ADOPTION STATEMENT for the SUSTAINABLE DESIGN AND CONSTRUCTION SUPPLEMENTARY PLANNING DOCUMENT

Reading Borough Council formally adopted the Sustainable Design and Construction Supplementary Planning Document on 16th December 2019.

This document is a Supplementary Planning Document (SPD). It provides supplementary information to support policies in the Reading Borough Local Plan, adopted in November 2019. It relates particularly to the sustainability policies of the Local Plan, specifically policies CC2, CC3, CC4, CC5, EN18 and H5. It replaces the previous Sustainable Design and Construction SPD, adopted in July 2011.

Any person with sufficient interest in the decision to adopt the SPD may apply to the High Court for permission to apply for judicial review of that decision. Such an application must be made promptly and in any event not later than Monday 16th March 2020.

A copy of the SPD is available for inspection at Reception, Ground Floor, Civic Offices, Reading, between 9am and 5pm Monday to Friday. Copies are also available for viewing at all Reading Borough Public Libraries, during normal library hours. The SPD and associated documents (including a Consultation Report including responses to comments received on the document) can also be viewed on the planning pages of Reading Borough Council's website, at www.reading.gov.uk/planningpolicy.

Changes made to the Draft version (published July 2019) can be viewed on the following pages.

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Date: 17 December 2019

Relevant legislation
Planning and Compulsory Purchase Act 2004
Town and Country Planning (Local Planning) (England) Regulations 2012

CHANGES

The table below shows the changes that have been made to the July 2019 consultation draft of the Sustainable Design and Construction SPD to form the adopted version. Changes have been made for a variety of reasons, including to: address points raised during consultation; incorporate recommendations of the review of the SPD by the Council's consultants; update the document as a result of new information; correct errors; and make clarifications.

Paragraph references in the table below refer to the draft for consultation (July 2019). Consequential changes as a result of the changes below (i.e. to paragraph or page numbering) are not shown unless they form part of a wider change.

Ref	Reference in document	Change
1	Paragraphs 1.2-1.8	1.2 The Earth's cities are becoming the dominant population centres. ~~Greater~~ The Reading ~~urban area~~ hosts approximately 4% of the UK population. The design and construction of the built environment is highly significant in ~~the~~ determining the impact that the residents of Reading will have on the local and global environment. 1.3 Reading Borough Council has declared a Climate Emergency, and set out its commitment to ~~become a zero carbon city by 2050~~working to achieve a carbon neutral Reading by 2030. ~~It~~ We also needs to consider carefully how ~~it~~ Reading adapts to a changing climate, the impact that its built space has on its own natural resources and habitats as well as pollution of its ground, water and air. 1.4 The National Planning Policy Framework (NPPF, February 2019) states in Paragraph 148: "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". 1.5 The Reading Borough Local Plan was adopted in November 2019, and this responds to the Climate Emergency by setting out ambitious but achievable standards for sustainable design and construction. It is vital that residential and non-residential schemes are built in a way that minimises their use of energy and harmful emissions, reducing and mitigating other environment impacts.

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		1.6 Everyone has a role to play in achieving the objectives of minimising pollution. This includes reducing carbon dioxide emissions, other greenhouse gases and ensuring our lifestyles are as sustainable as possible. The design of the built environment has a significant role to play in the impact that individuals have. 1.7 There is a clear role, and indeed expectation, within national and local planning policy for planning to contribute towards achieving environmental objectives. 1.8 This Supplementary Planning Document (SPD) therefore explains planning requirements with regard to energy, climate change, water management and waste reduction. It is intended to supplement the policies of the Local Plan, particularly: • CC2: Sustainable Design and Construction • CC3: Adaptation to Climate Change • CC4: Decentralised Energy • CC5: Waste Minimisation and Storage • EN18: Flooding and Drainage • H5: ~~Housing~~ Standards for New Housing
2	Paragraph 1.10	1.10 Reading ~~Borough Council~~'s existing Climate Change Strategy, entitled 'Reading Means Business on Climate Change – Reading's Climate Change Strategy 2013 – 2020' set~~s out a vision that~~ ~~'Reading's thriving network of businesses and organisations will be at the forefront of developing solutions for reducing carbon emissions and preparing for climate change. Low carbon living will be the norm in 2050.'~~ ~~The strategy sets~~ a target of reducing the Borough's carbon footprint in 2020 by 34% compared with 2005 levels. This aim has been achieved, with CO2 emissions in the Borough falling by 41% since 2005, within the top 5% of authorities in Great Britain. Reading is also a signatory to UK100 'aiming to have 100% clean energy by 2050'. ~~Reading's next climate change strategy is due in 2020. Two core elements will be incorporated: 1. a zero carbon Reading (reducing the emissions of green-house gases to net zero), and 2. adapting to the future climate.~~ 1.11 However, it is recognised that much more needs to be done at all levels, and in February 2019 the Council declared a Climate

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		Emergency. As part of this, the Council committed to playing a full role in the aim of achieving a carbon neutral Reading by 2030. However, it recognises that this aim can only be fully achieved with policy changes from local government. 1.12 In response to the Climate Emergency, a new Climate Change Strategy is in preparation through partnership working across the Borough, to set out the local actions to help achieve a carbon neutral Reading. These local actions will include implementing the measures in the Local Plan to significantly improve the environmental performance of new development. However, this is only part of the picture, and there will need to be actions cutting across all aspects of the work of the Council and its partners.
3	Paragraph 1.15	1.~~15~~17 This SPD was adopted on 16th December 2019. It followed a period of public consultation between July and September 2019, the responses to which were taken into account in preparing this final version. As an adopted ~~supplementary planning document (~~SPD~~)~~ which supplements policies in the Local Plan, this document is a material consideration in the determination of planning applications. This guidance replaces the previous Sustainable Design and Construction Supplementary Planning Document adopted on 11th July 2011.
4	Paragraphs 1.16-1.17	~~**Consultation**~~ ~~1.16 This Draft Sustainable Design and Construction SPD has been published for public consultation. This consultation will include statutory bodies, business organisations, community and voluntary groups, adjoining authorities, infrastructure providers and interested individuals. The policies supported by this SPD were consulted upon extensively during the production of the Local Plan. As the Local Plan is not yet adopted, we are consulting on the basis that it will adopted as to include the sustainability policies listed in section 1.8 above. Any changes required as a result of the Inspector's report on the Local Plan will be made, as needed.~~ ~~1.17 Your representations on the Draft Sustainable Design and Construction SPD are welcomed. Please send any comments by 5 pm on 6th September 2019 to~~ ~~planningpolicy@reading.gov.uk~~ ~~Planning Policy Team~~ ~~Planning Section~~ ~~Reading Borough Council~~ ~~Civic Offices~~ ~~Bridge St~~

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		~~Reading~~ ~~RG1 2LU~~
5	Paragraphs 2.1-2.2	**National Planning Policy Framework and recent changes to national policy** 2.1 National planning policy has changed significantly since the previous version of the Council's Sustainable Design and Construction SPD. The Secretary of State for Communities and Local Government used a Ministerial Statement in March 2015 that changed and rationalised the way planning policies should seek specific standards in new housing. It removed the Code for Sustainable Homes and introduced new additional optional Building Regulations on water and access, and a new national space standard. 2.2 A revised National Planning Policy Framework (NPPF)[2], incorporating the content of the Ministerial Statement, was published in July 2018 along with an accompanying Government response[3] to consultation on the draft version. The revised NPPF continues a commitment that Local Plans will support the transition to a low carbon future by planning for new development which reduces greenhouse gases. 2.3 The Government's Response to the Draft Revised NPPF consultation states[4]: "To clarify, the Framework does not prevent local authorities from using their existing powers under the Planning and Energy Act 2008 or other legislation where applicable to set higher ambition. In particular, local authorities are not restricted in their ability to require energy efficiency standards above Building Regulations. The Government remains committed to delivering the clean growth mission to halve the energy usage of new buildings by 2030." (pp 48) 2.~~14~~ The most recent version of the NPPF was produced in February 2019. It gives ~~National planning policy is giving~~ increasing emphasis and weight to addressing sustainability, carbon reductions, climate change and waste reduction. The ~~National Planning Policy Framework (~~NPPF~~)~~[5] states that the planning system plays an important environmental role by helping to use natural resources prudently, minimising waste and pollution and mitigating and adapting to climate change, including through moving to a low carbon economy. 2.~~2~~5 Paragraphs 148 to 165 detail measures that local planning authorities should take to support a move to a low carbon future.

Ref	Reference in document	Change
		These include planning for new development in locations and ways which reduce greenhouse gas emissions and actively supporting energy use reduction and energy efficiency improvements to existing buildings. In determining planning applications, local planning authorities should expect new development to: • comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and • take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption. [2]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf [3]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728498/180724_NPPF_Gov_response.pdf [4]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728498/180724_NPPF_Gov_response.pdf [5] National Planning Policy Framework, Ministry of Housing, Communities and Local Government (~~July 2018~~February 2019). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf ~~https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf~~
6	Paragraph 2.5	2.~~5~~8 National planning policy reflects the Climate Change Act 2008 which sets legally binding reduction targets for greenhouse gas emissions (at least 34% by 2020 and at least 80% by 2050). The Climate Change Act 2008 (2050 Target Amendment) Order 2019 subsequently committed the UK to a reduction of 100% by 2050.
7	Paragraph 2.8	2.~~8~~11 Reading's existing Climate Change Strategy 2013 – 2020, "Reading Means Business on Climate Change" set~~s~~ a target of reducing the carbon footprint of the B~~b~~orough by 34% in 2020 compared with levels in 2005. This ~~will~~ require~~d~~ a reduction of around 7% annually. Of the strategic priorities identified, the following are relevant to planning policy: • Energy supply – reduce electricity consumption, develop heat supply networks to deliver low carbon heat in Reading and increase the amount of energy generated locally using renewable technologies; • Low carbon development – buildings in Reading to be built to high standards of energy efficiency incorporating on-site renewable energy where possible, retrofit energy efficiency measures into Reading's buildings, minimise the 'embodied carbon' incorporated in construction projects and continue to develop planning policies that support the reduction of greenhouse gas emissions directly and indirectly from the Borough and reduce the risks of climate change to the communities of Reading; • Natural environment – improve the quality and connectivity of natural habitats; • Water supply and flooding – Manage demand for and supply of water to reduce the expected impact of water shortages on consumers and on wildlife and reduce the risk of damage due to flooding;

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		• Transport – develop a transport infrastructure which supports more low carbon travel options for people in Reading and encourage non-car travel for all sectors of the population; and • Purchasing, supply and consumption – reduce waste by supporting the re-use and repair of products and materials. 2.12 A new version of the Climate Change Strategy is in production to respond to the Climate Emergency and to set out local measures to help achieve the aim of a carbon neutral Reading by 2030. Planning policies will be part of a wide-ranging package of ambitious local measures that make up that strategy.
8	Paragraph 2.9	**Reading Borough Local Plan** 2.~~9~~13 The ~~Submission Draft~~Reading Borough Local Plan was ~~submitted to the Secretary of State in March 2018 and is expected to be~~ adopted ~~in~~ on 4th November 2019. One of the main objectives of the new Local Plan is to ensure new development and existing areas are sustainable, including reducing its effects on and adapting to climate change. The Local Plan requires development to both adapt to a changing climate and mitigate the worsening effects of climate change.
9	Paragraph 2.10	• CC2: Sustainable Design and Construction This policy seeks improved sustainability performance of buildings by setting out BREEAM requirements for non-residential developments and conversions to residential. It also sets out the general principles of sustainability in new development that applies to both residential and non-residential uses. Requiring the specified BREEAM levels will significantly contribute to achieving Reading's emissions targets, as well as mitigating the effects of climate change.
10	Paragraph 2.10	• EN18: Flooding and ~~Sustainable~~ Drainage ~~Systems~~
11	Paragraph 2.11	2.~~11~~15 The following policies provide further guidance to sustainable design and construction, but are not ~~considered to be~~ directly supplemented by this document:
12	Paragraph 2.11	• CC9: Securing Infrastructure This policy ensures that development proposals mitigate all relevant impacts on local infrastructure in order to ensure that they are sustainable. It will help to ensure that infrastructure, services and facilities are delivered according to the priorities stated in the policy.

Ref	Reference in document	Change
13	Paragraph 2.12	Applicants will be expected to adapt design and construction in order to make sustainability measures viable. If compliance cannot be achieved, applicants will need to demonstrate why not and will be expected to install the proportion of measures that are viable. Applicants must demonstrate that all options have been explored. In many cases, whole-life considerations may justify capital costs at the time of construction. For example, installation of energy-efficient technologies will likely decrease the electricity and gas costs for users over ~~of~~ the lifetime of the development. It is recognised that, in some cases, for instance retail developments, the whole-life considerations may partly depend on the occupant, and may not be fully clear at application stage.
14	Paragraphs 2.15-2.17	~~**Recent Changes to National Policy**~~ ~~2.15 The Secretary of State for Communities and Local Government used a Ministerial Statement in March 2015 that changed and rationalised the way planning policies should seek specific standards in new housing. It removed the Code for Sustainable Homes and introduced new additional optional Building Regulations on water and access, and a new national space standard.~~ ~~2.16 The Revised National Planning Policy Framework[9] was published in July 2018 along with a Government response[10] to accompany the revised NPPF. The Revised NPPF continues a commitment that Local Plans will support the transition to a low carbon future by planning for new development which reduces greenhouse gases.~~ ~~2.17 The Government's Response to the Draft Revised NPPF consultation states[11]:~~ ~~"To clarify, the Framework does not prevent local authorities from using their existing powers under the Planning and Energy Act 2008 or other legislation where applicable to set higher ambition. In particular, local authorities are not restricted in their ability to require energy efficiency standards above Building Regulations. The Government remains committed to delivering the clean growth mission to halve the energy usage of new buildings by 2030." (pp 48)~~
15	Paragraphs 3.2-3.3	3.2 To comply with the relevant policies and standards on energy, a combination of measures including those for energy efficiency, energy conservation and inclusion of renewable or low carbon sources should be considered and factored in from the design stage onwards. 3.3 Sustainability Statements typically require the developer to ~~take consideration~~ consider ~~of~~ all aspects of development form which can contribute to securing high standards of sustainable development from the outset, including but not limited to: • Energy efficiency and carbon emissions of the building;

Ref	Reference in document	Change
		• Water conservation; • Flood risk and drainage strategy; • Community impacts; • Transport; • Health and Wellbeing including day-lighting analysis and thermal comfort; • Material usage, wastage, responsible sourcing and environmental impact, including embodied carbon; • Pollution issues, low NOx, low global warming potential (GWP), reducing need for mechanical cooling; • Ecological aspects to enhance the proposed developments for flora and fauna; and • Best practice management of the site.
16	Paragraph 3.4	• Cost information of technically feasible low or zero carbon renewable technologies, including additional insulation, ~~combined heat and power~~low carbon decentralised energy, heat pumps etc;
17	Table 3.1	Additional information: • For mixed-use development, depending on the specific mix, a combination of standards may be sought. • Applications for change of use may fall to be considered as refurbishment depending on the level of internal alterations proposed. The appropriate approach with regards to sustainability will be considered on a case by case basis. • Requirements in the table are subject to the caveats in the relevant policies (CC2 and H5) around viability and achievability.
18	After paragraph 3.4	3.5 Applications affecting some heritage assets may have difficulty achieving the required standard. For this reason, listed buildings, scheduled ancient monuments and buildings in a conservation area are exempt from the provisions of Part L of the Building Regulations where compliance would unacceptably alter their character and appearance. Where this is the case, requiring compliance with standards over and above Part L would clearly conflict with heritage policies in the Local Plan, in particular EN1, and would not be appropriate. Where there are proposals for conversions and refurbishments of listed buildings, scheduled ancient monuments or buildings in conservation areas where compliance with sustainability policies would unacceptably alter their character and appearance, appropriate measures that are sensitive to the heritage asset should be taken to achieve improvements to the performance of the building insofar as is possible. Current environmental performance of an asset to be converted or refurbished should be analysed in the first instance in order to support proposals using a 'whole house' approach. The first priority for listed buildings should be for non-invasive measures. Measures will depend on the significance of individual listed buildings. Historic England has published guidance on the application of Part L to historic buildings which will be of use in informing the approach[17]. [17] https://historicengland.org.uk/images-books/publications/energy-efficiency-historic-buildings-ptl/heag014-energy-efficiency-partII/

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19	After paragraph 3.5	3.7 Paragraph 4.1.4 of the Local Plan recognises, however, that: "… some types of development, such as industrial uses, warehouses and schools might find it more difficult to meet these standards. In these cases, developments must demonstrate that the standard to be achieved is the highest possible for the development, and at a minimum meets the BREEAM 'Very Good' standard."
20	Paragraph 3.6	The 'buffer' is important to ensure the development as built complies with local plan policies. A ~~3~~5% buffer should be included in the pre-assessment estimator.
21	Table 3.2	• Pre-assessment estimator incorporating a ~~3~~5% buffer and provision of other appropriate information to provide confidence to the LPA that policy requirements can be achieved; • Draft Sustainability S~~s~~tatement for all major development; … • A pre-assessment estimator incorporating a ~~3~~5% buffer and provision of other appropriate information to provide confidence to the LPA that policy requirements can be achieved; … • Condition to ensure sustainability requirements as set out in the policies are met. Typically, this would be through a condition requiring an interim BREEAM certificate as appropriate to be submitted prior to commencement of development and a final BREEAM certificate, as appropriate, to be submitted ~~prior to occupation~~ after completion of the development.
22	Paragraph 3.7	3.~~7~~9 For residential development of ten dwellings or more, the Local Plan requires 'Zero Carbon' development, unless it can be clearly demonstrated that this would render a development unviable. Zero carbon homes is an achievable standard that, until recently, was intended to be a national requirement in the Building Regulations. It is required through planning policy for major residential new build development, and the viability of this approach was tested through the Local Plan and was not found to place an unreasonable burden on development. ~~If carbon neutral development is not achievable, this will mean a minimum 35% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations, and financial contributions through a Section 106 agreement to offset remaining carbon emissions to zero.~~ The paragraphs below describe the requirements in more detail.
23	Table 3.3	• Draft Sustainability ~~s~~S tatement for all major development; … • Condition to ensure sustainability requirements as set out in the policies are met. Typically, this would be through a condition requiring final SAP report, as appropriate, to be submitted ~~prior to occupation~~ after completion of the development.

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24	Paragraphs 3.8-3.9	3.~~8~~10 ~~All major new-build residential development (10 dwellings or more) should be designed to achieve zero carbon homes. All other n~~New building housing on sites less than 10 dwellings will achieve at a minimum a 19% improvement in ~~the dwelling~~ regulated emission rates over the target emission rate, as defined in the 2013 Building Regulations unless it can be clearly demonstrated that this would render a development unviable. ~~Zero carbon homes is an achievable standard that, until recently, was intended to be a national requirement in the Building Regulations. It is RBC's policy to continue applying these requirements through planning policy until such time as the Government updates the Building Regulations to require equivalent sustainability standards.~~ 3.~~9~~11 ~~Where~~ In achieving Zero Carbon Homes for major residential developments, the preference is that~~possible,~~ new build residential of ten or more dwellings will achieve true carbon neutral development on-site. If this is not ~~possible~~ achievable, it must achieve a minimum of 35% improvement in regulated emissions over the Target Emissions Rate ~~over~~ in the 2013 Building Regulations, plus a Section 106 contribution of £1,800 per remaining tonne towards carbon offsetting within the Borough (calculated as £60/tonne over a 30 year period).
25	Paragraphs 3.10-3.12	3.~~10~~12 The price per tonne of CO2 may be reviewed over time in order to account for the effects of inflation, the decreasing carbon intensity of the electricity grid or other changes in the future. 3.13 ~~This~~ The approach means that in most cases, the assessment required to satisfy the Part L of the Building Regulations will need to be carried out at the application stage, rather than afterwards. ~~Contributions~~ The financial contributions towards carbon offsetting will be secured through a S106 agreement ~~and will be due upon first occupation~~. In order to account for the performance gap between a building as designed and as occupied, the as-built Standard Assessment Procedure (SAP) assessment for major developments will need to be carried out after occupation. As a baseline, the Section 106 agreement will usually require submission of the as-built assessment at the latest six months after first occupation, unless a different timescale is agreed with the Council to reflect the characteristics of the development. This assessment will inform the final contribution due. 3.~~11~~14 Contributions will be ring-fenced for projects which deliver a carbon saving in Reading, including energy-efficiency improvements or renewables projects ~~within the Borough~~. The carbon saving will need to be at least equivalent to the amount of carbon offset via the financial contributions. The Council will keep the projects that will benefit under review, as the relative carbon savings and value for money may change over time. It is not for this SPD to specify exactly which projects will benefit. However, an initial list of possibilities would ~~This may~~ include (but is not limited to): • Upgrading and retrofitting of existing housing;

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		• ~~Visits~~ Home visits ~~from~~ for energy saving advice ~~officers~~ that leads to installation of energy efficiency saving measures; ~~• Free energy-efficient lightbulbs;~~ ~~• Subsidised loft and cavity wall insulation;~~ • Installation of heat pump based heating system where carbon emission savings can be demonstrated~~Boiler cash-back scheme for replacement of inefficient boilers with higher rated boilers; and~~ • ~~Draught proofing~~ Generating and supporting renewable and low carbon energy and heat projects; • Provision of grants for renewable energy and energy efficiency; • Energy projects for community buildings, e.g. solar panels; • Installation of electric vehicle charging infrastructure; and • Tree planting and greening measures. 3.~~12~~15 ~~Projects~~ Most projects funded through the offset fund ~~cannot also be listed on the CIL 123 List, as they~~ are not 'infrastructure' ~~in the sense~~ as covered by CIL, and therefore require a Section 106 agreement. Projects funded by the offset fund ~~should emphasise energy efficiency improvements and should~~ can also maximise co-benefits, such as alleviating fuel poverty, reducing energy bills, improving air quality, providing heat for vulnerable residents, increasing the efficiency of public sector buildings and reducing operations costs. The Council will report on how contributions have been used through its Annual Monitoring Report, published in December each year. 3.16 The policy position is that off-site carbon offsetting will be in the form of a financial contribution. Any proposals to diverge from the policy and offset the remaining carbon through non-financial means, for instance through off-site renewable energy, will need to be clearly justified at application stage in terms of how much carbon it would offset, and must be over and above measures that would have been taken in any case or to comply with other policies.
26	Paragraph 3.13	3.~~13~~17 The purpose of a pre-assessment estimator, or as-proposed SAP assessment, is ~~the~~ to help provide confidence to the LPA that the requirements of the Local Plan have been considered and can be met. Pre-assessment estimators or as-proposed SAP assessments are typically completed prior to the final details of the scheme being established. Where an applicant for minor development does not feel they would be in a position to submit a pre-assessment estimator, it would be the applicant's responsibility to provide alternative information to the LPA so the decision-maker can be confident that the requirements will be met. However, a pre-assessment estimator is the recommended approach for all applications which require a BREEAM assessment as specified in table 3.2, whilst an as-proposed SAP assessment is recommended for new-build residential.

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27	Paragraph 3.23	3.~~23~~27 A draft Energy Statement should be submitted at the pre-application stage to demonstrate how energy will be considered and incorporated as part of the proposal. ~~Omission of a draft Energy Statement will decrease the likelihood that a planning application will be approved at application stage~~As for Sustainability Statements, whilst a pre-application enquiry can be considered without a draft Energy Statement, this will affect the quality of advice that can be given and it is in the applicant's interest to submit a statement to be considered at this stage.
28	Paragraph 3.28	3.~~28~~32 A condition/s will be attached to any permission granted requiring a BREEAM sustainability assessment and/or Final/As-Built Building Regulations Compliance Report. This information will include final data on predicted carbon emissions from the building. ~~Typically~~ Unless there is a particular need for another approach for a development, this would typically be in two stages. Firstly, a condition will ~~requiring~~ require an Interim BREEAM Certificate or design stage SAP assessment to be submitted prior to commencement of development demonstrating that the development will be built in accordance with the pre-assessment estimator and meet the requirements of CC2 or H5. ~~Additionally~~Secondly, ~~it~~ a condition will typically require that a Final BREEAM Certificate and/or Regulations Compliance Report or as built SAP assessment is submitted after completion. Whilst this would ideally be prior to occupation of the development, it is accepted that, due to capacity issues and the need to ensure the performance can be accurately measured, it can take some time to produce a final assessment. In such cases, a timescale of six months after first occupation may be more appropriate, and, in the case of major residential, this will tie in with the trigger points for a Section 106 contribution. ~~This information will include final data on predicted carbon emissions from the building.~~
29	After paragraph 3.29	Standard Assessment Procedure (SAP) assessment 3.34 Where a SAP assessment is required to demonstrate compliance with policy H5 for new-build residential, applicants are expected to use updated (SAP 10) carbon emission factors to assess the expected carbon performance of a new development. Applicants should continue to use the current Building Regulations methodology for estimating energy performance against Part L 2013 requirements as set out in Policy H5 but with the outputs manually converted for the SAP 10 emission factors[24]. This is for demonstrating performance against planning policy targets and is separate to Building Regulation compliance. [24] The GLA uses a spreadsheet to calculate the conversion to the SAP 10 emission factors, which will be useful, and which can be found on their website: https://www.london.gov.uk/sites/default/files/copy_of_gla_carbon_emission_reporting_spreadsheet_v1.1.xlsx
30	Paragraph 4.3	4.3 Passive and active solar gain can make a significant contribution towards the lighting and heating of a building. Different approaches to maximising passive and active solar gain are needed depending on the size and use of buildings. To maximise access to the sun, buildings should have their main elevations facing within 30° of due south (either to the east to maximise morning sunlight

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		or to the west to maximise evening sunlight). A slight easterly orientation has advantages over a south-westerly position due to the fact that it maximises early morning light and heat gains while reducing the possibility of overheating on a summer afternoon or evening. Main living or working spaces with maximum occupancy should be located on southerly facing elevations to make the best use of solar gain. Rooms with lower occupancy, such as toilets, cloakrooms and storage space that require less heating should be located on the northern side of the building. Rooms that contain machinery or equipment that generate heat should also be located on the northern sides of buildings. To minimise the requirements for additional space heating, elevations to the south should have increased areas of glazing compared to those facing north. Care must however be taken to prevent excessive solar gain, particularly in the summer, with a building requiring the unnecessary use of energy to cool the internal environment, although this must be balanced against maximising solar gain in the winter. Carefully designed natural ventilation is important. Landscaping, in particular design of natural shading by trees and plants, also has a role in energy efficiency. Applicants should seek detailed technical advice as this SPD is not intended to serve as a technical guide. The measures described above simply represent examples of possible strategies.
31	Paragraph 4.5	~~Natural~~ **Ventilation** 4.5 Maxim~~um use of~~ising natural ventilation is appropriate in most circumstances and is usually a more sustainable option than air conditioning systems, albeit that a building should be able to be made airtight to reduce energy demand for heating or cooling in extreme weather. The simplest method is to create opportunities for cross ventilation. Openings on ~~opposite~~ opposing ~~walls~~ (or even adjacent ~~walls~~) walls can draw air through a space. Windows should be openable, if possible, and trickle vents or other such devices should be installed to provide controllable background ventilation. Mechanical ventilation may be required to supplement natural ventilation but this ~~can~~ should be very energy efficient, requiring only small levels of energy to run, yet achieve significant benefits in a development. Natural ventilation can also be achieved through the use of 'passive stack effect' and pressure differentials to bring cool fresh air form outside the building without the use of mechanical systems. Design should ensure that cool air is introduced in summer and warm air in winter in order to reduce heating and cooling loads.
32	Paragraph 4.6	Thermally massive materials should be ~~internally~~ located ~~(i.e.~~ inside the insulated layer~~)~~ so that the internal air temperatures can benefit from the diurnal and ~~inter-seasonal~~ day to day stabilising effects. Thermal mass located externally could be utilised to precondition incoming ventilation. Earth sheltered housing, where it can be achieved, may provide an opportunity to build on challenging sites and will benefit from low temperature variations.
33	Paragraph	4.7 To maximise energy efficiency the heat losses from the building envelope must be kept to a minimum with ~~maximum~~ high levels of air-tightness. Heat loss can be prevented by applying high levels of insulation to the roof, walls and floors. Heat loss from

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	4.7	windows can be further reduced through double or triple glazing, however, adequate ventilation ~~without draughts is essential~~ is always a requirement, and ~~to~~ avoids condensation problems.
34	Paragraph 4.8	They also provide important habitats for wildlife and reduce the speed at which rain water runs off buildings as the vegetation absorbs some rainwater. Where green roofs increase the embodied carbon in a building and have running/maintenance costs through energy and water use, the associated carbon impacts should be accounted for in any such proposals. This also applies to green walls below.
35	Paragraph 4.10	The plants may purify slightly polluted water ~~(such as greywater)~~ by absorbing the dissolved nutrients.
36	Paragraph 5.5	Deciduous trees in particular are very beneficial. They allow sunlight to reach buildings during the cooler winter months and protect from sunlight (UV) and overheating during the warmer summer months. Species selection ~~and~~, siting and maintenance should be carefully considered to maximise the ecosystem benefits of trees on a development site, and to avoid shading solar panels or blocking drainage systems with leaves.
37	Paragraph 5.8	~~Development will not be permitted which would~~ Local Plan policies seek to avoid development that would significantly undermine current levels of soft landscape provision, particularly tree cover as this is likely to be damaging to climate change adaptation strategies
38	Paragraph 6.1	Water consumption in the South East has grown significantly in recent years, and the region has the highest per capita consumption rate in the UK. The reasons for this growth in consumption include the greater use of water intensive white goods such as washing machines and the growth in the number of households. As such, it is important to improve efficiency in the use of water and conserve water supplies. Furthermore, a significant part of the Reading area is at risk of flooding, being located within the floodplain~~. , As such, it is important to improve efficiency in the use of water, conserve water supplies~~ and ~~minimise~~ minimising the risk of flooding is therefore essential.
39	After paragraph 6.2	6.3 Installing water saving devices can reduce consumption levels considerably. These include low flush toilets, aerating taps and low flow shower heads. Developers are encouraged to engage with water utility companies at the earliest opportunity in order to ensure that water and waste water provision is considered at an early stage in the design of development.
40	Paragraphs 6.3-6.4	6.~~3~~5 Buildings can be designed to allow recycling of grey water for purposes that do not require mains supplies such as flushing toilets and gardens/green space irrigation, and policy CC2 states that this should be included where systems are energy and cost-effective. This must comply with relevant regulations. It should be noted that the use of grey water for some non-potable uses such

Ref	Reference in document	Change
		as washing up will normally require physical and chemical processes to ensure that they remove pathogenic micro-organisms. 6.6 There can be tensions between energy improvements and water efficiency. For instance, water-cooled chiller systems for building space cooling supply, although efficient in energy terms, can consume large volumes of water. For the avoidance of doubt, developments should meet all relevant parts of the policies, so the water consumption aspects of the policy should not be breached in order to meet energy requirements. ~~6.4 Installing water saving devices can reduce consumption levels considerably. These include low flush toilets, aerating taps and low flow shower heads. Developers are encouraged to engage with water utility companies at the earliest opportunity in order to ensure that water and waste water provision is considered at an early stage in the design of development.~~
41	Paragraph 6.6	SuDS improve water quality and can provide other social, environmental and economic benefits for residents and developers. On extensively contaminated sites, some SuDS techniques may be difficult to achieve.
42	Paragraph 6.7	Applicants should refer to the CIRIA SuDS Manual C753[26]. [26] A free copy of the manual is available for download at https://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters ~~https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx~~
43	Paragraph 6.8	All major developments must incorporate SuDS as appropriate (as outlined in Policy EN18: Flooding and ~~Sustainable~~ Drainage ~~Systems~~ of the Local Plan) and in line with the Government's Technical Standards
44	Paragraph 7.1	Policy CC5: Waste Minimisation and Storage of the Local Plan requires that development should demonstrate measures to minimise the generation of waste in the construction, use and life of buildings.
45	Paragraph 7.2	The Council's Waste Minimisation Strategy 2015 – 2020[28] sets out how Reading will improve the way it manages waste with a growing population, an increase in the number of households and limited resources. [26] http://www.reading.gov.uk/media/4418/Waste-Minimisation-Strategy-2015---2020/pdf/HNL_15th_March_WMStrategy_Revision_Appendix_B.pdf ~~http://www.reading.gov.uk/media/2525/WM-Strategy/pdf/WM_Strategy.pdf~~
46	Paragraph	There are three basic strategies for dealing with waste: reduce (i.e. avoid or prevent), re-use, recycle, and only as a last resort, dispose. This hierarchy is outlined below.

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	7.5	
47	Paragraph 7.7	The UK Government has introduced a landfill tax, aggregate levy and other waste management regulations to encourage the diversion of waste from landfill, promote re-use and recycle strategies and emphasise environmental responsibilities.
48	Paragraph 7.8	Measures that applicants should consider to achieve the ~~aims~~ requirements of policy CC5 could include:
49	Paragraph 7.8	• Development should consider the incorporation of the following strategies within the developments to help reduce waste: - Greywater recycling ~~- Composting toilets~~ - On site food composting - Off-site recycling facilities
50	Section 8	**8 DECENTRALISED ENERGY AND DISTRICT HEATING~~SITE SPECIFIC CONSIDERATIONS~~** **Local Plan Requirements** 8.1 Policy CC4 of the Local Plan deals with decentralised energy, and expects developments of more than 20 dwellings and/or non-residential development of over 1,000 sq m to consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision. It also expects developments of over 10 dwellings or more or non-residential development of 1,000 sq m or more to link into an existing district energy network, where one is present within the vicinity of an application site, or demonstrate why this is not feasible. 8.2 There are particular issues worthy of further guidance in terms of District Heating (DH). The supporting text to the policy in particular (paragraph 4.1.15) states that air-source or ground-source heat pumps should be considered in the first instance, as these methods are less carbon intensive than CHP. **Combined Heat and Power** 8.3 The background to the approach to CHP is the fact that the proportion of the UK electricity grid that is from renewable energy has grown significantly in recent years, with 30% of all generation from renewables in 2018, with an additional 20% coming

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		from nuclear (a zero-carbon power source). This means that there is an ongoing decarbonisation of the grid. This has implications for the efficacy of carbon reductions from gas-fired CHP. It is estimated that by 2030 the electricity generated by CHP engines will be more carbon intensive than use of gas boilers for buildings, which will make gas-fired CHP redundant as a carbon-saving measure. Combustion-based CHP is also a significant contributor to poor air quality. 8.4 Combustion-based CHP should therefore be avoided. An acceptable CHP approach involves fuel cells producing electricity through the electrochemical reaction of hydrogen and oxygen, which produces heat as a by-product. These can use a range of fuel sources, including natural gas, hydrogen and biofuels. The commercial readiness and viability of these technologies differs, and not all will be realistic in the short term, but there is potential for this to change during the lifetime of this SPD. **Ground-Source and Air-Source Heat Pumps** 8.5 The preference for air-source and ground-source heat pumps over CHP is set out in the Local Plan, but in general GSHPs should be investigated as a priority over ASHPs. This is because they enable greater seasonal efficiencies. 8.6 Evidence should be provided at the detailed planning application stage where GSHP systems are discounted, and ASHP systems selected, with the following technical analyses: • Calculated system seasonal efficiency comparison; • Evidence of any constraints on boreholes related to existing utilities or other sub-surface infrastructure; • Borehole spatial constraints; and • Any other technical reasons why GSHP cannot be progressed and ASHP must be taken forward as the primary heat technology. **Town Centre District Heating** 8.~~1~~7 Element Energy was commissioned by RBC to undertake a heat mapping and energy masterplanning study for Reading town centre. The number of anticipated redevelopment sites and existing density of domestic and non-domestic energy uses present an opportunity to establish heat network schemes.
51	Paragraph 8.2	CR11h: Napier Road ~~Corner~~ Junction …

Ref	Reference in document	Change
		CR14b: Former Reading Family Centre, North ~~Road~~ Street
52	Paragraphs 8.3-8.5	~~8.3 A range of heat supply technologies were assessed:~~

~~Option~~	~~Pros~~	~~Cons~~
~~Water-source heat pumps (WSHP)~~	~~✓ Potential to be very **low carbon**~~ ~~✓ Can be relatively cost-effective where **supported by RHI**~~ ~~✓ Where **cooling** is also required, economics improved significantly~~	~~• **High capital cost**~~ ~~• Requires substantial **electrical grid capacity**~~ ~~• Some risk of RHI support being reduced/withdrawn~~
~~Gas combined heat and power (CHP)~~	~~✓ **Mature and proven** technology~~ ~~✓ Relatively **cost-effective** without subsidy~~ ~~✓ Opportunity to deliver **on-site electricity**~~	~~• **Fossil fuel-based**, so carbon savings may not be large (and may be negative in future)~~
~~Biomass boiler / Biomass CHP~~	~~✓ Potential to be very **low carbon**~~ ~~✓ Biomass boiler – Cost-effective option where **supported by renewable heat incentive** (RHI)~~	~~• **Regular deliveries** and/or large **storage** required for biomass~~ ~~• **Air Quality** and environmental issues~~ ~~• Some risk of RHI support being reduced/withdrawn~~ ~~• Biomass CHP **High capital cost**~~
~~Waste heat from industry, power and Energy from Waste plants~~	~~✓ Potential to be **very low cost heat**~~ ~~✓ **Very low carbon** (exact carbon intensity depending on source)~~	~~• Unless heat source close to demand centres, heat transmission cost can be high~~ ~~• Likely to have some downtime so additional backup plant required~~ ~~• None available in town centre~~

Ref	Reference in document	Change
		~~Figure 8.2 Summary of Heat Supply Options Pros and Cons (Element Energy)~~ 8.~~4~~9 A detailed technical and economic assessment identified several potentially deliverable heat network scheme options centred on the four clusters. These would reduce energy costs and carbon emissions, as well as improve air quality and increase inward investment, spurring local economic growth. Almost all scheme options in all four clusters were found to be viable, some with additional financial support and some without. ~~8.5 Water Source Heat Pump (WSHP) was determined to be the most viable heat supply option for schemes in all four clusters.~~ At the time of writing, all four clusters are entering detailed feasibility analysis. 8.10 The provision of a district heating scheme will rarely be something that can be achieved by a developer as part of a single development. However, where developments are located in high priority areas for district heating, either as identified in existing heat mapping work, or in future work during the lifetime of the SPD, and where there is no existing network to connect to, the following provisions should be made in the design of the building: • Designing the development with wet (i.e. hydraulic) space heating and hot water distribution systems, so that the building heat distribution network can interact with (i.e. supply heat to/extract heat from) a DH network; • Space provision in heating plant rooms for connection to a DH network – this may include (but is not limited to): wall penetrations for DH pipework into plant room; reserved plinths for plate heat exchangers (including redundant units) • Where necessary, provide buried and capped-off DH pipework from the development's plant room to a convenient location (to be agreed with RBC) in preparation for connection to the DH network
53	Table A1.1	11. How will the selected materials help retain local character, ensure long life and ensure a low environmental impact, including consideration of embodied energy?
54	Table A1.2	19. How will the selected materials help retain local character, ensure long life and ensure a low environmental impact, including consideration of embodied energy? … 27. What measures have been incorporated to ensure that noise and light pollution plus pollution transported through surface water runoff or infiltration will be minimised through the development? … 29. What consideration has been given to reducing refrigerants and minimising nitrogen dioxide emissions?

Ref	Reference in document	Change
55	Appendix 2	**APPENDIX 2: ENERGY EFFICIENCY AND RENEWABLE AND LOW CARBON ENERGY SOURCES** This appendix describes a number of potential energy efficiency measures and renewable and low carbon energy sources. It does not seek to weigh the merits of particular measures or technologies. Some of these approaches will have their own implications, in particular in terms of carbon emissions or impacts on air quality, which will need to be assessed as part of any proposal.
56	Appendix 2	**b. Combined Heat and Power/Combined Cooling Heat and Power (CHP/CCHP)** This simultaneous generation of usable heat and power (usually electricity) in a single process, thereby reducing wasted heat and putting to use heat that would normally be wasted to the atmosphere, rivers or sea. CHP is an efficient form of decentralised energy supply and provides heating and electricity at the same time. CHP units generate electricity through an engine and capture the by-product, ~~combustion~~ heat, for use in heating and hot water systems. Opportunities for CHP can be exploited in mixed used development, large buildings (offices, shopping centres), hospitals and leisure centres and refurbished buildings through the use of district heating systems.
57	Appendix 2	**d. Solar Water Heaters/Solar Thermal Heating Systems** Solar water heating involves the use of solar collectors (panels containing fluid) that absorb the sun's heat and use this to heat water contained within a storage tank. This is achieved by using a solar collector filled with liquid, which absorbs heat from the sun and transfers this heat via a heat exchange system to a dual coil (or supplementary) hot water tank that is also attached to the main boiler or immersion for backup as and when required. Solar collectors can be installed at low level or on the roof of a building or incorporated as part of the roof finish. The optimum location is facing slightly west of due south and at a tilt of 30-40°, although a collector set anywhere between east and west and at a tilt of between 10° and 60° will perform at 90% of the optimum performance. ~~**e. Solar Thermal Heating Systems**~~ ~~Solar thermal heating systems (STHS) utilise thermal energy from the sun to supply heat to hot water systems – as opposed to generating electricity, which is a separate technology (see photovoltaic below). This is achieved by using a solar collector filled with liquid, which absorbs heat from the radiation coming from the sun and transfers this heat via a heat exchange system to a dual coil (or supplementary) hot water tank that is also attached to the main boiler or immersion for backup as and when required.~~
58	Appendix 2	~~**f.**~~**e. Photovoltaic (PV) Arrays** Solar photovoltaics (PV) are a semiconductor-based technology that converts the sun's energy into electricity. This is one of the easiest renewable energy systems to install in the urban environment as PV panels can be fixed to or form an integral part of the roof covering, do not require any additional land and do not require the specific topographical features that other forms of renewable

Ref	Reference in document	Change
		energy do. PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that can be used on conservatories. PVs can be used to provide extra power for customers already connected to the ~~natural~~ national grid or can also provide the only source of electricity for a building.
59	Appendix 2	~~j.~~i. **Energy from Waste** An Energy from Waste (EfW) facility can take waste from households, businesses and industry and use it for recycling and energy recovery. Energy recovery is widely used as a way of gaining value from waste. Vitally, this technology also plays a key role in reducing reliance on landfill and meeting renewable energy targets. Energy can be generated from organic waste products in the form of slurry such as sewage, animal wastes and waste products from the food industry. A digestion process provides a gaseous product ~~composing~~ composed of methane and carbon dioxide. The gas can be used as fuel in an engine for electricity production or it can be used for heating purposes to power a boiler, or both at the same time in a CHP system, but this is unlikely to be viable on a small scale.
60	Appendix 2	~~k.~~j. **Ground Source Heat Pumps** Ground source heat pumps make use of the ~~natural~~ heat capacity in the soil to provide heating and cooling to buildings. The temperature just a couple of metres down into the earth is roughly constant all year round at 12 degrees C in the UK. The difference between this constant temperature and fluctuating air temperature can be harnessed through a network of underground pipes. ~~Water~~ A fluid is pumped through the pipes absorbing the ground heat, which can be utilised by a heat pump to provide heating or cooling in a building~~used to provide relatively cheap heating for buildings in the winter months and cooling in the summer months~~. For heating in domestic buildings underfloor heating is appropriate, but for cooling and heating commercial units, forced air systems work best. ~~It works best with under floor heating systems in maximising the heating and cooling effect.~~
61	Appendix 2	~~l.~~k. **Air Source Heat Pumps** Air source heat pumps take energy from the air and raise it to a higher temperature, using a process which is similar to a reverse refrigeration process. For commercial and large spaces a row or bank of air source heat pumps (air handling units) will be required along with an internal heat pump and a ~~pressured~~ hot water tank for ongoing water usage. This is a system which utilises no external pipes and most of the working elements reside within building. The air handling unit draws air across through a heat exchanger and delivers heated or cooled air into the building~~the water and anti-freeze solution and transfers this energy into the refrigerant. The refrigerant boils and the gases from this are compressed to produce temperatures in excess of 100 degrees C~~. This part of the process mirrors a ground source heat pump. Air source heat pumps can be used in many more applications including large commercial projects where land space is restricted. Air source heat pumps can be used as a complete solution for room heating using the same distribution system as a ground source heat pump or a traditional system. ~~Air source heat pumps are ideal for very tight spaces and~~

Ref	Reference in document	Change
		~~within an eco-architectural design or within the design of a building which has large internal spaces such as audience halls and public places.~~
62	Appendix 3	***CC3: ADAPTATION TO CLIMATE CHANGE*** ***All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development:*** • ***~~New~~ Wherever possible, new buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements;***
63	Appendix 3	***CC4: DECENTRALISED ENERGY*** ***In meeting the sustainability requirements of this plan, developments of the sizes set out below shall demonstrate how consideration has been given to securing energy for the development from a decentralised energy source~~, including CHP~~.*** ***Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq m shall consider the inclusion of ~~a CHP plant, or other form of~~ decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.*** ***Where there is existing decentralised energy provision~~, including a CHP plant or a district energy network~~ present within the vicinity of an application site, further developments of ~~over~~ 10 dwellings or more or non-residential development of 1,000 sq m or more will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.***
64	Appendix 3	***H5: STANDARDS FOR NEW HOUSING*** ***New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable:*** ***a. All new build housing outside the Central Area as defined on the Proposals Map will comply with the nationally-described space standard.***

Ref	Reference in document	Change
		b. All new build housing will be built to the higher water efficiency standard under Regulation 36(3) of the Building Regulations. ***c. All major new-build residential development should be designed to achieve zero carbon homes;*** ***d. All other new build housing will achieve at a minimum a 19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations.*** ***e. All new build housing will be accessible and adaptable in line with M4(2) of the Building Regulations ~~where it is viable~~, unless it is built in line with M4(3) (see below).*** ***f. On developments of 20 or more new build dwellings, at least 5% of dwellings will be wheelchair user dwellings in line with M4(3) of the Building Regulations. Any market homes provided to meet this requirement will be 'wheelchair adaptable' as defined in part M, whilst homes where the Council is responsible for allocating or nominating an individual may be 'wheelchair accessible'.***
65	Appendix 4	**Carbon Neutral Development** Development that ~~is truly zero carbon, meaning~~ generates no CO2 emissions ~~are generated~~ on-site
66	Appendix 4	**Combined Heat and Power** Combined Heat and Power (CHP) units generate electricity ~~through an engine~~ and capture the by-product, ~~combustion~~ heat, for use in heating and hot water systems.
67	Appendix 4	**Net CO2 Emissions** The annual dwelling CO2 emissions per m^2 (~~$KgCO_2$~~$kgCO_2/m^2/yr$~~.~~) as defined by the Building Regulations.
68	Appendix 4	**Renewable and low carbon energy** Includes energy for heating and cooling as well as generating electricity. Renewable energy covers those energy flows that occur naturally and repeatedly in the environment – from the wind, the fall of water, the movement of the oceans, from the sun and also from ~~biomass and deep geothermal~~ heat within the substrate. Low carbon technologies are those that can help reduce emissions (compared to conventional use of fossil fuels).

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69	Appendix 4	**TER – Target Emission Rate** The Target Emission Rate is the maximum allowable carbon dioxide emissions per m^2 (~~$KgCO_2$~~$kgCO_2$/m^2/y~~ea~~r) arising from energy used in heating, cooling, hot water and lighting which would demonstrate compliance with AD L1A.