Local Plan 2040: Construction carbon emissions and energy standards

Current standards, central policy changes and options for improvements through local policy

CDLP2040-CC02
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Executive Summary

The energy efficiency standards of new building construction and modifications to existing buildings in Canterbury district are not high enough to achieve net zero emissions and the embodied carbon emissions from constructing buildings is currently unregulated and is a significant contributor to the district carbon footprint.

This report evaluates the current policies and regulation and provides recommendations for the Local Plan 2040:

- A net zero operational energy standard for new buildings
- A requirement to evaluate the embodied carbon for planning applications
- New standards to improve the whole building energy efficiency for modifications to existing buildings

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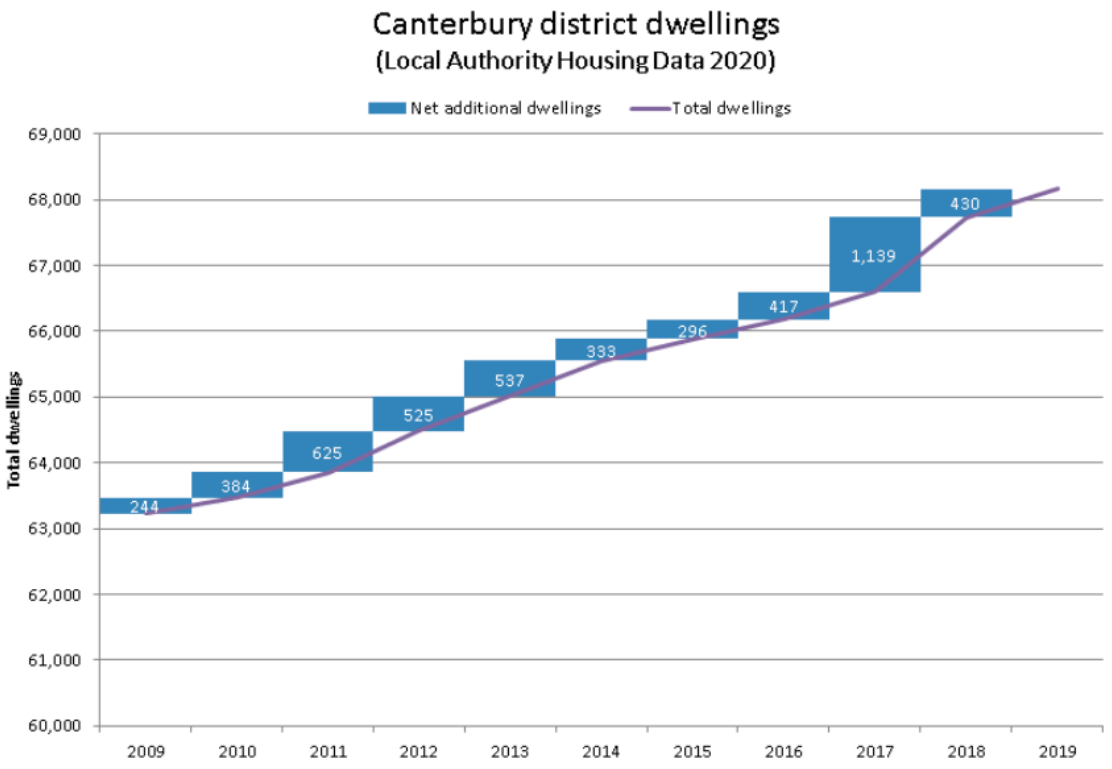
Construction emissions in Canterbury district in context

The total annual carbon emissions for Canterbury District in 2017 were around 1,500,000 tonnes CO2e (based on population pro-rata from DEFRA UK Consumption Emissions). This footprint includes all the energy emissions within the district (around 600,000 tonnes CO2e) and all of the emissions generated from goods and services imported and used within the district. This footprint includes the emissions from construction - including building, modifying and maintaining property - and emissions from heating and powering buildings. Emissions from the construction process are referred to as embodied emissions, and emissions from powering buildings are referred to as operational emissions.

Embodied emissions

Construction of a typical UK dwelling is estimated to produce about 500 kgCO2e/m2 during the construction process (Atkins/RICS) for all 1-3 storey housing types. This equates to 42.5 tonnes CO2e (tCO_2e) for the average UK house of 85m2 usable floor area. CITU quotes 50-80 tonnes CO2e per traditional brick and mortar type house. These embodied carbon estimations include the associated groundworks, utility connections and surfacing around the dwelling.

Figure 1: Canterbury district housing data 2009-2019



In recent years Canterbury district has seen around 500 new build dwellings completed each year. At approximately 50 tCO2e per dwelling this equates to 25,000 tCO2e/y embodied carbon emissions per year. In addition to the new build work, an initial estimate of a comparable amount of embodied emissions may be emitted due to refurbishment, extensions and remodelling of existing dwellings is 17,500 tCO2e/y (based on average 20 years between refurbishment/extension, and 5 tCO2e per refurbishment). Data is required to improve this estimate; the emissions associated with housing construction and development are not currently gathered or evaluated at a local authority level.

Each year domestic construction in Canterbury district therefore contributes to somewhere in the region of 3% of the total annual carbon footprint of the district ((25,000 for new build + 17,500 for refurbishment and extension)/1,500,000). This estimate does not factor in non-domestic developments or other built infrastructure, or the embodied emissions from low-rise multiple occupancy housing developments such as apartments and student accommodation which are

much higher per m2 than general housing construction. Multiple storey large developments are more material intensive - particularly in concrete and steel - and therefore have a higher embodied carbon.

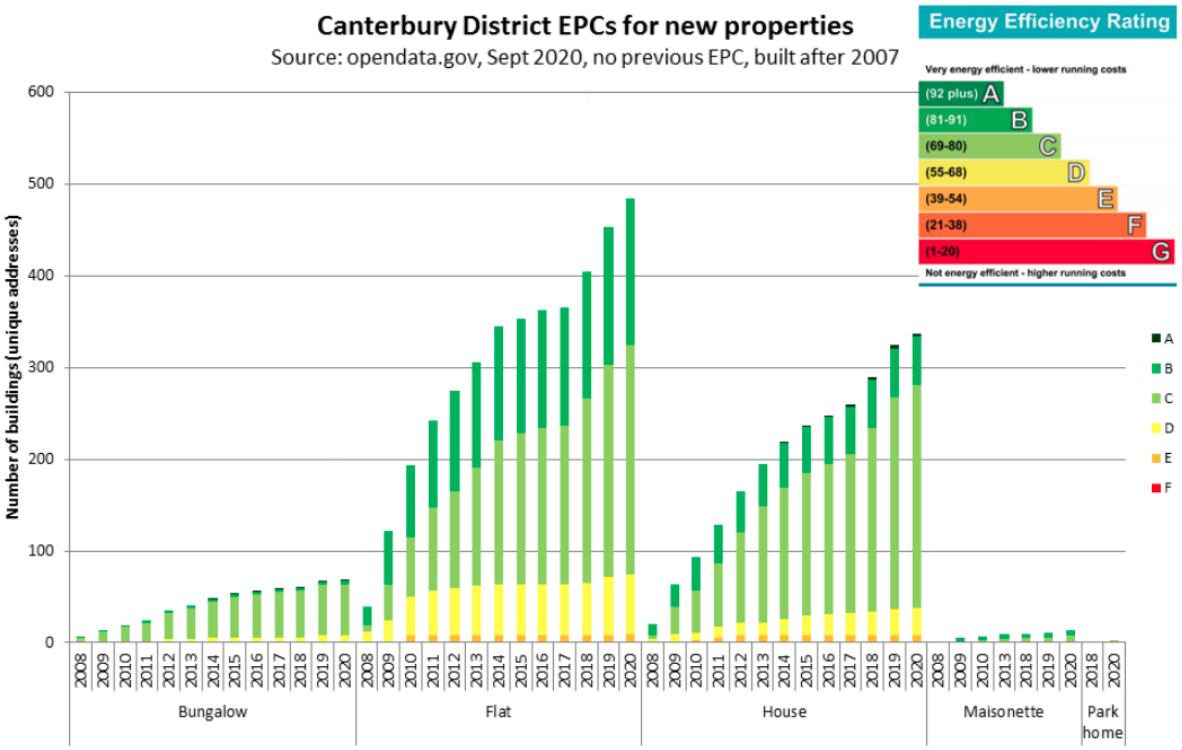
The Committee on Climate Change report Options for incorporating embodied and sequestered carbon into the building standards framework (2018) states:
Lifecycle GreenHouse Gas (GHG) emissions need to be considered under current Environmental Impact Assessment (EIA) Regulations; planning authorities also have the option to address lifecycle GHG emissions associated with buildings through local planning policy including any local offsetting schemes.

Key issue 1: Evaluate and record embodied carbon in construction
Evaluation of embodied emissions is not currently included in the planning or building control processes and there is no data record against which to measure performance. Evaluating embodied carbon for projects is an objective of both RIBA and RICS and therefore should be required and recorded as part of the planning and building control processes.

Operational emissions

Operational emissions from homes are evaluated through EPC certificates and are on average around 3 tonnes CO2 per year from gas central heating and hot water. An initial analysis of the Energy Performance Certification (EPC) register shows that recent completions (new housing) are **predominantly at EPC standard C and B**, with very few at standard A:

Figure 2: Distribution of Energy Efficiency ratings in Canterbury District - homes built since 2007



EPC standards in context

Energy Performance Certificates are calculated using a model called the Standard Assessment Procedure (SAP) which is a digital tool that energy assessors use when designing and inspecting buildings. The EPC and SAP are the UK method for evaluating and controlling energy standards of domestic and non-domestic buildings and there are laws on the minimum energy standards for new construction, private and social rental of existing buildings based on EPC ratings.

EPCs are based on an assessment of the building dimensions, fabric - the materials and insulation, air tightness - how much heat leaks out, heating, lighting and hot water systems. It is not a measure of the actual energy used by the residents. Not all homes have an EPC - it is only required for sale or letting a property - 43,000 out of around 70,000 homes in the district have an EPC. All new homes since the mid 2000s have EPCs; pre-2005 construction homes and less likely to have an EPC (which are only required when houses are for sale, rent or receive subsided energy upgrade works) and therefore homes without EPCs are likely to be in lower EPC bands.

Table 1: Energy efficiency ratings of Canterbury district homes

EPC rating Source: September 2020 extract from the national EPC register	**Number of certificates in Canterbury district (out of c.70,000 dwellings)**	**Average emissions per year (tCO2/y)**	**Average energy demand (kWh/m2.y)**
A	**64**	**0.6**	**20**
B	**5236**	**1.4**	**102**
C	**12220**	**2.6**	**185**
D	**16725**	**4.0**	**266**
E	**6637**	**6.1**	**378**
F	**1453**	**8.7**	**526**
G	**441**	**10.0**	**721**

A 2017 study by Changeworks compared actual energy readings to EPCs for 11 properties of a range of age and build type and concluded that for new or recent construction, EPC estimates of annual energy consumption are more accurate than for lower banded older properties where the energy consumption tends to be overestimated.

Current Canterbury City Council energy standards

Building energy standards are referred to in the Local Plan policies and associated Supplementary Planning Guidance documents. These policies encourage energy-efficient design at the planning stage.

Policy CC2: Reducing Carbon Emissions From New Development Development in the Canterbury District should include proportionate measures to reduce carbon and greenhouse gas emissions (as outlined table D1 and Policy DBE1) As well as incorporating measures to reduce carbon emissions development proposals shall show how they have taken account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

Policy CC3 Local/District Renewable and Low Carbon Energy and Heat Production Schemes Strategic Sites (as shown on the Proposals Map) and other sites over 200 units, health facilities, education institutions and schools or substantial commercial developments should provide site wide local renewable or low carbon energy and/or heat generation schemes such as gas fired Combined Heat and Power (CHP). If a local renewable/low carbon scheme or district heating scheme is not proposed it will need to be demonstrated that the provision would not be viable or feasible, or it can be demonstrated that an alternative carbon reduction strategy would be more appropriate.

Policy DBE1 Sustainable Design and Construction All development should respond to the objectives of sustainable development and reflect the need to safeguard and improve the quality of life for residents, conserve resources such as energy, reduce/minimise waste and protect and enhance the environment. The City Council will require development schemes to incorporate sustainable design and construction measures, to show how they respond to the objectives of sustainable development. Sustainability statements will be required for all applications for major developments and for the strategic housing sites identified in Policy SP3. They should demonstrate how the proposal has responded to the objectives of sustainable development and had regard to the measures outlined in table D1. Energy statements should be submitted for all strategic development sites. Non-residential developments should meet a ‘very good' BREEAM rating and provide evidence as to why an ‘excellent’ rating cannot be achieved. Development proposals should also show how measures outlined in any sustainable design guidance or SPD adopted by the City Council have been considered. New developments will also need to be resilient to climate change. Appropriate climate change adaptation measures include flood resilient measures, solar shading and drought resistant planting, limiting water runoff, reducing water consumption and reducing air pollution. As defined in Article 2 of the Town and Country Planning(Development Management Procedure) (England) Order 2015(no.595) or any later amendment.

Table D1 on page 182 - 184 of the 2017 adopted Local Plan contains a ‘checklist’ of generally good practice towards low carbon homes.

There are, however, no numerical targets for energy consumption or carbon emissions per m2 of construction, and in practice developments are not achieving any of the goals for sustainability in the policy which has no specific regulations.

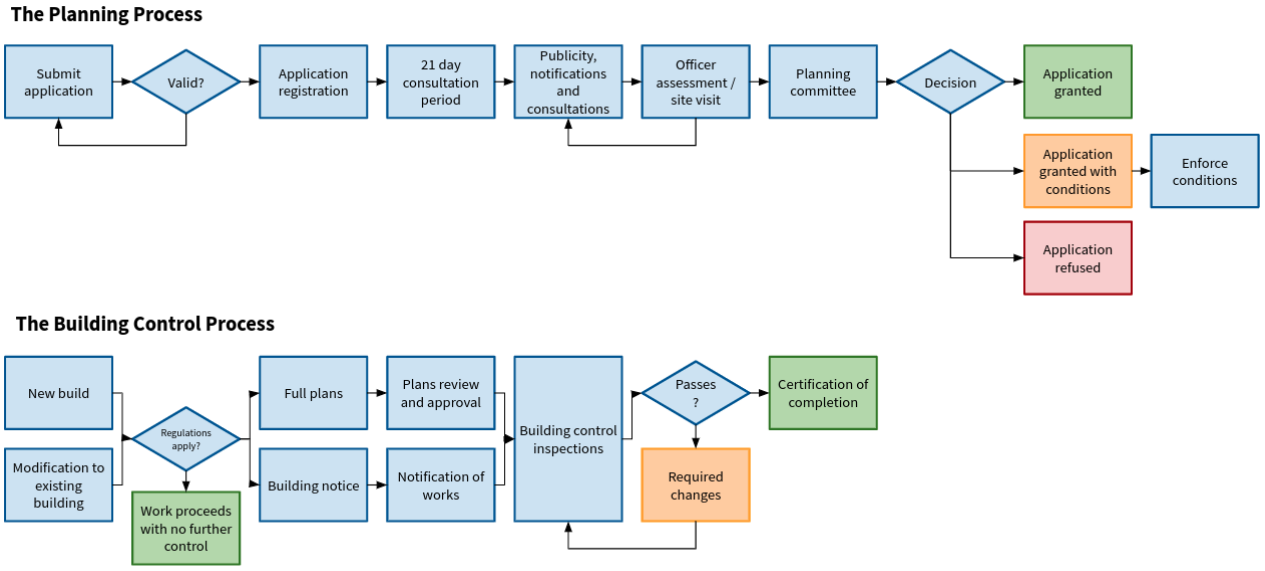
Indeed, section 7.13 (page 161) sets out the absence of a standard as it relied upon the implementation of the UK Government's proposed but aborted Zero Carbon Homes Standard from 2016:

> 7.13 The final shape of the Government's Zero Carbon Homes Standard was due to be determined by the Government for implementation in 2016. It was anticipated to require all carbon dioxide emissions arising from energy use regulated under Building Regulations to be abated from 2016. Regulated energy may derive from sources such as fixed heating, hot water, ventilation and fixed lighting and other fixed building services (but does not include appliances such as white goods). It was expected that to meet a Zero Carbon Standard, each home would need to meet minimum standards for fabric performance (Fabric Energy Efficiency Standard), on site carbon compliance and then achieve zero carbon emissions from regulated energy use (0kg CO2 per m2) which was expected to be achieved via the use of Allowable Solutions. The Government has now indicated that it does not intend to move forward with the implementation of Allowable Solutions. Irrespective of whether this zero carbon target is brought into force, the Council will expect all development to make carbon savings. When seeking to reduce carbon emissions all development should take account of the following energy hierarchy:
>
> - Fabric Energy Efficiency: Achieving improvements in fabric energy efficiency is a key first stage. The fabric energy efficiency of a home is determined by the annual space heating and cooling demand in KWh per m2 , assessed using the Standard assessment Procedure (SAP).
> - Carbon Compliance: Once improvements to fabric energy efficiency have been made the next step is , reducing the level of on-site CO2 emissions . This is termed carbon compliance and again calculated using SAP. The Dwelling CO2 Emission Rate includes efficiency of energy supply and the type of fuel used as well as energy requirement in the calculation. This second stage should demonstrate the use of on-site low and zero carbon energy technologies for heat and power. This could include electric power generation from photovoltaics and wind generators, and heat from biomass and wind pumps. It could include micro-generation on individual homes up to development-scale district heat or CHP systems.

Key issue 2: Include actual fabric energy efficiency and carbon compliance targets that need to be met.

Include a requirement that the embodied and operational compliance values must be identified at planning stage against targets and to be made a condition of the planning approval.

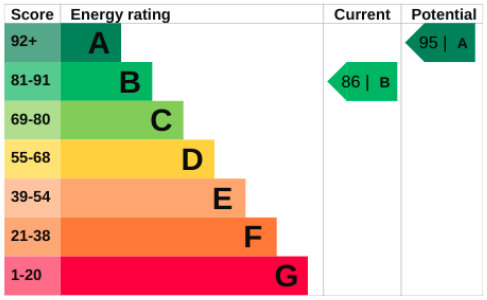
There is an opportunity for the planning process and building control to have a greater connection in ensuring development achieved energy standards. The Planning Approval process is managed by the planning authority (within Canterbury City Council), and the fulfilment of planning conditions is through planning enforcement officers. Building Control is a subcontracted service and runs separately and independently from planning; building control enforcement focuses on compliance with Building Regulations. If better standards to achieve carbon emissions reduction are implemented this gap between the two processes will need to be bridged.



Examples of existing conventional and net zero operational emissions construction in Canterbury district

Example 1: Baldock Road, Canterbury

This house was newly built in 2020 by a major UK housebuilder using a conventional design. The home is brick construction, gas centrally heated and is rated mid band B on the Energy Performance certificate.



Environmental impact of this property

One of the biggest contributors to climate change is carbon dioxide (CO2). The energy used for heating, lighting and power in our homes produces over a quarter of the UK's CO2 emissions.

An average household produces	6 tonnes of CO2
This property produces	1.3 tonnes of CO2
This property's potential production	0.1 tonnes of CO2

Feature	Description	Rating
Walls	Average thermal transmittance 0.25 W/m²K	Very good
Roof	Average thermal transmittance 0.11 W/m²K	Very good
Floor	Average thermal transmittance 0.15 W/m²K	Very good
Windows	High performance glazing	Very good
Main heating	Boiler and radiators, mains gas	Good
Main heating control	Time and temperature zone control	Very good
Hot water	From main system	Good
Lighting	Low energy lighting in all fixed outlets	Very good
Air tightness	Air permeability 4.5 m³/h.m² (as tested)	Good
Secondary heating	None	N/A

Primary energy use

The primary energy use for this property per year is 67 kilowatt hours per square metre (kWh/m2).

Energy Performance Certificates contain recommendations based on the calculations from the reduced Standard Assessment Procedure used to calculate the building energy performance. These are designed to act as guidance to the building residents on what changes to consider in order to improve energy efficiency, reduce carbon emissions and energy costs. The SAP is due for an update to take account of reduced emissions factors from UK electricity production, improvements to heating and ventilation technologies and a more urgent need to move away from gas as

a primary energy source. However, the recommendations are a useful starting point for a more comprehensive assessment of how to reduce energy consumption:

Recommendation 1: Solar water heating

Solar water heating

Typical installation cost	£4,000 - £6,000
Typical yearly saving	£31
Potential rating after carrying out recommendation 1	87 | B

Recommendation 2: Solar photovoltaic panels, 2.5 kWp

Solar photovoltaic panels

Typical installation cost	£3,500 - £5,500
Typical yearly saving	£361
Potential rating after carrying out recommendations 1 and 2	95 | A

This is a typical example of a higher-standard new-build in the district. It shows that the energy demand of the house will require retrofit work to reach an A standard, and that even then it will not be a net zero level energy performance. The work on the heating system and mechanical ventilation will be invasive.

What would have been required to make the property at Baldock Road, Canterbury a net zero house?

1. Install a ground source or air source heat pump. (The Baldock Road development scheme was ideal for a common ground source loop low temperature heat network as it was new build development.)
2. Better orientation(N-S instead of E-W) to benefit from solar gain and shading to improve energy efficiency and shading.
3. A higher level of insulation and air tightness
4. Solar thermal and PV installation
5. Mechanical ventilation with heat recovery.

The additional cost at the time of construction to build this home to a net zero standard would be around £10,000 (based on industry data - see section 'Meeting affordability and viability requirements'). It would save running costs for the residents, reduce emissions by over 1 tCO2 per year and remove the need for expensive and invasive retrofit works in the future.

Key issue 3: Set a more detailed and condition-based checklist that ensures that future proof fabric, heating and ventilation technology is included in all new developments.

Make sure that new construction does not omit the necessary measures that achieve the lowest operations emissions now and safeguards the property against expensive and invasive retrofit work.

Orientation, solar gain and shading are key design attributes that are very difficult to rectify later.

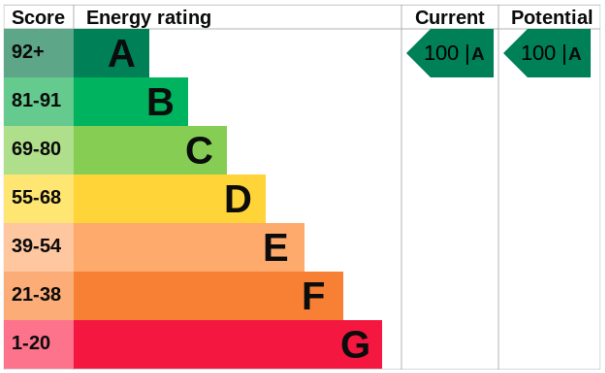
Example 2: Raymond Avenue, Canterbury

Redeveloped in 2017, a former detached house was removed and a pair of semi-detached homes were built to passive house standard - achieving full marks for EPC rating and a primary energy use that exports energy to the grid. These homes have insulation and air tightness than example 1.

Environmental impact of this property

One of the biggest contributors to climate change is carbon dioxide (CO2). The energy used for heating, lighting and power in our homes produces over a quarter of the UK's CO2 emissions.

An average household produces	6 tonnes of CO2
This property produces	-0.3 tonnes of CO2
This property's potential production	-0.3 tonnes of CO2



Feature	Description	Rating
Walls	Average thermal transmittance 0.10 W/m²K	Very good
Roof	Average thermal transmittance 0.09 W/m²K	Very good
Floor	Average thermal transmittance 0.07 W/m²K	Very good
Windows	High performance glazing	Very good
Main heating	Air source heat pump , electric	Poor
Main heating control	Time and temperature zone control	Very good
Hot water	From main system, plus solar	Poor
Lighting	Low energy lighting in all fixed outlets	Very good
Air tightness	Air permeability 0.5 m³/h.m² (as tested)	Very good
Secondary heating	None	N/A

The primary energy use for this property per year is -15 kilowatt hours per square metre (kWh/m2) - i.e. it is better than net zero and exports energy. It has better wall, roof and floor insulation and has much better air-tightness than the conventional example.

The homes feature high insulation and air tightness, full solar PV roofs, air source heat pumps.

Current national regulations

The legislation:

Regulation 25B

Regulation 25B states: 'Where a building is erected, it must be a nearly zero-energy building'. For new buildings owned and occupied by public authorities, the coming-into-force date for Regulation 25B was 1 January 2019. For all other buildings, the coming-into-force date for Regulation 25B was 31 December 2020. Compliance with Regulation 25B Compliance with this requirement is achieved by both: a. meeting the Target Emission Rate required under Regulation 26 and b. undertaking an analysis of the technical, environmental and economic feasibility of using high-efficiency alternative systems, which include decentralised energy supply systems based on energy from renewable sources and taking this analysis into account as required by Regulation 25A.

The legislation is expressed through the building regulations which are currently Building Regulations 2010 (2013 edition incorporating 2016 amendments)

Part LA Conservation of fuel and power in new buildings

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Minimum energy performance requirements for buildings

25. Minimum energy performance requirements shall be set by the Secretary of State calculated and expressed in accordance with the methodology approved pursuant to regulation 24, for–

(a) new buildings (which shall include new dwellings), in the form of target CO_2 emission rates; and

(b) new dwellings, in the form of target fabric efficiency rates.

The Target Emissions Rate (TER) is calculated by the SAP assessment based on a notional model house. The TER is updated via new releases of the SAP tool. It is specific to each house and depends on the fabric, layout, storeys, party walls etc. There is a lack of transparency of TERs - it is not easy to see the benchmarks and this obfuscates what efficiency is actually being delivered by the design.

Proposed new national regulations

Proposed new regulations (in consultation)

2021 consultation-stage guidance for Approved Document L (conservation of fuel and power), Approved Document F (ventilation) and Overheating.

- 'The Government's preferred option will deliver a 27% reduction in carbon emissions on average per building compared to the existing standard.'

Future Buildings Standard for 2025

Open consultation phase 2

- 75-80% better than current existing standards (i.e. not a net zero standard - referred to as 'net zero ready')

1.2 The energy performance of the notional dwelling, which forms the target for the actual dwelling, is described using the following metrics.

a. The Target Primary Energy Rate, in kWhPE/m2 /year: this is the primary energy used by the dwelling, influenced by the fabric and fuel choice.

b. The Target Emission Rate, in kgCO2e/m2 /year: this is the minimum standard for CO2 emissions from the dwelling, influenced by the fabric and the fuel choice.

c. The Target Fabric Energy Efficiency Rate, in kWh/m2 /year this is the fabric energy efficiency of the dwelling, influenced by the fabric only.

The numerical targets for the Future Homes Standard have not yet been determined.

Figure 1.1: Contents of the Future Homes Standard and Future Buildings Standard consultations.
i - The Fabric Energy Efficiency Standard (FEES) is being reconsulted on in this consultation, alongside some building services standards and guidance on the calibration of devices that carry out airtightness testing.

The current proposed timelines for national building regulations legislation include the uplifts to current building regulations in 2021 followed by more substantial changes in 2025.

Both sets of regulations give a period of grace of 18 months for the regulations to apply to developments that have planning approval.

Timeline for improving new construction standards through the Local Plan and building regulations

The current UK Government timetable for Building Standards legislation is as follows:

	2021	2022	2023	2024	2025	2026
New domestic buildings	Built to current Part L standards.	If agreed, new 2021 Part L applies, with an 18-month window between planning approval and application. Potential for higher energy standard to be required at the planning stage by Local Plan policy (mid 2022)	First homes get built to an improved SAP Target Energy Rate (or Local Plan specified higher standards (depending on phasing arrangements)	All new homes built now have to comply with the higher TER	Future Homes Standards implemented	
Modifications to existing buildings	Current LP has no guidance on modifying existing buildings; Building Regulations only require improvement in energy for large extensions (>1000m2) and changes of use.	If agreed, 2021 uplift will bring higher standards to extensions (except garden rooms and conservatories).			Future Homes Standards treats extensions as requiring energy efficiency upgrade work to the whole home (as per fire regulations)	

Options for early implementation of higher standards

Option	Option detail	Advantages	Disadvantages	Examples
Status quo	Do nothing	No effort	Perpetuates the construction of homes in the district that have low energy standards and will need expensive retrofit.	Most LAs
Indicative Net Zero now	Provides guidance without actual enforcement.	Easy to do quickly	Likely to have low impact (as per current guidance).	Swale
Future Homes Standard now	Publish new supplementary planning guidance with energy policy asap as a modification to the current Local Plan At Future homes standard level	Can be done now and would bring a step change to standards required for new applications and modifications to existing housing.	Requires resources to do this. Anxiety about doing this even though the NPPF allows it, in case it brings legal challenges. How to implement it, given that the standards are governed by SAP, where the standards are published nationally within the model.	
Net Zero Now	Publish new supplementary planning guidance with energy policy asap as a modification to the current Local Plan At Future homes standard level	London has implemented a zero carbon standard since 2016. The London method brings in additional revenue through the carbon charge as well as improving standards in London.	Requires considerable resources to do this as it also needs the setting up of the carbon charging system and the standards to be defined (separately from the Future Homes Standard)	London Plan, Bristol, Cornwall
Local Plan 2040 FHS	Incorporate new standards into the new Local Plan (from mid 2022) at Future Homes Standard level at Future homes standard level	Higher standards in the new Local Plan are generally expected; the NPPF encourages early adoption of standards that have been pre-announced nationally.	No new standard implemented until late 2022. The Future Homes Standard is not a net zero standard (only 75-80% better than 2018 Building Regulations Part L)	Tonbridge and Malling, Milton Keynes
Local Plan 2040 Net Zero	Incorporate new standards into the new Local Plan (from mid 2022) at Future Homes Standard level at full net zero level	As for Net Zero now, but one year later.	As for Net Zero now, but one year later.	

How to implement a net zero carbon standard at a district level

The National Planning Policy Framework (NPPF) allows Planning Authorities to set housing standards at an authority level and in January 2020 the Ministry of Housing Communities and Local Government reiterated that the Planning and Energy Act 2008 gives local authorities powers to set local energy efficiency standards for new homes through to 2025 at the earliest.

Challenges that all local authorities face in setting local standards include

- how to specify a clear and measurable standard that can be applied and monitored through planning conditions?
- will a higher standard affect the development viability?

Specifying a clear energy standard

The current UK energy standard set by the Secretary of State through the building regulations is through Standard Assessment Procedure (SAP) standard model. It is not a specific value for energy demand and is a 'closed box' calculation; it is difficult for Planning Authorities to set their own local measure using this route

Summary views of some key local architects working in high energy performance buildings from interviews:

Architect	**Views**
Local architects, Canterbury (Established Canterbury practice with experience in low carbon design)	'The absence of clear local energy standards means that our designs are too often dictated by conventional views of the developer - They don't see why they should do something different if there is no regulated need to do it.'
Local architect, Canterbury (Net zero house designer)	'All the evidence is that we should work to the Passive House Standard - it is the one clear measure that delivers zero carbon homes because it specifies the actual performance of the building before the design stage. Passive House has been demonstrated to work, is an international standard with an accreditation certificate that is enforceable as a planning condition. I don't see how a planning authority would be able to implement a zero carbon standard without this. Moreover, the Passive standard also works for modifications to existing buildings.
Local architect, Bridge (Net zero house designer)	'We have been demonstrating that Passive House works - our successful projects here in Canterbury district and beyond show that it is possible and affordable to build zero carbon homes right now.'
Local architects, Faversham (Award -winning low carbon social housing designer)	'Through our social housing schemes in Norwich and York we are showing that passive house zero operational carbon design works and is affordable. We would love to be doing similar work in Canterbury district.'

Options to set a net zero energy standard at a Planning Authority level:

Net zero specification	**Advantages**	**Disadvantages**
Specify net zero operational emissions as calculated by SAP (for the EPC) [as per London policy], charging for any non-compliance based on a carbon price	• Provides an approach consistent with the methodology and certification used by central government • Avoids the problem of being challenged over economic viability as developers can choose to pay a carbon charge if they claim they cannot achieve a cost-effective zero carbon design. • The policy provides a mechanism for London Boroughs to gain funding for other low carbon initiatives • Easy to specify and to check up on - as all new homes must have an EPC assessment for sale or rent	• The relatively low carbon cost means that developers often pay when their designs do not achieve zero operational carbon - around £2,500 per home one-off cost. • SAP is not designed as a zero carbon design tool and has not been used as such; this option needs testing • SAP emissions, insulation and technology factors are often out of date and many commentators criticise its validity
Specify Passive House Standard, make certification a planning condition	• The de-facto net zero carbon standard with international recognition • Simple to specify and ensures good design principles from the outset • Certification is easy to follow up as a condition and enforce	• For developments including heritage elements it requires much greater design thought • Relies on the independent Passive House Standard and assessment methodology
Design a local policy that takes into account local factors or design guidance	• Can be tailored to the local issues and may include a mix of incentives and regulations	• Does not provide the clarity and consistency with national standards • Difficult to design numerical standards that fit in with / do not conflict with Building Standards • Prior experience across the UK of local energy standards independent of the established metrics has shown poor compliance

Meeting affordability and viability requirements

As part of implementing higher Planning Authority energy standards, Swale Borough Council commissioned economic viability research for the immediate implementation of a minimum energy efficiency rating of B for all new development, progressing through minimum standard A in 2035 to a net zero standard by 2030. The viability assessment by Aspinall Verdi calculated the premium to deliver higher energy standards for new homes:

CO_2 operational emissions reduction from current Building regulations part L standards (2013)	Average cost per dwelling (£)	Details and source
20%	£2,557	MHCLG Future Homes Standard assessment 2019
31%	£4,850	MHCLG Future Homes Standard assessment 2019
72%	£7,300	Currie & Brown, Cost of Carbon Reduction in New Buildings, 2018
Zero operational emissions	£10,100	Currie & Brown, Cost of Carbon Reduction in New Buildings, 2018
Passive house standard	£9,775	Passive House Trust analysis of certified schemes, 85m^2 average house

Exeter City Living has been providing zero carbon homes to Exeter City Council since 2010 and reports that the construction premium for social housing built to passive house standard is currently at 9% and continues to reduce through growth in skills, experience and the supply chain.

Net zero operational emissions homes have much lower operating costs than conventionally heated homes - saving on average in excess of £1,000 per year in fuel bills and over £100 per year in gas safety certification for rental properties. There is already an indication that high efficiency and 'future-proofed' housing commands a higher sale value and some lenders provide preferential rates for low energy consumption homes.

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