number of hours the turbines can operate.

Planning permission may be required and will be subject to local and national policies relating to wind turbines.

22 www.ioa.org.uk/publications/wind-turbine-noise

Table 18:

Hydro

What is it?

Energy harnessed from falling or flowing water in rivers/dams, using kinetic energy to move turbines, create mechanical energy and drive a generator to create electrical energy.

Micro-hydro plant produce <50 kilowatts (kW), small scale plants between 50kW and 5 megawatts (MW) and large-scale plants >5MW[23].

How efficient is it?

Efficiency of the hydro turbine is usually >80%, which is double that of a steam engine.[24]

The amount of hydroelectric power for a system is dependant on the vertical distance that the water falls (the 'head') and the level of water flow[25].

Location and space requirements

Local opportunities for hydropower may exist in areas with hills/waterfalls/weirs. Some local potential at weirs at Barford on the River Avon is identified in the 2021 Warwick Low Carbon Energy Feasibility report (although there may also be other local opportunities).

The availability of a suitable water source and adequate space to develop a hydropower plant mean the number of feasible sites are quite restricted. Many of the viable sites for hydro have been considered in the UK already.

Hydroelectric schemes in the UK typically are[25]:

- storage schemes (using a dam).
- pumped storage using electricity to pump water between two reservoirs. Water is pumped when the demand and electricity price is low (e.g.: at night) and water is released when demand and price are higher. May not be considered fully renewable as it requires electricity central to its operation.
- run-of-river hydro using a weir to enhance the natural river flow.

Things to be aware of (e.g. noise and visual impact)

Before a scheme can be built, the upfront and operational costs, environmental permits, planning consent and connection to local electrical grid must be considered. These are in addition to heritage and historic environment considerations.

An ecologist must be appointed, and local environmental/ conservation bodies must be consulted at early stages of development in order to fully consider potential environmental impacts on biodiversity, water wildlife and wider impacts from interrupting natural water flows; this includes consultation with the Environment Agency and Natural England.

Suitability/applicability across schemes

Please refer to the Warwick District Low Carbon Energy Feasibility Report (RINA Tech UK, June 2021).

23 www.gov.uk/guidance/harnessing-hydroelectric-power

24 www.british-hydro.org/hydro-facts

25 www.gov.uk/guidance/harnessing-hydroelectric-power

The role of district heating and cooling networks

5.6

District heating (DH) and cooling networks supply thermal energy (heating and/or cooling) to multiple buildings, usually from a centralised heat source (energy centre), through a network of insulated pipes and heat exchangers. District heating (or heat networks) are 'energy source agnostic' meaning they can accommodate a range of heat sources. These can include heat pumps (both ground and air source) and waste heat from industry or commercial uses.

5.7

DH networks can be designed for new-build schemes as well as allowing the connection of existing buildings. They can supply heat at the same conditions as existing individual boilers, allowing internal heating systems to remain unchanged, however newly designed heat networks can use lower temperature sources that operate at lower temperatures and a wider delta T (the temperature difference between supply and return) compared to individual boilers. This translates to lower energy consumption, both in terms of heat losses and pumping energy, but connecting to these can be problematic for existing, older buildings as their existing internal heating systems may not be designed to emit heat at a lower temperature (and may therefore need to be upgraded to operate at this lower temperature if connecting to such a network).

5.8

Shared heating and cooling networks can also operate on a partly decentralised heat source, e.g. heat removed by active cooling from offices, refrigerated areas and ICT server rooms could be inserted into the network and transferred to where it is needed (e.g showers, laundries, etc). This is a key opportunity in mixed-use development, or residential development that takes place near existing large heat rejection, such as supermarkets, cold storage or ICT server farms.

5.9

As per Warwick Local Plan Policy CC2-Planning for Renewable Energy and Low Carbon Generation (point 'e') where possible, homes and buildings should maximise appropriate opportunities to address the energy needs of neighbouring uses and should link to existing or planned local carbon district heat networks where this would result in lower carbon emissions than a reasonable on-site alternative.

5.10

DH networks are often most beneficial for new development sites and in areas where there is a high energy demand density. Therefore, town centres or larger new-build masterplans are ideal locations due to the range of use classes and densities. However, heat networks can also be beneficial in rural, off gas areas where homes are currently reliant on more volatile energy source such as oil and LPG. Examples include the Swaffham Prior heat network in Cambridge that could connect up to 300 homes. The Swaffham Prior network will be fed by heat pumps (a combination of air-source and ground-source). In this instance the switch to low carbon energy sources and network can have wider benefits such as reducing instances of fuel poverty.

5.11

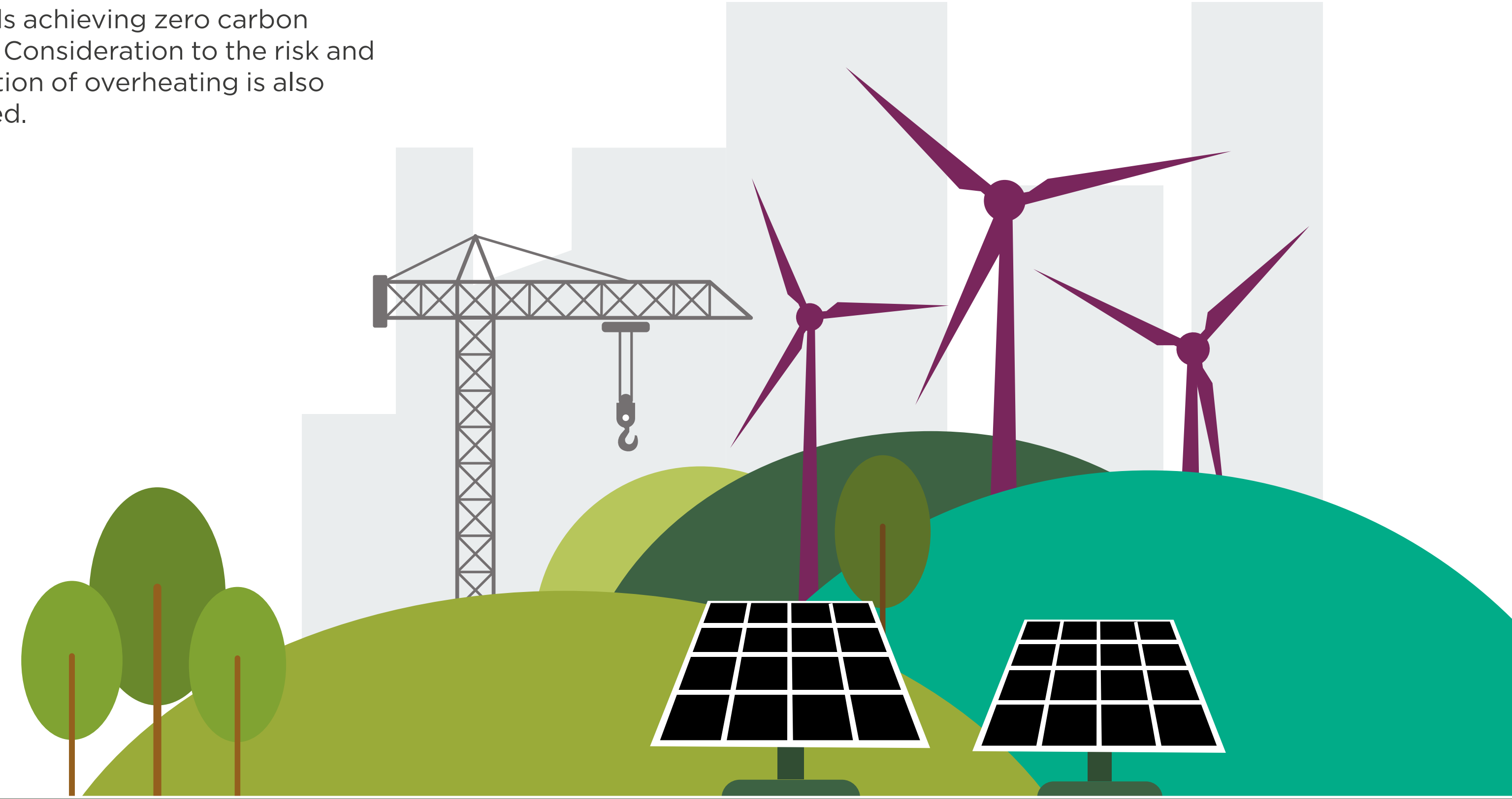
Where DH networks are specified, it is critical that all heat networks provide affordable, reliable year-round, hot water and heating and ideally also cooling where there is a cooling demand. Heat networks must demonstrate compliance with appropriate technical standards (currently CIBSE's Heat Networks Code of Practice for the UK) and be registered with the Heat Trust.

5.12

Consideration must also be given to the installation of the pipe networks and other wider development plans in the area and the potential impact on local landscape and biodiversity due to the scale of works required.

5.13

As per NZC2(B) of the Net Zero Carbon DPD, where DH networks are proposed, applications should be accompanied by an energy statement that includes an assessment of the advantages of a network system vs individual systems, an accurate assessment of distribution heat losses, a long term strategy for the sustainable supply of low carbon fuel and that the network has a credible route towards achieving zero carbon status. Consideration to the risk and mitigation of overheating is also required.



6.

Policy NZC2(C) – Carbon Offsetting

6.1

Applicants who cannot demonstrate full compliance with the suite of NZC policies, and achieve net zero operational (regulated) energy on-site, will be required to offset any residual regulated carbon emissions.

6.2

Carbon offsetting should only be used as a last resort, and only when an applicant has maximised on site carbon reductions through stages 1 and 2 of the energy hierarchy. The Council will only accept offsetting where it is demonstrated that measures under NZC2(A) and NZC2(B) are not feasible having regard to the design and type of development involved. This should be demonstrated within the Energy Statement and justification provided where Policies NZC2(A), NZC2(B) and on-site net zero regulated carbon is not achieved.

Policy NZC2(C): Carbon Offsetting

Where a development proposal of one or more new dwellings (C3 or C4 use class) and/or 1,000sqm or more of new non-residential floorspace, hotels (C1 use class), or residential institutions (C2 use class) cannot demonstrate that it is net zero carbon, it will be required to address any residual carbon emissions by:

- a cash in lieu contribution to the District Council's carbon offsetting fund

and/or

- at the Council's discretion, a verified local off-site offsetting scheme. The delivery of any such scheme must be within Warwickshire or Coventry, guaranteed and meet relevant national and industry standards. If it is a nature-based carbon sequestration scheme, then it must be backed by the national government's Woodland Carbon Code initiative (or future replacement/equivalent national scheme) and meet the Warwickshire ecosystem service market trading protocol.

Where full compliance is demonstrably not feasible having regard to the type of development involved and its design, proposals must offset any residual carbon emissions to the greatest extent viable.

Contributions to an offsetting scheme shall be secured through Section 106 Agreements and will be required to be paid prior to the occupation of the development.

The amount of carbon to be offset will be calculated according to the SAP or SBEM carbon emissions submitted in the energy statement required under policy NZC(1). This must then be multiplied to reflect emissions over a period of 30 years from completion. Where "zero-carbon ready" technology is proposed, associated carbon emissions should be calculated in accordance with the stated national trajectory for carbon reduction of the energy source (i.e. annual Treasury Green Book BEIS projections of grid carbon intensity or future national equivalent).

The carbon offset contribution amount will be calculated within the energy statement at the submission of the application. It must then be recalculated at completion and pre-occupation. Where assessment undertaken at completion shows that there is a performance gap between the design and the performance of the completed building, carbon offsetting contributions will be required to reflect any associated additional carbon emissions not accounted for at the point of determination of the planning application and an adjusted payment made if necessary.

The carbon offset price is the central figure from the nationally recognised non-traded valuation of carbon, updated annually as part of the Treasury Green Book data by BEIS.

Funds raised through this policy will be ringfenced and transparently administered by the Council to deliver a range of projects that achieve measurable carbon savings as locally as possible, at the same average cost per tonne. The fund's performance will be reported in the Authority Monitoring report on: amount of funds spent; types of projects funded; amount of CO_2 saved.

6.3

Where there is genuine viability concerns the Council expects that contributions to the Carbon Offsetting Scheme are made to the greatest extent viable. See Section 11 of the Net Zero Carbon DPD.

6.4

The Energy Pro-Forma (Annex 1) includes the calculation of any residual emissions and the total monetary value of carbon offsetting required for a development. The Pro-Forma includes the following options for calculating the monetary value of offsetting:

- Static offset: applying the BEIS carbon value over the 30-year period
- Dynamic Offset: incorporating the BEIS projections for grid decarbonisation over the 30-year period - this approach is only recommended for wholly electric schemes.

These funds represent a contribution to the Council's Carbon Offsetting Scheme which would be secured via a Section 106 agreement and paid before the occupation of a development.

6.5

The Section 106 agreement would include the Council's approved formula for calculating the offsetting amount based on the 'as built' calculations of carbon emissions as submitted via a discharge of condition. This is to ensure that the offsetting contributions reflect the residual carbon emissions of a building as constructed.

6.6

Contribution to Warwick's Carbon Offsetting Fund is the preferred form of offsetting as the Council are already partners in a verified scheme of delivering carbon offsets through woodland creation within Warwickshire.

6.7

Warwickshire County Council have prepared the Warwickshire Environmental Services Trading Protocol (WESTP). The WESTP details what nature-based solutions are available to compensate for development and outlines the principles and rules for the creation, enhancement and maintenance of habitats by landowners in order to be traded as compensation units.

6.8

The Council's prioritised method of carbon offsetting is through tree planting and aligns with Warwickshire's target to plant 566,000 trees by 2030. Warwickshire's Natural Environment Investment Readiness Fund (NEIRF) Report identifies that 1 tree can offset 1 tonne of carbon in its lifetime, providing that the trees are managed in good condition to maturity.

6.9

In the future the Council will also consider applying the carbon offset fund to other forms of carbon offsetting, including other habitat creation/restoration, retrofit of council owned buildings for improved energy efficiency, or the provision of renewable energy. It is important to note that funds received from offsetting would not fund projects where funding could be secured from other sources or grants. Projects must demonstrate that funding from the Council's Carbon Offset Fund would be 'make or break' for the project, and that the carbon emissions saved relate exactly to those which are being offset.

Can applicants provide carbon offsets directly rather than contributing to the Council's Offsetting Fund?

6.10

NZC2(C) includes the mechanism for applicants to offset residual carbon emissions through a verified offsetting scheme. This is at the discretion of the Council and will only be deemed acceptable where an applicant can demonstrate that the offset scheme is:

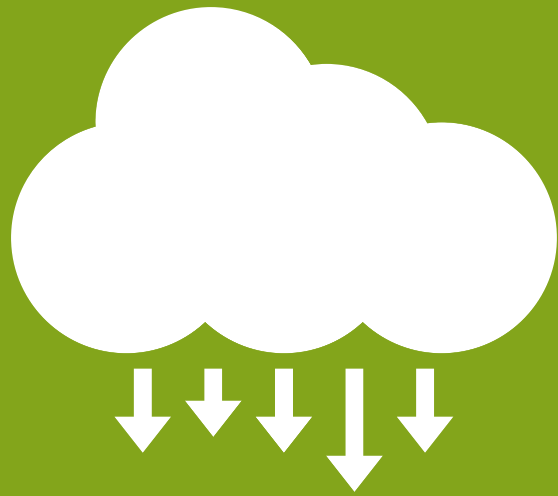
- Located in Warwickshire or Coventry.
- Guaranteed to meet national or industry backed standards.
- For nature-based solutions:
  - Registered with the Woodland Carbon Code;
  - Created and maintained for a period of 100 years;
  - Adheres to the Warwickshire landscape character guidelines
  - Complies with the Warwickshire's Ecosystem Trading Protocol (WESTP), including the Compensation Hierarchy

6.11

Carbon offsetting undertaken through the Council's offsetting fund scheme will meet the requirements set out above through the WESTP, and such it is the expectation that applicants will use the opportunity to contribute to the Council's fund over organising their own scheme which meets the requirements.

7.

Policy NZC3 – Embodied Carbon



Policy NZC3: Embodied Carbon

New major development should demonstrate in the energy statement or design statement how the embodied carbon of the proposed materials to be used in the development has been considered and reduced where possible, including with regard to the type, life cycle and source of materials to be used.

Proposals for development of 50 or more new dwellings and/or 5,000sqm or more of new non-residential floorspace should be accompanied by a whole-life assessment of the materials used.

Embodied carbon overview

Table 19: Summary of Policy NZC3

Threshold	Requirement - Outline applications	Requirement - Reserved matters / Detailed applications	To be submitted
New major development	Set out the embodied carbon strategy for the development, where relevant setting out methodology and targets to be considered at the detailed design stage.	Demonstration of how embodied carbon has been considered and reduced where possible.	Energy Statement
Proposals for development of ≥50 new dwellings and/or ≥5,000sqm	Set out the embodied carbon strategy for the development, setting out methodology and targets to be considered at the detailed design stage. Provide an estimate of the embodied carbon of the proposed development utilising the RICS Whole Life Carbon Assessment methodology.	Demonstration of how embodied carbon has been accounted for and reduced where possible.	Whole-life embodied carbon assessment

7.1

Policy NZC3 sets out the following requirements in Table 19.

7.2

Embodied carbon relates to emissions associated with materials, construction processes, maintenance/refurbishment during their lifetime and the eventual end of life of a development, measured in $kgCO_2e$ (kilogrammes of carbon dioxide equivalent[26]).

For example, carbon emissions associated with the energy used in the manufacturing process of extracting and producing a product, transporting it to the site, assembling it into a building or using it to maintain or refurbish that building.

7.3

For embodied carbon assessments, embodied carbon is usually reported as kilogrammes of carbon per m^2 (GIA).

7.4

The majority of a building's embodied carbon is associated with the construction of the building, but a smaller amount of embodied carbon is also associated with the building's lifetime through refurbishment and maintenance, and its eventual demolition and disposal. Table 20 provides a summary of the associated carbon emissions per stage of a buildings lifetime.

26 Carbon dioxide equivalent refers an amount of different types of gas that have a global warming effect, expressed as the amount of carbon dioxide that would have the same degree of global warming effect within a 100-year period. It is a way of making different greenhouse gases comparable to each other.

Guidance on embodied carbon assessments

7.5

For both major and super-major developments, design principles for embodied carbon reduction should be adopted throughout the planning and construction process. The set of principles noted in the Greater London Authority Whole Life-Cycle Carbon Assessment guidance provides a good example and include:

- Reusing and retrofitting existing built structures
- Utilising repurposed or recycled materials
- Choosing low-carbon materials (e.g. timber, lime or low-carbon production materials)
- Fabric first approach to holistically reduce embodied and operational carbon
- Low-carbon operational water use
- Design for future deconstruction and reuse
- Design an efficient building shape and form
- Incorporate carbon sequestering materials
- Design for durability and flexibility
- Address embodied and operational carbon reductions together
- Determine expected building lifespan
- Source materials locally
- Minimise waste
- Efficient and lightweight construction
- Follow circular economy principles

7.6

Applicants for major developments should demonstrate through their Energy Statement how the proposed development aims to achieve embodied carbon reductions against each of the principles identified above. Reduction measures should be considered in relation to the specific setting and type of development, but the principles and measures in the list above should be used as a starting point to develop a detailed strategy.

7.7

Embodied carbon assessments, of the type relevant to the scale of the proposal, will be required to be submitted at each stage of the planning process:

- **For Outline Planning applications:** Applicants should identify the expected design principles and materials and how embodied carbon has been considered and reduced.
- **For Full Planning applications, Reserved Matters and S73 applications:** Applicants should identify how the selection of the specific proposed building design and materials has considered embodied carbon and how this has been reduced.

7.8

The following materials have high embodied carbon and should be replaced with lower impact alternatives where possible or used as sparingly as possible via efficient design:

- Concrete and cement
- Steel
- Other metals (e.g. aluminium, zinc and copper)
- Plastic and glass
- Materials that require long-distance transportation between source and site, especially by road.

Table 20: Overview of embodied carbon emission sources in the stages of a building's lifetime.

Embodied Carbon Process	Emissions Source
Raw material extraction	Extraction of raw materials uses energy and commonly result in carbon dioxide emissions, particularly for timber, metals and minerals. Mining and refinement add to emissions.
Manufacturing and processing	CO_2 produced during this process often requires heavy machinery that operates at high temperatures and subsequently emit large quantities of CO_2.
Transportation	Material transportation from source to construction sites can often involve long distances, which is often through carbon intensive transport methods.
Construction and assembly	The majority of these emissions arise from on-site energy use from machinery to assemble the building. Site lighting and site office heating can also contribute a significant amount.
Maintenance and operation	In-use maintenance of structures and systems, involving consumption for heating, lighting and cooling.
Demolition and disposal	Embodied carbon emissions are heightened throughout this process if building materials are simply demolished, incinerated, or placed in landfill to decompose. Reuse of materials should be prioritised.

7.9

When considering the replacement of materials with high embodied carbon, the Materials Pyramid (Figure 5) is a useful high-level tool to identify what alternative sustainable materials are suitable for the development to reduce embodied carbon, and how much improvement these deliver against the more conventional materials.

7.10

To increase understanding of the impacts of typically used materials, the **LETI Embodied Carbon Primer** Appendix 8 provides in depth analyses of primary construction materials, such as timber, aluminium, glass, steel and bricks. Applicants are encouraged to review this guidance to determine appropriate material selection for their development, or at the minimum consider low embodied carbon materials as per Materials Pyramid.

Figure 5:

Construction materials pyramid. Materials on the top of the pyramid have the highest embodied carbon, therefore should be used most sparingly and where possible substituted with materials further towards the bottom of the pyramid. Interactive version available: www.materialepyramiden.dk

7.11

For major development, which is not required to complete a whole-life embodied carbon assessment, the Council requires that applicants demonstrate consideration to the actions noted below to illustrate how embodied carbon has been reduced where possible.

- Using reused materials
- Using cement replacement, cement products with clinker replacement, or using less cement
- Using recycled aggregate
- Using renewable materials e.g. certified sustainably sourced timber or other plant-based materials
- Using steel sourced from producers that use electric arc furnaces rather than coal-fired furnaces
- Replacing high-carbon materials with lower-carbon materials as per the Materials Pyramid
- Using products with EPD specification or from the BRE Green Guide to Specification.

7.12

To provide evidence of the consideration and reduction of embodied carbon, major development may submit 'life cycle assessment' calculations or other evidence that may have been produced within the following common industry certifications/ approaches:

BREEAM:

- Output from BREEAM LCA tool. These will have been produced where the scheme is targeting credits under BREEAM topic 'Mat 01' ('Environmental impacts from construction products - Building life cycle assessment'). This is not a minimum credit required for any BREEAM rating, but will help a development to achieve the minimum total percentage score for the BREEAM rating that it is targeting.
- Evidence produced in support of BREEAM credit Mat 02 ('Environmental impacts from construction products – Environmental Product Declaration'). Again, this credit is optional within BREEAM but would contribute towards the overarching BREEAM score.

Home Quality Mark (HQM):

- Evidence produced in support of HQM topic '6.2 Environmental Impact of Materials'. These may include the LCA output and/ or evidence of specification of products with environmental product declarations (EPDs). As with BREEAM Mat 01/02 (above), this topic within HQM is optional but will earn points towards an overarching HQM score.

BRE Green Guide

- Evidence that the proposed scheme has prioritised materials according to the BRE Green Guide to Specification.

Whole Life Embodied Carbon Assessment methodologies

7.13

The industry standard method to account for a building's embodied carbon is the RICS Whole Life Carbon Assessment for the Built Environment. This is based on the relevant British and European Standards. The RICS method defines the various parts of the building that should be assessed, and divides the stages of a building's life into several stages or 'modules' as follows:

- **A1–A5:** All stages up to completion of the building. This is also known as 'upfront embodied carbon'.
- **B1–B5:** The building's in-use lifespan. Includes use, maintenance, repairs, replacements, refurbishments.
  - (Sometimes also includes B6 and B7, which relate to operational energy use and operational water use respectively).
- **C1–C4**: End of life of the building and disposal of its waste materials.

7.14

A 'Whole life embodied carbon' assessment therefore refers to the sum of all carbon in stages A1-A5, B1-B5 and C1-C4.

7.15

The largest contributor to embodied carbon is through stages A1-A5. Carbon emitted through these stages occurs 'today' and can therefore have a greater contribution to reducing carbon emissions to meet local, national and international carbon targets.

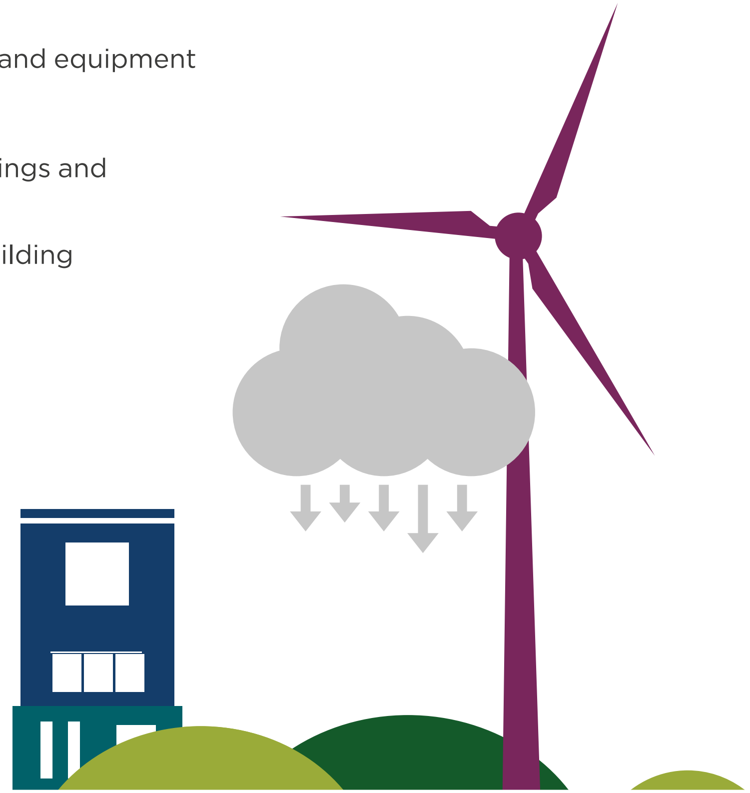
7.16

For super-major developments, applicants are required to complete a whole-life embodied carbon assessment, the following construction elements should be examined, as set out under NRM 2 (RICS) and following the RICS Whole Life Carbon Assessment method:

- Substructure
- Superstructure
- Finishes
- Fittings, furnishing and equipment
- MEP services
- Prefabricated buildings and building units
- Work to existing building
- External works

7.17

The RICS methodology is the only extant such methodology that the Council is aware of; however, should applicants propose an alternative methodology in future this must also conform with BS15978 Sustainability of construction works or relevant successor standard of the same or improved quality.



Estimating the embodied carbon of materials and products

7.18

The following sources of data are preferable for reliable embodied carbon estimations:

- **Environmental Product Declarations** for specific products you propose to use – these are certificates disclosing the embodied carbon (and other environmental impact factors) that are based on the specific conditions in which an individual product is produced. Not all products on the market have EPDs, but many products claiming 'green' credentials do have these to evidence their claims. You can use embodied carbon data from EPDs in combination with generic embodied carbon data for other products or materials from the databases noted below. EPDs should conform with relevant standards including ISO 14025: 2010 (Environmental labels and declarations. Type III environmental declarations. Principles and procedures).
- **The University of Bath ICE database** – free-to-use; registration required.
- **Built Environment Carbon Database** – currently in development (as of the time of writing this SPD) led by RICS along with several other industry bodies.

7.19

Where specific carbon factors are not available, carbon factors can be manually generated using the RICS Methodology to Calculate Embodied Carbon of Materials. Associated assumptions and principles should also be addressed, which are set out in the Institution of Structural Engineers' How to Calculate Embodied Carbon for Construction Materials guidance.

7.20

LETI guidance also lists out the actions for embodied carbon at each stage of the project, listing actions for the designer and for the life cycle assessment specialist at each RIBA Stage (see Appendix 0.2 of the LETI Climate Emergency Design Guide).

Industry benchmarks for embodied carbon

7.21

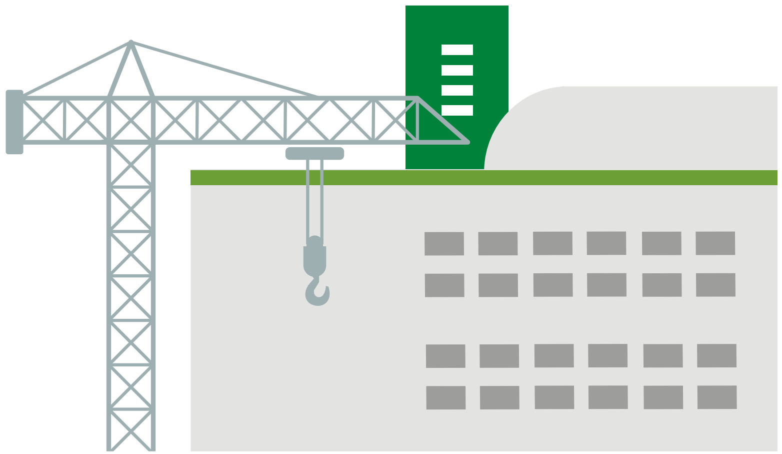
Developed by building environment professionals and experts, the RIBA 2030 Climate Challenge sets voluntary targets for embodied carbon, operational energy and water consumption. Version 2 of their targets has been updated so that embodied carbon targets align with LETI, GLA and UKGBC guidance. RIBA states that the Climate Challenge *“presents ambitious but achievable forward-facing performance outcomes that are in line with the Future Homes Standard and future regulation, set against business-as-usual compliance approaches”*. In their guidance, buildings should adopt the 2025 guidance as a minimum where buildings are being designed today, since the targets are based upon operational performance (as it is likely that buildings designed today will be completed closer to 2025).

7.22

Although applications subject to NZC3 are not required to meet specific embodied carbon emissions targets, it is highly important to understand best practice benchmarks when considering embodied carbon in new developments. Super-major applications in particular, which are required to complete a whole-life embodied carbon assessment, should aim to achieve the 2025 targets set out below in Table 21.

Table 21: RIBA Climate Challenge suggested targets for whole life embodied carbon, differentiated by use.

Use type	Embodied carbon target	Business as usual (kgCO_2e/m^2)	2025 target (kgCO_2e/m^2)	2030 target (kgCO_2e/m^2)
Residential	Life cycle stages A1-A5, B1-B5, C1-C4, AND sequestration	1200	<800	<625
Commercial office	Life cycle stages A1-A5, B1-B5, C1-C4, AND sequestration	1400	<970	<750
School	Life cycle stages A1-A5, B1-B5, C1-C4, AND sequestration)	1000	<675	<540



8.

Policy NZC4 – Existing Buildings

Policy NZC4: Existing Buildings

All developments should demonstrate a consideration to sustainable construction and design in accordance with Local Plan Policy CC1 'Planning for Climate Change Adaptation'.

In addition, all development should consider alternatives to conventional fossil fuel boilers. This should be explored through a Low/Zero Carbon assessment of low carbon energy supply options within the submitted application documents.

Development proposals which would result in considerable improvements to the energy efficiency, carbon emissions and/or general suitability, condition and longevity of existing buildings will be supported, with significant weight attributed to those benefits.

The sensitive retrofitting of energy efficiency measures and the appropriate use of micro-renewables in historic buildings, including listed buildings, locally listed buildings and buildings within conservation areas will be encouraged, providing the special characteristics of the heritage assets are conserved in a manner appropriate for their significance.

8.1

Policy NZC4 requires that for developments relating to existing buildings (including extensions and conversions) applicants should demonstrate that sustainable construction and design has been considered in line with Local Plan Policy CC1. Policy NZC4 requires that applicants consider the alternatives to fossil fuel boilers and submit an assessment of low carbon energy supply options with their application.

8.2

Applicants are also encouraged to demonstrate how sustainable design, material choices and construction methods will also reduce carbon emissions through construction and operation. The Council recognises the significant opportunity to reduce the District's carbon burden by retrofitting existing building stock, and will apply significant weight to proposals that deliver energy and carbon savings in existing buildings. The guidance in this section aims to outline a range of potential carbon-saving interventions in existing buildings according to the energy hierarchy.

8.3

Policy NZC4 recognises the value of embodied carbon in existing buildings and encourages an approach to existing buildings that pursues energy efficiency measures, low carbon energy supply, and renewable energy generation, relevant to the scope and scale of the proposed development/redevelopment to ensure that buildings contribute to lowering carbon emissions over the course of their lifespan.

8.4

Retrofit strategies can be identified by the level of intervention, including:

- very low cost or free quick wins;
- low cost and technically easy measures;
- high cost and technically difficult measures and deep retrofit requiring technical expertise.

Fabric First Approach

8.5

These measures are often at a lower cost and quick to implement, but form an important part to lowering carbon emissions from existing buildings. Measures can often be made in operation or continued use of the building and can include:

- **Energy saving measures:** fixing draughts or areas of damp, installing low energy lighting or appliances, and reducing wasted energy through behavioural change.
- **Water saving measures:** fixing leaks and reducing total demand for water through fittings and or behaviour change.

8.6

Building fabric interventions; upgrading windows and doors, installation of secondary glazing, improved levels of insulation (cavity wall/ceiling insulation/raft roof/loft/ floor), and chimney improvements.

8.7

Building fabric upgrades and improved energy efficiency should always be addressed prior to low carbon energy sources or renewable energy.

Employing low or zero carbon technologies

8.8

NZC4 requires all developments to consider alternatives to fossil fuel boilers through the submission of a planning application. NZC4 requires that applicants assess, and implement where feasible, low or zero carbon technologies as an alternative to new fossil fuel boilers. This assessment should be presented in a Design Statement proportionate to the type of application e.g. where a small extension is proposed it may not be feasible to replace a fossil fuel boiler but fabric first measures should still be considered.

8.9

Applicants should consider the use of the following for retrofitting into existing buildings and should refer to the guidance provided on the technologies in Section 5 above:

- Air source heat pumps
- Ground or water source heat pumps
- Domestic hot water storage
- Heat recovery systems
- Direct electric heating
- Energy storage
- Biomass heating
- Combined heat and power
- Solar photovoltaic panels
- Solar thermal
- Wind generation
- Hydro

8.10

The **UK Government's Heat and Buildings Strategy (2021)** set out to define the transition to low carbon buildings, including halting any new gas connections to homes from 2025 (and replacement gas boilers from 2035), in favour of low carbon heat strategies. Alternatives to gas boilers are explored in Section 5, in this SPD. The Council will expect applicants to outline what alternative measures are feasible to be included within the development with reference to the site's context and any constraints.

8.11

Installation of heat pumps can provide economic benefits and will provide significant carbon emission benefits to homeowners. Installation of a heat pump could reduce a home's heating carbon emissions by at least 60% today (compared to a gas boiler system), and the home will decarbonise further over time as the electricity grid decarbonises. However, consideration should be given to any accompanying measures needed to make the existing building suitable for these. For example:

- Heat pumps can run more efficiently in well insulated buildings that are able to retain their heat for longer. Some existing buildings will need improvement of airtightness and/or insulation in order for the heat pump to provide good value for the occupant. Without this, running costs may become excessive due to the price of electricity.
- Because heat pumps typically deliver heat at a lower temperature, the building may need larger heat emitters (larger pipework and radiators or underfloor heating); the conventionally sized existing radiators used with an existing gas boiler are likely to no longer be suitable. Without the larger heat emitters, the system may not heat the building effectively to a comfortable temperature.

8.12

Mechanical ventilation with heat recovery is similarly most effective in buildings that have good insulation and airtightness.

8.13

Each building and low carbon heat and energy options should be appraised on a case-by-case basis. Homeowners should consult with a PAS 2035 accredited retrofit coordinator if possible, to develop a bespoke retrofit plan. Installation of a heat pump is a skilled activity; building owners should consult with a qualified and experienced MCS certified installer for a quote based on an in-person inspection of the building.

8.14

Energy efficiency approaches can also include improved air tightness, insulation, glazing, and ventilation strategy improvements in addition to consideration of overheating mitigation measures.

Recommended retrofit targets and quality assurance standards

8.15

Recommended targets that applicants could pursue in order to demonstrate that their proposal delivers significant benefits include:

- **40kWh/m²/year space heating energy demand:** A target taken from the LETI Climate Emergency Retrofit Guide. Policy NZC4 expects this target to be considered and recommends that it is applied for proposals including alterations, extensions, and changes of use.
- **LETI Climate Emergency Retrofit best practice guidance** recommends: a space heat demand limit of <50 kWh/m2 / year; a hot water demand limit of 20 kWh/m2 /year; an energy use intensity (EUI) limit of 50 kWh/m2 /year; and for 40% of the roof area to be covered in PV panels.
- **The Passivhaus Trust retrofit EnerPHit methodology** sets a **space heat demand limit of <25kWh/m²/year**, in addition to primary energy/primary energy renewable limit of <65.5kWh/m²/ year, surface temperature limit of >17 degrees Celsius, summer overheating limit of 10% at >25 degrees Celsius, ventilation rate minimum of 30 m3/hour/person and airtightness limit of <1 air change per hour @ 50 Pascals. The Council considers that this would represent exemplary performance in an energy retrofit.

8.16

Significant weight will be attributed to applications that demonstrate considerable improvements to energy efficiency, carbon emissions, condition, and longevity of existing buildings – such as those which achieve the recommended targets above. A building that is low-carbon and affordable to run is more likely to remain in use in the long term.

8.17

The above targets from LETI and EnerPhit frameworks, where pursued, would need to be calculated using energy modelling methods proven to be accurate in their ability to predict buildings' energy demands. Building Regulations National Calculation Methods SAP and SBEM are not well suited to this as they are not typically accurate in reflecting actual performance. Instead, the applicant is likely to find the most utility in alternative accurate energy modelling methods such as PHPP or CIBSE TM54. These can be used to plan and evaluate the performance of the retrofit, and to demonstrate the proposals' benefits within the planning application.

8.18

Many of these targets may also be verified through actual in-use energy monitoring. Performance in line with the EnerPhit approach can be demonstrated via EnerPhit certification.

8.19

Finally, retrofit interventions have the opportunity to not only improve energy efficiency, potentially lower the cost of energy bills, but also to improve the thermal comfort of occupants and thus support the health and wellbeing of building users.

8.20

Certain standards are available to assure the quality of energy retrofitting, two of which are noted as follows. Application evidence of the implementation of these will be looked upon as a measure that is likely to improve the credibility and quality of proposals relating to existing buildings:

8.21

PAS 2035 is a best practice standardised process for retrofitting dwellings for energy efficiency in the UK. PAS 2038 is the equivalent process for non-domestic buildings. They allow retrofits to be Trustmark certified, providing security and reducing risks for building owners. Using PAS 2035, a risk appraisal can be carried out to demonstrate how retrofit measures have been carefully designed to minimise overheating risk (from increased airtightness) and minimise health risks to occupants (including condensation, mould and improper ventilation).

8.22

BS 40101 is the standard for building performance evaluation of occupied and operational buildings (using data gathered from tests, measurements, observation and user experience). This provides designers and procurers of buildings with insights into the performance of the building for the purpose of planning and implementing retrofit, modification and improved management of existing buildings.

8.23

Please also refer to the following external guidance:

- LETI Climate Emergency Retrofit Guide (LETI, 2021)
- Net Zero Carbon Toolkit (Etude, Elementa, Passivhaus, Levitt Bernstein, 2021); or
- Passivhaus Trust's Retrofit Primer (version 2, 2022)

8.24

In an average home, fabric improvements or the installation of low or zero carbon technology are unlikely to require planning permission. However, planning permission may be required where the proposed measures affect the external appearance of a building. Applicants are urged to check what permitted development rights are available to them, and if unsure contact the Council before implementing these measures, or applying for planning permission.

8.25

Internal or external alterations to listed buildings will require listed building consent – please see the following section below.

Historic Buildings and Contexts

8.26

Some measures noted in the above two sections require further consideration when dealing with historic buildings (designated and non-designated heritage assets, including locally listed buildings) and buildings in a Conservation Area. However, the sensitive retrofitting of energy efficiency measures and the appropriate use of micro-renewables will be encouraged, providing the special characteristics of the heritage assets are conserved in a manner appropriate for their significance. Applicants may find it useful to refer to guidance from Historic England[27] on Retrofit and Energy Efficiency in Historic Buildings (Historic England, 2020).

8.27

In line with new buildings, building fabric upgrades and improved energy efficiency should be addressed prior to low carbon energy sources or renewable energy.

For further guidance please refer to the Council's Energy Efficiency for Historic Buildings Guidance. This provides further details on the general principles and retrofit solutions for historic buildings.

27 Historic England (2023), *Retrofit and Energy Efficiency in Historic Buildings.*

Glossary

Term	Term Acronym Used	Definition
Air Permeability or Airtightness	-	A measure of how much (or how little) air leakage a building experiences, due to its fabric. Measured in air changes per hour at a pressure of 50 pascals, sometimes abbreviated to 'ACH@50PA'. Air permeability is one of notional building specification elements defined by Building Regulations Part L.
Air Source Heat Pump	ASHP	A form of low-carbon heat delivery in which an electrical pump utilises a reverse-refrigeration cycle to absorb free energy from outdoor air and emit it at a higher temperature indoors. Considered partially or fully renewable as the ASHP uses electricity to run, but delivers more heat energy than it consumes in electrical energy. Can be fully renewable and zero carbon if run entirely on renewable electricity.
British Standard 40101	BS 40101	An independent and non-statutory building performance evaluation standard for occupied and operational buildings.
Building Emissions Rate	BER	A metric used in Building Regulations Part L to express the predicted carbon emissions rate of a non-residential building associated with its regulated energy uses. See also TER.
Building Regulations	-	National legal requirements for minimum quality standards in buildings. Different 'parts' of Building Regulations cover various topics including energy conservation, and access and use of buildings by people, including disabled people. The section relating to energy and carbon is 'Part L'.
Building Regulations Approved Document Part L	-	Conservation of fuel and power; this the part of Building Regulations that sets minimum standards for energy-related carbon emissions and efficiency of buildings.
Building Research Establishment (Group)	BRE	A building science research entity which, among many other roles, hosts and updates the calculation methods 'SAP' and 'SBEM' that are used to measure compliance with Building Regulations Part L. Formerly a civil service body; now owned by a charitable trust.
Building Research Establishment Environmental Assessment Methodology	BREEAM	A voluntary sustainability certification for buildings, covering topics including energy, materials, waste, water, health, ecology, pollution, transport, and management. Offers several levels of achievement from 'pass' to 'outstanding'. Mainly used in non-residential but is also available for multi-residential.
Carbon Offsetting	-	Payments made, or actions taken, to remove or reduce a certain amount of carbon to match a certain amount of emissions. Where a development must offset any residual carbon emissions, either through contribution to the District Council's fund, or to a verified local off-site offsetting scheme.
Chartered Institute of Building Services Engineers	CIBSE	Professional association body for Building Services Engineers
Coefficient of Performance	COP	A ratio used to indicate the performance a heating, ventilation or air conditioning system offers.

Term	Term Acronym Used	Definition
Combined Heat and Power	CHP	A highly efficient process that captures and utilises the heat that is a by-product of the electricity generation process.
Direct Electric Heating	-	Systems in which heat is generated directly within a material by passing an electric current through; e.g. convector heaters or electrical underfloor heating. The source of electric can be renewable or non-renewable.
Dwelling Emissions Rate	DER	A metric used in Building Regulations Part L to express the predicted carbon emissions rate of a dwelling, associated with its regulated energy uses. See also TER.
Embodied Carbon	-	Carbon that was emitted in the production, transport and assembly of materials that make up a building or product.
Environmental product Declarations	EPD's	A declaration attached to a product expressing the calculated environmental impacts associated with its production (and sometimes also its use and end of life) using life-cycle analysis. Usually includes embodied carbon and may include other information such as impact on ozone or ocean acidification.
Form Factor	-	The ratio of a building's total thermal envelope surface area (the walls, roof and ground floor) to its treated (heated) floor area. The smaller the form factor, the more efficient the shape of the building and the less surface area from which heat can escape.
Fossil Fuels	-	Non-renewable, carbon-based, carbon-emitting fuel sources.
Fuel Poverty	-	Households that cannot meet their energy needs at a reasonable cost.
Future Homes Standard	FHS	Central government proposed changes to Parts L and F of the national Building Regulations, anticipated to come into force in 2025.
Glazing Ratio	-	The proportional relationship between a building's opaque and glazed surfaces; i.e. a wall-to-window or roof-to-window comparison. Sometimes expressed as a ratio of glazed area to total *floor* area (for example in SAP, the notional dwelling has a *maximum* limit to the 'opening area' as a percentage of 'total floor area', while in SBEM the reference building has a *minimum* 'opening area' as a percentage of 'exposed wall area' and 'exposed roof area' which varies by building usage).
Gross Internal Area	GIA	Gross Internal Area. A measure of total floor space in a building.

Term	Term Acronym Used	Definition
Ground Source Heat Pump	GSHP	A form of low-carbon heat delivery in which in which a pump captures the latent heat from the ground and uses it to heat a building or the hot water used in that building. Considered partially renewable as the heat captured is 'ambient' environmental heat from the ground, and the heat pump delivers more heat energy than it uses in electrical energy. Can be fully renewable and zero carbon if run entirely on renewably generated electricity.
G-value	-	Amount of sunlight energy transmitted through (a window's or door's) glass.
Home Quality Mark	HQM	A voluntary quality certification system for dwellings, which includes some environmental criteria as well as criteria relating to the resident's experience of using the home. This system is devised and run by the BRE (see BRE in this glossary).
Infrared Thermographic Survey	-	A building heat study undertaken using thermal imaging cameras, which detect infrared light that is not visible to the human eye. Everything that has a temperature above absolute zero emits infrared light, and as a result it is possible to detect variations in the temperatures of different surfaces.
Low Energy Transformation Initiative	LETI	A voluntary network of over 1,000 energy-related built environment professionals working to improve practices in relation to design for energy efficiency and carbon reduction to make the built environment compatible with the UK's net zero carbon future. It has devised and released publications relating to net zero carbon buildings including definitions, targets and design guidance including for new and existing buildings, operational and embodied carbon.
Mechanical Ventilation and Heat Recovery	MVHR	A ventilation system which recovers heat from outgoing air, to warm up the fresh incoming air.
National Calculation Methodology	NCM	The methodology approved by the Secretary of State for calculating the energy performance of buildings.
Net zero carbon	NZC	Net zero refers to achieving a balance between the amount of greenhouse gas emissions produced and the amount removed from the atmosphere. For the purpose of the Warwick DPD and SPD, 'net zero carbon' refers to operational, regulated carbon.
Natural Environment Investment Readiness Fund	NEIRF	Supports the government's goals in the 25 year environment plan, green finance strategy and 10 point plan for a green industrial revolution. It aims to stimulate private investment and market-based mechanisms that improve and safeguard the domestic natural environment by helping projects get ready for investment.
Operational Carbon	-	Energy use and carbon emissions caused by the operation of a building. Operational carbon is almost entirely due to energy use, but can have other smaller causes, such as leaked refrigerant gases from air conditioning.

Term	Term Acronym Used	Definition
Part L	-	See 'Building Regulations Approved Document Part L'.
Passivhaus	-	A standard and certification for buildings that achieve an exemplary level of energy efficiency. Certified by the Passivhaus Trust. Several levels of certifications are available; the lowest level relates to only energy efficiency, while the higher levels also require renewable energy generation.
Passive House Planning Package	PHPP	A modelling methodology used to very accurately calculate/predict the total energy use of a building. This method is used as part of the process for undergoing Passivhaus certification (see above), but can also be used as a design tool in its own right without any involvement in the certification scheme.
Performance gap	-	There is significant evidence that suggests that buildings do not perform as well when they are completed as when was anticipated when they were being designed. The difference between anticipated and actual energy performance is known as the performance gap.
Photovoltaics	PV	A form of renewable, non-carbon-based electricity production which utilises sunlight as an energy source.
Publicly Available Specification 2035 & 2038	PAS 2035 / PAS 2038	A best practice standardised process for retrofitting dwellings for energy efficiency in the UK. It allows retrofits to be Trustmark certified, providing security and reducing risks for building owners.
Regulated Carbon	-	The share of those operational carbon emissions that are from an energy use that is regulated by Building Regulations, for example heating and hot systems, or fixed lighting circuits
Renewables	-	Renewable resources; usually energy.
Royal Institute of British Architects	RIBA	Professional association body for the architectural profession. Among its many and wide-ranging activities it has published a set of aspirational targets for buildings to aim for in energy efficiency, embodied carbon and water efficiency to ensure they are fit for the UK's net zero carbon future and also reduce the demands they place on the UK's water resources.
Royal Institute of Chartered Surveyors	RICS	Professional association body for the chartered surveyor profession. Among its many and wide-ranging activities it has published a methodology to account for the embodied carbon of buildings across their lifespan (the Whole Life Carbon Assessment) in a way that complies with the relevant British Standard, BS15978.
Simplified Building Energy Model	SBEM	The calculation method used to set and comply with energy- and carbon-related targets within Building Regulations Part L for non-domestic buildings.
Standard Assessment Procedure	SAP	The calculation method used to set and comply with energy- and carbon-related targets within Building Regulations Part L for domestic buildings.

Term	Term Acronym Used	Definition
Super Major Development	-	Proposals for development of ≥50 new dwellings and/or ≥5,000sqm non-domestic floor space
Supplementary Planning Document	SPD	A document (like this one) that provides additional guidance on how to comply with policies set by a DPD or other part of the local plan.
Target Emissions Rate	TER	A metric used in Building Regulations Part L (for both dwellings and non-domestic buildings) to express a limit which must not be exceeded by the predicted carbon emissions associated with the building's regulated energy uses. The TER is set by applying a certain minimum standard of fabric and services to an imaginary building of the same size, shape and use as the proposed building. This minimum standard of fabric and services is laid out in Approved Document Part L, and is updated every few years. Expressed in kg of carbon dioxide per square metre of floor space ($kgCO_2/m^2$).
Target Fabric Energy Efficiency	TFEE	A metric used in Building Regulations Part L to express a limit on a dwelling's demand for heating and cooling, determined only by the fabric of the dwelling, irrespective of the type or efficiency of the various building services such as heating system. Expressed in kWh/m^2 floor space / year.
Technical Memorandum 23	TM23	Best practice published by the Chartered Building Services Engineers in testing buildings for air leakage.
Unregulated carbon		The share of those operational carbon emissions that are from an energy use that is not regulated by Building Regulations, for example plug-in electrical appliances.
Woodland Carbon Code	WCC	The UK's voluntary carbon standard for woodland creation projects, which provides reassurance about the carbon savings that woodland projects may realistically achieve. This entails a high quality, robust voluntary carbon standard, a transparent UK Woodland Carbon Registry, a robust science to predict and monitor carbon sequestration, and an independent validation and verification of projects.
Warwick District Council	WDC	
Water Source Heat Pump	WSHP	A form of low-carbon- heat delivery system in which in which a pump captures the thermal energy from a water source and uses it to heat a building or for hot water use within the building. Considered partially renewable as the heat captured is 'ambient' environmental heat, and the heat pump uses less electrical energy than it delivers in heat energy. Can be fully renewable and zero carbon if the heat pump is run on entirely renewably generated electricity.
Waste Water Heat Recovery	WWHR	A form of secondary heat delivery in which heat from wastewater (e.g. used shower or bath water) is captured for reuse in the building, for example to pre-heat water entering a boiler/water tank in order to reduce demand on primary methods of heating water to a set temperature.
Warwickshire Environmental Services Trading Protocol	WESTP	A Warwickshire County Council protocol which details what nature-based solutions are available to compensate for development, and outlines the principles and rules for the creation, enhancement and maintenance of habitats by landowners in order to be traded as compensation units in carbon offsetting.
U-values		The rate of thermal transmittance measured in Building Regulations.

Annex

Annex: Energy Pro-Forma

Policy NZC1 states that:

New developments of one or more dwellings (C3 or C4 use class) and/or 1,000sqm or more of new non-residential floorspace, hotels (C1) or residential institutions (C2 use class) should achieve net zero operational regulated carbon emissions by implementing the energy hierarchy.

Part 1 of this Energy Pro-Forma must be completed for all applications as set out above to demonstrate compliance with policy requirements of NZC1, NZC2A-C and NZC3. Alternatively, if Passivhaus accreditation is being sought applicants will need to submit PHPP calculations to demonstrate compliance with NZC1.

For residential development please complete 1A, for non-domestic development please complete 1B.

For developments where repeated house typologies are being used, or where multiple non-domestic buildings are being proposed, the applicant can apply an aggregated average of carbon emissions across these typologies or building types. The tables below indicate where aggregated data should be input if being used, otherwise please complete each table according to the proposed dwelling(s) or building(s) being proposed.

A separate Energy Pro-Forma has been prepared for Existing Buildings (householder, extensions and conversions) to demonstrate compliance with NZC4. This is set out in Part 2.

Annex Part 1: New Build Development

Site Address			
Description of Development			
Type of application	Full	☐	
	Outline	☐	
	Reserved Matters	☐	
	Section 73	☐	
Dwellings	**Number of dwellings**	**Use Class**	**Total gross internal floor area (sqm)**
		☐ C3	
		☐ C4	
Aggregated developments (for schemes of 10+ dwellings where repeated house types are used)	**House Typology**	**Number of dwellings per house type**	**Total gross internal floor area per house type (sqm)**
	1:		
	2:		
	3:		
	4:		
	5:		
	6:		
	7:		
	Please add lines above if required		
For residential dwellings please complete > Part 1A			

Annex Part 1: New Build Development

Number of non-domestic buildings including hotels and residential institution buildings	Number of buildings	Use Class		Gross internal floor area for development (sqm)
		☐	C1	
		☐	C2 or C2a	
		☐	B2	
		☐	B8	
		☐	E	
		☐	F1	
		☐	F2	
		Sui Generis (please specify):		
For non-domestic development please complete > Part 1B				

To be completed for residential and non-residential developments:		
Primary heating source	Electrical systems (including air source heating, ground source heating, thermal storage, heat recovery, direct electric heating)	☐
	Biomass systems	☐
	Fossil fuel systems (including gas and oil boilers)	☐
Secondary heating source (if required)	Electrical systems (including air source heating, ground source heating, thermal storage, heat recovery, direct electric heating)	☐
	Biomass systems	☐
	Fossil fuel systems (including gas and oil boilers)	☐
Heating split between primary and secondary heating source	Primary:	Secondary:
Will the development have a mains gas connection (existing or proposed)	Yes (existing)	☐
	Yes (proposed)	☐
	No	☐

Part 1A – Residential Dwellings

NZC1: The overall % carbon emissions reduction against Building Regulations

Target Emission Rate*(TER) in $kgCO_2/m^2/yr$.	
Dwelling Emission Rate (DER) in $kgCO_2/m^2/yr$.	
Overall % Reduction in CO_2 emissions	
	Version of SAP carbon factors used – confirming that the same carbon factors were used for the TER and DER given above:
Informative:	***Based on the relevant version of Building Regulations Part L as outlined in policy NZC1.** **These figures should be obtained from calculations using SAP (the Standard Assessment Procedure for domestic buildings).** **Where multiple house types are proposed information should be presented for each house type – see section 3.23 to 3.29.**

Energy Hierarchy Stage 1

NZC2(A): % improvement of energy efficiency against Building Regulations

Target Fabric Energy Efficiency (TFEE) of notional building of Building Regulations Part L 2021.		
Dwelling Fabric Energy Efficiency (DFEE) after the proposed improvements have been applied.		
DFEE as a % improvement on TFEE (Target Fabric Energy Efficiency)		
Building fabric element:	**Part L 2021 notional dwelling[28] (provided as baseline)**	**Proposed Specification**
External walls (including semi-exposed walls)	**U value 0.18 W/(m².K)**	
Floors	**U value 0.13 W/(m².K)**	
Roofs	**U value 0.11 W/(m².K)**	
Doors* (*whether opaque or up to 60% glazed)	**U value 1.0 W/(m².K)**	

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28 HM Government Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2023) Building Regulations Part L ("Conservation of Fuel and Power Approved Document L) 2021 edition incorporating 2023 amendments. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1133079/Approved_Document_L__Conservation_of_fuel_and_power__Volume_1_Dwellings__2021_edition_incorporating_2023_amendments.pdf

Part 1A – Residential Dwellings

Building fabric element:	Part L 2021 notional dwelling[28] (provided as baseline)	Proposed Specification
Windows and glazed doors (>60% glazed)	U value 1.2 W/(m^2.K)	
Roof windows** (**If vertical. If not vertical, see conversions in SAP Appendix R)	U value 1.2 W/(m^2.K)	
Rooflights** (**If horizontal. If not horizontal, see conversions in SAP Appendix R)	U value 1.7 W/(m^2.K)	
Air permeability (air tightness)	5 m^3/(h·m^2) at 50	
Glazing ratio (% of total floor area, and area broken down by each façade direction)	North	
	East	
	South	
	West	
Informative:	These calculations are to demonstrate how energy improvements have been applied in pursuit of NZC2(A). For residential dwellings a 10% improvement on the Part L 2021 Target for Fabric Energy Efficiency is sought. The accompanying Energy Statement should outline in detail the energy efficiency measures employed in the development. Where full compliance is demonstrated the Energy Statement should justify how energy efficiency measures have been incorporated to the greatest extent feasible and viable. See SPD Section 4 for further information.	

Energy Hierarchy Stage 2

NZC2(B): kWh of energy generated onsite through zero or low carbon energy sources, and regulated carbon emissions reduction as a result of this.

Residential Target Emission Rate (TER) of the notional dwelling of Part L 2021	
	Version of SAP version carbon factors used:
Dwelling Emission Rate (DER) after NZC2(A) energy efficiency measures have been applied.	
DER after renewable and low carbon energy measures towards NZC2(B) have been applied, *subsequent to the improvement made by measures under NZC2(A).*	
	Version of SAP version carbon factors used:
Actual % improvement on TER as a result of renewable and low carbon energy measures	
Informative:	These calculations are to demonstrate how zero or low carbon energy generation technologies have been applied in pursuit of achieving on-site net zero operational carbon (regulated energy). The accompanying Energy Statement should include an assessment of renewable and low carbon technologies and the specification of the technologies employed. Where on-site net zero regulated carbon is not demonstrated the Energy Statement should demonstrate and justify that zero or low carbon technologies have been provided to the greatest extent feasible and viable. See SPD Section 5 for further information.

Part 1A – Residential Dwellings

Energy Hierarchy Stage 3

NZC2(C): residual carbon emissions are offset

DER after all on site measures (NZC2A+B) have been applied in $kgCO_2/m^2/yr$.	
	For aggregated developments using repeated house types, the average across all residential development, weighted by amount of GIA created by different residential typologies and orientations:
Residual regulated carbon emissions per dwelling $kgCO_2/yr$	
	For aggregated developments using repeated house types, the total across all residential development: average DER x residential total GIA:
Converted to **tonnes**CO_2/yr.	
Total residual carbon emissions across 30 years tonnes CO_2/year X 30 years (Static offset)	
BEIS Carbon Value £ **tonne** CO_2	
Total carbon emissions x BEIS carbon value	
Total Offset Figure for residential dwellings (Static offset)	£
Dynamic Offset Option for total regulated carbon emissions over 30 years in **tonnes** CO_2 To be used in all-electric proposal only. Applying BEIS projected grid carbon reductions. See SPD Section 6.	
Informative:	This calculates the total carbon offset amount by taking the residual amount of carbon emissions from the building over a 30 year period. Applicants can apply BEIS projected grid carbon reductions should they wish providing they indicate the source of these projections, and providing that this future grid carbon reduction is not applied to types of energy use to which the projections do not apply, e.g., fossil fuels. See SPD Section 6 for further information. If it is not considered viable to make the offsetting contribution in full or part please see Net Zero Carbon DPD Section 11 for Viability guidance.

Part 1B – Non-domestic Buildings

NZC1: The overall % carbon emissions reduction against Building Regulations

Target Emission Rate*(TER) in $kgCO_2/m^2/yr$.	
Dwelling Emission Rate (DER) in $kgCO_2/m^2/yr$.	
Overall % Reduction in CO_2 emissions	
	Version of SBEM carbon factors used – confirming that the same carbon factors were used for the TER and BER given above:
Informative:	*Based on the relevant version of Building Regulations Part L as outlined in policy NZC1. These figures should be obtained from calculations using SBEM (the Simplified Building Energy Model for non-domestic buildings)

Energy Hierarchy Stage 1

NZC2(A): % improvement of energy efficiency against Building Regulations

TER of notional building using Part L 2013 specification	
	Version of SBEM carbon factors used:
Optional: *TER of notional building using Part L 2021 specification, and version of SBEM carbon factors used*	
	Version of SBEM carbon factors used:
BER after all energy efficiency improvements (including fabric) have been applied. *Excluding any renewable/low carbon energy measures*	
	Version of SBEM carbon factors used:
BER after all energy efficiency improvements (including fabric) have been applied. *Excluding any renewable/low carbon energy measures*	
	Version of SBEM carbon factors used:
BER % improvement on TER as a result of energy efficiency improvements Exclude any renewable energy measures.	

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Part 1B – Non-domestic Buildings

Building Specification	Notional Spec (baseline)	Proposed Specification
External walls (inc. semi exposed walls)		
Floors		
Roofs		
Doors (opaque or semi glazed)		
Windows and glazed doors		
Rood windows		
Rooflights		
Efficiencies of building services		
Air permeability (air tightness)		
Glazing ratio (% of total floor area, and area broken down by each façade direction)	North	
	East	
	South	
	West	
Optional: Building Primary Energy Rate as a % improvement on Part L Target Primary Energy Rate.		
Informative:	These calculations are to demonstrate how energy improvements have been applied in pursuit of NZC2(A). For non-residential buildings a 19% reduction in carbon emissions compared to Part L 2013 is sought through energy efficiency measures. The accompanying Energy Statement should outline in detail the energy efficiency measures employed in the development. Where full compliance is not demonstrated the Energy Statement should demonstrate how energy efficiency measures have been incorporated to the greatest extent feasible or viable. See SPD Section 4 for further information.	

Energy Hierarchy Stage 2

NZC2(B): kWh of energy generated onsite through zero or low carbon energy sources, and regulated carbon emissions reduction as a result of this

Building Emission Rate (BER) after NZC2(A) energy efficiency measures have been applied.	
	Version of SBEM carbon factors used:
Building Emission Rate (BER) after renewable and low carbon energy measures towards NZC2(B) have been applied, *subsequent to the improvement made by measures under NZC2(A).*	
Actual % improvement on non-residential TER as a result of renewable and low carbon energy measures	
Informative:	These calculations are to demonstrate how zero or low carbon energy generation technologies have been applied in pursuit of achieving on-site net zero operational carbon (regulated energy). The accompanying Energy Statement should include an assessment of renewable and low carbon technologies and the specification of the technologies employed. Where on-site net zero regulated carbon is not demonstrated the Energy Statement should demonstrate and justify that zero or low carbon technologies have been provided to the greatest extent feasible and viable. See SPD Section 5 for further information.

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Energy Hierarchy Stage 3

NZC2(C): residual carbon emissions are offset

BER after all on site measures (NZC2A+B) have been applied in $kgCO_2/m^2/yr$.	
	For aggregated development, the average amount of GIA proposed per non-residential building typology or use:
Residual regulated carbon emissions per building $kgCO_2/yr$	
	For aggregated development, the average BER x the total non-residential GIA:
Converted to **tonnes** CO_2/yr.	
Total residual carbon emissions across 30 years **tonnes** CO_2/year X 30 years (Static offset)	
BEIS Carbon Value £ **tonne** CO_2	
Total carbon emissions x BEIS carbon value	
Total Offset Figure (static offset)	£
Dynamic Offset Option for total regulated carbon emissions over 30 years in **tonnes** CO_2 To be used in all-electric proposal only. Applying BEIS projected grid carbon reductions. See SPD Section 6.	
Informative:	This calculates the total carbon offset amount by taking the residual amount of carbon emissions from the building over a 30 year period. Applicants can apply BEIS projected grid carbon reductions should they wish providing they indicate the source of these projections, and providing this future grid carbon reduction is not applied to types of energy use to which the projections do not apply e.g., fossil fuels. See SPD Section 6 for further information. If it is not considered viable to make the offsetting contribution in full or part please see Net Zero Carbon DPD Section 11 for Viability guidance.

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Annex Part 2: Existing Buildings

Site Address		
Description of Development		
Type of application	Full	☐
	Section 73	☐
	Householder	☐
	Listed Building Consent	☐
Existing primary heating source	**Electrical systems** ***(including air source heating, ground source heating, thermal storage, heat recovery, direct electric heating)***	☐
	Biomass systems	☐
	Fossil fuel systems ***(including gas and oil boilers)***	☐
Heating split between primary and secondary heating source	**Primary:**	**Secondary:**
Proposed primary heating source	**Electrical systems** ***(including air source heating, ground source heating, thermal storage, heat recovery, direct electric heating)***	☐
	Biomass systems	☐
	Fossil fuel systems (including gas and oil boilers)	☐

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Existing secondary heating source (if present)	**Electrical systems** *(including air source heating, ground source heating, thermal storage, heat recovery, direct electric heating)*	☐
	Biomass systems	☐
	Fossil fuel systems *(including gas and oil boilers)*	☐
Heating split between primary and secondary heating source	**Primary:**	**Secondary:**
Will the development have a mains gas connection (existing or proposed)	**Yes (existing)**	☐
	Yes (proposed)	☐
	No	☐
Does the development reach any targeted space heat demand as recommended under 16.28 of the SPD?	**Yes** **Please provide details:**	☐
	No	☐