Number: WG38670

Welsh Government
Consultation Document

Building Regulations Part L and F Review -

Changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings

Date of issue: 19/12/2019
Action required: Responses by 12/03/2020

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.
This document is also available in Welsh.

Overview

The Building Regulations and the associated guidance set out in Approved Documents seek to ensure buildings meet certain standards for minimum health, safety, welfare, convenience and sustainability.

This document covers proposals for changes relating to Part L (Conservation of fuel and power) and Part F (ventilation) for new dwellings.

This consultation is aimed primarily at firms, individuals and their representative bodies within construction and construction-related industries and the building control bodies that enable the building control system to operate. Specific elements may be of interest to members of the public.

How to respond

You can email your response to the questions in this consultation to: enquiries.brconstruction@gov.wales.

If you are responding in writing, please make it clear which consultation and which questions you are responding to:

Written responses should be sent to:

Changes to the Building Regulations in Wales for new dwellings, Building Regulations, Welsh Government, Rhydycar, Merthyr Tydfil, CF48 1UZ

When you reply, it would be useful if you confirm whether you are replying as an individual or submitting an official response on behalf of an organisation and include:

- your name,
- your position (if applicable),
- the name of organisation (if applicable),
- an address (including post code),
- an email address, and
- a contact telephone number

Further information and related documents

Large print, Braille and alternative language versions of this document are available on request.

Contact details

For any enquiries about the consultation please contact the Welsh Government Building Regulations team by emailing: enquiries.brconstruction@gov.wales

For further information:
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General Data Protection Regulation (GDPR)

The Welsh Government will be data controller for any personal data you provide as part of your response to the consultation. Welsh Ministers have statutory powers they will rely on to process this personal data which will enable them to make informed decisions about how they exercise their public functions. Any response you send us will be seen in full by Welsh Government staff dealing with the issues which this consultation is about or planning future consultations. Where the Welsh Government undertakes further analysis of consultation responses then this work may be commissioned to be carried out by an accredited third party (e.g. a research organisation or a consultancy company). Any such work will only be undertaken under contract. Welsh Government's standard terms and conditions for such contracts set out strict requirements for the processing and safekeeping of personal data.

In order to show that the consultation was carried out properly, the Welsh Government intends to publish a summary of the responses to this document. We may also publish responses in full. Normally, the name and address (or part of the address) of the person or organisation who sent the response are published with the response. If you do not want your name or address published, please tell us this in writing when you send your response. We will then redact them before publishing.

You should also be aware of our responsibilities under Freedom of Information legislation.

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Chapter 1. Introduction

Background

1.1 Internationally, the world is coming together to take action on climate change. The United Nations (UN) has put in place a 2030 framework to drive forward sustainable development and climate change through the UN Sustainable Development Goals and the UN Framework Convention on Climate Change (UNFCCC) Paris Agreement. The UK and 194 other countries endorsed the Paris Agreement to limit global temperature rise this century to "well below 2°C" above preindustrial levels and to "pursue efforts towards 1.5°C". Signatories committed to making pledges to reduce emissions (Nationally Determined Contributions) and to reviewing these pledges every five years to steadily increase ambition over time. Most recently at the UN's Conference of the Parties in Poland (COP24), countries agreed many of the rules required to implement the Agreement.

1.2 In Wales the Welsh Government has declared a Climate Emergency, which builds on the ambitious actions set in the Environment (Wales) Act 2016, which requires Welsh Government to reduce emissions of greenhouse gases (GHGs) in Wales by at least 80% for the year 2050 with a system of interim emissions targets and carbon budgets.

1.3 Furthermore, earlier this year, Welsh Government received commissioned advice from our statutory climate change advisors, the UK Committee on Climate Change (UKCCC) recommending increasing our decarbonisation target to 2050 from at least 80% decarbonisation to at least 95%.

1.4 Welsh Government commissioned the advice alongside UK and Scottish Governments, following the publication of the Intergovernmental Panel on Climate Change Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels (2018) with the intent of alignment to the Paris Agreement.

1.5 On 11 June Welsh Government accepted the UKCCC advice and announced the intention to bring forward legislation in 2020 to adopt a 95% carbon reduction target, representing a huge increase in ambition from our current target.

1.6 The new 95% target will not limit our ambition. We will continue to work with stakeholders to explore how we can set a net zero target in the future. We are the first UK nation to declare the intent to go beyond UKCCC advice and have asked the UKCCC to provide further advice on how the revised headline target should affect interim targets for 2030 and 2040 and our second carbon budget alongside the process of setting our third carbon budget in 2020.

1.7 The Environment (Wales) Act 2016 places a duty on successive Governments to set five year carbon budgets, commencing on the 1st January 2016 and publishing a plan to demonstrate how the carbon budget will be met. Welsh Government's statutory delivery plan for meeting the first carbon budget (2016-20) was published in March 2019. Prosperity for All: A Low Carbon Wales contains 100 policies and proposals to meet the first carbon budget and first interim target of 2020, with our

next plan setting our measures to meet emissions reduction targets for 2021-26 being developed. Proposal 39 of the current plan commits us to set higher energy efficiency standards for new builds through reviewing Building Regulations Part L (Conservation of Fuel and Power).

1.8 Homes – both new and existing – account for 20% of greenhouse gas emissions in the UK.[1] By improving energy efficiency and moving to cleaner ways to heat our homes, we can reduce carbon emissions and keep down household energy costs now and in the future. The new homes that we are constructing now will exist in 2050, and therefore we must ensure that the standards we set for these homes put us on the right path.

1.9 Part L (Conservation of Fuel and Power) and Part 6 of the Building Regulations are the means by which we regulate for minimum energy efficiency standards in new homes. The current requirements mean that new homes are already very energy efficient with lower heating bills compared to existing older homes.[2] However, we propose that the standards need to be uplifted as a stepping stone towards the next Part L changes in 2025, and in particular towards future-proofing homes for low carbon heating. In December 2016, the Cabinet Secretary for Energy, Planning and Rural affairs announced, as part of your energy statement the intention to start a review of Part L which has resulted in this consultation.

The Consultation Package

1.10 The key purpose of this consultation is to seek views on proposed changes to Part L (Conservation of Fuel and Power) and Part F (Ventilation) of the Building Regulations for new homes, and the associated statutory guidance (Approved Document L Volume 1 and Approved Document F Volume 1). In particular it seeks to make new homes more energy efficient and to future-proof them for the introduction of low carbon heating systems. It also includes changes to Part L to align it with the 2018 recast of the Energy Performance of Buildings Directive (EPBD)[3], and proposals for a new approach to transitional arrangements.

1.11 In addition, the consultation considers proposals for improving compliance and performance to ensure that energy efficiency requirements are delivered on the ground.

1.12 The Building Regulations are supported by the National Calculation Methodology, which is used to calculate building energy performance for compliance checking purposes. For homes this is the Standard Assessment Procedure (SAP). Changes are periodically made to these tools to ensure that they remain fit for purpose to support the Building Regulations and other government policies. A consultation version of SAP allows consultees to model the effects of the different uplift options.

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[1] UK housing: Fit for the future?, Committee on Climate Change (2019) https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/

[2] Energy efficiency in the British housing stock: Energy demand and the Homes Energy Efficiency Database, Energy Policy (60), Hamilton, Steadman, Bruhns, Summerfield and Lowe (2013) https://www.sciencedirect.com/science/article/pii/S0301421513002413

[3] Directive (EU) 2018/844 amending Directive 2010/31//EU on the Energy Performance of Buildings, OJEU, 2018

1.13 This consultation also sets out our view on what we think building regulations for our future Part L standard in 2025 may look like and the roadmap for achieving it. This gives the necessary context to the proposed changes to the energy efficiency requirements outlined in the consultation.

Leaving the EU – Brexit

1.14 A substantial body of legislation has been developed at the EU level which helps reduce Wales' greenhouse gas emissions and protects Wales' environment and social well-being and the UK's withdrawal from the EU does not affect the need for action now. To ensure protections and standards which benefit our citizens, and the well-being of society as a whole, are not eroded, this consultation will bring forward changes as part of the implementation of the Energy Performance of Building Directive (EPBD) 2010 (Recast).

Development of these proposals

1.15 Using the five ways of working set out in the Well-being of Future Generations (Wales) Act 2015 the proposals have been developed with our stakeholders. Welsh Government is grateful for the input and support from industry and other stakeholders in attending technical working groups, and providing other advice throughout the development phase to inform our direction of travel and final proposals. In addition, we are grateful to the advice provided by the Building Regulations Advisory Committee for Wales (BRACW) in shaping these proposals.

1.16 The proposals set out in this consultation will actively deliver four of the well-being goals, a prosperous Wales, a healthier Wales, a more equal Wales and a globally responsible Wales.

1.17 The proposals will deliver a prosperous Wales as they seek to make new homes more energy efficient and to future-proof them for the introduction of low carbon heating systems. This directly delivers an innovative and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including acting on climate change). The introduction of these changes will reduce the energy costs associated with the building. As buildings are cheaper to run, this will ensure a more equal Wales as they will help people no matter what their background or circumstances (including their socio economic background and circumstances).

1.18 The proposals also make amendments to Part F (Ventilation) to ensure the supply and removal of air to and from a space or spaces in a building provides good air quality. These amendments will help ensure people's physical well-being is maximised. All of the actions also ensure Wales is taking action to improve the well-being of Wales, whilst also taking account of whether such actions make a positive contribution to global well-being.

Further Consideration

1.19 This consultation focusses on the proposed changes for 2020 and the future direction of building energy policy in 2025. There are a number of items which relate to energy efficiency standards but fall outside the scope of this consultation. We intend to consult on the matters discussed in the following paragraphs in the coming months:

Work to existing dwellings

1.20 We intend to consult on standards when building work is carried out in existing dwellings, with a view to uplifting the standards. To reduce the risks associated with energy efficiency works to existing buildings, for example the associated impacts on airtightness which reduce the overall amount of fresh air entering the home, we also propose to introduce new guidance for Part F (Ventilation) to provide clarity on the expected ventilation standard when retrofit work is carried out.

New and existing non-domestic buildings

1.21 We also intend to revise standards for buildings other than dwellings. We propose to consult on making improvements to Building Regulations requirements for new and existing non-domestic buildings, including opportunities to promote low carbon and higher energy efficiency heating, ventilation and air conditioning systems in new buildings, and the performance gap.

Overheating in new dwellings

1.22 In 2018 the Parliamentary Environmental Audit Committee (EAC) held an inquiry into heatwaves and their impact on the UK. Within the final report the EAC recommended that the UK government should create a new regulation to stop buildings being built which are prone to overheating.

1.23 In addition to future risks of climate change there are already concerns in Wales of existing buildings overheating, we therefore intend to consult on proposals to reduce the risk of overheating in new dwellings.

Timetable for introduction of changes

1.24 The dates for the introduction of changes are set out below.

Date	Preferred option on timing
Early 2020	Subsequent consultation on: • Overheating in new dwellings • Energy efficiency standards for work carried out in existing dwellings • Energy efficiency standards for new buildings other than dwellings • Energy efficiency standards for work to existing buildings other than dwellings

Early/mid 2020	Publication of new Part L, Part F and overheating regulations, associated guidance and supporting analysed consultation response document.
Mid/late 2020	Part L, Part F and overheating regulations come into force

Building regulations

1.25 Building Regulations control certain types of building work, principally the erection and extension of buildings and provision or extension of certain services or fittings, chiefly to ensure that buildings meet certain standards of health, safety, welfare, convenience and sustainability.

1.26 Compliance with the Building Regulations is the responsibility of the person carrying out the work and the building control system helps to ensure that the required level of performance has been met. The role of a building control body, either the Local Authority or a private sector Approved Inspector, is to act as an independent third-party check to help achieve compliance. As an alternative to third-party checking by building control, some types of work may be self-certified as being compliant by installers who are registered as a member of a competent person self-certification scheme and have been assessed as competent to do so.

1.27 Building Regulations greatly influence how our buildings are constructed and used. As such, they help to deliver significant benefits to society. Regulation can also impose costs on both businesses and individuals. The "functional" nature of the Building Regulations, by having regulation setting out the broad requirement rather than prescribing how it must be achieved, seeks to minimise this cost and also ensure innovation is not hindered. Guidance in the Approved Documents that accompany the Regulations then sets out some of the ways that these requirements can be met although it does not have to be followed if the required level of performance can be shown to be achieved in a different way. This approach provides clarity for building control bodies and industry alike.

1.28 To avoid the risk of unnecessarily onerous and costly standards being imposed on industry it is important that a proper cost/benefit assessment and consultation with industry has been undertaken by the Welsh Government to assess what reasonable minimum standards are appropriate.

Chapter 2. Future Part L 2025 onwards

Background

2.1 Making our homes and other buildings more energy efficient can improve the comfort and energy efficiency of people's homes and boost economic growth while meeting our targets for carbon reduction. Our current Part L requirements already require good levels of energy efficiency, and our proposals for 2020 set leading standards but we need to push further.

2.2 We must ensure that we continue to build on these standards and further improve energy efficiency standards in new homes. We recognise that to meet higher standards industry will need to develop the necessary supply chains, skills and construction practices to deliver low-carbon heat, and highly energy efficient new homes. We consider the first step to help facilitate these changes is to provide a clear vision to industry for our future Part L in 2025.

What we think Part L 2025 in Wales will look like?

2.3 We envisage our Part L 2025 standard will have very high fabric standards that limit heat loss and reduce the demand for heat. We consider the fabric package for Part L 2025 should be based on the fabric specification proposed for Option 1 (as set out in annex A), but with higher a specification for glazing (i.e. triple glazing).

2.4 However, although reducing the demand for heat through improved fabric standards in new homes has a key role to play it will not, on its own, meet our ambitions for the future. Therefore, in addition to a high level of fabric efficiency we also propose that a low carbon heating system is integral to the specification. The CCC stated in its report *Net Zero: The UK's contribution to stopping global warming* that achieving the net zero target will require the full decarbonisation of buildings by 2050.[4] There are a number of existing low carbon heating technologies with the potential to support the scale of change needed. We anticipate that low carbon heating may be delivered through heat pumps, heat networks and in some circumstance's direct electric heating.

2.5 We anticipate that an average semi-detached home built to meet the Part L 2025 Standard would produce 75-80% less carbon dioxide emissions than one built to the 2014 Part L requirements.

Heat pumps

2.6 We anticipate that the installation of heat pumps, particularly air-to-water and air-to-air heat pumps, will play a major role in delivering low carbon heat for homes built to meet our future Part L 2025 standard. Heat pumps come with the same low-carbon benefits as direct electric heating but can deliver heat much more efficiently which can help to overcome the affordability and grid-resource constraints associated with direct electric heating.

Heat networks

2.7 Heat networks (sometimes referred to as district heating) are a method of delivering heating and hot water to multiple buildings from a central heat source and, particularly in urban areas, can be the most effective way to provide low carbon heat. These heat networks could form an important part of our plan in the future of low carbon heat, in particular in cities and high-density areas. Heat networks can decarbonise more easily compared to most other heat sources

[4] *Net Zero: The UK's contribution to stopping global warming* was published by the Committee on Climate Change on 2 May 2019 and is available at: https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf

because new technologies can be added to the system with little disruption to individual householders. They provide a unique opportunity to exploit larger scale, renewable and recovered heat sources that can't be accessed at an individual building level. Heat networks also provide system benefits such as thermal storage and reducing the energy demand of the grid at peak times.

Direct electric heating

2.8 We anticipate that direct electric heating will play a minor role in our plan for the future of low carbon heat. Direct electric heating is a well-established technology that produces heat through a near-100% efficient process, with no emissions at the point of use. Despite this, direct electric heaters can be very expensive to run, and if deployed at scale may have a significant effect on the national grid. Under some circumstances it may be an appropriate technology in applications where heat demand is particularly low, for instance where a home is built to the very highest fabric standards.

Other technologies

2.9 Other technologies, such as hydrogen, may have a role to play in heating systems of the future. However, for new homes, we anticipate that heat pumps and heat networks (and to a lesser extent direct electric heating) will be the principal means of producing low-carbon heat for buildings built to our future Part L 2025 standard.

Question 1
Do you agree with our expectation that a home built to our future Part L 2025 standard should produce 75-80% less CO2 emissions than one built to current Part L requirements?

- **a. Yes**
- **b. No – 75-80% is too high a reduction in CO2**
- **c. No – 75-80% is too low a reduction in CO2**

If no, please explain your reasoning and provide evidence to support this.

Question 2
We think heat pumps and heat networks should typically be used to deliver the low carbon heating requirement of the future standard. What are your views on this and in what circumstances should other low carbon technologies, such as direct electric heating, be used?

Question 3
Do you agree that the fabric package for Option 1 set out in Chapter 3 and Annex A, but with the addition of higher specification glazing (i.e. triple glazing units), provides a reasonable basis for the fabric performance of part L 2025?

- **a. Yes**
- **b. No – the fabric standard is too demanding**
- **c. No – the fabric standard is not demanding enough**

d. No - high specification glazing (i.e. triple glazing) should be specified in option 1 for the 2020 proposed specification

If no, please explain your reasoning

Implementing the Future Part L 2025 Standard

2.10 We envisage the next Part L will come into force in 2025, meaning it will be the national minimum energy performance requirement for all new homes when introduced.

2.11 We recognise some home-builders are already building to energy standards above the current Building Regulations and some are already installing triple glazing, low carbon heating systems and renewable energy, which we encourage. However, we consider that not all home-builders are ready to build to higher energy targets yet. Furthermore, there may not be the necessary supply chains, trained installers and product availability needed for every home-builder to do so.

Preparing for future Part L 2025 standard - timeline.

2.12 This consultation contains our initial thoughts on the future direction of building regulations. It provides a strong indication to industry where we are headed and provides an opportunity for feedback on our proposals.

2.13 We are considering research into the proposed methods of heating which would underpin the new standards through pilot studies being undertaken in Welsh Government funded housing developments. We believe this will provide technical evidence and learning around implementation experience of heat pumps.

2.14 We envisage the next review of Part L will commence in 2022, with the intention of consulting on the implementation of the 2025 standard in 2024. However, given the increased urgency with which tackling climate change is viewed we cannot sit back between reviews. We need to be flexible to respond to changes in technology and industry practice in the intervening period. These changes may influence the programme and timing of the next review.

Chapter 3. Part L Standards for New Dwellings in 2020

Background

3.1. This consultation sets out both our intention for 2020 and the desire to move to low carbon heating at the next review. This would require a very considerable step up in energy efficiency standards compared to the level currently required by Part L of the Building Regulations. Industry needs to prepare for this, to

develop the supply chain capacity, to develop the necessary installation skills in order to avoid issues with build/installation quality when introduced. We therefore propose introducing an achievable but significant uplift to energy efficiency standards to be brought in as soon as possible (2020) as a stepping stone to low carbon heat for our future Part L 2025 standard.

3.2. In preparing for low carbon heating this review proposes an element of future proofing. There are changes we can make now that prepare us for example when low carbon heating becomes the main heat source. We therefore need to make sure that any uplift to energy efficiency standards that we introduce in 2020 means that new homes are future-proofed for low carbon heat, with build standards that minimise heat loss and are affordable to run.

3.3. This chapter focuses on two options for an uplift in energy efficiency standards in Part L to be brought in during 2020. We have sought to find proposals which make a strong and meaningful contribution to reducing the carbon and energy impact of new homes, while recognising that our ambition needs to be balanced against the desire for standards to be cost-effective, affordable and practical.

3.4. In non-technical terms, Options 1 and 2 are intended to deliver a 37% and 56% improvement on the current Part L standard.[5] We expect both options to be delivered through high fabric standards alongside the use of low-carbon heating and/or renewables, such as photovoltaic panels. The key difference between the two options is that Option 1 is expected to be delivered through natural ventilation whilst Option 2 is expected to be delivered through mechanical ventilation with heat recovery (MVHR) with a higher standard of airtightness. Details of the costs and benefits of both options are set out below and in the Impact Assessment, but in broad terms Option 2 would deliver more carbon savings and result in lower fuel bills for the householder but has higher build costs and maintenance.

3.5. Option 1 is our preferred option. There are several reasons for this:

- Option 1 delivers a significant improvement to the current standard. It builds upon the approach we took for Part L 2014 based on natural ventilation with additional measures to further reduce energy demand (improved building fabric and a waste water heat recovery system).
- There is concern in Option 2 encouraging significant take-up of MVHR systems at this time. Recently published research commissioned by MCHLG[6] shows that the actual ventilation rates from mechanical ventilation not achieving the standards set out in Approved Document F. This aligns with research produced by the Mackintosh Environmental Architecture Research Unit[7] and the Zero Carbon Hub[8]. Issues identified include the design,

[5] Based on CO_2 reduction for a semi-detached home. This is estimated to be equivalent to around 35% and 53% improvement for Options 1 and 2 respectively over the national build mix.
[6] https://www.gov.uk/government/publications/ventilation-and-indoor-air-quality-in-new-homes
[7] Sharpe, McGill, Gupta, Gregg, Mawditt (2016) *Characteristics and Performance of MVHR systems.* MEARU, fourwalls, Oxford Brookes University
[8] Nicholls, Dollard, Mawditt, Pannell (2016) *Ventilation in New Homes* . London: Zero Carbon Hub http://www.zerocarbonhub.org/sites/default/files/resources/reports/ZCH_Ventilation.pdf

installation, commissioning and/or operation of mechanical ventilation. Whilst these studies also identify issues of the under-performance of natural ventilation systems, this is expected to have greater impact in homes with MVHR systems installed as they tend to be used in more airtight properties with less infiltration i.e. more reliant on their ventilation system performing as designed.

- There is limited design flexibility to meet the Option 2 target uplift if the developer chose not to use MVHR e.g. adopts natural ventilation. It may not be feasible or viable to design an alternative option with gas heating and it is likely to require a low carbon heating source, such as an air source heat pump. It is further recognised that a significant transition to low carbon heat requires the market for technologies such as heat pumps, as well as those qualified to install these technologies, to be significantly developed.

3.6. To note, Part L sets energy efficiency standards by requiring a minimum performance level that must be achieved which is measured in terms of energy and carbon dioxide (CO_2). This is a technical process and as such the sections below are set out in quite technical detail. The sections below also refer to homes as 'dwellings' as this is the legal term used in the Building Regulations.

Uplift of the Part L minimum standard

Setting the primary energy and CO_2 targets

3.7. The proposed primary energy and CO_2 targets set the performance level that a new dwelling must achieve; detail on these performance metrics is provided below. We carried out detailed modelling to determine what a reasonable level of energy and CO_2 performance might be for a new dwelling, taking account of carbon savings, running costs, capital costs, and impact on housebuilding.

3.8. Our modelling included considering improvements to the minimum energy efficiency standards in the following areas:

- improving fabric and services
- introducing low-carbon heat
- heat recovery technologies
- on-site generation

3.9. The modelling was principally undertaken on a core set of four building types: detached home, semi-detached home, mid-terrace home and a 4-storey block of flats (made up of 16 1-bed single aspect and 16 2-bed corner flats), Some modelling with additional dwelling types was used for sensitivity analysis. The building energy modelling was undertaken using a consultation version of SAP (cSAP) with updated carbon emission and primary energy factors; these factors can be found in the consultation version of SAP (cSAP) and in Annex E of this document. AECOM provided current capital and lifecycle cost data for Wales. The resultant cost benefit analysis is presented in the accompanying Impact Assessment.

3.10. Following discussion with our technical working group and our Building Regulations Advisory Committee for Wales, and an assessment of the modelling analysis, two options for the 2020 CO_2 and primary energy targets are proposed for consultation. The options below are presented in terms of CO_2 reduction to aid comparison with current standards. We plan to use either option 1 or option 2 as the basis of the new primary energy and CO_2 targets for new dwellings, with option 1 as the government's preferred option:

a. **Option 1 -** This would be a 37% reduction[9] in CO_2 from new dwellings, compared to the current standards. This performance standard is based on the energy and carbon performance of a home with:

   i. High fabric standards to minimise heat loss from windows, walls, floors and roofs
   ii. Natural ventilation system
   iii. A gas boiler
   iv. A waste water heat recovery system
   v. Photovoltaic panels

3.11 This would add £5900 to the build-cost of a new home and would save households £180 a year on energy bills[10]. The estimated impact on housebuilding is discussed in the impact assessment.

b. **Option 2 -** This would be a 56% reduction[11] in CO_2 from new dwellings, compared to the current standards. In comparison with option 1, this option is likely to strongly encourage the use of mechanical ventilation with heat recovery (MVHR) or provide greater encouragement for low-carbon heating. The performance standard is based on the energy and carbon performance of a home with:

   i. High fabric standards to minimise heat loss from windows, walls, floors and roofs
   ii. Mechanical ventilation with heat recovery
   iii. A gas boiler
   iv. A waste water heat recovery system.
   v. Photovoltaic panels

3.12 Meeting this specification would add £8300 to the build-cost of a new home and would save households £190 a year on energy bills[12]. The estimated impact on housebuilding is discussed in the impact assessment.

3.13. Both options would give a reduced CO_2 saving for flats (25% and 42% respectively) due to the standard including solar panels and flats having a smaller

[9] Based on a semi-detached home. As an aggregate across the build-mix, this would be an estimated 35% CO_2 saving for option 1.

[10] Based on a semi-detached home. As an aggregate across the build-mix, these values would be an estimated £5550 additional build cost and £170 a year saving on energy bills for option 1.

[11] Based on a semi-detached home. As an aggregate across the build-mix,this would be an estimated 53% CO_2 saving for option 2.

[12] Based on a semi-detached home. As an aggregate across the build-mix, these values would be an estimated £8000 (Option 2 *does not include any heating distribution system cost savings due to reduced space heating demands associated with MVHR*) additional build cost and £180 a year saving on energy bills for option 2.

roof area per home. The additional cost per flat is also less at £2700 and £4900 respectively.

3.14. In practice, we expect that some developers would choose less costly ways of meeting these two standards, such as putting in low-carbon heating now. As an example, an air source heat pump would cost less than the specifications for options 1 and 2 shown in Annex A for a semi-detached house. This is due to the heat pump having lower carbon emissions and primary energy than a gas boiler and therefore the developer would not need to install renewables and/or higher fabric specifications to meet the performance targets.

3.15. We propose that the targets will be performance-based. The specifications on which both of the options above are based represent one way of meeting the primary energy and CO_2 targets for each of the options; we expect developers will find a wide variety of ways to meet these targets, utilising many different technologies.

Question 4
What level of uplift to the energy efficiency standards in the Building Regulations should be introduced in 2020?

a. **No change**
b. **Option 1 – 37% CO_2 reduction (the government's preferred option)**
c. **Option 2 – 56% CO_2 reduction**
d. **Other**

Please explain your reasoning.

Question 5
Do you agree with the concerns raised in paragraph 3.1 regarding MVHR systems at this time?

a. Yes
b. No

Please explain your reasoning or how these concerns could be overcome in the future.

Performance metrics

3.16. We propose four performance metrics for buildings to be measured against. These are:

- Primary energy target
- CO_2 emission target
- Householder affordability rating
- Minimum standards for fabric and fixed building services

3.17 This is a change from the current performance metrics of:

- CO_2 emission target
- Minimum standards for fabric and fixed building services

The rationale for each of these is described below.

Setting the energy target for new dwellings using primary energy and CO2 metrics

3.18 The 2014 Part L standard sets performance targets for new dwellings based on the CO_2 emissions of that dwelling. CO_2 is important, but it is not a direct measure of energy efficiency.

3.17. Over time, the electricity grid will become zero carbon, and we have made considerable progress in reducing the carbon intensity of the electricity grid already. Where a new dwelling uses electricity, CO_2 will become a less important measure of performance because it will ultimately come from an electricity grid that is zero carbon.

3.18. We are proposing that, from 2020 the energy efficiency of new dwellings should be assessed as the basis for the Part L performance target. Primary energy is the means we are proposing as a measure of energy efficiency. More information on our proposals for primary energy, including an explanation of what primary energy is and how it is calculated, can be found in the *Briefing Note – Derivation and use of Primary Energy factors in SAP*, which will be available on the SAP website: https://www.bregroup.com/sap/sap10/.

3.19. Despite the new focus on primary energy, reducing CO_2 emissions of new homes and buildings remains a critical objective for the Welsh Government. Although we consider primary energy to be a good means of driving energy efficiency, it may not drive low carbon choices in all scenarios by itself. For this reason, we propose to continue to use CO_2 targets for buildings alongside a primary energy target. The consultation version of SAP10 shows how we propose to apply primary energy to the compliance calculations in future.

Question 6
Do you agree with using primary energy as the principal performance metric?

a. **Yes – primary energy should be the principal performance metric**
b. **No – CO2 should remain the principal performance metric**
c. **No – another measure should be the principal performance metric**

Please explain your reasoning and provide evidence to support this.

Question 7
Do you agree with using CO2 as the secondary performance metric?

a. **Yes**
b. **No**

Please explain your reasoning.

Ensuring heating is affordable for householders

3.20. Electricity now has a lower CO_2 emission factor than natural gas. While electricity continues to have a higher primary energy than gas, it could be an appealing low capital cost option for developers to install direct electric heating solutions to meet primary energy and CO_2 targets. However, there is a risk of higher running costs to the resident; the UK Government's consultation on Part L 2020 [13] suggests that direct electric heating installed in new homes could incur over £350 higher bills per year for occupants when compared to gas heating.

3.21. To address this issue, and to reduce the risk that energy bills are unaffordable for consumers, we are proposing to introduce a new requirement for new dwellings in addition to primary energy and CO_2, based on the theoretical energy cost of the dwelling. This is referred to in the draft Approved Document L as the Householder Affordability Rating.

3.22. This would ensure that, where direct electric heating is installed, the theoretical energy bills would be reasonable. This could be achieved, for example, through any combination of the following:

- Increased fabric efficiency
- Heat recovery devices
- Renewable generation
- On-site energy storage

3.23. As part of producing an Energy Performance Certificate, an energy cost calculation is carried out based on the combined costs of heating, lighting and hot water. This is the Energy Efficiency Rating. A possible test for affordability would be to use the Energy Efficiency Rating as a measure, and to set a minimum Energy Efficiency Rating that must be achieved. As the Energy Efficiency Rating (EER) includes the theoretical costs of heating and hot water for the dwelling, higher cost heating approaches (compared to gas heating) can have a large effect on the rating. It is noted that the Energy Efficiency Rating does not account for other factors such as maintenance costs.

3.24. The minimum Energy Efficiency Rating could be based on the current Part L 2014 standard. This would help ensure that fuel bills for new homes do not increase (and should in general decrease) compared to today. It is noted that there may be a risk that dwellings approaching Passivhaus standards with direct electric heating may not comply even with a low energy demand due to the higher costs of electricity compared to gas usage.

Question 8

[13] https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings

Do you agree the need to set a minimum target to ensure that homes are affordable to run?

a. **Yes**
b. **No**

Please explain your reasoning.

Question 9

If yes above should the minimum target used to ensure that homes are affordable to run be a minimum Energy Efficiency Rating?

a. **Yes**
b. **No**

If yes, please suggest a minimum Energy Efficiency Rating that should be achieved and provide evidence to support this.

If no, please suggest an alternative metric, explain your reason and provide evidence to support this.

Minimum fabric standards

3.25. Our climate change and carbon budgeting responsibilities mean we need to take every opportunity to reduce our existing carbon emissions. It is, therefore, important that the impact of any new development is minimised. The fabric first principle is still as relevant now as in our 2014 Part L changes and it will help keep carbon emissions and energy demand/running costs low and futureproof the house for low carbon/temperature heating systems.

3.26. The proposed carbon emissions and primary energy performance targets as detailed in Paragraph 3.10 will encourage good fabric standards. However, we propose to prescribe good fabric by improving the worse acceptable performance values for individual fabric elements (walls, roofs, floors, windows etc). These are regulatory minima that must be achieved and are linked to current regulation 26B - Fabric performance values for new dwellings and regulation 25C - New Buildings: Minimum energy performance requirements. Our proposed uplifts to the worse acceptable values can be found in the draft Approved Document L and below.

3.27. In order to demonstrate compliance with regulation 25C (b), the fabric performance values must be as good as or better than the worst acceptable values set out in the table below:

Table 3.1 - Worse acceptable fabric performance values		
External walls	Dwelling-houses	0.18 W/m^2.K
	Flats	0.21 W/m^2.K
Party walls		0.20 W/m^2.K
Floor		0.15 W/m^2.K
Roof		0.13 W/m^2.K
Windows, roof windows, glazed roof lights[1], curtain walling[2] and pedestrian doors		1.4 W/m^2.K

Air permeability	8.00m^3/hr.m^2 at 50Pa

[1] The U-value of upstands and builders' kerbs is subject to the limiting U-value for external walls.
[2] The limiting value for curtain walling is an area-weighted average for the whole facade.

3.28. We propose that the minimum standard for external walls should differ by dwelling type. The value for flats accounts for proposals for non-combustible materials above 18m and that flats generally have less external fabric area and therefore the small relaxation will have less impact. The Welsh Government has consulted on banning the use of combustible materials in the external walls of high-rise residential buildings, and published a response at: (https://gov.wales/banning-use-combustible-materials-external-walls-high-rise-residential-buildings)

3.29. We propose that the limiting U-value for roof-lights should be based on a roof-light in a horizontal position, rather than the vertical. Most roof-lights are tested and installed in the horizontal position. This proposed change reduces the need for conversion factors, which add unnecessary complexity.

3.30. We propose to adopt the new version of BR 443, which gives guidance on conventions for U-value calculations. In general, BR 443 (2019) is an update to the 2006 edition, primarily reflecting changes in British, European and International standards; industry practice; and industry publications. The main changes are listed in Annex B to this document, however the new BR 443 should be reviewed in full for other minor changes. The latest version is available for this consultation at: https://www.bregroup.com/sap/sap10/ .

3.31. Without strong minimum elemental fabric standards, it is possible that designers could use low carbon technology and achieve the carbon emission and primary energy targets with much poorer fabric performance. Furthermore, a poorer fabric can result in higher heat demands and lower efficiencies for low carbon heating systems.

Question 10
Do you agree with the proposed minimum fabric standards set out in Table 3.1? If you do not agree with any one or more of the proposed standards, please explain your reasoning and provide evidence to support this.

Question 11
Do you agree that the limiting U-value for roof-lights should be based on a roof-light in a horizontal position?

a. **Yes**
b. **No**

If no, please explain your reasoning and provide evidence to support this.

Question 12
Do you agree that we should adopt the latest version of BR 443?

a. **Yes**
b. **No**

If no, please explain your reasoning and provide evidence to support this.

Removing the fuel factors - phasing out high-carbon fossil fuels

3.32. If Wales is to meet its climate targets, buildings will need to operate at close to zero emissions by 2050. This will require a substantial change in how we heat and power buildings in the future. The amount of energy used in our buildings will have to be significantly lower. The remaining energy demand will need to be delivered through low carbon and renewable sources.

3.33. The 2014 version of Approved Document L1A includes a table of 'fuel factors'. The purpose of the fuel factors, which were introduced in 2006, was to provide some relief for those using more carbon intensive fuels either because gas is not available or because (for example) electrically driven heating, such as heat pumps is preferred.

3.34. Grid electricity now has a lower carbon emission factor than gas. It therefore no longer needs a fuel factor to support its use. We propose to remove the fuel factor for grid electricity.

3.35. For other fuels (e.g. liquid petroleum gas (LPG), oil, solid mineral fuel heating) we consider that fuel factors should also no longer be applied. Reducing the use of high-carbon fossil fuels supports our Low Carbon Wales plan[14] which sets out the Welsh Government's approach to cut emissions and increase efficiency in a way that maximises wider benefits for Wales, ensuring a fairer and healthier society.

3.36. Therefore, we propose to remove fuel factors, so that any new building will need to meet primary energy and CO_2 emissions equivalent to that of one of the options presented in Annex A. Although this is not an outright ban on LPG, oil and solid mineral fuels being used in new buildings, these fuels are all more carbon intensive fuels than gas. This means that if oil, LPG or solid mineral fuel are to be used in new buildings, considerable mitigating measures would need to be installed to reach parity with a new gas-heated building. However, there are alternative low carbon heating solutions (e.g. air source heat pumps) that could be used as a solution in off-gas grid areas.

Question 13
Do you agree with the proposal of removing fuel factors to aid the transition from high-carbon fossil fuels?

a. **Yes**
b. **No**

If no, please explain your reasoning.

[14] https://gov.wales/sites/default/files/publications/2019-06/low-carbon-delivery-plan_1.pdf

Building services - minimum efficiencies and controls

3.37. Part L 2014 sets minimum standards for the efficiency and controls for building services (such as heating, lighting and hot water). These are currently detailed in the Domestic Building Services Compliance Guide.

3.38. We propose that minimum standards for building services should be set in the Approved Documents, and that the guidance for building services should be simplified. The Guidance section of this consultation sets out the proposal to restructure the Approved Document in more detail. We also propose uplifting the minimum building services standards where any of the following apply:

- Evidence suggests that specifying higher performance or controls for certain technologies has become cost-effective
- Evidence suggests that the minimum standards are below that of typical practice
- Other regulatory requirements apply which increase the minimum standard (for example, Ecodesign requirements)

3.39. In response to these criteria, we propose uplifting the minimum standards for building services efficiencies and controls. This includes an uplift in the minimum efficiency of heat pumps, comfort cooling, ventilation systems, and lighting.

3.40. Table 3.2 outlines the proposed changes in minimum standards for the following applications for new dwellings.

Table 3.2: Proposed revisions to minimum building services efficiencies and controls for new dwellings

Application	Current Part L 2013 standard	Proposed Part L 2020 standard	Comments
Gas boiler efficiency	88% SEDBUK 2009	92% ErP	Consistent with Boiler Plus measures for existing dwellings
Heat pump efficiency	SCOP 'D' if ≤12kW COP 2.5	SCOP 2.80	Consistent with Ecodesign standard
Comfort cooling efficiency	EER 2.4 (air cooled) EER 2.5 (water cooled)	SEER 3.87	Consistent with Ecodesign standard
Lighting	45 lamp lumens per circuit-watt	60 lamp lumens per circuit-watt	Uplift to reflect common practice

Question 14
Do you agree with the proposed changes to minimum building services efficiencies and controls set out in table 3.2?

a. **Yes**
b. **No**

If you do not agree with any or more of the proposed changes, please explain your reasoning and provide evidence to support this.

Future-proofing

3.41. It is important that carbon emissions and energy use from new homes are minimised from first occupation, but also that these new homes are future proofed to allow the capability for even further reductions in energy use and carbon emissions.

3.42. In particular, we would like to make it easier for new homes to install low carbon heating in the future. This could include making space for hot water storage, installing suitable emitters, improving the building fabric or installing low-carbon heat sooner.[15]

3.43. Because of the diverse possibilities for low carbon heat in future, we cannot futureproof for every scenario. However, one proposal which would provide benefits now, and make it easier to install heat pumps or district heating in future, is for new buildings to have a space heating system which operates at a low temperature. Heat pumps operate best at temperatures of 55°C or lower. This flow temperature would also have benefits of increasing the efficiency of condensing boilers, giving an immediate energy saving to the consumer. It would also reduce losses and improve system efficiencies in district heating and facilitate the transition to low carbon technologies.

3.44. We propose that wet space heating systems should be designed to operate with a flowrate temperature of 55°C or lower in the final heating circuit. To encourage this, we could either:

- design the notional building in the Standard Assessment Procedure with the assumption that its heating system operates at 55°C.
- set a minimum standard that heating systems should be designed to operate at temperatures of 55°C or lower

3.45. The proposal for low-temperature heat would likely result in larger heat emitters (e.g. radiators). The proposal aims to provide low cost and low disruption to householders when low-carbon heat is installed in the future, because they will not need to have new radiators installed.

3.46. Another proposal which would provide benefits now, and make it easier to install heat pumps or district heating in future, is improving the building fabric. We have already presented in Paragraphs 3.25 onwards, proposals to improve the building

[15] These four policy options were all considered after a BEIS call for evidence on phasing out fossil fuels on the off-gas grid, which covered future-proofing. The call for evidence, as well as the government's response, can be accessed here: https://www.gov.uk/government/consultations/a-future-framework-for-heat-in-buildings-call-for-evidence

fabric to help futureproof the house for low carbon/temperature heating systems. In a poorer insulated home, a higher flow temperature is required to meet the space heating demand, meaning the heating system will operate at a lower efficiency, will cost more to run and result in higher carbon emissions.

Question 15
Do you agree with the proposal that heating systems in new dwellings should be designed to operate with a flow temperature of 55°C?

a. **Yes**
b. **No – the temperature should be below 55°C.**
c. **No – dwellings should not be designed to operate with a low flow temperature**
d. **No – I disagree for another reason**

If no, please explain your reasoning and provide evidence.

Question 16
How should we encourage new dwellings to be designed to operate with a flow temperature of 55°C?

a. **By setting a minimum standard**
b. **Through the target primary energy and target emission rate (i.e. through the notional building)**
c. **Other**

Please explain your reasoning.

Question 17
Do you agree with the proposal to improve minimum fabric standards in new dwellings to help futureproof the house for low carbon/temperature heating systems?

a. **Yes**
b. **No – the current minimum fabric levels are sufficient**
c. **No – I disagree for another reason**

If the final option, please explain your reasoning.

Consideration of high-efficiency alternative systems

3.47. Regulation 25A of the Building Regulations deals with high-efficiency alternative systems. It requires the person who is to carry out the work to analyse and consider the technical, environmental and economic feasibility of using high-efficiency alternative systems in the construction. We propose to simplify these requirements by both:

- removing the list of example systems at 1(a)-(d) of Regulation 25A
- removing the requirement to give notice to the Local Authority that states the analysis has been carried out.

3.48. These proposed amendments do not change the need for the analysis of high-efficiency alternative systems to be undertaken, nor does it prevent Local Authorities from requiring evidence of such an analysis having been carried out.

Question 18
Do you agree with the proposals to simplify the requirements in the Building Regulations for the consideration of high-efficiency alternative systems?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Calculating the primary energy rate and emission rate

Changes to the Standard Assessment Procedure

3.49. The Standard Assessment Procedure (SAP) is the methodology used by the Welsh Government to assess and compare the energy and environmental performance of dwellings, and is used to determine compliance with the energy efficiency requirements of Part L. The Standard Assessment Procedure for Energy Rating of Dwellings will continue to be used to calculate compliance metrics for Part L; proposed in this consultation to be the primary energy rate and the emission rate. A consultation version of the Standard Assessment Procedure 10.1, cSAP, is available at this web page: wales.isap.org.uk

3.50. The UK Government develops and publishes SAP. It consulted on SAP 2016, now named SAP 10, in 2016.[16] The UK Government responded to this consultation[17] in 2017 and published SAP 10 in 2018.

3.51. The UK Government is currently consulting on minor changes to SAP 10 to create SAP 10.1[18]. Details are duplicated in the paragraph below of these latest changes. Any comments on these changes should be made to the UK Government's consultation.

3.52. The changes to SAP proposed by the UK government which have not been previously consulted on are:

- A minimum recognised level of airtightness in naturally ventilated buildings has been introduced ($AP_{50} = 3m^3/m^2.h$). Lower values may be entered, but further energy savings will not accrue below this level. This is outlined further in chapter five and is consulted on separately there.

[16] https://www.bre.co.uk/sap2016/page.jsp?id=3619
[17] https://www.gov.uk/government/consultations/public-consultation-on-proposals-to-amend-the-standard-assessment-procedure-sap
[18] https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings

- Provision has been added to allow the standing losses for heat interface units (for use with heat networks) to be taken from Product Characteristics Database (PCDB). Where no PCDB data is available a default of 1.46 kWh/day will be used.
- The in-use factor of 1.15 for heat networks has been removed from specification and instead will be part of the PCDB record, allowing it to be varied depending on the nature of the source of the data.
- A procedure for modelling solar thermal heating systems implementing EN15316-4-3:2017 has been added.
- The minimum recognised rate for showers has been set to 8l/min for new homes, or 7l/min for existing homes.
- A requirement and method to include 'significant' point thermal bridges has been added to meet a requirement of EN52016-1:2017.
- The treatment of electricity generated by PV where not connected directly to the dwelling's meter has reverted to being as in SAP 2012.
- The table of reference building characteristics used for setting regulatory targets has been updated. The key changes are to the fabric values and to the building services, which are considered in more detail in this chapter. Please consult Appendix R of SAP 10.1 for the full updated list of reference values.

3.53. The UK Government intends to publish version 10.2 of the Standard Assessment Procedure at implementation of its new Part L standard. The Welsh Government will also use this version of SAP for its new Part L standard. This version 10.2 of the Standard Assessment Procedure will take account of any changes from the outcome of the UK Government's current consultation. Within this, the UK Government plans to change the source of most fuel prices used in SAP from Sutherland Tables data to BEIS's 'Domestic energy price indices'[19]. This data has been assessed by the UK government to be more robust than Sutherland Chart data for some fuel prices, therefore where BEIS collates price information, this should be used to better inform SAP and RdSAP. Figures not available from the BEIS source will continue to be taken from the current source.

Approach to calculating Primary Energy and CO_2

3.54. As outlined earlier in this chapter, we propose that primary energy should form one of four performance metrics that buildings are measured against.

3.55. The Standard Assessment Procedure uses factors to convert modelled energy use into primary energy and CO_2. *Briefing Note – Derivation and use of Primary Energy factors in SAP* (available at: https://www.bregroup.com/sap/sap10/) sets out the UK government's proposed method for calculating primary energy, CO_2 and emissions factors. The calculated primary energy and CO_2 emissions factors to be used with the 2020 version of Part L can be found in the consultation version of SAP (cSAP) and in Annex E of this document.

3.56. In summary, the UK government are using the same general approach towards calculating primary energy and CO2 factors as in the 2014 version of Part L for

[19] https://www.gov.uk/government/statistical-data-sets/monthly-domestic-energy-price-stastics

Wales. The treatment of onsite and offsite renewable electricity is also the same as in Part L 2014, with renewable electricity produced onsite accounted for by deducting the electricity produced by renewables from the electricity demand for the building. For district heating systems with renewable components, any renewable energy in the system will not count towards the primary energy of these systems, with the overall primary energy factor of a district heating system dependent on the mix of renewables and fossil fuels within it.

3.57. The UK Government have also updated fuel prices, CO2 and primary energy factors to reflect the latest data and the decarbonising grid. They have moved from a three-year to a five-year average of predicted values.

3.58. New tables have also been added to allow for the monthly variation of electricity, CO2 and primary energy factors. These are detailed in Annex E.

3.59. Similar to the section above, comments on these changes should be made to the UK government consultation detailed in Paragraph 3.51.

Removal of Government's Approved Construction Details

3.60. The UK Government previously developed and published a series of detailed drawings to help home builders minimise heat loss at joints, junctions and corners (known as 'thermal bridging') and to help achieve performance standards in earlier versions of Part L. However, these drawings, known as Approved Construction Details, have become out of date. We are proposing to remove the option of adopting Approved Construction Details, because these will no longer work with new fabric specifications required to meet the new standards detailed in this chapter. Alternative methods of assessing thermal bridging are in the Approved Document under *Continuity of Insulation*.

Question 19
Do you agree with the removal of government Approved Construction Details from Approved Document L?

a. **Yes**
b. **No**

If no, please explain your reasoning.

New technology factors for community heating schemes

3.61. As outlined in Chapter two, district heat networks comprise an important part of our energy future. Where there is potential for decarbonising, we consider that new connections to existing heat networks can be appropriate, and part of our transition to low carbon heating. We need to maximise the benefits of continuing use of existing heat networks, while also incentivising new networks to be lower carbon.

3.62. The Welsh Government supports the establishment of District Heat Networks, as part of delivering the urban growth set out in the National Development Framework. In order to encourage heat networks, we propose that weighting, which we refer to as 'technology factors', is applied into calculations for the target emission rate and target primary energy for new dwellings where the design incorporates heat networks. Applying these technology factors is intended to encourage heat networks; this is in recognition of the ability of heat networks to decarbonise over time.

3.63. The draft Approved Document supplied alongside this consultation provides detail (paragraph 1.3) of the proposed technology factors for heat networks.

Question 20
Do you agree with the proposal to introduce the technology factors for heat networks, as presented in the draft Approved Document?

a. **Yes**
b. **No – they give too much of an advantage to heat networks**
c. **No – they do not give enough of an advantage to heat networks**
d. **No – I disagree for another reason**

Please explain your reasoning.

Guidance

3.64. Dame Judith Hackitt's final report on the Independent Review of Building Regulations and Fire Safety[20] includes in Appendix F recommendations for ways in which the Approved Documents could be improved. This review of Parts L and F presents an opportunity to consider who the intended audience is for the Approved Documents and Compliance Guides, and how the readership can most usefully interact with this guidance.

3.65. We have presented restructured guidance for Parts L and F alongside this consultation, in line with this recommendation. The new guidance aims to be clearer about what is expected of home builders and developers in complying with the regulatory requirements, while the following supplementary information has been removed:

- guidance on Energy Performance Certificates;
- advice on including adequate levels of daylight;
- note that future temperatures may want to be considered;
- detailed notes regarding the Standard Assessment Procedure;
- advice on facilitating incorporation of improvements in system efficiencies;
- guidance on what might be 'useful' to include in a commissioning plan;
- suggestion that until the building control body receives the commissioning notice, it may not consider it appropriate to give a completion/ final certificate.

[20] https://www.gov.uk/government/publications/independent-review-of-building-regulations-and-fire-safety-final-report

While this is correct it is unnecessary information to include in an approved document;

- guidance for the minimum efficiencies and controls for building services unlikely to be installed in new dwellings, including in particular oil-fired boilers and solid mineral fuel appliances, among others.

3.66. The intention is that the Welsh Government will adopt MCHLG's approach to restructuring the Parts L and F guidance in England which is being separately consulted upon. This aids members of both the construction industry and building control who work both in Wales and England. It is dependent on the consultation responses i.e. responses to this consultation may recommend a different approach to that taken in England. The proposed changes identified above currently replicate those being proposed by MHCLG for England i.e. no substantive justification for any difference have been identified.

Question 21
Do you agree with removing this supplementary guidance from Approved Document L, as outlined in paragraph 3.65 of the consultation document?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Question 22
Do you agree with the external references used in the draft Approved Document L, in Appendix C and Appendix D?

a. **Yes**
b. **No**

If no, please explain your reasoning and suggest any alternative sources.

Restructuring the statutory guidance

3.67. Statutory guidance for Part L is currently given in the following documents:

- Approved Document L1A *Conservation of fuel and power in new dwellings*
- Approved Document L1B *Conservation of fuel and power in existing dwellings*
- Approved Document L2A *Conservation of fuel and power in new buildings other than dwellings*
- Approved Document L2B *Conservation of fuel and power in existing buildings other than dwellings*

3.68. The Approved Documents are supported by the following MHCLG publications, which, in practice, are seen to form an extension to the Approved Documents:

- *Domestic Building Services Compliance Guide*

- *Non-Domestic Building Services Compliance Guide*
- *Guide to the condensing boiler installation assessment procedure for dwellings*

3.69. MHCLG is consulting on restructuring the statutory guidance for its Part L and F and, as above, the Welsh Government intends to replicate the statutory guidance where is considers it reasonable to do so. The proposed changes below replicate those currently being proposed by MHCLG for England i.e. no substantive justification for any difference have been identified.

3.70. The structure of the guidance associated with Part L is inconsistent with other Approved Documents, most of which have been split between dwellings and non-dwellings. Each of the Building Regulations functional requirements could be provided with Approved Documents in two volumes as follows: *volume 1* to provide guidance for dwellings, and *volume 2* to provide guidance for buildings other than dwellings. The guidance would therefore be as follows:

- *Approved Document L: volume 1 – dwellings*
- *Approved Document L: volume 2 – buildings other than dwellings*

3.71. The Compliance Guides – namely the Domestic Building Services Compliance Guide[21] and the Domestic Ventilation Compliance Guide[22] – were introduced at a time when the industry was undergoing rapid change to implement new energy efficiency standards, and the documents have served an important purpose in providing additional guidance to the Approved Documents. The Guides themselves comprise a mixture of good practice guidance, minimum standards, and references to regulations other than the Building Regulations. However, MHCLG have received feedback that the status of the Compliance Guides is unclear to stakeholders – particularly which parts are regulatory, and which are guidance. There is a case for making this clearer, by restructuring the guidance associated with Parts L and F.

3.72. We propose to take all of the minimum standards from the Compliance Guides and incorporate them into the Approved Documents. To match the style of the Approved Documents, it would mean removing all 'good practice' guidance, supplementary information, and guidance relating to non-Building Regulations matters. We recognise that this means government is providing less guidance for industry on best practice, and system-specific guidance. This is an opportunity for industry, who are better placed to provide best practice and sector-specific guidance, to provide their own guides to supplement the Building Regulations minimum guidance.

3.73. We have also simplified the guidance on building services in a number of ways, including:

[21] https://gov.wales/sites/default/files/publications/2019-05/building-regulations-guidance-part-l-conservation-of-fuel-and-power-domestic-building-services-compliance-guide.pdf

[22] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/456656/domestic_ventilation_compliance_guide_2010.pdf

- Setting the structure to avoid repetition, and include common guidance which relates to different fuel types
- Simplifying the tables and figures
- Simplifying the pipework heat loss criteria to make this easier for designers to understand, and for building control bodies to check

Question 23
Do you agree with incorporating the Compliance Guides into the Approved Documents?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Question 24
Do you agree that we have adequately covered matters which are currently in the Domestic Building Services Compliance Guide in the new draft Approved Document L for new dwellings?

a. **Yes**
b. **No**

If no, please explain which matters are not adequately covered.

Question 25
Do you agree that we have adequately covered matters which are currently in the Domestic Ventilation Compliance Guide in the new draft Approved Document F for new dwellings?

a. **Yes**
b. **No**

If no, please explain which matters are not adequately covered.

3.74. Collating all guidance for dwellings into a single document makes it necessary for us to restructure within the Approved Documents themselves. This is an opportunity to review the way in which these Approved Documents work. ADL1A and ADL2A are currently not structured in line with the regulatory requirements, and in the main refer to the Building Regulations *energy efficiency standards* rather than individual regulations. Compliance with the regulations is currently presented as a number of Criteria, as follows:

- Criterion 1: Achieving the Target Emission Rate and Target Fabric Energy Efficiency
- Criterion 2: Limits on design flexibility
- Criterion 3: Limiting the effects of heat gains in summer
- Criterion 4: Building performance consistent with Dwelling Emission Rate and Dwelling Fabric Energy Efficiency
- Criterion 5: Provisions for energy-efficient operation of the dwelling.

The new structure is presented in Section 0: Introduction of the consultation draft of *Approved Document L: volume 1 – dwellings.*

3.75. Introducing a new overheating standard (as outlined in the introduction) may result in Criterion 3 being relevant to a different part of the Building Regulations. Continuing to use the 'criteria' as a way to describe the Part L guidance is not consistent with the principles of providing clear guidance which matches closely with the legislative requirements. The restructured draft Approved Document, with sections corresponding with each legislative requirement, is provided alongside this consultation.

Question 26
Do you agree with all of the proposals for restructuring the Approved Document guidance?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Transition and Implementation

3.76. Proposed transitional arrangements for the Part L changes in 2020 are outlined in chapter seven of this consultation.

Energy Performance of Buildings Directive

3.77. Part L of the Building Regulations forms part of an ambitious domestic energy efficiency agenda and is used to set minimum energy performance standards for buildings to drive reductions in emissions. It was in place before the EU introduced the recast Energy Performance of Buildings Directive[23] in 2010, which was informed by policies the UK were already doing, and so Part L has been used to transpose relevant parts of the Directive. The EPBD has recently been amended[24]. Subject to the terms of the EU exit withdrawal agreement and implementation period, Part L may be used to transpose relevant requirements of the revised EPBD. We have set out proposals in this consultation to align with the latest changes to the requirements in the Directive for new dwellings, in the following areas:

- Primary energy (see performance metrics section of this consultation).
- Self-regulating devices (see below)
- Building automation and control systems

[23] DIRECTIVE 2010/31/EU of the European Parliament and of the Council of 19 May 2010: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32010L0031&from=EN

[24] EPBD DIRECTIVE (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency.

3.78. The EPBD requires all new buildings to be 'nearly zero-energy buildings' by January 2021.[25] The UK already exceeds EU minimums in a number of areas, and we will continue to lead the way on these important issues in the future. We consider that both of the uplift options presented in Chapter 3 meet the definition for nearly zero-energy buildings and meet the 'cost optimal' definition.

Self-regulating devices

3.79. A self-regulating device is a device or system that automatically controls the output of heating and/or cooling emitters to independently control the temperature in each room, (or, where justified, a heating and/or cooling zone) where heating and/or cooling is provided by a fixed building service.

3.80. A heating and/or cooling zone is a treated area of a building (i.e. an area with either heating or cooling or both) which is on a single floor and has homogenous thermal parameters and homogenous temperature regulation requirements. This can include adjacent spaces which are not physically separated from each other e.g. open plan kitchen and living area.

3.81. In order to align with the third subparagraph of article 8(1) of the EPBD (EU) 2018/844 we plan to introduce a new regulation in the Building Regulations 2010 to ensure that when a dwelling is erected it must be equipped with self-regulating devices for the separate regulation of the temperature in each room or designated heating zone of the building unit, where technically and economically feasible. This consultation concerns only the new build elements of the proposals.

3.82. A common way of achieving this requirement in practice for new homes would be having thermostatic radiator valves (TRVs) on radiators in each room, which are often already installed as standard practice.

3.83. Suggested guidance for new dwellings is provided in the draft Approved Document L volume 1.

Question 27
Do you agree with our proposed approach to mandating self-regulating devices in new dwellings?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Question 28
Are there circumstances in which installing self-regulating devices in new dwellings would not be technically or economically feasible?

a. **Yes**
b. **No**

[25] https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-performance-of-buildings/nearly-zero-energy-buildings.

If yes, please explain your reasoning and provide evidence.

Information about Building Automation and Control Systems

3.84. A building automation and control system is a term used for a centralised system installed to monitor and control a building's environment and services i.e. its heating, ventilation, air conditioning, lighting and other systems (such as security alarms and lifts). Such systems would typically be installed in large commercial buildings but not usually in dwellings. However, it is possible that a building automation and control system could be installed in a large apartment block. If building automation and control systems are installed in new dwellings, we propose that information about the energy performance of the building automation and control system must be provided to the building owner. This requirement aligns Part L with the EPBD.

3.85. Guidance on providing information about building automation and control systems for new dwellings is provided in the draft Approved Document L volume 1.

Question 29
Do you agree with proposed guidance on providing information about building automation and control systems for new dwellings?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Chapter 4. Part F Changes

Background

4.1. Ventilation is the supply and removal of air to and from a space or spaces in a building, whether through natural or mechanical means. Adequate ventilation in homes is important for good air quality.

4.2. To investigate whether the ventilation provisions for good indoor air quality set out in Part F 2010 were effective, MHCLG commissioned research into ventilation and indoor air quality in new homes, and the full research report is published alongside this consultation. The research suggested that a large proportion of homes may be failing to meet the technical standards set out in Approved Document F. This led to poor indoor air quality in several of the sample of houses tested. The research also identified some issues where people shut trickle ventilators or turned off extract fans to reduce noise.

4.3. Research produced by the Mackintosh Environmental Architecture Research Unit,[26] the Zero Carbon Hub[27] and MHCLG identified similar issues with new homes not meeting the standards set out in Approved Document F.

4.4. When Part F was last consulted on, several revisions were made to improve the as-built performance of ventilation systems in new homes, these included:

a. Introducing a new regulation that ventilation systems must be installed and commissioned in accordance with a procedure approved by the Secretary of State.
b. Introducing a new regulation that air flow rates for mechanical systems should be measured in all new dwellings.

4.5. It is our view that these revisions are still sound in principle, but there are further enhancements we can make in this review to improve the performance and application of Part F in practice.

4.6. MHCLG is consulting on changes to Part F for England. The intention is for the Welsh Government to align with Part F for England where reasonable to do so as both have similar policies and aids those working on both sides of the border. The consultation proposals for Part F for Wales are the same as those proposed by MHCLG, with the exception of one change identified in Table 4.1 below.

4.7. The draft Approved Document integrates Appendix D from Part F 2010 into the main body of the statutory guidance. This editorial change clarifies the status of this part of the guidance as an essential part of the performance-based guidance.

4.8. The proposed changes to the Approved Document include simplifying guidance for natural ventilation systems and for mechanically ventilated systems as per Table 4.1.

Table 4.1: Proposed Changes to the Approved Document F

System Type	**Dwellings covered by proposed guidance changes**
Natural ventilation (formerly System 1)	Less-airtight
Continuous mechanical extract ventilation (formerly System 3)	Any level of airtightness[28]
Continuous mechanical supply and extract ventilation (formerly System 4)	Any level of airtightness

4.9. It is the government's view that for scenarios outside the scope of Table 4.1, suitable expert advice should be sought in order to ensure new homes provide healthy indoor environments whilst delivering lower carbon emissions.

[26] Sharpe, McGill, Gupta, Gregg, Mawditt (2016) *Characteristics and Performance of MVHR systems.* MEARU, fourwalls, Oxford Brookes University

[27] Nicholls, Dollard, Mawditt, Pannell (2016) *Ventilation in New Homes* . London: Zero Carbon Hub http://www.zerocarbonhub.org/sites/default/files/resources/reports/ZCH_Ventilation.pdf

[28] The MHCLG Part F consultation proposes that MEV systems are suitable for highly airtight homes only

Performance based ventilation standards

4.10. MHCLG has assessed the underlying assumptions on ventilation rates based on the latest available evidence. The technical work, undertaken as part of the review, suggests that these assumptions are sufficiently robust. We agreed with their conclusions from this work that the performance-based ventilation approach presented in Appendix B of the draft Approved Document is an appropriate basis for determining ventilation rates.

4.11. There is limited evidence on the ventilation rates required to meet individual levels of volatile organic compounds, although we recognise that an assessment of individual volatile organic compounds could be a better means of determining appropriate control of indoor air pollutants. Latest scientific evidence from Public Health England (PHE) proposes a list of pollutants for consideration when designing healthy indoor environments[29].

4.12. We are considering whether designers should have the option to assess ventilation strategies against individual volatile organic compounds informed by empirical evidence from PHE, as an alternative to using total volatile organic compound; we have incorporated that option into the draft Approved Document.

Question 30
Do you agree that the guidance in Appendix B to draft Approved Document F provides an appropriate basis for setting minimum ventilation standards?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Question 31
Do you agree that using individual volatile organic compounds, informed by Public Health England guidelines, is an appropriate alternative to using a total volatile organic compound limit?

a. **Yes**
b. **No – the Public Health England guidelines are not sufficient**
c. **No – individual volatile organic compounds should not be used to determine ventilation rates**
d. **No – I disagree for another reason**

If no, please explain your reasoning, and provide alternative evidence sources if appropriate.

[29] PHE. (2019). IAQ guidelines for selected volatile organic compounds in the UK. https://doi.org/10.1016/j.buildenv.2019.106382 https://www.gov.uk/government/publications/air-quality-uk-guidelines-for-volatile-organic-compounds-in-indoor-spaces

Minimising the ingress of external pollutants

4.13. The draft Approved Document F provides guidance in section 2 on minimising the ingress of external pollutants. This clarifies the existing guidance in the Approved Document. The new guidance states that particular attention should be given to the guidance for minimising the ingress of external pollution in locations where the Air Quality Standards Regulations 2010 Schedule 2 limit values are exceeded.

Question 32
Do you agree with the proposed guidance on minimising the ingress of external pollutants in the draft Approved Document F?

a. **Yes**
b. **No**

If no, please explain your reasoning

Noise

4.14. We have considered the issue of noise from mechanical ventilation systems. We do not consider that simple product-testing or type-testing is an appropriate mechanism for controlling noise from mechanical ventilation systems, as the noise in-situ is highly dependent on the quality and nature of the installation as much as the products within it. We have not proposed mandatory in-situ noise testing as part of this review, although it is something that government could consider in future (for example, as part of a future Part E consultation). We have, however, clarified the draft Approved Document to make it clear that ventilation installations should not be unduly noisy, and provided some simple guidance.

Question 33
Do you agree with the proposed guidance on noise in the draft Approved Document F?

a. **Yes**
b. **No – this should not form part of the statutory guidance for ventilation, or the guidance goes too far**
c. **No – the guidance does not sufficiently address the problem**
d. **No – I disagree for another reason**

If no, please explain your reasoning.

Ventilation Solutions for Dwellings

4.15. Part F currently provides guidance for the following ventilation solutions:

- System 1 – Background ventilators and intermittent extract fans
- System 2 – Passive stack ventilation (PSV)

- System 3 – Continuous mechanical extract ventilation (MEV)
- System 4 – Continuous mechanical supply and extract with heat recovery (MVHR)

This section considers:

- Should System 2 still warrant specific guidance in AD F?
- A redrafting of the Approved Document for Part F

Passive Stack Ventilation

4.16. We have considered whether passive stack ventilation is installed sufficiently often by non-specialist designers and installers to warrant detailed guidance in the Approved Document. Our understanding is that, while passive stack ventilation can be an appropriate system for use in new dwellings, it remains a specialist system. Recently published research estimates that the market share of PSV in new homes is estimated to be <1%.[30]

4.17. Because passive stack ventilation is typically installed by specialists carrying out full design, and it is installed in a very small number of new build properties, we proposed that guidance on PSV is no longer included in Approved Document F.

Question 34
Do you agree with the proposal to remove guidance for passive stack ventilation systems from the Approved Document?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Developing simplified ventilation standards

4.18. Approved Document F 2010 recommends two sets of minimum standards for a dwelling's ventilation provision depending on the design air permeability as follows:

- *Default approach*: Intended to work at any level of airtightness.
- *Alternative approach*: Intended only for less airtight dwellings.

4.19. The impact of this approach is that Approved Document F includes two sets of guidance for each ventilation system – one for each of these ventilation standards. This introduces complexity both for the designer in determining the appropriate standard and ventilation provisions and for the building control body to assess compliance at completion. Given the general improvements in air permeability for

[30] Crawley, J., Wingfield, J., & Elwell, C. (2019). The relationship between airtightness and ventilation in new UK dwellings. Building Services Engineering Research and Technology, 40(3), 274–289.

new homes, and the intention to simplify the guidance, there is a question as to whether setting multiple ventilation standards is still justified.

4.20. For natural ventilation systems (formerly referred to as *System 1*), it is proposed to only provide guidance for less airtight homes. We consider that, in more airtight dwellings, the reliance on purpose-provided ventilators is more important. The design, sizing and positioning of ventilators to provide effective ventilation is more critical, and we propose that is not practical for Approved Document F to provide such guidance.

Mechanical Ventilation

4.21. There is a general trend for more airtight new homes and thus less need for guidance specifically for less airtight homes. Furthermore, mechanical ventilation with heat recovery is generally considered most suitable for more airtight buildings for energy efficiency reasons.

4.22. Continuous mechanical extract systems are intended to remove air on a continuous basis from wet rooms, drawing air via ventilators and infiltration pathways in habitable rooms. If background ventilators are not installed in the dwelling, this risks reduced air supply to some habitable rooms and consequent impact on indoor air quality. To mitigate this risk, it is proposed that background ventilators are also recommended.

4.23. We propose to set guidance for continuous *mechanical extract ventilation* and for continuous *mechanical supply and extract* which would be appropriate for any level of airtightness.

Question 35
Do you agree with the proposal to remove guidance for more airtight naturally ventilated homes?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Simplification of Design Guidance

Natural Ventilation

4.24. The current approach to determining minimum size for background ventilators is fairly complex. We have listened to feedback that our approach to calculating background ventilators could be simplified and optimised. Our proposal is to set guidance for the size of background ventilators by room end-use rather than on a whole house basis. Whilst the current approach is more detailed, it can lead to complexities in design and compliance checking.

4.25. In developing the simpler room-based approach, we have looked to achieve at least the same level of background ventilators as in the current Approved Document F. In some cases, it results in more ventilation opening area than necessary to meet the minimum ventilation rates, but in practice, householders have the ability to adjust their ventilation.

4.26. The proposed minimum ventilator areas are given in in the draft Approved Document.

Question 36
Do you agree with the proposed guidance for background ventilators in naturally ventilated dwellings in the draft Approved Document F?

a. **Yes**
b. **No – the ventilator areas are too large**
c. **No – the ventilator areas are too small**
d. **No – I disagree for another reason**

If no, please explain your reasoning.

Intermittent extract fan rates

4.27. No changes are proposed to the actual extract rates for intermittent extract fans. We do propose, however, that the draft Approved Document presents the guidance in a simplified manner.

Mechanical Ventilation

4.28. Approved Document F currently specifies whole dwelling ventilation rates to supply air to habitable rooms according to the number of bedrooms, the number of occupants and a minimum ventilation rate by internal floor area.

4.29. Currently AD F requires an assessment of the likely occupancy of a bedroom and 4 litres per second added to the whole house ventilation rate for each additional occupant (i.e. 4 litres per second for single occupancy and 8 litres per second for dual occupancy). To simplify this, we propose to increase the supply rate to 6 litres per second per bedroom independent of the number of occupants. This saves a designer or commissioning engineer predicting the occupancy of a bedroom (another step and potential uncertainty in the process) and this proposal should help simplify the approach as well as the guidance in the Approved Document. We propose that the minimum whole dwelling ventilation rates are amended to reflect this approach. More detail is provided in the draft Approved Document which accompanies this consultation package.

Question 37
Do you agree with the proposed approach for determining minimum whole building ventilation rates in the draft Approved Document F?

a. **Yes**

b. **No – the ventilation rate is too high**
c. **No – the ventilation rate is too low**
d. **No – I disagree for another reason**

If no, please explain your reasoning.

Additional background ventilators for continuous mechanical extract ventilation (MEV) systems

4.30. We propose that the minimum level of background ventilators is increased from 2500 mm^2 to 5000 mm^2 per habitable room.

4.31. For a known pressure difference across a background ventilator, the air flow rates can be calculated for a given equivalent area. We assume, for the purpose of this calculation, that the ventilator acts as a simple sharp-edged orifice which is the approach adopted in current Approved Document F.

4.32. For background ventilators with equivalent areas of 2500, 4000 and 5000 mm^2, the flow rates have been calculated for pressure differences between 1 and 20 Pa as shown in Table 4.2.

Table 4.2 Flow rates through 2500, 4000 and 5000 mm^2 sized ventilators at different pressure differences

Pressure difference across vent (Pa)	Air flow rate through vent (l/s)		
	Equivalent Area of 2500 mm^2	Equivalent Area of 4000 mm^2	Equivalent Area of 5000 mm^2
1	2.0	3.2	3.9
2	2.8	4.5	5.6
3	3.4	5.5	6.8
4	3.9	6.3	7.9
5	4.4	7.0	8.8
7.5	5.4	8.6	10.8
10	6.2	10.0	12.5
15	7.6	12.2	15.3
20	8.8	14.1	17.6

4.33. For a small dwelling with an air permeability of zero (the default option should apply to all levels of air permeability):

- The minimum extract air flow (high) rate for a small dwelling is currently 21 l/s (assuming one kitchen at 13 l/s and one bathroom at 8 l/s). These are the recommended 'boost rates' to allow more rapid removal of moisture and other indoor pollutants.
- If this dwelling has two habitable rooms, the current guidance would require two background ventilators of 2500mm^2 each.

- An equal distribution of air through each habitable room would result in an air flow of 10.5 l/s through each of the two ventilators.
- To achieve this flow rate, a pressure difference in excess of 20 Pa would be required across each ventilator.

4.34. There are no published recommendations for setting a suitable pressure differential range across a ventilator when designing a ventilation system. However, the level of depressurisation of a dwelling with an MEV system is unlikely to create a differential of 20 Pa per ventilator. If the size of ventilator in each of the two rooms were increased to 5000mm^2, the required flow rate of 10.5 l/s through each would result in a pressure differential of 7 Pa approximately, which is more likely to occur in practice. As the number of habitable rooms and, therefore, ventilators increase, the pressure would reduce across each ventilator, e.g. three ventilators for the same flow rate of 21 l/s would result in between 3 and 4 Pa per ventilator. This increase in background ventilator sizing should be suitable for larger dwellings as well.

Question 38
Do you agree that background ventilators should be installed for a continuous mechanical extract system, at 5000mm^2 per habitable room?

a. **Yes**
b. **No – the minimum background ventilator area is too low**
c. **No – the minimum background ventilator area is too high**
d. **No – other**

If no, please explain your reasoning.

Updating reference documents

4.35. We have presented simplified guidance in Approved Document Part F alongside this consultation as outlined in Chapter 3. The revised document proposes to update references for British Standards, World Health Organisation guides and CIBSE guides in Appendices B, D and E. This aims to reflect the industry development in providing more robust standards.

Question 39
Do you agree with the external references used in the draft Approved Document F, in Appendices B, D and E?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Providing information to building owners

4.36. Existing Part F 2010 requires that a completion checklist and commissioning sheet is completed by the installer of the ventilation system. The completion checklist and commissioning sheet from the Domestic Ventilation Compliance Guide have now been integrated as Appendix C of the draft Approved Document F. As part of educating owners about how their ventilation system performs in practice, we propose that a copy of the completed Appendix C document is provided to the building owner.

Question 40
Do you agree with the proposed commissioning sheet proforma given in Appendix C of the draft Approved Document F, volume 1?

a. **Yes**
b. **No**

If no, please explain your reasoning and suggest any alternative sources.

Question 41
Do you agree with the proposal to provide a completed checklist and commissioning sheet to the building owner?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Chapter 5. Airtightness

Background

5.1. Airtightness refers to the 'leakiness' or 'draughtiness' of a building. It is a factor in the energy performance of a building; less airtight buildings can waste energy by losing warm internal air to the atmosphere and taking in cold air from the outside during the heating season.

5.2. In the 2020 review we are consulting on improving the way airtightness is considered in the Building Regulations. The proposed changes are detailed below. These align with the changes being proposed as part of the Part L and F review in England.

Encouraging appropriate levels of airtightness

5.3. To reduce the negative impact of poor indoor air quality associated with making buildings increasingly airtight, we plan to review the way in which the guidance and SAP encourage airtightness through carbon emission incentives.

5.4. Currently increased airtightness is always rewarded in SAP due to the improvement in energy efficiency that airtightness brings in theory. In practice, for naturally ventilated dwellings, very high levels of airtightness can either result in poor indoor air quality, or the need to provide additional ventilation. We wish to discourage making buildings with insufficient ventilation very airtight. To achieve this, we propose to introduce a limit to the energy/ CO2 credit in SAP so that naturally ventilated buildings are not credited with additional energy savings from any airtightness of 3m3/m2.h or lower.

5.5. Dwellings with full mechanical ventilation would continue to receive modelled energy savings from increased airtightness, even at air permeability levels less than 3m3/m2.h. This is because mechanically ventilated dwellings, broadly speaking, should have enough ventilation to prevent poor indoor air quality.

Question 42
Do you agree that there should be a limit to the credit given in SAP for energy savings from airtightness for naturally ventilated dwellings?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Question 43
Do you agree that the limit to the credit should be set at $3m^3/m^2.h$?

a. **Yes**
b. **No – it is too low**
c. **No – it is too high**

If no, please explain your reasoning and provide evidence.

Accounting for uncertainty in airtightness test results

5.6. To better reflect the uncertainty associated with a typical airtightness test, we plan to reduce the precision to which airtightness tests are reported in SAP to a granularity of 0.5 $m^3/m^2.h$. This may have a small effect on the energy calculation in SAP.

Question 44
Is having a standard level of uncertainty of 0.5$m^3/m^2.h$ appropriate for all dwellings undergoing an airtightness test?

a. **Yes**
b. **No – a percentage uncertainty would be more appropriate**
c. **No – I agree with having a standard level of uncertainty, but 0.5$m^3/m^2.h$ is not an appropriate figure**
d. **No – I disagree for another reason**

If no, please explain your reasoning.

Review of sampling approach

5.7. To ensure that airtightness is appropriately tested and understood across developments, and to align with changes to Part F, we plan to mandate airtightness testing in all new dwellings.

5.8. Currently only a portion of the dwellings on a development are required to be airtightness tested, with the option to accept a SAP penalty of +2 m3/m2.h at 50Pa for dwellings that are not tested. This may lead to untested dwellings not meeting the required standard.

5.9. AD L1A states that when a dwelling fails an airtightness test, other similar homes should be examined and remediated. We have heard that in some cases, this is not consistently happening. There is also evidence of a 're-test until it passes' culture (with failed tests not consistently being reported), which would suggest that extrapolating results across a site based on sample testing may not be appropriate.

5.10. Testing all properties on a development should demonstrate that they all meet the desired standard. For this reason, we are proposing to airtightness test all new dwellings. If this proposal is taken forward, small developments would no longer be exempt from airtightness tests, and these dwellings must be airtightness tested alongside all other new dwellings.

Question 45

Currently, only a proportion of dwellings are required to be airtightness tested. Do you agree with the proposal that all new dwellings should be airtightness tested?

a. **Yes**
b. **No**

If no, please explain your reasoning and provide evidence to support this.

Question 46
Currently, small developments are excluded from the requirement to undergo airtightness tests. Do you agree with including small developments in this requirement?

a. **Yes**
b. **No**

If no, please explain your reasoning and provide evidence to support this.

Introducing an alternative to the blower door test

5.11. Currently, airtightness is commonly tested using the blower door method. To provide an alternative method of airtightness testing, we are seeking views on introducing the Pulse test as an approved airtightness testing methodology. The Pulse test dynamically measures building air leakage directly at low pressure.

5.12. The Pulse test is performed at a pressure differential of 4Pa as opposed to 50Pa, which is more representative of conditions that properties are likely to experience.

5.13. A constant conversion factor has been identified to convert measurements performed at a pressure differential of 4Pa to 50Pa in SAP.

5.14. The effectiveness of the test in very airtight dwellings has yet to be demonstrated. Therefore, we want to seek views on introducing the Pulse test as an approved method of airtightness testing for new dwellings with a designed airtightness of between 1.5 $m^3/m^2.h$ and the maximum allowable airtightness value in Approved Document volume 1. This is the range that a 58.5l Pulse unit has been demonstrated to perform at in the field trial, which can be accessed via the link below.

5.15. If a building has a design airtightness within the range above, we propose that it can be airtightness tested using the Pulse methodology. If the actual airtightness is then shown to fall outside this range, the test would have to be performed again using a blower door test.

5.16. Further information on the Pulse method of airtightness testing can be found published on the following website, under the downloads tab labelled 'Pulse Test Reports':https://buildtestsolutions.com/technologies/pulse-air-permeability-measurement-system/ or downloaded directly via the following link: https://buildtestsolutions.com/wp-content/uploads/2019/09/Pulse-Test-Reports-as-submitted-to-UK-Government.zip .

Question 47
Do you agree that the Pulse test should be introduced into statutory guidance as an alternative airtightness testing method alongside the blower door test?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Question 48
Do you think that the proposed design airtightness range of between 1.5$m^3/m^2.h$ and the maximum allowable airtightness value in Approved Document L Volume 1 is appropriate for the introduction of the Pulse test?

a. **Yes**
b. **No**

If no, please explain your reasoning and provide evidence to support this.

Revising the approved methodology

5.17. To ensure that the approved methodology for airtightness testing is independent of all organisations with an associated competent person scheme, we propose approving an airtightness testing methodology written by the Chartered Institute of Building Services Engineers (CIBSE), an independent organisation. A draft consultation version of this methodology is available on the following website: https://cibse.org/TM23revision.

5.18. If the Pulse method is introduced as an approved method for performing an airtightness test, the revised approved document will include a section on the Pulse methodology alongside other methods of airtightness testing.

Question 49
Do you agree that we should adopt an independent approved airtightness testing methodology?

a. **Yes**
b. **No**

Please explain your reasoning.

Question 50
Do you agree with the content of the CIBSE draft methodology? Please make any comments here.

Chapter 6. Compliance, Performance and Providing Information

Background

6.1. Studies have shown there is a significant difference between the design intent and measured energy performance of new build homes, which is often referred to as the "performance gap" [31] [32] [33] [34]. The performance gap in new built homes is particularly affected by three major factors: limitations of energy models; different occupant behaviour of each dwelling; and build quality. Poor build quality in particular can lead to a new home not meeting the intended primary energy rate, CO_2 emission rate, or limiting U-values and can result in higher energy bills for occupants. As the energy performance of new dwellings is also affected by compliance with Building Regulations requirements, the government is considering it within the broader review of reforms on building safety, design, construction and occupation.

6.2. In this section of the consultation, we are proposing changes to improve performance and compliance for Part L-specific issues only. Our aim is to enhance the evidence used when producing as-built energy calculations.

6.3. We are proposing to improve the accuracy of as-built energy calculations and reduce the performance gap by providing clearer information about the as-built specifications of new buildings to both Building Control Bodies and to building occupiers. This is part of our wider approved document review.

Proposed measures to improve compliance and performance

Guidance for typical performance gap issues

6.4. Common examples of poor build quality have been identified in a number of research projects that increase the performance gap in new homes, as referenced above. Technical guidance on how to prevent common issues has been developed and we propose that this be provided throughout Approved Document Part L under the titles *Build Quality*.

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[31] Palmer, J., Godoy-Shimizu, D., Tilson, A. & Mawditt, I., 2016. Building Performance Evaluation Programme: Findings from domestic projects, Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/497758/Domestic_Building_Performance_full_report_2016.pdf .

[32] Bell, M., Wingfield, J., Miles-Shenton, D. & Seavers, J., 2010. Low carbon housing Lessons from Elm Tree Mews., p.118. Available at: https://www.jrf.org.uk/report/low-carbon-housing-lessons-elm-tree-mews.

[33] ZCH, 2014. Closing the gap between design and as-built performance: Evidence Review Report, London: Zero Carbon Hub.

[34] Gupta, R., Kotopouleas, A., 2018. Magnitude and extent of building fabric thermal performance gap in UK low energy housing. Available at: https://www.sciencedirect.com/science/article/pii/S0306261918304343#b0240.

6.5. We propose that the guidance on build quality become part of the minimum standard, i.e. reasonable provision for compliance would include the performance gap guidance and would be placed under each functional requirement. It is expected that this minimum guidance should reduce the fabric performance gap, which has been highlighted in research studies.

6.6. The requirements under build quality are standard practice amongst the majority of the housebuilding industry. This guidance is a clarification of the minimum performance expected, should only affect a fraction of existing poor practices and will therefore have minimal impact on capital cost to the housebuilding process.

6.7. The proposed 'Build Quality' sections are summarised below and included in full in Annex C. We propose that they are incorporated into Approved Document L, depending on the outcome of this consultation.

Build Quality: Insulation gaps

6.8. Gaps in insulation can have a significant impact on heat loss and thermal bypass, and risks of condensation and mould. Attention to detail at both the design and construction stages is required. The guidance in this section draws upon some of the key recommendations, applicable to masonry construction, from the Zero Carbon Hub's *Builders' Book*.[35]

6.9. Key points include: design drawings, foundations, floors, windows, doors, walls, roofs, insulation boards, elements bridging external walls, careful coordination of work and comparison against design drawings.

6.10. The full proposed text is in Annex C.

Build Quality: Thermal bridging at junctions

6.11. Thermal bridges occur when an area of a building has significantly higher heat transfer than the surrounding parts. Breaks in insulation, reduced insulation, or more conductive materials can contribute to higher heat losses, which should be quantified and accounted for in SAP calculations.

6.12. This guidance draws upon Zero Carbon Hub's *Thermal Bridging Guide*[36], which provides more detail for masonry and timber construction. The strategies for reducing thermal bridges include: isolate the thermal bridge with insulation (to minimise direct contact with inside/outside); change the geometry of the thermal bridge (to move, remove or reduce size of the component); increase the thermal bridge heat path (to make heat travel further to escape); change the thermal bridge material (to be less conductive). Other third-party publications are also available which provide guidance on junction detailing for particular situations.

6.13. Key points to check include: buildability, product specification, product substitution, foundations, floors, windows, roofs, comparison against design drawings. Blocks

[35] Zero Carbon Hub, *Builders' Book*, 2015

[36] Zero Carbon Hub, *Thermal Bridging Guide*, 2016

below the damp proof course should match those specified in the design (for example, with the correct thermal conductivity).

6.14. The full proposed text is in Annex C.

Build Quality: Airtightness – incoming service penetrations

6.15. Utility services, heating ducts and cables can pass through the primary airtightness membrane (including DPM) and through insulation in the ground floor and external walls, potentially compromising airtightness and thermal performance. These interactions must be carefully planned for and care must be taken during construction.

6.16. Key points to check include: drawings, positioning, groundworks, floor works, sealing.

6.17. The full proposed text is in Annex C.

Build Quality: Airtightness of structure – including walls, roof, floor junction, partitions

6.18. The primary airtightness layer is typically within the external walls, floors and roofs, and so care is needed during construction of these elements to ensure continuity of the air barrier.

6.19. Key points to check include: drawings, external walls, floors and roofs, penetrations, detailing, cavity walls, timber frame, sequencing.

6.20. The full proposed text is in Annex C.

Build Quality: Airtightness around openings – including windows, doors, loft hatches

6.21. Windows and doors should be aligned with the insulation layer in the walls and connect up to the primary air barrier, to avoid compromising airtightness.

6.22. Key points to check include drawings, fixings, sealing, doors and loft hatches.

6.23. The full proposed text is in Annex C.

Build Quality: Airtightness – internal services

6.24. Services can increase air-leakage if they penetrate through the building fabric and air barrier. Every one of these penetrations is a potential weak point if not made good and sealed adequately.

6.25. Key points to check include: drawings, design to avoid unnecessary penetrations and seal necessary penetrations.

6.26. The full proposed text is in Annex C.

6.27. Suggested illustrations:

- Example drawing clearly identifying thermal envelope and air barrier
- Thermal bridging strategies from ZCH *Thermal Bridging Guide* p.37

Question 51
Do you agree with the introduction of guidance for Build Quality in the Approved Document becoming part of the reasonable provision for compliance with the minimum standards of Part L?

a. **Yes**
b. **No**

Please explain your reasoning and provide evidence to support this.

Question 52
Do you have any comments on the Build Quality guidance in Annex C?

New-style compliance report

6.28. Currently Building Control Bodies receive a range of different outputs from SAP software, with varying levels of detail, for them to check Part L of the Building Regulations. We think that a unified approach, with BCBs receiving the same, clear information for every building will improve compliance.

6.29. We have developed a new compliance report, this would be the domestic version of the BRUKL report currently produced for non-domestic buildings. It is proposed to be called a Building Regulations Wales Part L report (BRWL) and would be produced using the information from the SAP calculations, see example in Annex D. The new compliance report would provide evidence that the completed work matches the as-built energy model including:

- the product-specific materials that have been used in the construction of the thermal elements;
- the product-specific equipment installed for heating, hot water, ventilation and micro-generation in the dwelling;
- a summary of the U-value and Ψ-value calculations, as used in the as-built emissions and primary energy rate calculations; and
- a summary of the thermal bridging details used, including the source and reference.

6.30. The report would have to be signed by the energy assessor to confirm that the as-built calculations are accurate. The report contains the client name, i.e. the company building the home or the name of the self-builder; the report would have to be signed by a representative of the developer to confirm that the as-built specifications are correct.

6.31. The report would have to be provided to the Building Control Body and could be used as a check list for site inspection of thermal elements. The report should also be provided to the owner of the new home.

Question 53
Do you agree with the introduction of a standardised compliance report, the Building Regulations Wales Part L (BRWL) report, as presented in Annex D?

a. **Yes**
b. **No – there is no need for a standardised compliance report**
c. **No – I agree there should be a standardised compliance report, but do not agree with the draft in Annex D**

If no, please explain your reasoning.

Photographic evidence

6.32. For existing domestic and non-domestic buildings, time stamped and geotagged photographic evidence of the various building elements to produce an Energy Performance Certificate (EPC) are a mandatory requirement. Currently, this is not a requirement for the Part L as-built energy calculations for new build dwellings using the SAP methodology.

6.33. Currently energy assessors must have the following evidence to demonstrate in order to produce an as-built energy calculation:

- construction drawings;
- construction specifications;
- service specifications; and
- a signed statement from the developer, or builder, that the dwelling has been built in accordance with the design.

6.34. We are proposing that photographic evidence is also included as a mandatory requirement to improve the accuracy of energy calculations and to provide assurance that the SAP energy models are a reflection of as-built dwellings.

6.35. To establish a level playing field across all developments, the minimum photographic evidence requirements include a short, non-exhaustive list of high-risk areas where changes, or substitutions, could occur during the construction process. The list includes six basic elements:

- Insulation levels and insulation product types – e.g. level and coverage of loft insulation, wall insulation, insulation type;
- Main and Secondary Heating systems – e.g. installed make and model; controls within zones/ areas;
- Ventilation system;
- Domestic hot water system type (only applicable if separate from heating system) – i.e. electric showers for example;
- Evidence of LZC technologies and relevant data – installed solar water heating, PV panels, battery for example; and
- Construction details – one image per thermal junction type would be sufficient.

6.36. If substitutions are made during the construction process, these would be reflected in the as-built photos. The government believes that it is standard practice across many organisations to record photographic evidence of the six proposed elements for internal auditing purposes and quality assurance of the build quality.

6.37. The government considers that photographic evidence offers a simple, effective and robust method of improving the quality of energy modelling and supporting more accurate assessment of the as-built energy performance of new dwellings.

Question 54
Do you agree with the introduction of photographic evidence as a requirement for producing the as-built energy assessment for new dwellings?

a. **Yes**
b. **No**

If no, please explain your reasoning.

Information to Building Control

6.38. Building Regulations (regulation 27 and 27B) requires the person carrying out the work (e.g. developer, or builder), to produce a notice that the building was constructed in accordance with the list of specifications to which the building is to be constructed.

6.39. We propose that the signed compliance report (BRWL) and the photographic evidence is provided to the Building Control Body to confirm that the minimum requirements of the relevant building regulations are met. Due to the complex nature of the SAP methodology, we expect that this change will simplify the process of checking compliance with the Part L requirements for Building Control. Considering the signed specification sheet is already a mandatory requirement, the proposed addition of photographic evidence is expected to provide Building Control Bodies with better information of how the as-built energy assessment has been produced.

6.40. Supplementing the new style compliance report (BRWL), if adopted, with photographic evidence aims to provide a simple and robust method of demonstrating compliance with the energy efficiency requirements of the proposed Part L.

Question 55
Do you agree with the proposal to require the signed standardised compliance report (BRWL) and the supporting photographic evidence to be provided to Building Control?

a. Yes
b. No

Please explain your reasoning.

Providing information to householders

6.41. Regulation 40 stipulates that the owner is provided with "sufficient information about the building, the fixed building services and their maintenance". We propose that the signed compliance report (BRWL) and the photographic evidence is provided to the owner; likely at the same time as the EPC. This aims to help homeowners understand better how the as-built energy calculation of their home was undertaken.

6.42. This approach champions transparency and provides occupiers with certainty that the home they are buying is built as per the energy efficient design specifications. As home purchasing is often said to be the most expensive and stressful of life experiences[37], the government aims to reassure consumers that the home they are purchasing is energy efficient. The signed BRWL document and photographic evidence would provide easy to understand information to the dwelling occupier on what technologies and construction details were used to make their home low carbon and energy efficient.

6.43. More information could also be given to the purchasers of new homes on their EPC. We think this information should include the version of Part L that the home is built to e.g. Part L 2010. This addition is expected to champion transparency of how the as-built energy assessment was calculated, improve standards and provide more clarity to consumers.

Question 56
Do you agree with the proposal to provide the homeowner with the signed standardised compliance report (BRWL) and photographic evidence?

a. Yes
b. No

Please explain your reasoning.

Question 57
Do you agree with the proposal to specify the version of Part L that the home is built to on the EPC?

a. Yes
b. No

Please explain your reasoning.

Home energy guides

[37] Research on buying and selling homes. BEIS, 2017 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/653581/buying-selling_homes-research.pdf

6.44. Information supplied to households on how to operate and maintain their home in an energy efficient manner varies in quality. We propose that a national template with minimum requirements for a home energy guide should be developed and required through building regulations. The NHBC and CIBSE TM60 provide good practice in the provision of home energy guides and we would look to require guides of this standard.

6.45. We are considering whether a consumer-friendly home energy guide should be provided to occupants explaining how to use the building services efficiently. Occupiers have a large role to play in how their homes perform in operation and providing easy-to-use educational guides can support them in saving carbon and keeping their fuel bills low.

6.46. Our proposal is for home energy guides and relates to energy efficiency and ventilation requirements only. This is in contrast to a home user guide which encompasses a wider scope. We propose that a home energy guide should contain clearly marked sections for ventilation, heating and hot water and staying cool in summer. The home energy guides could use colour-coding, illustrations and tutorials and very simple advice that occupiers without any technical background could use to maintain a healthy, energy efficient home.

Question 58
Do you agree Approved Document L should provide a set format for a home energy guide in order to inform homeowners how to efficiently operate their dwelling?

a. Yes
b. No

If yes, please provide your views on what should be included in the guide.

Chapter 7. Transitional Arrangements

Background

7.1 Whenever changes to the Building Regulations or approved standards take place, transitional arrangements apply. When a developer submits a building notice or full plans application to the local authority, the Building Regulations standards in place at the time of the application will apply, so long as work under the building notice or full plans application has already started or starts within a specified period of the notice being given.

7.2 The transitional arrangements exist for good reason – they mean that developers have assurance about the standards to which they must build, and that they should not have to make material amendments to work which is already underway when new regulations came into force.

7.3 Commencement of building work is the point at which the project requires building control input and without such control would be a case for enforcement. The work should be permanent in the sense that it will be incorporated into the completed building. In order to provide clarity, building work which is carried out in accordance with a relevant notice or building plans can be said to have been commenced upon completion of work such as (not an exhaustive list):

- excavation for strip or trench foundations or for pad footings;
- digging out and preparation of ground for raft foundations;
- vibroflotation (stone columns) piling, boring for piles or pile driving

7.4 However, currently only one dwelling on a multi-dwelling application will need to have commenced to enable all the other dwellings to also be built to same standards, even if the other dwellings were not commenced for many years later. We are aware of cases of housing developments being built out to requirements that have been superseded long after new standards have come into force, and highlighted this in our 2016 circular on commencement of building works and transitional provisions (WGC 007/2016 - https://gov.wales/sites/default/files/publications/2019-06/commencement-of-building-work-and-regulation-37a-wg-0072016.pdf).

7.5 While we appreciate that many housebuilding sites are built out over a number of years, it cannot be right that new homes are being built to old standards. It means that occupiers do not benefit from the levels of energy efficiency and the bill savings they would expect from a brand-new home. It also means that new homes are contributing more carbon dioxide emissions than should be expected, which has an impact on climate change.

7.6 To mitigate this we propose to introduce a more stringent set of transitional requirements in 2020 to make sure that developers do not continue to build to older energy efficiency standards for longer than is appropriate.

Transitional arrangements for 2020 uplifts

7.7 Where a building notice, initial notice or full plans deposit is submitted to the building control body before the new energy efficiency standards described in chapter three of this consultation come into force, we propose that the transitional arrangements should only apply to individual buildings on which building work has started within a reasonable period.

7.8 Where work has not commenced on a specific building covered by the building notice, initial notice, or full plans within a reasonable period, that building would not benefit from the transitional provisions and so it (and any other non-commenced buildings covered by the notice/plans) would need to comply with the latest set of energy efficiency standards. Those already benefiting from transitional provisions applied to earlier changes to Part L and the energy efficiency standards would not be affected.

7.9 This is a more stringent transitional arrangement than usual to try to ensure new dwellings are meeting up to date standards. Although this may result in different houses in the same development being built to different standards, we expect housebuilders will be encouraged to build out more quickly on their sites.

Question 59
Do you agree that the transitional arrangements for the energy efficiency changes in 2020 should not apply to individual buildings where work has not started within a reasonable period – resulting in those buildings having to be built to the new energy efficiency standard?

a. Yes – where building work has commenced on an individual building within a reasonable period, the transitional arrangements should apply to that building, but not to the buildings on which building work has not commenced

b. No – the transitional arrangements should continue to apply to all building work on a development, irrespective of whether or not building work has commenced on individual buildings

If yes, please suggest a suitable length of time for the reasonable period in which building work should have started.

If no, please explain your reasoning and provide evidence to support this.

Question 60
Do you foresee any issues that may arise from the proposed 2020 transitional arrangements outlined in this consultation?

a. Yes

b. No

Please explain your reasoning and provide evidence to support this.

Chapter 8. Development Viability

Viability modelling

8.1 As part of the development of these consultation proposals for Part L we have considered the impact on the viability of housing development of the options proposed.

8.2 Analysis of typical development costs and the impact of the proposed increase in standards was undertaken to assess the impact of higher costs on existing developer planning. The mix of financial contribution and affordable housing provision will be influenced by the characteristics of individual developments including density and site conditions and the economic micro-climate. Assessments were therefore made of planning contributions based on local plan and supplementary planning guidance taking account of actual development data obtained from house builders and planning authorities.

8.3 Costs were assessed against a baseline of a range of 2014 Building Regulations Part L compliant homes. A cost build-up (including design and professional fees, site costs and abnormals as well as contingencies) was developed for each of the two consultation options for a detached (117m^2 total floor area(TFA)), semi-detached (84m^2 TFA) and terraced house (84m^2 TFA) as well as for an apartment (50m^2 TFA 1 bed apartment and 70m^2 TFA 2 bed apartment). Specifications and sizes of homes were the same as employed for the modelling of carbon emissions and for primary energy.

8.4 Modelling was undertaken of theoretical new development sites comprising 0-10 dwellings: 10 dwellings at a density of 11 dwellings/acre (27 dwellings/hectare); 11-20 dwellings: 20 dwellings at a density of 14 dwellings/acre (35 dwellings/hectare), and >20 dwellings: 51 dwellings at a density of 16 dwellings/acre (40 dwellings/hectare).

8.5 Analysis was based on information received from Economists as a projected build out in Wales for the next 10 years:

- Detached: 42%
- End Terrace: 20.0%
- Mid Terrace: 16.0%
- Apartments: 22%

8.6 The development mix was tested for practical application with local planning authorities (LPAs). Private land purchase and sales values data was obtained from Land and Estate Agents and a reasonable sales regime assumed

8.7 The percentage of Affordable Homes (AHs) were considered based on LPA policies and the percentage being achieved in practice, with costs assumed to be the lower of the Acceptable Cost Guidance or the current average sales price. It was assumed that all AHs are social housing and sold rather than rented. It is also assumed that all developments are built out in one phase. Variations on the level of AHs was utilised to undertake sensitivity testing. Consideration of Section106 costs, and the inter-relationship with AHs has been incorporated into modelling.

8.8 The Ministry of Housing, Communities and Local Government's (MHCLG) Development Viability tool was used to assess the impact on Affordable Housing contributions and land values. .

8.9 Two local authority areas were considered, Cardiff and Powys Other local planning authority areas were utilised to carry out sensitivity testing of the proposals.

8.10 The conclusions were:

- The difference in residual land values across the board between the preferred proposal (Option 1) and the alternative option (Option2) is 1-4%.
- In many situations, based on viability considerations, developers have already negotiated lower levels of affordable housing than required by the local plan or supplementary planning guidance.
- The greatest impact of higher construction costs will be felt in medium size (20 and 50 unit) developments as an affordable housing contribution is often not expected on smaller sites (<10) and planning contributions as a proportion of total costs are less on the largest sites.
- The increased construction costs of both option 1 and 2 are likely to be accommodated in higher land value areas (Cardiff, Newport, Swansea) through reductions in planning contributions, developers profit and/or the land value paid to the land owner.
- Data indicated viability issues already exist in the lowest value areas. In addition to no contribution to affordable housing the additional costs will require a reduction in developers profit or land value for the development to be considered viable. This is also likely to be the case in areas that are currently viable, for both the preferred proposal and the alternative option.

8.11 The impact on capital costs is given in the table below.

Table 8.1: Representative incremental costs against a compliant 2014 Part L baseline for a private sector semi-detached dwelling

	Option 1	Option 2
Increased capital costs (£)	£6,132	£8,484
% Increase in capital costs	5.0%	6.9%
Range % of selling price*	2.4%-4.1%	3.3%-5.7%

*Prices based on currently available developments with an allowance for price discounting

8.12 The tables below show the estimated reduction in land value for the 10, 20 and 50 options based on the assumed development mix and achieving a viable scheme. The approach taken has been to vary the affordable housing level to produce the minimum decrease in land value. Actual affordable housing contributions are shown in brackets. In practice a lower developer return combined with a reduction in land value may be required to provide a level of affordable housing and secure a viable scheme. Changes have been rounded to the nearest whole percentage point.

Table 8.2: A 10 dwelling brownfield development

	% land value reduction against current policy	
	Cardiff	Powys
Option 1	1% (20%)	2% (0%)
Option 2	2% (20%)	3% (0%)

Table 8.3: A 20 dwelling development

	% land value reduction against current policy	
	Cardiff	Powys
Option 1	2% (20%)	2% (23%)
Option 2	3% (20%)	3% (23%)

Table 8.4: A 50 dwelling development

	% land value reduction against current policy	
	Cardiff	Powys
Option 1	2% (20%)	2% (22%)
Option 2	3% (20%)	3% (22%)

Question 61
Overall, do you think the assessment of the impact on development is broadly fair and reasonable?

Please justify your view and provide alternative evidence if necessary.

Chapter 9. Feedback on the Impact Assessment

9.1 Building Regulations greatly influence how our buildings are constructed and used. As such, they help to deliver significant benefits to society. Regulation can also impose costs on both businesses and individuals. We have published an Impact Assessment which considers the costs and benefits of the proposed changes to Part L and Part F of the Building Regulations. The Impact Assessment is an important part of the consultation, as its analysis has shaped the proposals, and we are keen to test the results. As such, consultees are encouraged to read the impact assessment and respond to the questions below.

9.2 To note, the impact assessment only covers the proposed changes to the Building Regulations to be implemented in 2020. A separate Impact Assessment will be produced for the future Part L 2025 standard when we consult in the future on its detailed implementation.

9.3 With regards to the Part L 2020 standard proposed for new homes, recent work for the Committee on Climate Change[38] adjusted the size of the heat distribution system to address the heating demand requirement. For example, it assumed that homes which required very little heat to achieve a comfortable indoor environment would have a reduced number of radiators and shorter heating distribution pipework. This approach was developed from feedback received from those delivering very energy efficient homes, e.g. to certified Passivhaus or close to Passivhaus standards. In terms of associated cost saving, for the domestic models with a space heating demand lower than 15kWh/m^2/year (as modelled in SAP) a 75% reduction of the combined cost of radiators and associated heating distribution pipework was incorporated for houses, and a 50% reduction for flats (compared to costs for dwellings with space heating demands of over 25kWh/m^2/yr).

9.4 SAP predicts that Part L Option 2 would have a space heating demand around 15kWh/m^2/year. Whilst not included in the Impact Assessment analysis, a 75% reduction of the combined cost of radiators and associated heating distribution pipework would save £2300 for a semi-detached house as an example. This would result in Option 2 having around the same capital cost as Option 1. More generally, it would result in similar capital costs for the houses for both Options 1 and 2, albeit Option 2 would still be £1000 more expensive for flats.

9.5 In practice, there are questions as to whether this level of cost reduction will be realised. It is not based on specific engineering designs. Furthermore, it is based on the assumption that there is little performance gap between the designed and actual building - if the as built performance is not as good as that intended at the design stage, the additional heat losses might mean that the reduced heating system would be insufficient to maintain comfortable temperatures, thereby limiting the applicability of this approach.

[38] https://www.theccc.org.uk/wp-content/uploads/2019/07/The-costs-and-benefits-of-tighter-standards-for-new-buildings-Currie-Brown-and-AECOM.pdf

9.6 It would be useful to have feedback from consultees on the cost reduction expected from the heat distribution system (pipework and radiators) from a space heating demand of around 15kWh/m^2/year.

Question 62
The Impact Assessment makes a number of assumptions on fabric/services/ renewables costs, new build rates, phase-in rates, learning rates, etc for new homes. Do you think these assumptions are fair and reasonable?

a. Yes
b. No

Please explain your reasoning and provide evidence to support this.

Question 63
Overall, do you think the impact assessment is a fair and reasonable assessment of the potential costs and benefits of the proposed options for new homes?

a. Yes
b. No

If no, please explain your reasoning and provide evidence to support this.

Question 64
Do you consider that it is reasonable for a 75% reduction of the combined cost of radiators and associated heating distribution pipework associated with reducing the space heating load to around 15kWh/m^2/year in SAP?

a. Yes
b. No

If either yes or no, please explain your reasoning and provide evidence to support this.

Annex A. Specification for each building type

	Part L 2014	Part L 2020 Option 1	Part L 2020 Option 2
External Wall U-value (W/m^2K)	0.18	0.13	
Corridor Wall U-value (W/m^2K)	0.18	0.18	
Party Wall U-value (W/m^2K)	0	0	
Roof U-value (W/m^2K)	0.13	0.11	
Floor U-value (W/m^2K)	0.13	0.11	
Window U-value (W/m^2K)	1.4	1.3	
Window g-value	0.63	0.63	
Door U-value (W/m^2K)	1.0	1.0	
y-value (W/m^2K)	Based on SAP 9.92 Appendix R		
Ventilation System Type	Intermittent extract fans with trickle vents		MVHR
Air permeability ($m^3/h{\cdot}m^2$ at 50 Pa)	5		3
Space Heating Source	Condensing gas boiler (regular for detached, combi for others)		
Domestic Hot Water Source	As for space heating		
Boiler Efficiency	89.5% (SEDBUK)		
Heat Emitters	Standard radiators	Large (low temp) radiators	
Space Heating Controls - individual space heating options	ErP Class V, time and temp control, interlock		
Hot Water Controls / insulation – individual water heating options where hot water cylinders present	Cylinder thermostat, separate timer, fully insulated primary pipework (where applicable)		
Shower flow rate	8 l/min		
Waste Water Heat Recovery (WWHR)	No	Efficiency of 55% Utilisation of 0.98	
Fixed lighting capacity (lm)	185 x TFA		
Lighting efficacy (lm/W)	80		
PV installation area (percentage of building foundation area)	0%	40%	
PV assumptions		SE/SW facing, 45-degree pitch, no/little overshading, 6.5m^2/kWp.	

Annex B Changes to BR 443

These are the main changes to the new version of BR 443 (2019), however the document should be reviewed in full for other minor changes. The latest version is available for this consultation at: https://www.bregroup.com/sap/sap10/ .

In general, BR 443 (2019) is an update to the 2006 edition, primarily reflecting changes in British, European and International standards; industry practice; and industry publications.

Since publication of the previous edition of this document, European standards specifying calculation methods for thermal properties have been amended, replacing the previous British standards BS EN ISO 6946, BS EN ISO 10211, BS EN ISO 10456, BS EN ISO13370, and BS EN ISO 13789 in addition to many other standards. Earlier versions of this publication included references to the standards which were applicable at the time of publication. This document uses references to BS EN ISO standards which were published from 2017.

Added:

- U-values obtained by in-situ measurement
- U-values of timber building kits
- U-values of "Green" roofs (inverted)
- U-values of "Blue" roofs (inverted)
- U-values for other types of roofs, e.g. "Green" or "Blue" roofs, which are not inverted
- New categorisations added to differentiate treatment of windows, roof windows and rooflights
- Methods of calculation of U-values given for each category, including calculation for the compliance and for energy calculations, including:
    - windows;
    - roof windows;
    - out-of-plane rooflights;
    - in-plane rooflights.

- Instruction for dealing with U-values for lantern- or box-style rooflight kerbs / upstands
- U-values of dynamic transparent building elements
- U-values of existing (old) walls, roofs and floors in dwellings
- Conventions for treatment of heat capacity
- Updates to appendix A: Glossary and definitions.

Expanded and clarified items:

- Thermal resistance of foam or mineral wool insulation with aluminium foil facing
- Thermal resistance of bubble-foil and multi-foil insulation
- Total thermal resistance of multi-foil insulation and adjacent airspaces
- Reflective breather membranes, vapour control layers, air barriers.
- Airspace resistance
- Wind-posts and masonry support brackets
- Slab-on-ground floor (ground-bearing floor slabs)

Revised:

- Voided masonry units
- Rainscreen cladding
- Inverted roofs

Annex C Build Quality

Build Quality: Insulation gaps

Gaps in insulation can have a significant impact on heat loss and thermal bypass, and risks of condensation and mould. Attention to detail at both the design and construction stages is required.

This draft guidance could be included in Approved Document L:

- **Design drawings**: review for clarity, buildability and robustness of details. Drawings should identify a continuous insulation layer. Where elements might interrupt the insulation layer, ensure that designs provide clear solutions for these.
- **Foundations**: insulation should be tight to the structure without gaps. Insulation should be fitted below damp proof course level.
- **Floors:** insulation should be installed tight to structure, without gaps. Perimeter insulation should be continuous and details should allow for insulation at door thresholds.
- **Windows**: should be installed with less than 10mm tolerance all around between the frame and structural opening; overlapping the frame with the cavity to a minimum of 30mm. Fully insulated and continuous cavity closers should be used, installed tight to insulation and cavity. Lintels that minimise heat loss should be used.
- **Doors**: should overlap with cavities by at least 50mm.
- **Walls:** insulation should be tight to structure, and to cavity closers, lintels and cavity trays. Where fire-stopping socks are required these should fully fill heads of cavities.
- **Roofs:** truss design should seek to increase the depth of roof insulation which can be accommodated at eaves. Insulation should be installed tight to structure, without gaps and continuous to the wall insulation.
- **Insulation boards:** where these are used care should be taken to avoid any gaps between boards or between the boards and structure (which may be affected by e.g. mortar snots). All joints between rigid insulation boards should be lapped or sealed with tape.
- **Elements bridging external walls**: should be reduced in the building design wherever possible. Examples include steel beams, cavity trays, meter boxes and subfloor vents. When present, their impact on the insulation layer should be mitigated (for example, through installing insulation behind them where they are on the cold side of the construction).
- **Careful coordination of work:** to avoid subsequent work stages damaging previous work, for example through displacing insulation.
- **Comparison against design drawings:** an on-site audit (supported by photographs) to ensure details have been followed prior to elements being closed off.

Build Quality: Thermal bridging at junctions

Thermal bridges occur when an area of a building has significantly higher heat transfer than the surrounding parts. Breaks in insulation, reduced insulation, or more conductive materials can contribute to higher heat losses, which should be quantified and accounted for in SAP calculations.

This draft guidance could be included in Approved Document L:

• **Buildability:** junction details should be reviewed for their buildability in practice and sequencing carefully considered.

• **Product specification:** whether opportunities have been considered to reduce thermal bridging – for example, in masonry construction using lightweight blockwork in

the inner leaf of the cavity wall can help reduce bridging at various junctions; and in timber construction using insulated plasterboard on the inside of the frame can help reduce bridging at various junctions. Using lightweight blockwork in the party wall can improve performance at junctions with the floor.

• **Product substitution:** it is particularly important that the correct products are used, matching design details.

• **Foundations:** blocks below the damp proof course should match those specified in the design (for example, with the correct thermal conductivity).

• **Floors:** the wall to floor junctions should be detailed to achieve continuity of insulation. Perimeter insulation and cavity insulation below the damp proof course (where applicable) should not be omitted. Increasing the perimeter insulation thickness can improve performance. Intermediate floor to wall junctions should be detailed to avoid insulation gaps.

• **Windows:** specify lintel designs which minimise thermal bridging and check these are not substituted on-site. Increasing frame overlaps can also improve thermal bridging at lintels, sills and jambs. Insulated cavity closers should be used. Detailing at reveals should be considered - for example, insulated plasterboard can improve performance.

• **Roofs:** continuity of insulation should be achieved at the wall to eaves and wall to gable junctions – for example, insulation should be installed to the top of the wall plate, soffit insulation should not be omitted at eaves, and designs should seek to increase the depth of roof insulation which can be accommodated at eaves. The roof insulation should be installed when the eaves are still accessible. The omission of perimeter roof insulation impacts negatively on thermal bridging at gable to wall and party wall head junctions.

• **Comparison against design drawings:** an on-site audit (supported by photographs) to ensure details have been followed.

Build Quality: Airtightness – incoming service penetrations

Thermal bridges occur when an area of a building has significantly higher heat transfer than the surrounding parts. Breaks in insulation, reduced insulation, or more conductive materials can contribute to higher heat losses, which should be quantified and accounted for in SAP calculations.

This draft guidance could be included in Approved Document L:

- **Drawings:** should clearly identify the position and the extent of the air barrier.
- **Positioning:** of services, ducts and cables in relation to the airtightness membrane before starting works.
- **Groundworks:** services need to be accurately set out by the groundworks sub-contractor to prevent screed, insulation and membranes having to be disturbed at a later stage. Check setting out before screeding works commence. Ensure sufficient space between adjacent service penetrations to allow adequate screed flow between ducts.
- **Floor works:** use temporary supports for services during floor works.
- **Sealing:** fit grommets, collars or use other proprietary air sealing medium to seal around incoming services.

Build Quality: Airtightness of structure – including walls, roof, floor junction, partitions

The primary airtightness layer is typically within the external walls, floors and roofs, and so care is needed during construction of these elements to ensure continuity of the air barrier.

This draft guidance could be included in Approved Document L:

- **Drawings:** should clearly identify the position and the extent of the air barrier.
- **External walls, floors and roofs:** should be abutted tightly at all junctions.
- **Penetrations:** such as structural steelwork need to be effectively sealed for airtightness. Timber joist hangers should be considered in lieu of penetrations.
- **Detailing:** ensure adequate detailing is provided and that the details are followed correctly.
- **Cavity walls:** the inner block leaf should be pointed up within the cavity with joints fully filled. Parge coats or plaster on blockwork should be considered to improve airtightness. In circumstances where internal plasterboard linings are used as a secondary air barrier, apply continuous ribbons of adhesive around board edges and any openings.
- **Timber frame:** the vapour control layer should be lapped at seams and junctions, and taped where it is the airtightness barrier. Any damage such as tears should be repaired prior to boarding.
- **Sequencing:** ensure internal sealing works, such as parge coats or vapour control layer seals are carried out prior to other constructions that may hinder the implementation of these works, e.g. staircase installations.
- **Build Quality: Airtightness around openings – including windows, doors, loft hatches**
- Windows and doors should be aligned with the insulation layer in the walls and connect up to the primary air barrier, to avoid compromising airtightness.

This draft guidance could be included in Approved Document L:

- **Drawings:** should clearly identify the position and the extent of the air barrier.
- **Fixings:** should be achieved by mechanical means wherever possible. Care should be taken to avoid damage to the airtightness barrier from fixings. Should it not be possible to achieve a good seal by mechanical means, compressible seals and expanding foam help to reduce unsealed and uninsulated gaps.
- **Sealing:** the sealing methods must be robust to ensure a good seal. Gun sealant should not be relied on for gaps greater than 5mm.
- **Doors:** architectural detailing needs to consider how the airtightness membrane within the floor slab and the insulation will connect up to the door and be protected during the works stage.
- **Loft hatches:** should be suitably chosen to ensure optimum airtightness.
- **Build Quality: Airtightness – internal services**
- Services can increase air-leakage if they penetrate through the building fabric and air barrier. Every one of these penetrations is a potential weak point if not made good and sealed adequately.
- This draft guidance could be included in Approved Document L:
- **Drawings:** should clearly identify the position and the extent of the air barrier.
- **Design to avoid unnecessary penetrations** through the air barrier – dedicated service zones can avoid most routing-related penetrations.
- **Core drill** service penetrations to limit damage and make good any damage caused.

- **Seal necessary penetrations** directly within the air barrier itself, using proprietary grommets or collars. Where membranes are employed use careful detailing to achieve a robust and durable seal at these penetrations. When cutting holes through the membrane double check locations co-ordinate with structure and minimise hole size.
- The Build Quality sections above can be integrated into the Approved Document dependent on the outcome of this consultation.

Annex D BRWL Compliance Report

Building Regulations Wales Part L (BRWL) Compliance Report

Approved Document L1A 20XX Edition, Wales assessed by xxx SAP 2019 program, x.x.x.x

Project Information			
Assessed By	Example Assessor	Building Type	e.g. Semi-detached House

Dwelling Details			
Assessment Type	New Dwelling – AS BUILT STAGE	Total Floor Area	e.g. 84m²
Site Reference	Example Site	Plot Reference	Example House
Address	Example Site Address		

Client Details	
Name	Example Client
Address	Example Client Address

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system:	e.g. Mains gas		
Target carbon dioxide emission rate	xx	kg/m²	
Dwelling carbon dioxide emission rate	xx	kg/m²	OK
1b Target primary energy rate and dwelling primary energy			
Target primary energy	xx	kWh/m²	
Dwelling primary energy	xx	kWh/m²	OK

2a Fabric U-values

Element	Average U-Value	Highest U-Value	Key layer elements to achieve U-Value: Mfr. / Product (Thickness)	
External Wall	0.15 (max. 0.21)	0.18 (max. 0.70)	Layer 1: Mineral wool batt Insulation Ltd / MB200 (xxx mm)	OK
Party wall	0.00 (max 0.20)	-	Cavity sock	OK
Floor	0.11 (max. 0.18)	0.11 (max. 0.70)	Layer 1: EPS EPS Insulation Ltd / EP150 (xxx mm)	OK
Roof	0.11 (max. 0.15)	0.15 (max. 0.35)	Roof 1, Layer 1: Mineral wool roll Insulation Ltd / MR 300 (xxx mm)	OK
			Roof 2, Layer 1: Mineral wool batt Insulation Ltd / MB200 (xxx mm)	
			Roof 2, Layer 2: Insulated lining board Thermal Boards Ltd / TB50 (xxx mm)	
Openings	1.19 (max 1.60)	1.20 (max 3.30)	Type 1: Windows Windows Ltd / DG Plus	OK
			Type 2: External Doors Doors Ltd / Door Plus	
			Type 3: Roof Windows Roofwindows Ltd / DG Roof 1	

2b Thermal Bridging

Summary of thermal bridging calculated from linear thermal transmittances for each junction					OK
Main element	**Junction detail**	**Source type**	**W/m.K**	**Reference**	
External wall	E2 Other lintels	Independently assessed	0.05	Xxxx/TB/01	
	E3 Sill	Independently assessed	0.05	Xxxx/TB/02	
	E4 Jamb	Independently assessed	0.05	Xxxx/TB/03	
	E5 Ground floor	Independently assessed	0.16	Xxxx/TB/03	
	E6 Intermediate floor	Table K1 default	0.14		
	E10 Eaves (ins. at ceiling)	Table K1 default	0.12		
	Etc				
Party wall	P1 Ground floor	Table K1 default	0.32		
	P2 Intermediate floor	Table K1 default	0.00		
	Etc				
Roof	R5 Ridge	Table K1 default	0.24		
	Etc				

3 Air permeability

Air permeability at 50 pascals	4.2 (measured value)	OK
Maximum	10.0 (limit value)	
Air permeability test certificate ref	e.g. iATS reference: 12345678 (hyperlinks to report)	

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor heating - mains gas *Minimum Efficiency XX.0 %*		OK
	Emitter type	Radiators	
	Flow temperature	55 °C	
	Type	System boiler	
	Manufacturer	Boiler Systems Ltd	
	Model	Boiler Model 12	
	SEDBUK Efficiency	89.5%	
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	200 litre cylinder *Maximum permitted loss xx kWh/day*		OK
	Type	200 litre cylinder	
	Manufacturer	DHW Cylinders Ltd	
	Model	DHW200	
	Declared cylinder loss	1.50 kWh/day	
Primary pipework insulated	Yes		OK
Waste water heat recovery	Type	Horizontal	OK
	Efficiency	60% efficient	
	Manufacturer	WWHR Ltd	
	Model	Shower-15	

6 Controls

Space heating	Time and temperature zone control (by plumbing arrangement)		OK
	ErP Class V Controls		
	Manufacturer	SHTG Controls Ltd	
	Model	Smart 247	

Hot water	Cylinderstat and independent timer		OK
	Manufacturer	DHW Controls Ltd	
	Model	Timer 247	
7 Low energy lights			
Installed efficacy (lamp lumens per circuit watt – lm/W)	66.9 (100% LED or CFL fixtures; 0% other fixture types)		OK
Minimum efficacy (lm/W)	60 (average)		
8 Mechanical ventilation			
Type of system	Continuous supply and extract system (MVHR) *Maximum specific fan power 1.5* *Minimum efficiency 70%*		OK
	Manufacturer	Ventilation Ltd	
	Model	MVHR300	
	Specific fan power	0.6	
	MVHR efficiency	89%	
Ventilation commissioning certificate	e.g. Part F commissioning certificate reference 12345678 (hyperlinks to report)		
9 Local generation			
Type of system	Solar PV		OK
	Manufacturer	Solar PV Systems Ltd	
	Panel type	Panel B	
	Array size	4 m²	
	Overshading	None/very little	
	Orientation	SE	
MCS certificate	e.g. 12345678 (hyperlinks to report)		

10 Supporting documentary evidence	
Documentary evidence identified in 10.1 and 10.2 is needed to confirm the data values used for any calculations undertaken, manufacturer declarations made, and tests performed as reflected in this As-Built BRWL Compliance Report are correct. 10.1 SAP Conventions (v7.01), Appendix 1 (documentary evidence) schedules the minimum documentary evidence required. 10.2 Photographic evidence of key stages during construction that confirm the products identified in this BRWL are used in this dwelling and workmanship is of sufficient quality to support the calculated values claimed in 2a and 2b.	OK
11 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BRWL report are a true and accurate reflection of the dwelling as-built and that the supporting documentary evidence (identified in 10.1 and 10.2) pursuant to Part L of the Building Regulations 2010 (as amended) has been reviewed in the course of preparing this BRWL report. Signed ..... Assessor ID ..... Name ..... Date	OK
b. Client Declaration	
This declaration by the client is confirmation that that the dwelling has been constructed and completed according to the specifications set out in this BRWL report. Signed ..... Organisation ..... Name ..... Date	OK OR FAIL*

* if not signed

Annex E Primary energy and carbon factors

The below tables contain the calculated primary energy and CO_2 emission factors used to develop the Part L 2020 options; these can also be found in cSAP and cSBEM.

Table C.1: Primary energy factors for electricity used in the analysis [kWh/kWh]												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Standard tariff	1.602	1.593	1.568	1.530	1.487	1.441	1.410	1.413	1.449	1.504	1.558	1.604
7-hour tariff (high rate)	1.635	1.626	1.600	1.562	1.518	1.471	1.440	1.443	1.479	1.535	1.591	1.637
7-hour tariff (low rate)	1.521	1.512	1.488	1.453	1.411	1.368	1.339	1.342	1.376	1.428	1.480	1.522
Electricity sold to or displaced from grid, PV	1.715	1.697	1.645	1.567	1.478	1.389	1.330	1.336	1.405	1.513	1.623	1.718

Source: BRE, CO_2 and Primary Energy Summary Tables for AECOM 2019_04_26

Table C.2: Primary energy factors for other fuels used in the analysis [kWh/kWh]	
	PEF
Mains gas	1.130
LPG	1.141
Heating oil	1.180

Source: BRE, CO_2 and Primary Energy Summary Tables for AECOM 2019_04_26

Table C.3: Primary energy factors for renewables in the analysis [kWh/kWh]		
	PEF	**Description of Application in Analysis**
Renewable heat on-site	0	Applied to heat pumps and solar thermal. Both technologies offset demand and therefore primary energy for other heating fuels.
Renewable electricity on-site	0	PV – applied to portion of electricity generated by PV and used on-site (as calculated in draft SAP 10). The total electricity generated by PV also offsets grid-supplied electricity at the 'electricity sold to or displaced from grid, PV' PEFs in Table C.1 above.
Renewable electricity off-site (as part of grid mix, or exported to grid)	1	Affects grid electricity factors in Table C.1 above. PV – applied to portion of electricity generated by PV and exported to grid (as calculated in draft SAP 10). The total electricity generated by PV also offsets grid-supplied electricity at the 'electricity sold to or displaced from grid, PV' PEFs in Table C.1 above.

Source: BEIS/MHCLG, 21/06/19

Table C.4: Carbon emission factors for electricity used in the analysis [kgCO_2e/kWh]												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Standard tariff	0.163	0.160	0.153	0.143	0.132	0.120	0.111	0.112	0.122	0.136	0.151	0.163
7-hour tariff (high rate)	0.171	0.168	0.161	0.150	0.138	0.125	0.117	0.118	0.128	0.143	0.158	0.171
7-hour tariff (low rate)	0.143	0.141	0.135	0.126	0.116	0.105	0.098	0.099	0.107	0.120	0.133	0.144
Electricity sold to or displaced from grid, PV	0.196	0.190	0.175	0.153	0.129	0.106	0.092	0.093	0.110	0.138	0.169	0.197

Source: BRE, CO_2 and Primary Energy Summary Tables for AECOM 2019_04_26

Table C.5: Carbon emission factors for other fuels used in the analysis [kgCO_2e/kWh]	
	CEF
Mains gas	0.210
LPG	0.241
Heating oil	0.298

Source: BRE, CO_2 and Primary Energy Summary Tables for AECOM 2019_04_26