APPENDIX 1

Planning for climate change

Supplementary Planning Document (SPD)

DRAFT for Cabinet

1 March 2023

New Forest District (outside the National Park)

Acknowledgements

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A summary of the changes made is available at (*Link to NFDC Webpage: forthcoming*)

Contents

Technical guidance sections from the Net Zero Carbon Toolkit (NZCT) to be published as a companion document to the draft SPD

- Construction methods and quality (NZCT Page 18)
- Airtightness for new build ((NZCT Page 19)
- Ventilation for a new build (NZCT Page 20)
- Low carbon heat: design, commissioning and operation of heat pumps (NZCT Pages 22 and 23)
- Water efficiency (NZCT Page 25)
- Which heat pump is best for me? (NZCT Page 24)
- Solar PV panels for houses (NZCT Page 26)
- Solar PV panels for blocks of flats (NZCT Page 27)
- Smart controls and demand flexibility (NZCT Page 28)
- Retrofitting existing homes (NZCT Pages 38 – 66)

Part A: Introduction

Purpose, objectives and structure

1. The purpose of the Supplementary Planning Guidance (SPD) is to provide guidance for the planning policies contained in Local Plan Part One 2016-2036: Planning Strategy (2020), Current and future flood risks were assessed in detail. Development locations with access to opportunities, facilities and services were prioritised, to help reduce the need to travel (to the extent practicable in a predominantly rural area).
2. The Supplementary Planning Document (SPD) clarifies how developers should address climate change in planning applications, in order to meet Local Plan requirements, in particular the two policies in the inset box below (other climate change related policies are listed in Appendix 1).

Policy STR1: Achieving sustainable development

All new development will be expected to make a positive social, economic and environmental contribution to community and business life in the Plan Area by: …

vi. Ensuring that new development is adaptable to the future needs of occupiers and future-proofed for climate change and innovations in transport and communications technology.

Policy ENV3: Design quality and local distinctiveness

… New development will be required to: …

v. Incorporate design measures that improve resource efficiency and climate change resilience and reduce environmental impacts wherever they are appropriate and capable of being effective…

3. It does so by setting out best practice approaches or standards that developers are encouraged to target or adopt, to
   - take all practicable steps to decarbonise the running of buildings;
   - to meaningfully reduce embodied carbon in construction; and
   - to ensure development is climate change adapted.

   The aim is to ensure that designs are climate change optimised before planning applications are submitted.
4. Whilst it is essential to make meaningful carbon savings now, it will not always be possible to achieve best practice standards for reducing carbon emissions in one step. Where it is not yet feasible for a building to be zero carbon in operation, an important second objective of this SPD is for all such development to be **zero carbon ready**, capable of running without carbon emissions.
5. To be 'zero carbon ready' requires that any additional steps needed to achieve zero carbon running are identified and enabled at design and build stage, when it is most cost efficient to do so. This will help to minimise the carbon impact, cost and inconvenience of future upgrading.

SPD structure

6. **Part A** (page 5) briefly sets out the implications of climate change locally, defines key terms and provides the international and national policy context. It also summarises the costs and benefits to developers and occupiers of achieving zero carbon development
7. **Part B** (page **Error! Bookmark not defined.**) sets out the information required to accompany planning applications.
8. Drawing on the Net Zero Carbon Toolkit, **Part C** (page **Error! Bookmark not defined.**) provides best practice guidance for climate change mitigation and carbon reductions for new development, in particular for new housing. It also provides guidance on climate change adaption.
9. The appendices (page 43) provide supporting information. The technical sections of the Net Zero Carbon Toolkit e.g., on building products and processes are published separately as a companion reference document supporting this SPD.

Climate and Nature Emergency

10. On 11 October 2021 New Forest District Council declared a Climate and Nature Emergency[1]. This SPD is part of the wider set of actions by the Council to deliver on the Declaration, outlined in a **Climate and Nature Emergency Action Plan**[2].
11. This SPD complements the Council's **Greener Housing Strategy[3]** which focuses on decarbonising the Council's own affordable house building programme and affordable housing stock. The Strategy also commits the Council to working with private owners and landlords to help decarbonise existing private homes.

CO_2, zero carbon and climate change effects

12. Climate change is widely accepted to be caused by increased greenhouse gases in the atmosphere. Two broad types of response to climate change are required, defined[1] as follows:
    - **Climate change mitigation:** Action to reduce the impact of human activity on the climate system, primarily through reducing greenhouse gas emissions.
    - **Climate change adaptation**: Adjustments made to natural or human systems in response to the actual or anticipated impacts of climate change, to mitigate harm or exploit beneficial opportunities.

Carbon emissions from development

13. Energy is consumed and carbon is emitted at all stages of the whole-life cycle of a development.
14. **Embodied carbon** is emitted from energy consumed during construction, including the production and transportation of building materials - processes developers have some ability to control or influence. Thereafter embodied carbon also arises from periodic maintenance and ultimately from building demolition and waste disposal processes (net of any carbon savings from materials that can be recycled and any energy that can be recovered from residual waste).
15. **Operational carbon** is emitted over time from the energy consumed during the occupation and use of the building, in two categories:

[1] Source: NPPF glossary

- **Regulated emissions** from energy used to run the building, including lighting, heating, cooling/ventilation and hot water - so known because energy efficiency and carbon standards in these areas are controlled by the Building Regulations.
- **Unregulated emissions** are the remaining emissions from user behaviour, the other appliances and devices occupiers choose to fit or plug in.

Policy context

International

16. In 2018, the Intergovernmental Panel on Climate Change (IPCC) showed the world there would be only 12 years (to 2030) to prevent irreversible catastrophic damage from a changing climate. Any temperature increase greater than 1.5°C above pre-industrial levels would trigger far worse effects than previously thought, in terms of drought, flood, poverty for many people, and catastrophic biodiversity loss.

Figure 1: IPCC and UN climate change documents front covers

National legislation

17. The **Climate Change Act** 2008 (as amended 2019) legally commits the UK government to achieving net zero carbon emissions by 2050. In 2021 the UK Climate Change Committee's Sixth Carbon Budget[2] committed to a 'world leading' 78% reduction carbon target by 2035, relative to 1990 levels.
18. The **Environment Act** 2021 requires the Secretary of State to introduce legally binding environmental targets on a range of matters including air quality, resource efficiency and waste reduction, published in December 2022[3].

National planning guidance

19. The **National Planning Policy Framework** (NPPF 2021) sets out that the overarching environmental objectives of the planning system include 'using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy'.

[2] Sixth Carbon Budget: https://www.theccc.org.uk/publication/sixth-carbon-budget/
[3] Environmental targets consultation summary of responses and government response (publishing.service.gov.uk)

20. The NPPF para 152 states that:

> 'The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure'.

21. The NPPF para 154 states that:

> 'new development should be planned for in ways that: (a) avoid increased vulnerability to the range of impacts arising from climate change… (b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design…'

22. The National Planning Practice Guidance section on Flood risk and coastal change was significantly updated in August 2022. The NPPF and NPPG now comprehensively address how developments should avoid, or if necessary mitigate or adapt to, all forms of flood risk, including predicted climate change effects.
23. The National Design Guide (MHCLG 2021) outlines and illustrates the Government's priorities for well-designed places. It states that well-designed places and buildings conserve natural and other resources including buildings, land, water, energy and materials. Their design responds to the impacts of climate change by being energy efficient and minimising carbon emissions to meet net zero targets[4].

Building Regulation

24. The Building Regulations regulate the 'operational' energy used to run buildings and the carbon emissions arising (Approved Document L: Conservation of fuel and power, as updated 2022). The following Approved Documents are also relevant to how buildings adapt to or mitigate climate change.
    - Approved Document F: Ventilation
    - Approved Document O: Overheating
    - Approved Document S: Infrastructure for the charging of electric vehicles.
25. In 2019-2021 the government consulted on a **Future Homes Standard** and **Future Buildings Standard**, proposals to amend the Building Regulations in 2025. The proposals would reduce regulated operational carbon emissions by 75 and 80% compared with 2019 standards, including banning fossil fuel boilers in new homes from 2025.

Benefits and costs of Net Zero carbon development

26. There is a cost to achieving net zero as a society. For some sectors it will require technological innovation and investments in research and development. New buildings are comparatively less challenging in terms of net zero in operation. Technologies, techniques and processes required to run buildings without adding to carbon emissions are already available.

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[4] National Model Design Code, Part 2: Guidance notes, 'Resources' section.

27. Lowering the embodied carbon of constructing new buildings will be more challenging and requires both material and procurement innovations. However, this does not have to lead to a significant cost premium either.

Buildings produce a lot of carbon – and are expensive to run

28. It is clear that a Net Zero UK will require a significant reduction in energy use and carbon emissions from all buildings and, in particular, homes. Even today, most new homes are being fitted with gas boilers and these will continue to emit carbon and also to degrade local air quality during their operational life.

Britain has not made sufficient progress on this

29. Despite rapid decarbonisation in many other sectors, the energy efficiency of new homes has remained almost constant over the last ten years. The rate of improvement stalled following the withdrawal of the Zero Carbon Homes target in 2016.

30. Interim improvements to the Building Regulations from 2022 will help (Part L 2021), but there is a need to do much better than the 'business as usual' practice of minimum regulatory compliance in the construction sector.

Heating: an important energy demand which can be reduced

31. Space heating during the winter months accounts for around 65% of the total energy demand in a new home. Space heating demand is an excellent proxy for the fabric efficiency of the building, which is why it is important to concentrate on a 'fabric first' approach.

A 2% - 6% cost premium for net zero carbon in operation

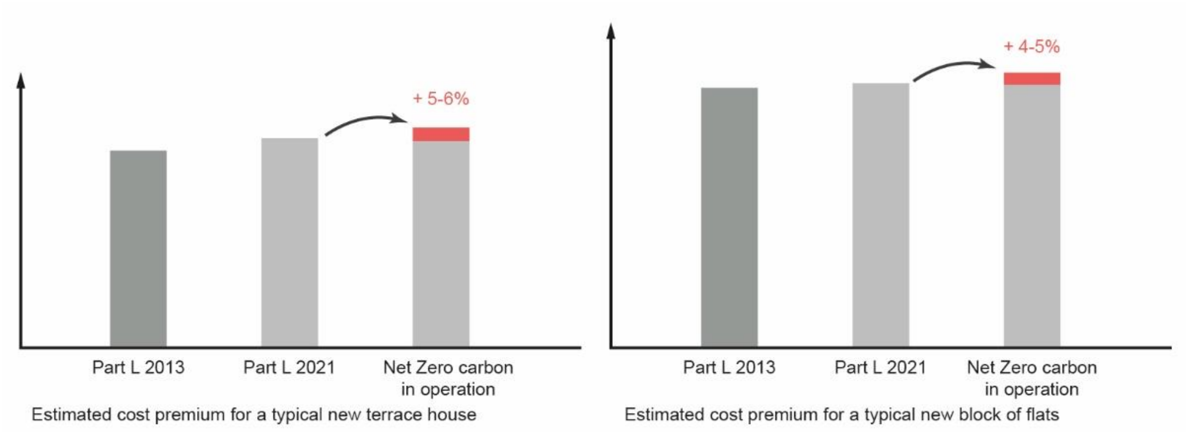

Figure 2: Estimated cost premium for a typical new terrace house, and Estimates cost premium for a typical new block of flats

32. The dwelling construction cost premium for delivering a new Net Zero carbon home has been estimated to be approximately 2% to 6% above a Part L 2021 compliant equivalent[5]. It will be a smaller percentage of final house sales prices,

[5] Recent evidence produced for Winchester and Cornwall Councils support this estimate. Technical evidence based for Policy SEC1 – new housing (Etude, Currie & Brown, July 2021). Net Zero Carbon Targets, Evidence Base for Winchester City Council (Elementa, Etude, Currie & Brown, Sept 2022).

which would additionally reflect the cost of land and any other facilities, community benefits or infrastructure provided.

Potential to drive down net zero costs

33. A significant advantage in committing to net zero new homes is that it is a sustainable standard for the future. It offers significant opportunities for developers, clients and contractors to reduce their additional costs over time by improving processes (e.g. airtightness) or contributing to driving down the cost of key technologies. Whilst inflation is currently high overall the general trend has been a significant reduction in the cost of solar PVs in the last ten years. Other reductions, albeit smaller, are expected for heat pumps and MVHR.

UK homebuyers are prepared to pay a green premium

34. Slightly higher build costs will not necessarily affect development viability. Allowance should be made for cost recovery from buyers prepared to pay more for a home in return for lower energy bills. A recent survey[6] of 2,300 buyers, agents and mortgage brokers found that buyers are already prepared to pay a 9.4% premium for previously owned homes that have been energy efficiency retrofitted, and 15.5% more for a home that meets high energy efficiency standards.

Significant cost savings for the residents

35. Net Zero carbon homes are significantly cheaper to run than a standard new build house. This is due to the combined effects of lower energy demand alongside greater flexibility of energy use during the day, and home use of solar electricity where PV is installed.

Avoided costs for retrofitting and to society as a whole

36. Continuing to construct buildings that use fossil-fuel dependent space and water heating systems will be financially misguided in most cases. Designing a home for a heat pump-based system from the outset is estimated to cost around one-fifth of the cost of retrofitting that technology to the same quality and standard[7].

37. There also wider off-site benefits of 'getting it right now 'in terms of reduced energy infrastructure costs as less renewable energy generation will be required to achieve a decarbonised national grid.

38. Within a generation the heating system will need to be replaced, and there is no guarantee that similar replacements will still be legal and available. Future retrofitting will also generate further embodied carbon emissions in the refurbishment process, especially if the original design was not future proofed for this eventuality.

39. Even in the unlikely event that there is no realistic alternative to a gas or oil boiler at the time of construction, future replacement costs can and should be avoided by designing and specifying the building to simplify a future air source heat pump retrofit for both space and water heating.

[6] Buying into the Green Homes Revolution, October 2022, Santander.

[7] UK housing: Fit for the future?, Climate Change Committee 2019, p14 See for example Buyers of brand-new homes face £20,000 bill to make them greener, Guardian 23 Jan 2021. Analysis cited used Climate Change Committee data.

Part B: Requirements for Planning applications

Summary

40. Figure 3[8] illustrates the recommended measures to achieve climate adapted development. Whilst the example shown is a residential dwelling the principles apply equally to other forms of development.

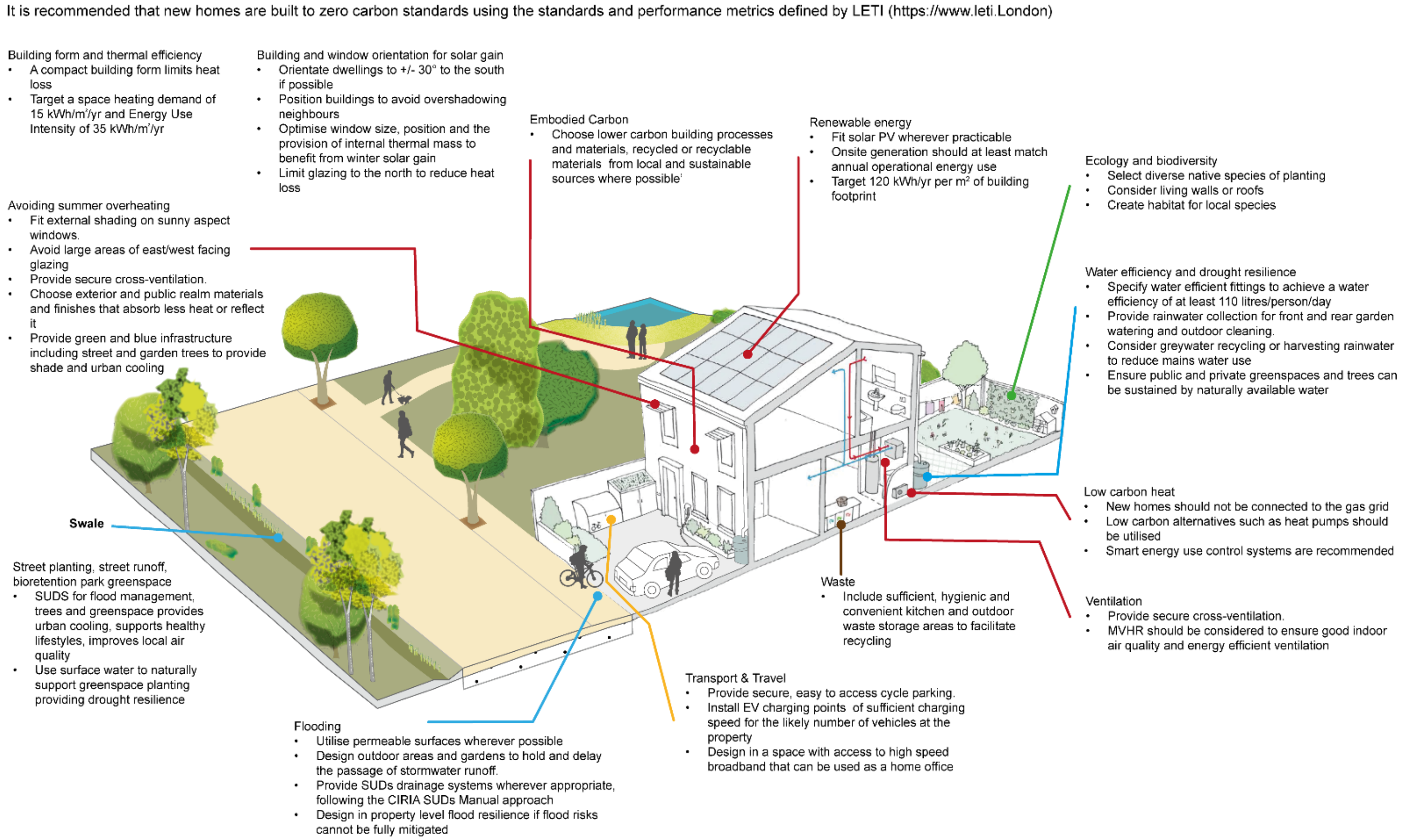

Figure 3: Recommended measures to achieve climate adapted development

[8] Image copyright, re-used and adapted with the permission of Cheltenham Borough Council; Etude; April Grisdale Illustrations

41. Figure 4 summarises the information to be provided with planning applications, set out in more detail later in his section. Table 1 overleaf sets out information requirements by planning application stage and type. Figures 5-6 set out recommended technical building standards for houses and flats. For other development uses see section C.

Climate change mitigation

1. Minimising energy demand targeting net zero carbon in operation: To set out how energy demand to use and occupy the buildings has been minimised to actively target net zero carbon in operation. To state whether or not the developer is making a **Future Homes and Buildings Now commitment** to only installing a low carbon heating system, otherwise to explain why not and how the lowest carbon heat source practicable has been specified. To provide calculations for space heating and total operational energy demand (Energy Use Intensity) and the resulting CO_2 emissions.

A secondary objective where a zero carbon in operation cannot be achieved and/or low carbon heating is impracticable, is to ensure that the development is future-proofed to be zero carbon ready without requiring significant retrofitting.

2. On-site renewable energy generation: To generate on-site renewable energy wherever possible, providing a calculation of the renewable energy generated.

3. Reducing embodied carbon emissions: To set out the steps taken to reduce carbon emissions from (embodied in) the construction process up to the point of practical completion. For major developments, to calculate the reductions achieved.

4. Sustainable travel: To address certain property level measures to support sustainable travel, including application of the Building for a Healthy Life design approach on residential developments of 50 or more homes (other aspects to be assessed from other transport information required at planning application stage).

Climate change adaption

5. Avoiding overheating: Residential developments to undertake a Good Homes Alliance early stage overheating risk assessment. All major developments to describe how heatwave mitigation has informed planting, green infrastructure and landscaping proposals.

6. Drought resilience and using water efficiently: to install water butts, and to summarise other measures proposed to reduce the need for mains water use and to make best use of surface water runoff.

7. Flood risk reduction and sustainable urban drainage: To provide permeable hardstanding surfaces and SUDs wherever appropriate, SUDs to be designed in accordance with the CIRIA SUDs Manual approach. Where applicable, to explain how the drainage system minimises nutrient run off, and how the development will mitigate residual flood risks in extreme flood events (NB emphasis on surface water management. Other aspects to be assessed from flood risks assessments, where they are required at planning application stage).

Figure 4: Summary of planning application information requirements

Table 1: CCS information requirements by planning application stage and type

		Minor development		Major development			Notes
		1-9 homes	Other < 1,000sqm	10-49 homes	50+ homes	Other ≥ 1,000sqm	
Climate change mitigation and zero carbon							
1. Minimising operational energy demand targeting net zero carbon in operation							
1a	Minimising energy demand by design	Y	Y	Y	Y	Y	All development
1b	Low carbon heating systems	Y	Y	Y	Y	Y	Future Homes & Buildings commitment
1c	Energy use and carbon calculations	Y	Y	Y	Y	Y	For detailed design approval stage
1d	Smart energy systems	Y	N	Y	Y	N	Residential development
1e	Future proofing statement	Y	N	Y	Y	N	Relevant residential developments
1f	Heat pump pre-installation option	N	N	Y	Y	N	If heat pumps are not already included
2. On-site renewable energy generation							
2a	Onsite renewable energy	Y	Y	Y	Y	Y	Wherever feasible
2b	Renewable energy calculation	Y	Y	Y	Y	Y	For detailed design approval stage
2c	Option to purchase PV pre-installation	N	N	Y	Y	N	If PV is not already included
3. Reducing embodied carbon emissions							
3a	Reducing embodied carbon	N	N	Y	Y	Y	All major developments
3b	Calculating embodied carbon savings	N	N	N	Y	Y	Larger major developments
4. Sustainable travel (assessment will mainly use other planning application supporting information)							
4a	Cycle parking and EV charging	Y	Y	Y	Y	Y	All development
4b	Design to Building for a Healthy Life	N	N	N	Y	N	Larger residential developments

Continued overleaf

		Minor development		Major development			Notes
		1-9 homes	Other < 1,000sqm	10-49 homes	50+ homes	Other ≥ 1,000sqm	
Climate change adaption							
5. Avoiding overheating							
5a	Natural heatwave mitigation	N	N	Y	Y	Y	All major development
5b	GHA Overheating risk assessment	Y	Y	Y	Y	Y	All residential developments
5c	Use of MVHR	Y	Y	Y	Y	Y	All developments
6. Drought resilience and using water efficiently							
6a	Managing surface water runoff	Y	Y	Y	Y	Y	All developments
6b	Reducing mains water demand	Y	Y	Y	Y	Y	All developments
7. Flood risk reduction and sustainable urban drainage (SUDs) (assessment will mainly use other planning application supporting information)							
7a	SUDs	N	N	Y	Y	Y	Wherever SUDs are appropriate
7b	Flood resilience measures	Y	Y	Y	Y	Y	Wherever residual flood risks remain

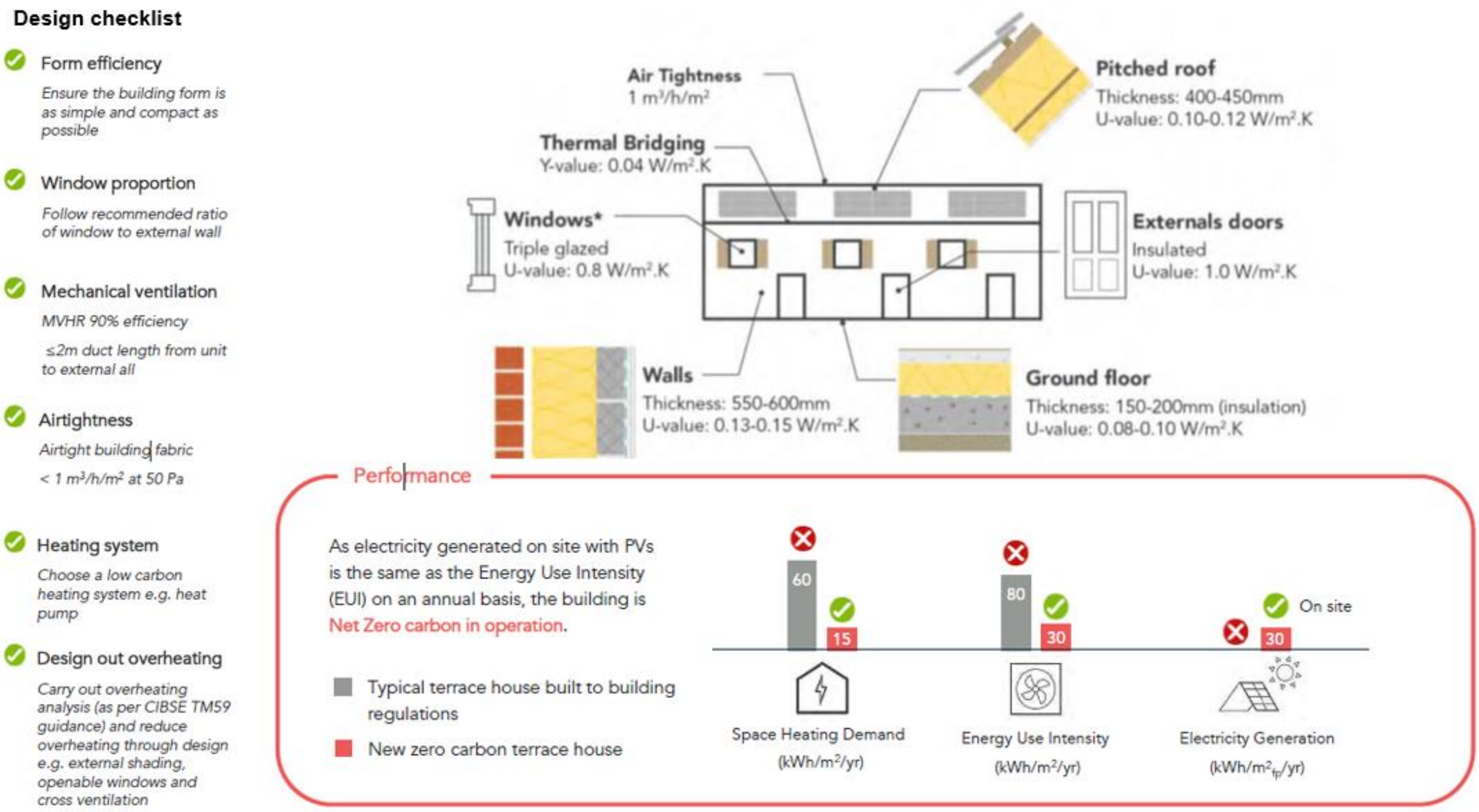

Figure 5: How zero carbon comes together – new terraced housing

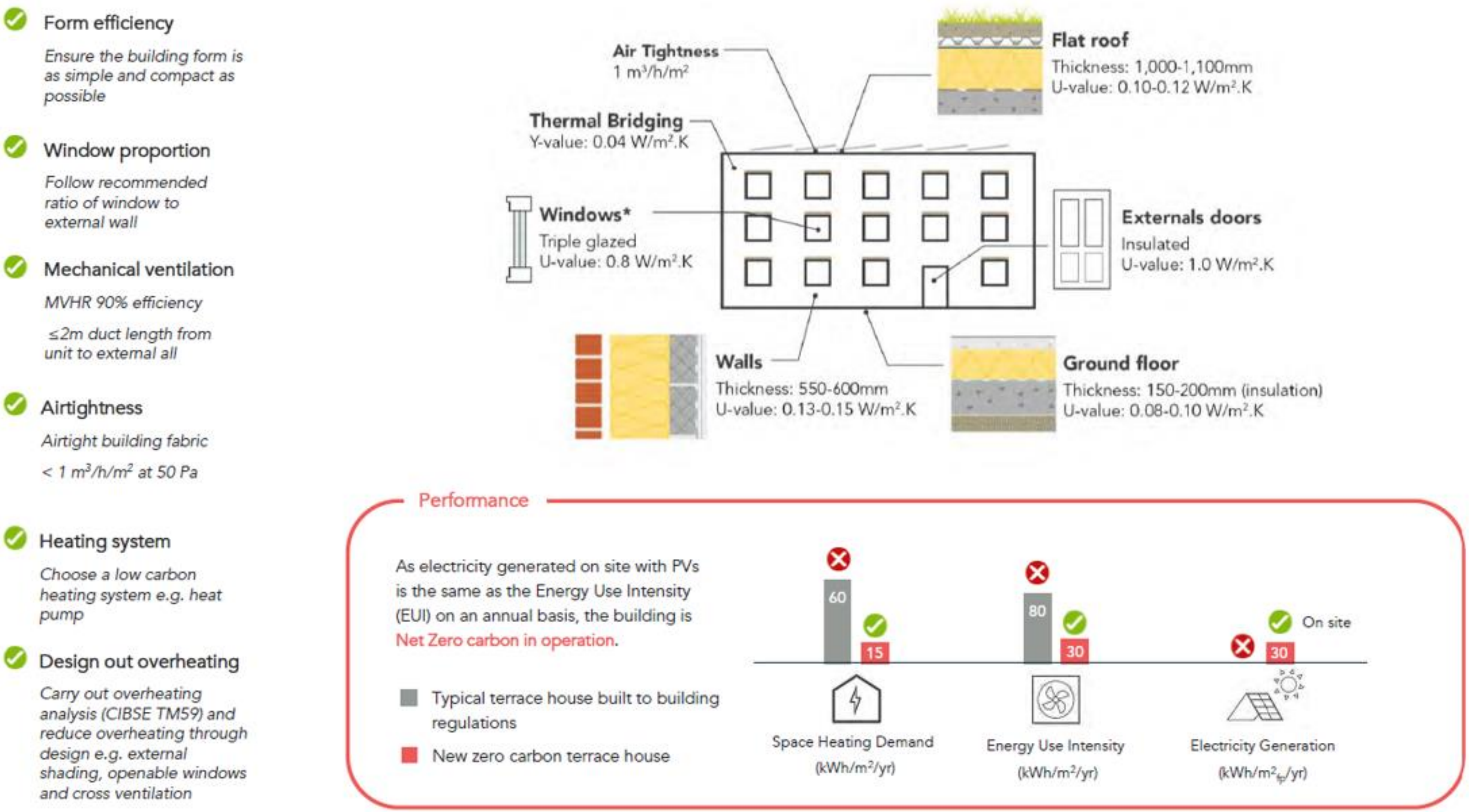

Figure 6: How zero carbon comes together – a block of flats

Planning application Climate Change Statements

Introduction

42. Planning applications must be supported by sufficient information to demonstrate how the proposed development will meet Local Plan requirements in relation to climate change (set out in paragraph 2 and Appendix 1). This evidence will be submitted in a **Climate Change Statement**[9] (CCS) that addresses all the best practice objectives and information requirements set out in this section, unless they are clearly not relevant to the development type or location.

43. CCS requirements 1-4 address climate change mitigation and will also demonstrate how the proposed development will play its part in achieving net zero carbon by 2050, and a 78% reduction on 1990 levels by 2035. Further information is provided in Part C of this SPD. Requirements 5-8 address climate change adaption.

Best practice and best endeavours

44. The Council recognises that some of the best practice standards are challenging, as they should be. The scale and urgency of the climate challenge means that 'business as usual' is not an acceptable option. It is a Local Plan requirement that meaningful steps are taken now, which means demonstrably improving on the carbon and energy efficiency performance and climate resilience of mainstream building practices.

45. The developers' CCS response will evidence the steps that will be taken to achieve best practice where possible. Developers also need to ensure that their designs are capable of meeting the Future Homes and Future Buildings standards. Where it is not possible to achieve best practice, the CCS will set out the options the developer has considered and tested. It will explain why the approach proposed represents best endeavours that reduce CO_2 emissions, energy demand and climate changes risks to the fullest extent practicable, and how future retrofitting costs have been minimised.

Proportionate information and what information to provide when

46. A reduced level of detail is acceptable for planning applications that are not 'major applications' i.e. less than 10 homes or less than 1,000 sqm (GIA) of other floorspace (both figures gross rather than net of any existing floorspace).

47. Where multiple buildings are proposed, data can be provided for a sample representative of the different types of buildings and their positioning and solar orientation on the site. The sample will be agreed in the planning application process.

48. Where the relevant design details are not known e.g. for outline planning applications, planning conditions to approve the details may be agreed. If during the life of an application material amendments are made the CCS may need to be updated.

Avoiding unnecessary duplication of information

49. Depending on the type, scale and location of the development a range of supporting information or technical studies must already submitted when a planning application is

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[9] The CCS is proposed to be added to the Local Information Requirements list, a process that will be undertaken and consulted on separately. Doing so would bring together in one place, and replace, equivalent information requirements already on the list in other documents e.g. the Renewable and Low Carbon Statement.

made. In addition, the Local Plan requires that non-residential development of 1,000 sqm GIA (gross) or more should attain BRE New Construction 'excellent' standard (Policy IMPL2), a process which culminates in an assessment report (development of 250-999 sqm GIA should attain excellent standard for water consumption).

50. This supporting information may provide a range of climate change related information. Where applicable and provided that the relevant matters are covered, it will be acceptable to address the information requirements of this SPD by submitting a CCS providing a summary response plus a cross reference to the parts of the submitted technical documents or assessments that cover the issue in more detail (provided that they are submitted at the point of planning application).

51. The same approach can be taken where the developer is using an independent benchmarking process for the quality, sustainability, carbon reduction or energy efficiency of the development, for example Passivhaus or BRE Home Quality Mark.

Climate Change Statement (CCS) contents

1. Minimising energy demand and targeting net zero carbon in operation

Best practice objectives:

The development process should actively target **net zero carbon in operation**, minimising by design the energy needed for heating, lighting, ventilation and cooling, opting wherever practicable for a heat pump or other efficient low carbon heating system. Passive design measures should be considered first to make effective seasonal use of solar gain and natural ventilation and cooling.

Specifications for new build fabric efficiency for residential development should target achieving a space heating demand under 15 kWh/m^2GIA/year, and total operational energy demand (Energy Use Intensity) of under 35 kWh/m^2GIA/year. Best practice benchmarks for re-purposing buildings for residential use, or other types of development should be agreed at pre-application advice stage, starting with the LETI / Net Zero Carbon Toolkit (SPD Section C 'Key Performance Indicators).

The inclusion of 'smart' energy use and heating control and monitoring systems that can also measure onsite renewable energy generation and use is recommended.

Secondary objectives:

Where net zero carbon in operation cannot be achieved currently, buildings should aim to be **zero carbon ready**[10].

If a heat pump or other efficient low carbon heating system is demonstrably not practicable, or net zero carbon readiness cannot reasonably be achieved, the building should be **future proofed**: designed to reduce energy demand and CO_2 emissions as far as is currently practicable, and to minimise the cost and disruption of retrofitting the building to run efficiently with a heat pump system in the future.

For further information see SPD Part C section: Getting the design right

and Consider Passivhaus tools and certification

[10] Meaning net zero carbon in operation will be achieved when national electricity supply is fully decarbonised.

52. Passivhaus certification is considered a robust means to meet the space heating demand and Energy Use Intensity KPIs. It also drives quality assurance during construction. A Passivhaus 'certifier' will be required to act as an impartial quality assurance check on predicted performance during design and to carry out site inspections. Appendix 3 provides some recent examples of Passivhaus developments. For housing the Passivhaus Design Easi Guide provides further good practice advice.

53. Whether or not the Passivhaus approach is adopted, accurate energy modelling is recommended. Passivhaus tools can be used whether or not Passivhaus accreditation is for example the Passive House Planning Package (PHPP 10). Alternatively CIBSE TM54 Evaluating operational energy use at the design stage (2022).

54. It is also possible to target best practice by setting the right fabric specification and design requirements as part of the project brief, and this approach may be more cost effective for smaller developments in particular. The LETI Climate Emergency Design Guide sets out more detailed thermal and other building fabric performance specifications that need to be met to achieve the KPIs recommended in this design guide.

Future proofing heating technology

. The construction methods, airtightness, ventilation, heat pump and smart controls sections of the companion technical guidance document may also be helpful.

CCS 1a: Minimising energy demand by design (all development):

Explain how the design brief, performance specification and commissioning process for the development has (or will) actively seek to minimise energy demand in use, in particular for space and water heating.

CCS 1b: Low carbon heating systems (all development):

(i) State whether or not the developer is making a **Future Homes and Buildings Now** commitment to the installation of a low carbon, energy efficient heating system, and if not, to explain why it is not possible to do so. If this commitment is made the heating system details can be dealt with by a planning condition.

(ii) At the point of planning application for approval of the detailed design, confirm the heating system specified for the development. If a heat pump-based or alternative low carbon heating system is not specified, detail the lower carbon options that have been considered and explain why they are not feasible[11].

CCS 1c: Energy use and carbon calculations (all qualifying development):

At the point of planning application for approval of the detailed design, provide calculations of the space heating demand, total operational energy demand (EUI), CO_2 emissions per sqm GIA for the building designs proposed[12], and the total operational carbon emissions in tonnes per annum for the development as a whole. If the results exceed the recommended best practice targets, provide an evidenced justification that

[11] This assessment may draw on information required to be provided in accordance with the Building Regulations, regulation 25A: Consideration of high efficiency alternative systems, but the information is required at the point of planning application. Compliance with regulation 25A may not be sufficient to achieve compliance with planning policy requirements.

[12] Where there are multiple building types a representative sample will be agreed.

the best practicable outcome has been achieved for the location, type and form of development.

For developments of 10 or more dwellings or 1,000 sqm or more of other[13] floorspace, energy use and CO_2 calculations should use an industry recognised method such as the Passivhaus Planning Package (PHPP) or CIBSE TM54 Evaluating operational energy use at the design stage (2022). For developments below these thresholds the same approach is recommended, but calculations based on the Target Primary Energy Rate required for Building Regulations (Part L) purposes will also be acceptable.

CCS 1d: Smart energy systems (all development):

Confirm whether or not smart energy use and heating control and monitoring systems will be fitted, and whether the system will be capable of measuring onsite renewable energy generation and use. If not, explain why it is not possible to do so.

CCS 1e: Future proofing statement (any residential development unable to commit to a low carbon heating system):

At the point of planning application for approval of the detailed design, provide a statement setting out all the works required to install a heat pump system in the future, including any associated building fabric or other upgrading necessary to ensure occupier comfort in winter. The future proofing statement is to be made available to all prospective buyers.

CCS 1f: Option to purchase heat pump pre-installation (relevant residential developments of 10 or more homes):

If heat pump installation is demonstrated by appropriate evidence to be unfeasible on the grounds of financial viability, buyers purchasing off-plan should be given the opportunity to purchase from the developer heat pump system pre-installation at a discounted supplementary cost.

2. On-site renewable energy generation

Best practice objectives:

On-site renewable energy generation should be provided wherever it is practicable to do so, wherever possible sufficient to at least meet annual operational energy use of the development to achieve net zero carbon development in operation.

Targeting on-site renewable energy generation of at least 120 kWh/year per square meter of building footprint is also recommended for residential development.

For further information see SPD Part C section: On-site renewable energy generation. The Solar PV sections of the companion technical guidance document may also be helpful.

CCS 2a: Onsite renewable energy (all developments)

Set out the development approach to optimising the generation of onsite renewable energy. If no onsite renewable energy provision is proposed explain why it is not possible to do so. If the developer makes a commitment to

[13] Information that already has to be provided in accordance with Building Regulations Part L(2), para 94

the provision of onsite renewable energy the details can be dealt with by a planning condition.

CCS 2b: Renewable energy generation calculation (all development providing onsite renewable energy generation):

At the point of planning application for approval of the detailed design, provide a calculation of the renewable energy that will be generated on-site, in total, per building[14] and per sqm of building development footprint. Express this value as a percentage of the best practice target of 120 kWhm^2/year, and as a percentage of the building operational energy use (EUI) calculated for CCS 1c.

If the onsite renewable energy generated is below the predicted annual regulated operational energy use, provide a justification that the best practicable outcome has been achieved for the development proposed.

CCS 2c: Option to purchase PV pre-installation (all residential developments of 10 or more homes where effective PV installation is feasible):

Where PV installation on a residential development is possible but demonstrated by appropriate evidence to be unfeasible on the grounds of financial viability, every new home buyer purchasing off-plan a dwelling with a roof suitable for PV should be given the opportunity to purchase from the developer pre-installation of a PV system at a discounted supplementary cost.

3. Reducing embodied carbon emissions

Best practice objectives:

As an interim step towards the full decarbonisation of construction by 2050, developers should take all practicable steps to meaningfully reduce embodied carbon emissions from construction materials and processes up to the point of practical completion.

If a UK Net Zero Carbon Buildings Standard is published this objective will be updated.

For further information see SPD Part C section: On-site renewable energy generation

55. As noted under KPIs, net zero carbon in operation can only be achieved by meeting the energy needs of the development using renewable electricity generation provided for the development, as fossil fuels are still used to produce mains electricity.

56. Solar PV panels installation is the recommended approach, a simple, mature and reliable renewable energy technology. They are a particularly good match for heat pumps, as much of the electricity generated outside peak use periods can be used to heat water or charge electric vehicles for later use. PV tiles are an alternative that may be more appropriate on heritage buildings or in conservation areas. Further information on PV systems is provided in the companion technical document to this SPD, the best examples convert solar energy more efficiently and have a longer lifespan.

57. A key advantage of PV is that it can be usually provided on-site as part of the development process without additional land take. The majority of new homes have sufficient space on site to generate as much energy as they need on an annual basis, especially if the roof design is optimised to make best use of southerly aspects. PV

[14] Where there are multiple building types a representative sample will be agreed.

can also be mounted over parking areas and on south facing walls. The latter is less efficient than roof mounting but it can improve power generation in winter months when the sun is lower and energy demand is higher.

Embodied carbon

CCSC 3a: Reducing embodied carbon (all major development):

Identify and describe any steps that have been or will be taken to reduce carbon emissions from the construction process up to the point of practical completion.

CCSC 3b: Calculating embodied carbon reductions (developments of 50 or more homes or more than 1,000 sqm GIA other uses):

Provide a calculation of the carbon emissions saved by these steps using a recognised methodology, expressed in tons $CO2_e$ and as a percentage of total embodied carbon in the development up to the point of practical completion.

4. Sustainable travel

Best practice objectives:

To minimise the need to travel, and to optimise opportunities to travel when needed by active and public transport modes, or by electric vehicle.

For further information see SPD Part C section:

Facilitating sustainable transport

Note: Sustainable travel implications will primarily be assessed from information in one or more of the following documents where they are required to be provided when a planning application is submitted: the Design and Access Statement, Transport Assessment, Travel Plan for the site.

CCS 4a: Cycle parking and EV charging (all development):

At property level provide secure and accessible cycle parking and EV charging capacity sufficient for the number of occupants/users likely to be present.

CCS 4b: Building for a Healthy Life (residential development 50+ homes):

Development proposals should be assessed using the Building for a Healthy Life design approach, and should seek to achieve a green light score for all assessment considerations.

5. Avoiding overheating

Best practice objectives:

To support building and general urban cooling in peak summer and heatwave conditions by good design, including planting strategies, green and blue infrastructure provision and hard landscaping. At building level, to design out summer overheating risks and to avoid the need to install air conditioning.

For further information see SPD Part C section: Designing out overheating risks

Note: Where relevant, CCS responses may briefly summarise and cross refer to information in one or more of the following documents, where they are required to be provided when a planning application is submitted: Biodiversity Survey and Report, Design and Access Statement, Sustainability Statement, Tree Survey /Arboricultural Statement, Ventilation/Extraction Statement.

CCS 5a: Natural heatwave mitigation (all major development)

Describe how heatwave avoidance and mitigation has informed the planting and landscaping strategy, including any green and blue infrastructure provision, and the choice of building materials and surfaces including hard landscaping.

CCS 5b: Overheating (all residential development)

For residential development complete and submit the Good Homes Alliance early stage overheating risk tool assessment prior to finalising the detailed design of the development (see appendix 2). The total overheating risk score should be 'low' in the design submitted for planning approval. If a low score cannot be achieved, explain why and set out how the residual overheating risks will be mitigated. Parts of the tool will be also useful for non-residential development.

CCS 5c: MVHR (all development)

Confirm whether or not Mechanical Ventilation Heat Recovery (MVHR) will be provided.

Designing out overheating risks

6. Flood risk reduction and sustainable urban drainage (SUDs)
7. Drought resilience and using water efficiently

Surface water management and drought resilience should be considered together.

Best practice objectives:

To reduce demand for mains water. To ensure that private gardens, public realm planting, greenspaces and water features are drought and climate resilient and can be sustained without using mains water.

To naturally and safely manage and dissipate surface water run off under climatic extremes. To incorporate SUDs wherever they are capable of being effective, designed to minimise runoff discharge to sewers and to maximise amenity, biodiversity and water quality co-benefits.

CCS 6a: Managing surface water runoff (all developments)

Identify measures included or proposed to naturally dissipate, hold or slow the movement of surface water in both public and private areas. Identify any hardstanding and paved surfaces that are not water permeable and explain why a permeable or partly permeable surface is not practicable.

CCS 6b: Reducing mains water use (all developments)

Describe the measures proposed, or at detailed design stage specified, to reduce the need for mains water use and to make best use of surface water runoff. Install appropriately sized water butts as standard in all front and rear gardens or yard spaces where a gutter downpipe can be provided.

CCS 7a: SUDs (all major developments where SUDs are appropriate)

i. Demonstrate how SUDS have been designed and specified as an integral part of the site masterplanning process in accordance with the best practice approach set out in the CIRIA SUDs Manual (C753). Identify any proposed piped or other runoff discharge to sewers and explain why a surface-based drainage approach discharging to a watercourse was not possible e.g., with a revised development layout.

ii. Explain how measures to minimise nutrient runoff have been incorporated into the SUDs design.

CCS 7b: Flood resilience measures (any development where its flood risk assessment identifies residual flood risks, including residual risks identified when applying the appropriate Environment Agency climate change allowance[15]).

Briefly summarise and provide a cross reference to the section of the FRA that addresses proposed flood resistance and flood resilience measures. Demonstrate that any such measures are specified in accordance with CIRIA Designing for exceedance in urban drainage - good practice (C635F) and the CIRIA Code of practice for property flood resilience (C790A).

For further information see SPD Part C sections:

Drought resilience and using water efficiently

Reducing mains water use

Reducing flood risk through Sustainable Urban Drainage (SuDS)

15 Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)

Part C: Climate Change mitigation and adaption

About this section

58. This section is derived in part from the Net Zero Carbon Toolkit (NZCT), updated for NFDC circumstances and with additional information added on aspects of climate change adaption. This toolkit was created to make Net Zero carbon building more accessible. Although it can be used by homeowners, it is aimed at those who already have some knowledge or experience of construction.

59. The main focus is on new housing, but the principles apply equally to other uses. Supporting information is provided in the appendices, and technical sections of the original NZCT document are provided in a companion document.

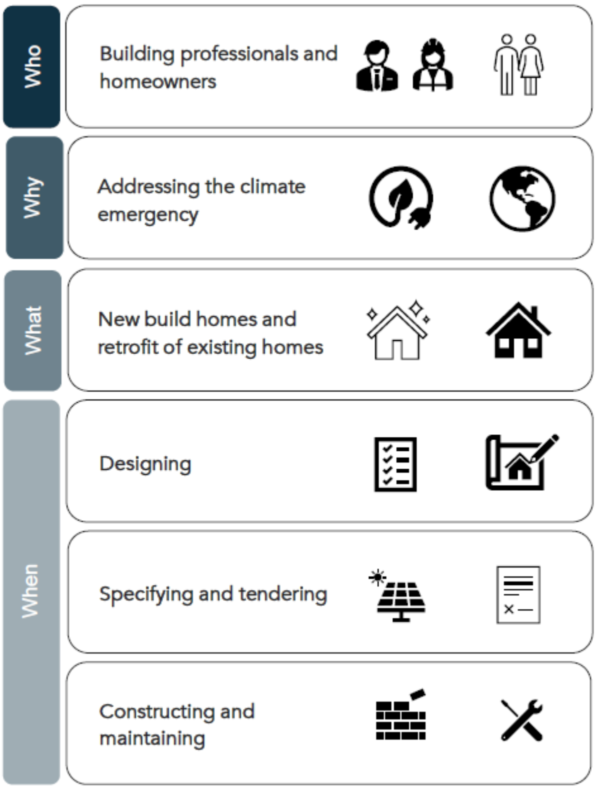

Figure 5: Toolkit breakdown

From site selection to construction to operation

60. The toolkit, including the appendices and the SPD companion document, covers all stages of building design and construction, including maintenance and operation.

Understanding the complete picture

61. The toolkit including SPD appendices aims to build the awareness and confidence of people implementing low or zero carbon projects and generally seeks to answer the following questions:

- Why do this?
- What does “good” look like?
- What to do when and how to bring it all together?
- What to specify and some product options.

Net Zero carbon buildings: core principles and definitions

Operational net zero carbon

62. The three core principles of buildings that are net zero in operation are energy efficiency, low carbon heat and the use of renewable energy. Buildings should also minimise carbon emissions from materials production and construction processes to be fully net zero.

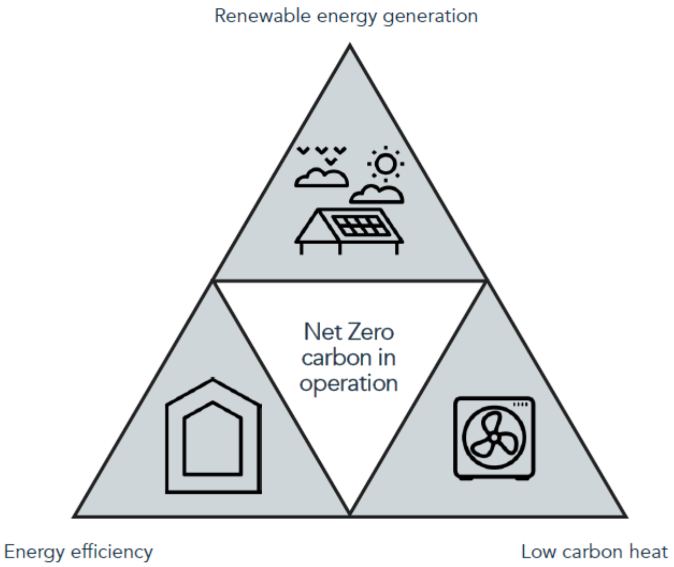

Figure 6 The three pillars of a Net Zero carbon building in operation

Energy efficiency

63. Buildings use energy for heating, hot water, ventilation, lighting, cooking and appliances. The efficient use of energy reduces running costs and carbon emissions. Importantly, it also reduces a building's impact on the wider energy supply network. There are two key metrics used in this toolkit to measure the energy efficiency of a building, both expressed in $kWh/m^2/yr$.

- **Energy Use Intensity** (EUI) is the annual total energy consumed running and occupying a building divided by its floor area. It is the sum of regulated energy (for heating, hot water, cooling, ventilation, and lighting systems – so called as it is covered by the Building regulations) and unregulated energy (use for plug in devices that is outside of the scope Building Regulations).
- **Space heating demand** is the energy required to heat the building, usually the largest component of regulated energy.

Low carbon heating

64. An essential feature of Net Zero carbon buildings is the use of low carbon sources of heat with no connection to the gas network.

Renewable energy generation

65. In new buildings, renewable energy generation should be at least equal to the annual energy use of the building for it to qualify as net zero carbon in operation. This is straightforward to achieve on site for most new homes by installing solar photovoltaic (PV) panels, which will also help to support the increased demand for renewable energy.

Key Performance Indicators (KPIs)

What energy use targets should I aim for?

66. Energy use targets are more transparent and robust than carbon reductions targets for ensuring zero carbon is delivered in practice. The Net Zero Toolkit recommends targets consistent with the LETI Climate Emergency Design Guide (2019).

Housing

67. Best practice KPIs for new homes are set out in figure 7. All KPIs except the embodied carbon target must be met for a home to be Net Zero carbon in operation and to achieve an ultra-low energy home with very low space heating demand. Space Heating Demand is an excellent proxy for the fabric efficiency of the building - 15 kWh/m^2/year is exemplary, requiring a fabric efficiency and airtightness equivalent to that of a new Passivhaus home.

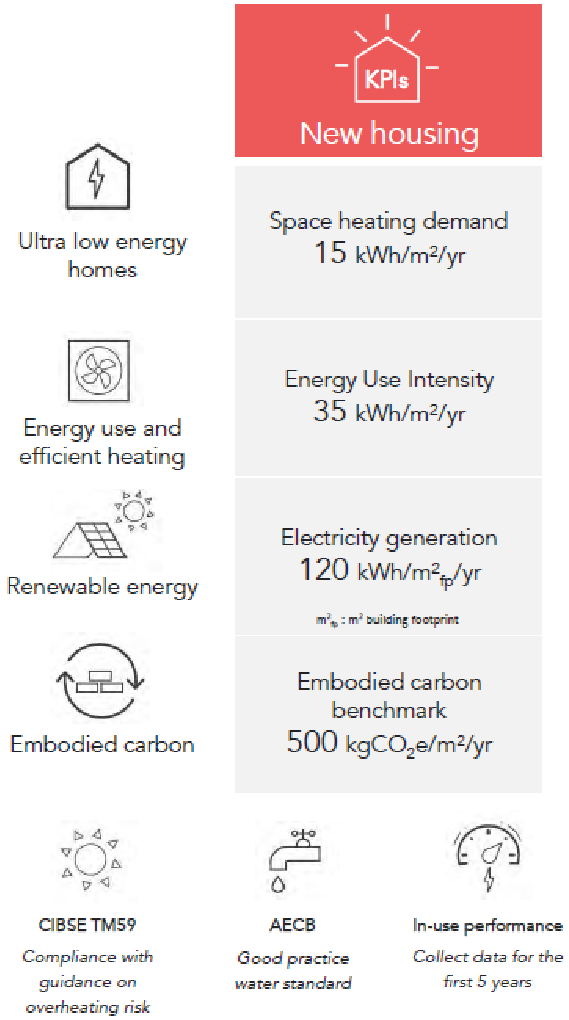

Figure 7: Housing KPIs

KPIs for other uses

68. Non-residential building types tend to vary more widely than housing, making it more difficult to reliably determine generic forms, energy use or occupancy models. However, as noted in the Net Zero Carbon toolkit the RIBA, LETI, the UKGBC and other organisations have published relevant guidance on performance targets for space heating demand, total energy use and renewable generation, summarised in Net Zero Carbon Toolkit as follows.

Schools

- Space heating demand of 15-20 kWh/m^2 GIA/year
- Total energy consumption of 65 kWh/m^2 GIA/year or less
- Solar electricity generation that exceeds metered energy use on site

Hotels

- Space heating and cooling demand of less than 30 kWh/m^2 GIA/year
- Total energy consumption of 55 kWh/m^2 GIA/year or less
- Solar electricity generation at least 120 kWh/m^2 GIA/year

Offices

- Space heating and cooling demand of less than 15 kWh/m^2 GIA/year
- Total energy consumption of 55 kWh/m^2/year or less
- Solar electricity generation at least 120 kWh/m^2 GIA/year

Light Industrial

- Space heating and cooling demand of 15-30 kWh/m^2 GIA/year
- Total energy consumption of around 55 kWh/m^2 GIA/year excluding specialist processes
- Solar electricity generation of least 180 kWh/m^2 GIA/year.

69. Note that the Local Plan 2020 requires that 'major' non-residential development of 1,000sqm GIA or Schools more should attain Building Research Establishment (BRE) New Construction 'Excellent' standard. Development of 250-999 sqm GIA should attain excellent standard for water consumption. The primary aim of BRE assessment is to mitigate the life cycle impacts of new buildings on the environment in a robust and cost-effective manner. In relation to zero carbon the BRE approach takes a 'whole life cycle' approach to construction impacts, encouraging measures to improve the energy efficiency of the building and to reduce carbon emissions. But as BRE New Construction does not set specific energy targets the energy efficiency benchmarks above are recommended as well.
70. Note that for non-residential development of 1,000sqm 'useable floorspace' energy use reporting is already a Building Regulations[16] requirement. In meeting this requirement an industry recognised energy forecasting methodology such as CIBSE TM54 Evaluating operational energy use at the design stage should be used.

Why set a renewable energy target?

71. Net zero carbon in operation can only be achieved by meeting the energy needs of the development using renewable electricity generation provided for the development. A significant proportion of mains electricity is currently generated from fossil fuels.

Reducing the embodied carbon of a building

72. To go beyond net zero in operation towards net zero for the whole building lifecycle, embodied carbon must be significantly reduced and any residual carbon can be offset, for example by tree planting. This can be achieved by making informed design decisions about materials based on quantified carbon reductions.

[16] Para 94 Building Regulations Part L(2).

A recipe for achieving Net Zero carbon development

Setting the right brief and targets is key

73. To achieve Net Zero carbon in reality it is important that the development design brief and its Key Performance Indicators (KPIs) reflect this ambition from the start. Getting the right people involved at the right points in the design and construction timeline is critical, including specialists in low energy and zero carbon design. The key steps up to building handover are set out in the **Error! Not a valid bookmark self-reference.** below, showing a timeline for design and construction. See Appendix 4 for a more detailed breakdown by RIBA design and construction stage.

PRE-PLANNING

Setting the brief and getting the right team

- Include Key Performance Indicators (KPIs) requirements in the brief
- Appoint the relevant consultants
- Require the assessment of embodied carbon particularly for medium to large scale developments.

Design considerations

- Optimise building form, orientation and window proportions
- Define building fabric performance e.g. U-values
- Allow sufficient thickness for all insulated walls, roofs and floor
- Incorporate Mechanical Ventilation with Heat Recovery (MVHR)
- Define airtightness strategy
- Consider low carbon heating options e.g. heat pumps
- Design roof to maximise renewables i.e. solar panels
- Carry out embodied carbon assessment

PRE-CONSTRUCTION

Detailing, specification and choosing the right products

- Include KPI requirements in the tender
- Detail build ups of all external elements including thickness and conductivity of all materials and contact suppliers for confirmation of U-values
- Identify all thermal bridges and conduct thermal bridge calculations
- Define airtightness testing requirement for contractor
- Specify high performing solar panels
- Agree scope of post-occupancy evaluation.

CONSTRUCTION

On-site quality inspections

- Run an ultra low energy workshop on site. Encourage contractor and team training to all attend.
- Review alternative materials or products proposed by the contractor and ensure these meet performance requirements to achieve KPIs
- Attend regular site visits and develop site quality tracker to assess against KPIs
- Witness commissioning of ventilation and heating systems.

HANDOVER AND USE

Handover and use

- Provide building user guides and instructions e.g. sticker on MVHR for filter replacement routine
- Carry out lessons learnt review
- Carry out post occupancy evaluation (POE) during the first five years of use to verify KPIs have been met
- Ideally, publicise performance against all KPIs and POE reports e.g. on a company website

Best Practice Route

- Appoint Passivhaus consultant
- Energy (PHPP) modelling carried out by Passivhaus consultant to accurately predict energy use
- Detailed U-value calculations and thermal bridge analysis
- Regular inspections on-site by Passivhaus certifier
- Clear responsibility for airtightness and several air testing to meet requirements
- Passivhaus certification
- Final as-built energy (PHPP) model provided at hand-over

Figure 8: Timeline for design and construction

Getting the design right

74. Making informed decisions at an early design stage is key to delivering energy efficiency in practice. A building's form, orientation and window proportions are all aspects that do not add extra construction cost, but if optimised within the design can significantly improve the building's efficiency (see figure 9).

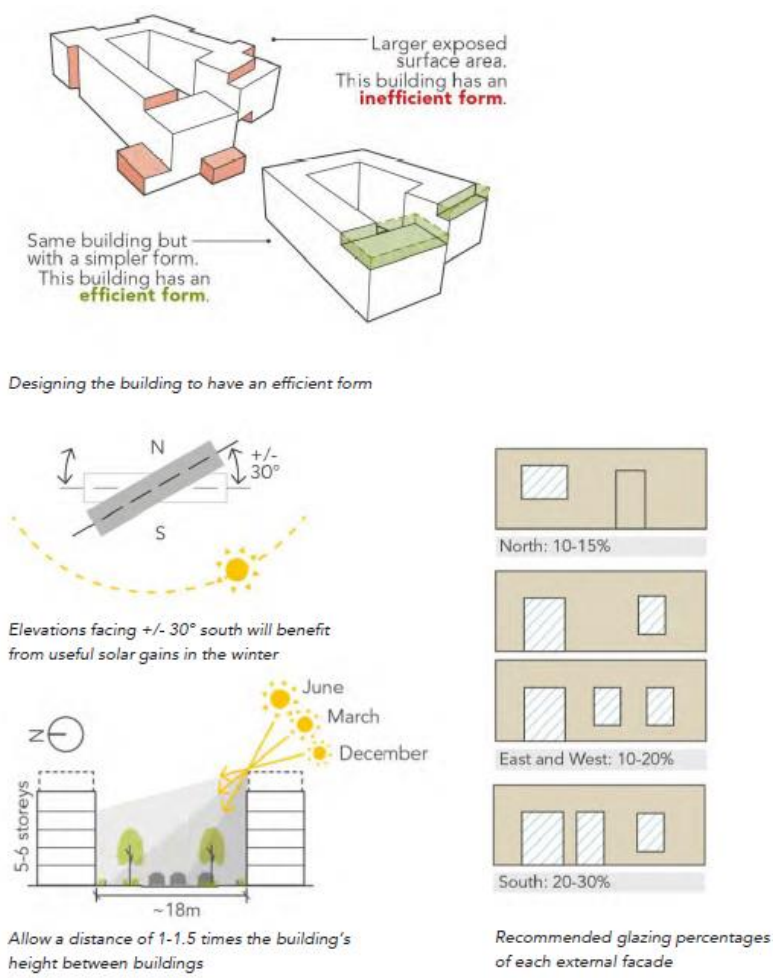

Figure 9: Optimising design (Source: Levitt Bernstein + Etude)

Building form and orientation

75. The building form should be as simple and compact as possible to reduce the surface area exposed for heat loss. Avoid or limit the use of stepped roofs, roof terraces, overhangs and inset balconies. These features will decrease the building's energy efficiency.

76. The orientation and massing of the building should be optimised to allow useful solar gains and prevent significant overshadowing in winter. Encourage south facing dwellings with summer solar shading and prioritise dual aspect.

Window proportions and thermal performance

77. Getting the right glazing-to-wall ratio on each façade is a key feature of energy efficient design. Minimise heat loss to the north (smaller windows) while providing sufficient solar heat gain from the south (larger windows). In a block of flats it is much easier to design smaller windows facing access decks and larger windows facing balconies. Therefore, try to orientate access decks to the north and balconies to the south.

Fabric first approach

78. Specifying a high level of thermal efficiency and airtightness of the building fabric, and for the thermal performance of elements such as doors and windows is critical to reducing energy demand. The LETI Climate Emergency Design Guide provides best practice thermal specifications for building elements cited in this SPD. It is equally important that high standards are maintained in the construction process[17] to deliver the full thermal efficiency potential of the materials used.

Consider Passivhaus tools and certification

79. Passivhaus certification is considered a robust means to meet the space heating demand and Energy Use Intensity KPIs. It also drives quality assurance during construction. A Passivhaus 'certifier' will be required to act as an impartial quality assurance check on predicted performance during design and to carry out site inspections. Appendix 3 provides some recent examples of Passivhaus developments. For housing the Passivhaus Design Easi Guide provides further good practice advice.

80. Whether or not the Passivhaus approach is adopted, accurate energy modelling is recommended. Passivhaus tools can be used whether or not Passivhaus accreditation is for example the Passive House Planning Package (PHPP 10). Alternatively CIBSE TM54 Evaluating operational energy use at the design stage (2022).

81. It is also possible to target best practice by setting the right fabric specification and design requirements as part of the project brief, and this approach may be more cost effective for smaller developments in particular. The LETI Climate Emergency Design Guide sets out more detailed thermal and other building fabric performance specifications that need to be met to achieve the KPIs recommended in this design guide.

Future proofing heating technology

82. As previously noted an essential feature of net zero carbon buildings is the use of low carbon sources of heat with no connection to the gas network. Heat pumps[18] are considered the most efficient low carbon heat source, significantly more efficient than direct electric heating as they generate 3-4 units of heat for each unit of electricity used. They should be specified wherever possible.

83. If specification of a gas or oil-fired boiler cannot be avoided in a new build, the CCS accompanying the planning application should directly address all the following matters in this section, as part of achieving or getting as close as is practicable to zero carbon readiness.

84. A responsible designer should ensure that the building can be easily retrofitted by making adequate provision in the initial design to ensure that a heat pump can be installed in the future with a minimum of cost and disruption. Any proposed building that would require extensive modifications to fit and efficiently operate with a heat pump cannot be considered local plan compliant in terms of being future proofed for climate change, let alone zero carbon ready.

85. A heat pump system typically requires a dedicated external space for a heat pump unit, sites where its operational noise will not disturb occupants or neighbours' sleep, and internal space nearby for a control system and a hot water cylinder. Sufficient space will be needed in the building and its curtilage, and these future installation spaces should be clearly identified on submitted plans.

86. Wherever a typical 'wet' heating system is installed with a gas or oil boiler feeding radiators or underfloor heating, the designer must ensure that the pipe diameters and heat radiating

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[17] Further information on construction standards and airtightness is provided in the accompanying document.
[18] Further information on heat pumps is provided in the accompanying document.

fixtures are sufficiently large to supply enough heat when attached to a heat pump with a lower flow temperature. The level of building insulation and thermal efficiency may also be relevant. Making changes retrospectively to the building fabric or to the heating system is likely to be costly and disruptive.

87. For an air-to-water heat pump BS EN 14511[19] specifies a return and flow temperature of 40ºC and 45ºC respectively. The Building Regulations Part L (2021), Annex D, provides a reference design flow temperature value of 45ºC for air source heat pump and radiators in a new dwelling. Note that heat pumps are usually more efficient operating at 30-35⁰C, and the Building Regulations set a maximum flow temperature of 55⁰C for residential gas boilers[20].

Designing out overheating risks

88. This section focuses on overheating risks can be reduced by good design and site masterplanning decisions early in the building design process. The aim should be to avoid unnecessary additional carbon emissions by using natural and design-based ventilation and cooling mechanisms, resorting to air conditioning only where there is no practicable alternative.

89. At building level, the Building Regulations regulate overheating (Part O: Overheating) and ventilation (Part F) based on the detailed building design. Part O applies to residential development only, requiring that all practicable passive means of limiting unwanted solar gains and removing excess heat have been used first before adopting mechanical cooling. Where the Building Regulations compliance process includes thermal modelling, the modelling process should include a summer design year (DSY) file with 2050 and 2080 climate scenarios. Building Regulation compliance outputs may usefully form part of the information provided under CCS section 5.

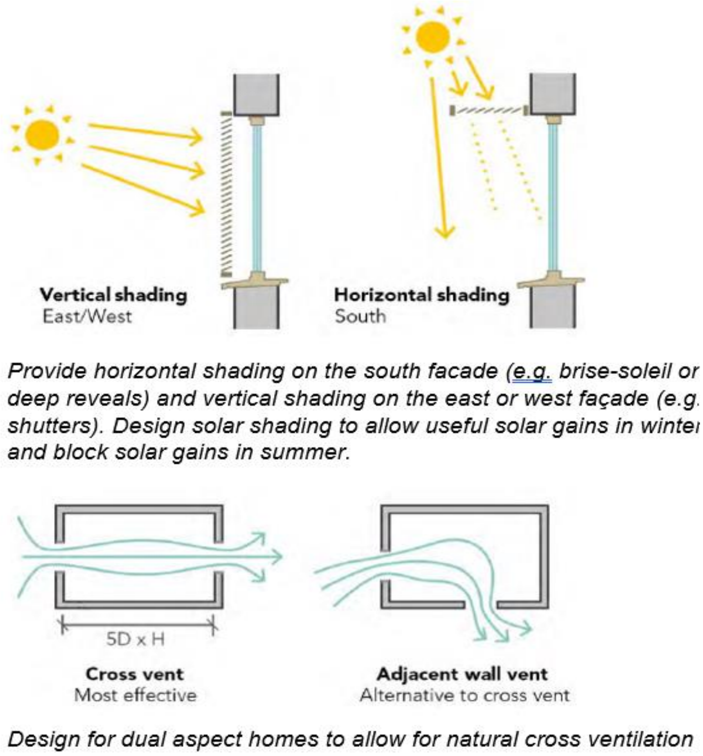

Figure 10: Overheating reduced by good design

[19] BS EN 14511: 2022 - Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling
[20] Part L 5.10

90. Design measures to avoid overheating include the following

- Ensuring glazing areas are not excessive i.e. not more than 20-25% of facade on south or west façades.
- Avoiding fixed panes and maximise opening areas of windows. Side hung windows typically allow more ventilation than top hung.
- Favouring dual aspect homes and other buildings to allow cross ventilation.
- Providing appropriate solar shading. South façades should have horizontal shading over the window and the west façade should ideally have movable vertical shading e.g. shutters.
- Avoiding relying on internal blinds, which can be removed by residents.
- Selecting a g-value (the solar factor indicating how much heat is transmitted from the sun) for glass of around 0.5 where possible.

91. For residential developments use of the Good Homes Alliance Overheating in New Homes Checklist (reproduced at Appendix 2) is recommended for overheating risk assessment early in the design process. It is intended to be used prior to the detailed design stage before planning submission and approval. Parts of the tool will also be useful for non-residential development.

92. A balanced approach is needed to optimise natural daylight, maximise winter solar gain, avoid excess summer solar gain and achieve good indoor air quality with high airtightness standards. Where noise is also a consideration use the Acoustics and Noise Consultants (ANC) Acoustics, Ventilation and Overheating Residential Design Guide to determine an approach to acoustic assessment.

On-site renewable energy generation

93. As noted under KPIs, net zero carbon in operation can only be achieved by meeting the energy needs of the development using renewable electricity generation provided for the development, as fossil fuels are still used to produce mains electricity.

94. Solar PV panels installation is the recommended approach, a simple, mature and reliable renewable energy technology. They are a particularly good match for heat pumps, as much of the electricity generated outside peak use periods can be used to heat water or charge electric vehicles for later use. PV tiles are an alternative that may be more appropriate on heritage buildings or in conservation areas. Further information on PV systems is provided in the companion technical document to this SPD, the best examples convert solar energy more efficiently and have a longer lifespan.

95. A key advantage of PV is that it can be usually provided on-site as part of the development process without additional land take. The majority of new homes have sufficient space on site to generate as much energy as they need on an annual basis, especially if the roof design is optimised to make best use of southerly aspects. PV can also be mounted over parking areas and on south facing walls. The latter is less efficient than roof mounting but it can improve power generation in winter months when the sun is lower and energy demand is higher.

Embodied carbon

96. For development embodied carbon emissions are associated with the extraction, processing, production and transportation of building materials and products, and in the construction of the building. Embodied carbon arises after the building is completed from its maintenance and the demolition and disassembly of the building at the end of its life.

97. Whilst embodied carbon is not currently (2023) covered by the Building Regulation or any other statutory controls, over time embodied carbon will become and even more significant proportion of whole-life carbon and commensurately more important to achieving zero carbon development. This is because:

    - Carbon emission from operational energy consumption will reduce independently of measures by developers or occupier behaviour as the National Grid decarbonises electricity supply
    - As new buildings become more energy efficient to run and switch to low carbon heating sources, operational carbon emission will become a smaller proportion of total carbon emissions than they are currently.

98. As building materials typically account for around 60-70% of the embodied carbon in a development, it is essential to consider embodied carbon at the start of the design process. Low embodied carbon design is not inherently more expensive or more complex, it just requires awareness, good design and specification informed by design the use of appropriate carbon calculation tools for building products, systems and processes.

99. Developers should demonstrate in their CCS submissions that they are taking active steps to reduce the embodied carbon and embed a sustainable approach to resource use in their developments, for example by an appropriate combination and balance of the following measures, wherever applicable and feasible.

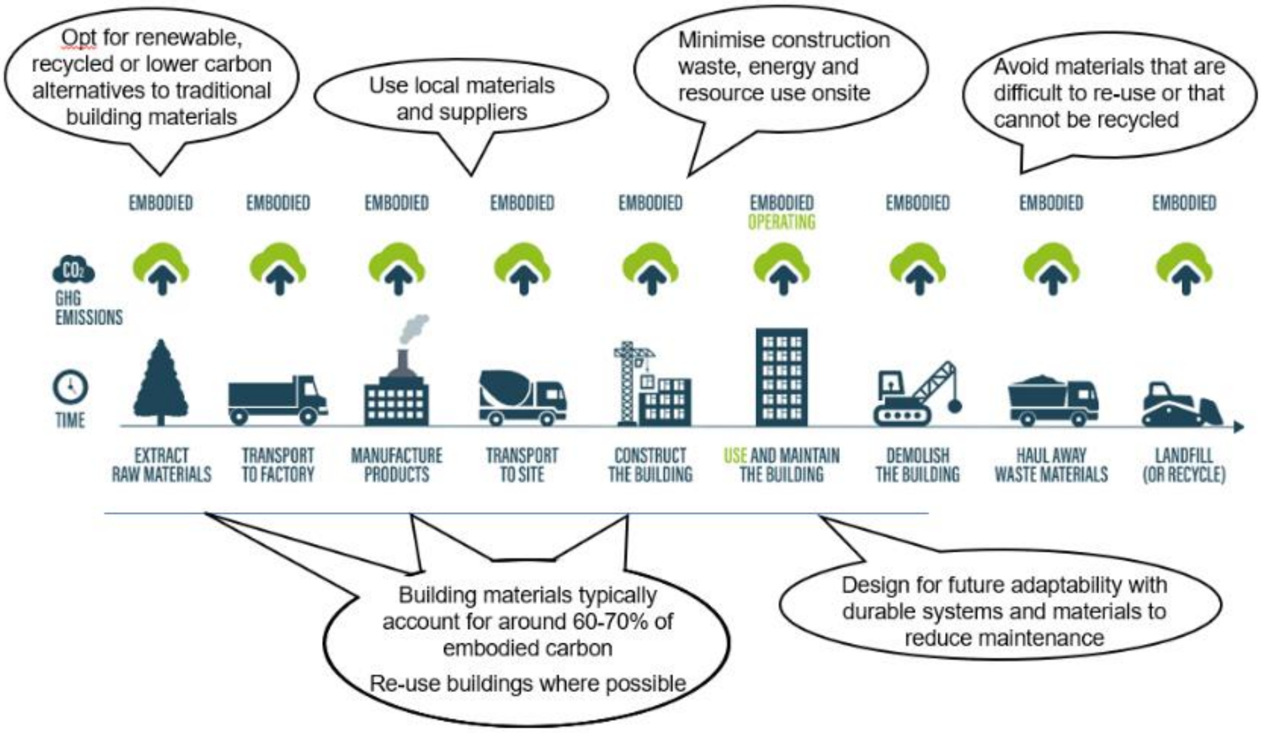

Figure 11: Reducing carbon emissions embodied in construction[21]

[21] Image copyright and re-used with the permission of Buildpass

What can you do?

1 **Refurbishment over new build**
Only build new when existing homes cannot be reused or refurbished.

2 **Lean design**
Structural: Design structure for 100% utilisation. Use bespoke loading assumptions, avoid rules of thumb. Reduce spans and overhangs.
Architectural: Use self-finishing internal surfaces. Reduce the quantity of metal studs and frames.
Building services: Target passive measures (e.g. improved fabric) to reduce the amount of services. Reduce long duct runs, specify low Global Warming Potential (GWP) refrigerant (max. 150) and ensure low leakage rate.

3 **Material and product choice**
Prioritise materials that are reused, reclaimed or natural from local areas and sustainable sources and that are durable. If not available use materials with a high recycled content. Use the following material hierarchy to inform material choice particularly for the building structure;

1. Natural materials e.g. timber
2. Concrete and masonry
3. Light gauge/Cold rolled steel
4. Hot rolled steel

Ask manufacturers for Environmental Product Declarations (EPD) and compare the impacts between products in accordance with BS EN 15804

4 **Housing adaptation & flexibility**
Allow for flexibility and consider how a layout may be adapted in the future.

5 **Easy access for maintenance**
Maintained equipment will last longer.

6 **Design for disassembly**
Consider disassembly to allow for reuse at the end of life of the building. Create material passports for elements of the building to improve the ability of disassembled elements to be reused.

Figure 12: Design for adaptation using a flexible floor plan e.g., one bed flat can be converted to a two bed fat or a one bed fat with space for home working.

Facilitating sustainable transport

100.Carbon emissions reductions can be made by reducing the need to travel, and by enabling lower carbon travel choices such as active travel (walking and cycling) for trips that need to be made.

101.Convenient and secure cycle storage is effective in encouraging journeys by bike. Consider how can they be integrated into the design. See the NFDC Parking Standards SPD (2022) for further guidance.

102.Consider how the home can support effective homeworking to help reduce unnecessary commuting. Are there sufficient plug and internet connectivity sockets? Is there room for a home office space?

103.The Building Regulations now require that new properties be supplied with electric vehicle charging points, in most circumstances. Faster and higher capacity chargers will be helpful especially for households with more than one electric vehicle.

Building for a healthy life

104.The Building for a Healthy Life (BFHL) design approach is recommended to help achieve active, well-connected and healthy communities, including by promoting sustainable movement and active travel. BHFL is backed by the NHS and endorsed and use by Homes England. BFHL is a collaborative design approach and process based on twelve design considerations organised into three themes: integrated neighbourhoods, distinctive places and streets for all. THE BFHL approach is aligned to Manual for Streets, the NPPF and the National Model Design Code.

105.The twelve BFHL considerations should be addressed from the start of the design process. The recommended approach is for the council and developers to discuss and agree at pre-application advice stage what best practice outcomes can and should be achieved under each consideration for that particular site and development.

106.The BFHL process culminates in an independent assessment of the development proposal, rating each consideration as green (achieves best practice), red (stop and rethink) or amber (try and improve). The aim is to achieve 12 green ratings where possible, and no avoidable amber ratings (some outcomes might be beyond the developer’s control, e.g. if they require unobtainable access to third party land). As the target best practice outcomes are tuned for the specific development, all red ratings are avoidable and should be designed out.

Drought resilience and using water efficiently

Reducing mains water use

107.New Forest District is within a wider water stressed area identified by the Environment Agency. Current rainfall levels already make it challenging to sustainably meet mains water demand without adversely affecting nationally and internationally protected habitats. The climate trend to drier and hotter summers may exacerbate these issues, increasing the frequency of periodic controls such as summer hosepipe bans.

108.Making more effective use of both mains and natural water resources will become an increasingly important part of living within environmental limits, with beneficial CO_2 emission savings possible from cumulative reductions to water supply and treatment. The measures in this section build on the SUDs approach that treats naturally available water on development sites as a valuable resource.

109.The Building Regulations set mains water use standards. Local Plan **Policy IMPL2: Development Standards** requires that new residential development meets the higher Building Regulations water efficiency standard of under 110 litres per person per day.

110.For residential developments in particular, more water efficient and sustainable measures are encouraged to help reduce water use further, to future-proof developments. Southern Water are championing Target 100, supporting personal consumption reductions to achieve a 100 litre per person per day standard.

111.More efficient water fittings and appliances will help, provided they are not later replaced with less efficient systems. Wherever appropriate water use efficiency should be evaluated using the 'Fittings Based Approach' as set out in section 2 and Tables 2.1-2.2 of Buildings regulations Approved Document G: Sanitation, hot water safety and water efficiency.

112.More enduring approaches could include rainwater harvesting (RWH) and grey water recycling (GWR) systems to reduce demand for treated mains drinking water for non-potable uses. The simplest example of rainwater harvesting is a water butt for garden watering and outdoor cleaning, connected to guttering downpipes. A roof of 60sqm (a typical terraced house) would receive around 5,000 litres rainfall per annum in Southern England. More sophisticated rainwater harvesting systems are encouraged, such as rainfall storage tanks integrated into plumbing systems for non-potable use (potable use may be possible where on-site treatment is practicable).

113.Greywater recycling is the re-use of wastewater from sinks, showers, baths, washing machines or dishwashers, usually for non-potable use: to flush toilets, wash clothes and water gardens or green spaces. About 70% of water used in the home is discharged as greywater, so unlike rainwater it is a seasonally consistent source of water for re-use. In-home re-use requires installation of a 'dual' plumbing system, which is most cost-effective to provide during construction.

Drought resilience in the public and private realm

114.To be self-sustaining and climate resilient, planting strategies for both public spaces and private gardens will need to consider both the warming climate and potentially available water. Equally, the design of the built environment and choice of drainage approach and mechanisms should ensure that naturally available water supports the green and blue infrastructure provided, now and in the future.

115.The alignment of green infrastructure and SUDs provision is an obvious opportunity to improve drought resilience. The default use of permeable materials for hard surfaces and bio-retention mechanisms such as rain gardens, swales and green rooves are recommended wherever practicable, to enable natural infiltration to support groundwater recharge as well as to reduce or slow drainage run-off. Scope to use runoff in SUDs or storage tanks for greenspace watering and public realm cleaning could also be explored if necessary e.g. in more urbanised contexts. Other useful resources include:

- Watersafe: Developing Water Efficient Homes
- Waterwise: Advice on Water Efficient Homes for England

Reducing flood risk through Sustainable Urban Drainage (SuDS)

116.Changes to our climate are predicted to result in increased rainfall and greater risk of flooding, including from the inundation of existing drains not designed for current conditions.

117.National Planning Practice Guidance on Flood risk and coastal change was significantly updated in 2022, requiring that flood risks including surface water management is fully considered from the outset of the planning application and Local plan-making processes.

118.NPPG changes reflect the National policy position that 'major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate[22]'. Integrating SuDS into a development can greatly improve the site's ability to capture, absorb and effectively retain water as part of a comprehensive green infrastructure design. Compared to the traditional approach of using underground pipes and tanks discharging to sewers to manage drainage, a surface-based SUDs approach can reduce total surface water run-off and support local drainage networks to function effectively, reducing the risk of flooding and untreated sewage discharges from overloaded sewers.

119. Where SUDs are provided, SUDs design should underpin the earliest stages of site masterplanning following the approach set out in the Construction Industry Research and Information Association (CIRIA) SUDs Manual (C753). The SUDs Manual explains how to maximise SUDs benefits for water quantity, water quality, amenity and biodiversity (the '4 pillars' of SUDs). The CIRIA approach treats surface water as a valuable resource that if appropriately managed can improve climate change resilience, enhance biodiversity, and add to the beauty and amenity of developments.

120. Provided that they are constructed in accordance with the SUDs Manual, water companies may formally adopt SUDs as part of the drainage network they manage. This is an outcome developers should actively pursue.

121. CIRIA guidance C808 Using SuDS to reduce phosphorus in surface water runoff (December 2022) explains how SUDs design can mitigate at source environmental impacts from phosphorus on the water environment. This approach addresses pollution impacts at source in accordance with the proximity principle, reducing the nutrient mitigation cost for the development. It should be followed for development in the Avon catchment. Additional funding is secured to extend this guidance to mitigating nitrogen runoff, and once published (anticipated mid 2023) this approach should be followed in Solent catchments.

Managing residual flood risks

122. NFDC considers that the updated NPPG approach and the requirements it places on developers to prepare flood risk assessments is now sufficiently precautionary to ensure early and more holistic consideration of water flood risks, including allowances for climate change[23]. But that there will still be some residual risks in some locations from infrequent extreme events, and these need to be recognised and properly addressed in the design approach.

123. Where flood risks cannot be fully eliminated but development is on balance justified under national policy, the overall development design should include a strategy to safely manage (absorb, channel, contain or delay) flows that exceed the design capacity of the drainage system, including any SUDs, specified in accordance with CIRIA Designing for exceedance in urban drainage - good practice (C635F). This document provides best practice advice for the design and management of urban sewerage and drainage systems to reduce or mitigate the impacts that arise when flows occur that exceed their design capacity. Example measures could include the design of safe and resilient flood overflow routes and temporary flood storage areas.

124. Where necessary flood resilience should also be designed into buildings, following the CIRIA Code of practice for property flood resilience (C790A) e.g. measures such as raised floor levels, water barriers to building openings or the use of materials or siting of services that would reduce recovery time and cost if a building is flooded.

Supporting ecology and biodiversity

125. NFDC has declared a nature emergency as well as a climate emergency, as they are inextricably linked. Enhancing biodiversity and providing green and blue infrastructure is

[22] NPPF para 169

[23] Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)

encouraged in new developments. It will help to increase the capacity of the environment to absorb CO_2 emissions in the local area. Maintaining and enhancing biodiversity and green infrastructure will also benefit occupants, the wider community and economy by supporting health and wellbeing, providing surface water management and flood resilience, absorbing pollutants improving local air quality, providing local shading and wider air cooling, as well as providing habitats for wildlife.

126. Since 2020 NFDC has sought a minimum of 10% biodiversity net gain as a requirement of planning permission for 'major' new build development (10+ homes, or at least 1,000 sqm of other development), pursuant to Local Plan **Policy STR1: Achieving Sustainable Development**. Further details are set out in the Ecology and Biodiversity net gain - Interim Advice and Information Note. Updated guidance will be provided in a Biodiversity Supplementary Planning Document to follow during 2023.

Appendices

Appendix 1: Local Plan 2020 - climate change related policies

Policy STR1: Achieving sustainable development

All new development will be expected to make a positive social, economic and environmental contribution to community and business life in the Plan Area by

v. Ensuring communities and workers are safe and feel safe, and the risks to people, places and to the environment from potential hazards including pollution, flooding and climate change effects are minimised;

vi. Ensuring that new development is adaptable to the future needs of occupiers and future-proofed for climate change and innovations in transport and communications technology.

Policy ENV3: Design quality and local distinctiveness

… New development will be required to: …

v. Incorporate design measures that improve resource efficiency and climate change resilience and reduce environmental impacts wherever they are appropriate and capable of being effective, such as greywater recycling and natural heating and cooling, and the use of Sustainable Urban Drainage Systems (SUDS); …

Policy CCC1: Safe and healthy communities

iv. In the interests of public safety, vulnerable developments will not be permitted (a) Within the defined Coastal Change Management Area at Barton-on- Sea to Milford-on-Sea unless in accordance with Saved Policy DM6: Coastal Change Management Areas; (b) In areas at risk of flooding unless in accordance with the sequential and exceptions tests

Policy CCC2: Safe and sustainable travel

New development will be required to:

i. Prioritise the provision of safe and convenient pedestrian access within developments, by linking to and enabling the provision of more extensive walking networks wherever possible, and where needed by providing new pedestrian connections to local facilities;

ii. Provide or contribute to the provision of dedicated cycle routes and cycle lanes, linking to and enabling the provision of more extensive cycle networks and providing safe cycle routes to local schools wherever possible …

v. Incorporate infrastructure to support the use of electric vehicles …

Policy IMPL2: Development Standards

New development will meet or exceed the following standards and requirements to help minimise their environmental impact and/or to be adaptable to the future needs of occupiers over their lifetime…

ii. The higher water use efficiency standard in accordance with Part 36(2) (b) of the Building Regulations, currently a maximum use of 110 litres per person per day.

iii. New commercial developments of 250 - 999 sqm gross internal area (GIA) are required to achieve Building Research Establishment Environmental Assessment Method (BREEAM) excellent standard in the water consumption criterion. Commercial development of 1,000 sqm or more GIA is also required to achieve BREEAM excellent standard overall.

v. Provision of a high-speed fibre broadband connection to the property threshold.

vi. Provision to enable the convenient installation of charging points for electric vehicles in residential properties and in residential, employee and visitor parking areas.

Saved Policy DM6: Coastal Change Management Area (CCMA)

[Defines an area where development is restricted due to erosion and land instability risks].

Appendix 2: Good Homes Alliance early stage overheating risk tool

127.The Good Homes Alliance website[24] provides guidance on use of the tool.

EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

Good Homes Alliance

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes.

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | **KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING**

Geographical and local context

Key factors increasing the likelihood of overheating		Score
#1 Where is the scheme in the UK? See guidance for map	South east	4
	Northern England, Scotland & NI	0
	Rest of England and Wales	2
#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	3
	Grtr London, Manchester, B'ham	2
	Other cities, towns & dense sub-urban areas	1

Key factors reducing the likelihood of overheating	Score
#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context	1

Site characteristics

Key factors increasing the likelihood of overheating		Score
#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	**Day** - reasons to keep all windows closed	8
	Day - barriers some of the time, or for some windows e.g. on quiet side	4
	Night - reasons to keep all windows closed	8
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4

Key factors reducing the likelihood of overheating	Score
#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	1
#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	1

Scheme characteristics and dwelling design

Key factors increasing the likelihood of overheating	Score
#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	3
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	3

Key factors reducing the likelihood of overheating		Score
#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance		1
#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans	>2.8m and fan installed	2
	> 2.8m	1

Solar heat gains and ventilation

Key factors increasing the likelihood of overheating		Score
#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space	>65%	12
	>50%	7
	>35%	4
#7 Are the dwellings single aspect? Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation	Single-aspect	3
	Dual aspect	0

#13 Is there useful external shading? Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per **#6**		Full	Part
	>65%	6	3
	>50%	4	2
	>35%	2	1

#14 Do windows & openings support effective ventilation? Larger, effective and secure openings will help dissipate heat - see guidance	Openings compared to Part F purge rates:	= Part F	+50%	+100%
	Single-aspect	minimum required	3	4
	Dual aspect		2	3

TOTAL SCORE [ ] = Sum of contributing factors: [ ] *minus* Sum of mitigating factors: [ ]

High — 12 — Medium — 8 — Low

score >12: Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	**score between 8 and 12:** Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	**score <8:** Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)

[24] https://goodhomes.org.uk/wp-content/uploads/2019/07/GHA-Overheating-in-New-Homes-Tool-and-Guidance.pdf

Appendix 3 Case studies for new build

Ultra low energy design is fast becoming the new normal

128. The energy efficiency of new homes is increasing year on year. Many self-builders and developers go beyond building regulations for energy efficiency because it makes sense. Not only can low energy building be cheaper to run, they can be easier and cheaper to maintain and crucially, will not need further expensive retrofit in the future.

Beautiful and efficient homes

129. Lark Rise in the Chiltern Hills is certified to Passivhaus Plus standards. It is entirely electric, and generates 2.5 times as much energy as it consumes in a year. Carefully optimised design has meant that it has a mostly glazed facade, minimal heat demand and stable temperatures over summer months.

Passivhaus/Ultra-low energy can be delivered at scale

130. Developers are building Passivhaus at scale. At the lower end Hastoe's development at Wimbish, Essex is a mixture of 14 houses and flats. certified to Passivhaus standards. The and average heating costs for the houses are £130/year (2020). The development is operating as designed and has effectively eliminated the 'performance gap'.

131. Other examples include Springfield Meadows in Oxfordshire and Agar Grove in Camden At nearly 500 homes Agar Grove estate regeneration in Camden, London, will be the largest Passivhaus development in the UK once completed. Phase 1A is occupied.

Lark Rise, Chiltern Hills. Passivhaus Plus certified. (Source: Bere:architects)

Springfield Meadows (Source: Greencore construction with Bioregional)

Wimbish, Passivhaus certified. (Source: Hastoe Housing Association)

Appendix 4: What to do when? Checklist for design and construction

RIBA Stage 2 & 3

RIBA Stage 2 - Concept Design	✓
Optimise building orientation to balance solar gain and increase south facing roof area. Design roof to maximise density of renewables.	
Calculate and report the building form factor for design options.	
Arrange embodied carbon workshops with design team to target lean design principles and reduce big tickets items e.g. structure.	
Identify design team members to carry out embodied carbon assessment. Carry out multiple embodied carbon calculations of key elements to demonstrate low carbon design choices.	
Mark-up insulation line on all plans and sections. Mark unheated external areas on plans.	
Allow sufficient wall construction thickness for all insulated walls, roofs and floors.	
Mark window openings for providing natural ventilation for summer comfort.	
Identify a location for the MVHR next to an external wall.	
Carry out preliminary overheating risk assessment using the Good Homes Alliance overheating checklist.	
Carry out initial PHPP model.	
For projects using Passivhaus certification this is a good time to consider an appointment.	

RIBA Stage 3 - Spatial Coordination	✓
Review mark-up of insulation line on all plans and sections and carry out initial U-value calculations.	
Carry out heating options appraisal including a low carbon option.	
Hold a thermal bridge workshop. Include the structural engineer for review of columns, masonry support etc.	
Provide MVHR layout including duct distribution and measurement of intake and exhaust duct lengths to external walls for sample dwellings.	
Carry out full embodied carbon assessment of whole building and compare against embodied carbon target. Implement reductions where necessary.	
MEP consultant to review embodied carbon impact of services and reduce the amount of kit where possible. Use CIBSE TM65 embodied carbon in building services to assess impact.	
Carry out PHPP modelling alongside SAP calculations. List all model assumptions including U-values, thermal bridges and system specifications etc.	
Carry out overheating assessment and eliminate overheating through passive strategies where possible (TM59). Ensure all element assumptions match PHPP and SAP models.	
Calculate electricity generation intensity of PV arrays and review against KPI.	
Define airtightness strategy and identify airtightness line on plans and sections.	
Measure heating and hot water pipe lengths for sample dwellings. Minimise distribution or standing losses.	
Demonstrate distribution losses have been calculated and reduced.	
Prepare RIBA Stage 3 report and include predicted operational cost to tenant.	

MVHR: Mechanical Ventilation with Heat Recovery

PHPP: Passivhaus Planning Package

This design checklist provides a list of key actions that should be carried out at each work stage to meet the KPI targets for new homes.

This should be shared with the design team to check off after each stage is complete.

Checklist for design and construction: RIBA Stage 3+, 4,5 & 6

RIBA Stage 3+ - Early Technical Design (and tender)	✓
Detail build-ups of all external elements including thickness and conductivity of all materials.	
Detailed U-value calculations (including masonry support system, etc.).	
Identification of all thermal bridge junction types (e.g. parapet A, parapet B).	
Thermal bridge calculations for a selection of the most important junctions.	
Definition of airtightness testing requirements for contractor.	
Include requirements for Environmental Product Declarations (EPD) in the tender. Make EPDs obligatory for structural materials, primary façade and any other major materials.	
Include KPI requirements in the tender.	
Agree scope of Post-Occupancy Evaluation in tender. Identify level of participation from contractor and design team.	

RIBA Stage 4 - Technical Design (in addition to Stage 3+)	✓
Develop junction details for window and doors.	
Review airtightness line on each drawing and identification of airtightness requirements for service penetrations.	
Carry out a thermal bridge workshop to review thermal bridge lengths and calculate Psi-values for all junctions.	
Review MVHR layout including duct distribution and measurement of length of intake and exhaust ducts for all homes.	
Measure heating and hot water pipe lengths for all communal areas and homes.	
Carry out embodied carbon assessment of whole building using accurate Bills of Quantities.	
Specify high performing PV panels.	

RIBA Stage 5 - Manufacturing and Construction	✓
Run an introduction to ultra-low energy construction workshop on-site.	
Encourage site manager and team training on construction quality requirements covering insulation and airtightness.	
Prepare toolbox talk information for site team inductions on low energy construction quality.	
Review alternative materials or products proposed by the contractor. Ensure substitutions do not compromise the thermal performance or embodied carbon target.	
Carry out regular construction quality assurance site visits and reports (depending on the size of the scheme – at least six) in tandem with regular visits.	
Develop site quality tracker, assess against KPIs and update regularly.	
Require leak finding airtightness tests at first fix and second airtightness test pre-completion.	
Witness commissioning of MVHR systems and heating system.	
Carry out predicted in-use energy model of each building leading to the final 'as built' PHPP model.	
Consider recalculating embodied carbon using 'as built' information.	

RIBA Stage 6 - Handover	✓
Provide building and operational information to residents in the form of site inductions and simple building user guides and instructions (e.g. sticker on MVHR for filter replacement).	
Consider embodied carbon as part of the replacement and maintenance strategy and include in the O&M manual.	
Carry out post-occupancy evaluation during first 5 years of use and verify KPIs have been met.	
Lessons learnt project review with design team.	
Publicly report KPIs.	

New Forest DISTRICT COUNCIL

Separate Companion Document

Supporting Our Community