Scottish Building Regulations – Proposed Changes to Energy Standards and associated topics

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Scottish Government
Riaghaltas na h-Alba
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Part 1 – Introduction and how to respond to this consultation

1.1 Introduction

1.1.1 Purpose of this review

The purpose of this review is to consider further improvements to the standards set within The Building (Scotland) Regulations 2004 (as amended)[1] (Building Regulations) to limit greenhouse gas emissions and energy use, both in new buildings and where work to existing buildings takes place.

The review considers the technical, commercial and wider policy implications of improvements to energy standards and offers proposals, as part of broader action by the Scottish Government on climate change, to further our ambition of becoming a net-zero society by 2045. It also presents proposals on the provision for electric vehicle charging infrastructure or facilities in buildings.

1.1.2 The Scottish building standards system

The building standards system in Scotland[2] is established by the Building (Scotland) Act 2003[3] (The 2003 Act). The system regulates building work on new and existing buildings to provide buildings that meet reasonable standards which:

- secure the health, safety, welfare and convenience of persons in or about buildings and of others who may be affected by buildings or matters connected with buildings,
- further the conservation of fuel and power, and
- further the achievement of sustainable development.

The Building Standards Division (BSD) is part of the Scottish Government Directorate for Local Government and Communities. Our purpose is to provide and maintain a robust legislative framework to ensure that the building standards system in Scotland protects the public interest.

We work in partnership with Local Authority verifiers and other key stakeholders across the construction industry, key stakeholders in policy development, and other parts of Scottish Government. As a Division, we contribute to wider policy objectives of government with regards to issues such as energy efficiency, climate change and building safety.

The BSD prepares and updates building standards legislation and guidance documents, conducting any necessary research and consults on changes as The 2003 Act requires.

Requirements applicable to building work are set through Building Regulations as a set of mandatory functional standards. These are simple statements on what outcomes must be achieved when undertaking building work. These standards

[1] See https://www.legislation.gov.uk/ssi/2004/406/contents/made
[2] Information on the building standards system can be found at www.gov.scot/bsd
[3] See https://www.legislation.gov.uk/asp/2003/8/contents

are supported by a body of guidance set out in Domestic and Non-domestic Technical Handbooks[4]. This published guidance assists by defining the scope of action expected under each standard providing one or more examples of how compliance with the standard can be achieved. Noting that the standards can also be met through solutions not included in published guidance.

1.1.3 Energy standards within building regulations

Since the introduction of national building regulations to Scotland in 1964, there have been energy standards, in one form or another. Initially these only applied to the external fabric of certain residential buildings and were minimal in nature. Later, they evolved to take account of commercial and industrial non-domestic buildings and to address the energy efficiency of the building services which are instrumental in providing comfort to the occupiers of buildings.

Prior to 2000, reviews of energy standards were less frequent, with the outcome of such reviews result in modest standards that kept pace with change but which could be comfortably achieved by all aspects of industry. An impact assessment carried out on subsequent changes over this era would show a cost-benefit for modest improvements that would pay back quickly through the occupier's energy bills.

Following the introduction of the Building (Scotland) Act 2003 and our current system of building standards in May 2005, energy standards within section 6 of the Building Standards Technical Handbooks were reviewed and improved in 2007, 2010 and 2015. For new buildings, The Building (Scotland) Amendment Regulations 2007 saw the introduction of a single means of demonstrating compliance for new buildings on the basis of calculated carbon dioxide emissions targets, using a Standard Assessment Procedure (SAP) for dwellings and Simplified Building Energy Model (SBEM) (or equivalent) for non-domestic buildings.

Each review introduced further staged improvement to standards and it is assessed that emissions arising from energy use in new buildings constructed to the 2015 standards are, on aggregate, around 75% lower for new homes and 80% lower for new non-domestic buildings, compared to the standards in force in 1990.

Following a commitment by Ministers within the Programme for Government 2019/20[5] to ensure that, from 2024, all new homes are required to use renewable or low carbon heat, this planned review of energy standards is aligned with ongoing work on this theme, as set out in our draft Heat in Buildings Strategy[6].

1.1.4 Review 2007 to 2013 - The Sullivan Report

Soon after the introduction of the 2007 energy standards, Ministers convened an expert panel to advise on the development of a low carbon building standards strategy to increase energy efficiency and reduce carbon emissions. The panel

[4] Published at https://www.gov.scot/policies/building-standards/monitoring-improving-building-regulations/
[5] https://www.gov.scot/publications/protecting-scotlands-future-governments-programme-scotland-2019-20/
[6] https://consult.gov.scot/energy-and-climate-change-directorate/heat-in-buildings-strategy/

was tasked with recommending challenging but realistic future targets for domestic and non-domestic buildings, both new and existing.

The output of this process was The Sullivan Report[7] – 'A Low Carbon Building Standards Strategy for Scotland'. This made 56 recommendations for the Scottish Government, the majority of which are within the remit of the BSD. The Scottish Government has acted in response to the panel's recommendations (a progress report[8] was published in early 2011). Key recommendations for section 6 (energy) included:

- staged increases in energy standards in 2010 and 2013 to substantially reduce carbon emissions from new buildings;
- the aim of net zero carbon (NZC) for space heating, hot water, lighting and ventilation within the next 10 years, if practical; and
- the ambition of total-life zero carbon buildings by 2030.

Whilst policy objectives have evolved over time, the principle objectives discussed in the Report remain relevant to this ongoing review:

- Research into 2021 newbuild targets includes the pre-NZC improvement levels recommended by the Report as a comparator for progress on deliverable levels of abatement;
- A revised 'net zero' goal for 2045 is at the heart of Ministers' Climate Change Plan and is led by current work on heat in buildings for 2024; and
- Consideration of mechanisms to deliver 'total life' zero emissions buildings, whilst outwith the scope of this current review, reflect the growing agenda to account for and manage embodied emissions across all sectors.

1.1.5 2006 to 2020 – The EU Energy Performance of Buildings Directive.

From 2006 until the end of 2020, Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings (the Directive) committed the UK, as a Member State, to review the energy performance requirements for buildings at intervals not exceeding 5 years. The Directive also required the setting of minimum energy performance requirements for new buildings and new building work and the application of a calculation methodology for the former. Transposition of much of the Directive was devolved in Scotland.

This review includes elements which transpose 2018 amendments to the Directive[9]. These are noted in each relevant part of the consultation text. Beyond these specific changes, Scottish Ministers have expressed a desire to 'keep pace' with EU law within areas of devolved responsibility, where this is practicable.

Amendment of building regulations in 2016[10] also made provision for new buildings in relation to requirements under Article 9 of the Directive for 'nearly zero

[7] See http://www.scotland.gov.uk/Resource/Doc/217736/0092637.pdf
[8] See http://www.scotland.gov.uk/Resource/Doc/217736/0113638.pdf
[9] See https://www.legislation.gov.uk/eudr/2018/844
[10] See https://www.legislation.gov.uk/ssi/2016/71/contents/made

energy' new buildings. The definition of such buildings was drawn relatively broadly and, accordingly, whilst the UK has demonstrated transposition, the term is not currently being used to describe the outcomes from national regulations. Ministers are of the view that further improvement is needed, focussed on reducing delivered energy, before new buildings can be considered 'nearly zero energy' in the broader sense.

Accordingly, the current review continues a focus on actions which are effective in reducing energy demand and the delivered energy needed at a new building. This also supports the intent set out in our recent draft Heat in Buildings Strategy (see section 1.2.2 below) to further reduce space heating demand in new buildings.

1.2 Drivers for current review

1.2.1 Scotland's Climate Change Act

The Climate Change (Scotland) Act 2009 (The 2009 Act), which originally received Royal Assent on 4 August 2009, remains a key commitment of the Scottish Government and is the most far-reaching environmental legislation considered by the Scottish Parliament during the first ten years of devolution.

The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 (The 2019 Act), which amends The 2009 Act, sets targets to reduce Scotland's emissions of all greenhouse gases to net-zero by 2045 at the latest, with interim targets for reductions of at least 75% by 2030 and 90% by 2040.

Our target of net-zero emissions by 2045, five years ahead of the rest of the UK, is firmly based on what the independent Committee on Climate Change (CCC) advise is the limit of what can currently be achieved. The levels of all of Scotland's targets are regularly reviewed following advice from the CCC.

We published our Climate Change Plan update in December 2020 which reflects the increased ambition of The 2019 Act. This update maintains the commitment to investigate the potential for further, significant improvement on 2015 energy standards and also how building regulations can support the achievement of these targets and other emissions and energy policy outcomes, including our decarbonisation of heat agenda.

It is recognised that, within their scope of application, Building Regulations already deliver a significant contribution to emissions reductions. However, it is the potential for practical delivery of further improvements to building performance through energy standards, and the extents to which regulation can support other policy work, which is being investigated by this review. This is subject to the caveat that such proposals should be subject to robust assessment of both benefits and costs and the implications to the construction industry in Scotland.

1.2.2 2021 Draft Heat in Buildings Strategy

Building on the policies and actions set out in the 2020 Climate Change Plan update, the draft Heat in Buildings Strategy sets out a pathway to zero emissions buildings by 2045 and details a series of near-term actions to put us on a clear

path towards this, as well as a range of further, longer-term commitments to accelerate and further scale the transformation of the nation's building stock.

Heating and powering buildings currently accounts for 40% of the UK's total energy usage – a figure which must be both significantly reduced and delivered through a transition to low and zero emissions heating systems if we are to achieve our goal of net zero by 2040.

We must continue to review standards set by building regulations for both energy and emissions performance, and to consider related issues such as the provision of ventilation and the risk of summertime overheating. These should be ambitious enough to drive improvement and innovation, support our Green Recovery and deliver buildings which are fit for purpose to meet our 2045 target and consider how our climate is likely to change over the coming years.

1.2.3 2024 New Build Heat Standard

As part of our Heat in Buildings Strategy, the Scottish Government is committed to ensuring that, from 2024, new buildings must use heating systems which produce zero direct emissions at the point of use.

A scoping consultation[11] on proposals was undertaken from December 2020 to March 2021 which set out our high-level vision for the new Standard. This focused upon regulation of new buildings to meet the commitment set out in the 2019 Programme for Government to require new buildings to use renewable or low carbon heat.

The Scottish Government is currently developing more detailed proposals for further, detailed consultation on this issue. Provisions within this energy standards consultation are framed in the context of the anticipated use of 'zero direct emissions' heat solutions in the very near future. Proposals offered include the need to 'futureproof' new buildings, by delivering very high levels of heat demand reduction and setting out information on simple, low cost adaptation where such solutions are not included on initial construction.

1.2.4 Decarbonisation of Transport in Scotland

The transport sector is the largest emitter of greenhouse gases in Scotland, accounting for 29% of all emissions in 2019 with road transport making up the majority of those emissions at 66%[12].

The Scottish Government's Climate Change Plan update (CCPu), published last December, set out the pathway to meet Scotland's statutory greenhouse gas emission reduction targets by 2032[13]. This includes an aim to phase out of the need for new petrol and diesel cars, and vans by 2030.

Part of that pathway is our commitment to the decarbonisation of transport in Scotland. The National Transport Strategy 2 sets out the strategic vision for Scotland's transport system and the Mission Zero for transport commitment - to

[11] See https://www.gov.scot/publications/new-build-heat-standard-scoping-consultation/
[12] Scottish Greenhouse Gas statistics: 1990-2019 - gov.scot (www.gov.scot)
[13] https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/

reduce our emissions by 75% by 2030 and to net-zero by 2045 - underlines the seriousness with which we are tackling the climate emergency[14].

The transition to Electric Vehicles (EVs) will contribute significantly to these goals and, with demand for EVs growing rapidly, we want people to have access to convenient and reliable EV charging infrastructure at home, at work and when out and about.

Therefore, through this consultation, we are seeking feedback to help inform the requirements we intend to set out in legislation and supporting guidance for the installation of EV charge points and enabling infrastructure in residential and non-residential buildings going forward.

1.3 Proposals to improve the emissions and energy performance of buildings

1.3.1 Scope of this consultation

Recognising the improvement already delivered by previous reviews, the current programme of work is seeking to look at opportunities for further improvement and can be summarised, briefly, under the following themes:

- Newbuild standards – level of ambition, impact and deliverability;
- Specific provisions to support the transition to low and zero emissions heat solutions, including a focus on reducing energy demand for heating;
- Changes to improve the specification of individual elements in new and existing buildings which are also deliverable and, for building services, aligned to a UK-wide specification/approach;
- Assurance that change does not increase the risk of unintended consequences for other aspects of building performance or function – ventilation and overheating risk;
- Reviewing how the building standards process can support better outcomes and performance in practice through more robust compliance processes; and
- Implementation of EV charge provision in new and retrofitted buildings.

For new buildings, this consultation proposes two specific levels of further improvement based upon research into solutions which are deliverable, reflecting levels of specification and construction solutions already in use in the development of new homes and new non-domestic buildings.

1.3.2 Review Topics

The following topics areas are identified within this review. An introduction on the issues being addressed is provided within each section:

- The setting of overall energy performance standards for new buildings (section 2);

[14] https://www.transport.gov.scot/publication/national-transport-strategy-2/

- Revision of elemental provisions for both building fabric and fixed building services, applicable to new buildings and work to existing buildings (section 3);
- Consequential changes to standards for building ventilation in response to energy provision (section 4);
- Introduction of overheating risk assessment and mitigation measures for new homes and other new residential buildings (section 5);
- A summary of action being taken to improve compliance with standards and the performance of buildings (section 6); and
- Provision for the installation of electric vehicle charging infrastructure in new buildings and those subject to major renovation (section 7).

In addition, action to improve compliance with building regulations is discussed, examining the delivery of energy related measures in the context of parallel development of the Compliance Plan approach to design and construction.

1.3.3 Consultation documents

In addition to this consultation paper, the consultation package comprises of nine further supporting documents published in pdf format:

- Respondent Information Form and Consultation Questions – available on the consultation webpage;
- Interim Business and Regulatory Impact Assessment - Section 6 (Energy) – Annex A to this document;
- Consultation proposals - Section 6 (Energy) Domestic;
- Consultation proposals - Section 6 (Energy) Non-domestic;
- Consultation proposals - Domestic Building Services Compliance Guide;
- Consultation proposals - Non-domestic Building Services Compliance Guide;
- Consultation proposals - Standard 3.14 (Ventilation) Domestic;
- Consultation proposals - Addressing Overheating Risk in New Dwellings; and
- Consultation proposals - NCM Modelling Guide for Scotland.

1.3.4 Supporting research

Research which underpins both the development and costing of options for revised performance targets for new buildings and an assessment of the risk of peak summer overheating in domestic/residential buildings is published in support of this consultation.

Links to these documents are provided below:

- Review of energy and emissions targets set for new domestic buildings – published at https://www.gov.scot/ISBN/978-1-80201-194-4.
- Review of energy and emissions targets set for new non-domestic buildings – published at https://www.gov.scot/ISBN/978-1-80201-192-0.

- Research – Overheating in New Homes – published at https://www.gov.scot/ISBN/978-1-80201-193-7.

1.3.5 Timetable for implementation

Subject to the outcome of this consultation, Ministers' would propose to introduce further improvements as set out in sections 2 to 6 (provisions for energy, ventilation and overheating) via amendment of Building Regulations and supporting guidance in late 2021, bringing changes into force in 2022.

Changes arising from proposals within section 7 (electric vehicle charging provision) will be subject to further development and implementation during 2022.

1.4 Responding to this Consultation

This consultation runs for 12 weeks. We are inviting responses to this consultation by Friday 15th October 2021.

1.4.1 Why we are consulting

Consultation is an essential part of the policy-making process. It gives us the opportunity to consider your opinion and expertise on a proposed area of work.

You can find all our consultations online: http://consult.scotland.gov.uk. Each consultation details the issues under consideration, as well as a way for you to give us your views, either online, by email or by post.

Responses will be analysed and used as part of the decision-making process, along with a range of other available information and evidence. We will publish a report of this analysis for every consultation. Depending on the nature of the consultation exercise the responses received may:

- indicate the need for policy development or review;
- inform the development of a particular policy;
- help decisions to be made between alternative policy proposals; and
- be used to finalise legislation before it is implemented.

While details of particular circumstances described in a response to a consultation exercise may usefully inform the policy process, consultation exercises cannot address individual concerns and comments, which should be directed to the relevant public body.

A series of questions on specific topics are posed, many of which are asked separately for both Domestic and for Non-domestic buildings, reflecting differences in proposals and also acknowledging that many respondents may only have an interest in one or other of these building categories.

When responding to the numbered questions which offer a choice of responses, please also provide information or evidence to explain your view on the topic wherever possible. This assists us in assessing the reason for your view and presenting the overall picture in reporting on each issue.

1.4.2 Replying on-line using Citizen Space

Please respond to this consultation using the Scottish Government's consultation platform, Citizen Space. You can view and respond to this consultation online at https://consult.gov.scot/local-government-and-communities/building-regulations-energy-standards-review/.

Using Citizen Space, you can save and return to your responses while the consultation is still open. Please ensure that consultation responses are submitted before the closing date of **Friday 15th October 2021**.

If you are uploading a supporting document to Citizen Space as part of your response, please wherever possible include a summary of the issue it covers against the relevant consultation question or in the general comments' question for each section for the consultation.

1.4.3 Replying by post

If you are unable to respond online, return your response, including the Respondent Information Form (see 'Handling your response' below) to:

2021 Energy Consultation
Building Standards Division
Denholm House
Almondvale Business Park
Livingston
EH54 6GA

It would be helpful to have your response by email or using the electronic response form. The electronic response form can be accessed at the following website address: https://consult.gov.scot/local-government-and-communities/building-regulations-energy-standards-review/.

You can also email your response to buildingstandards@gov.scot.

1.4.4 Handling your response

If you respond using Citizen Space, you will be directed to the 'About You' page before submitting your response. Please indicate how you wish your response to be handled and, in particular, whether you are content for your response to be published. If you ask for your response not to be published, we will regard it as confidential, and we will treat it accordingly.

If you are unable to respond via Citizen Space, please complete and return the Respondent Information Form which is downloadable as a supporting document on the consultation webpage.

All respondents should be aware that the Scottish Government is subject to the provisions of the Freedom of Information (Scotland) Act 2002 and would therefore have to consider any request made to it under that Act for information relating to responses made to this consultation exercise.

To find out how we handle your personal data, please see our privacy policy: https://www.gov.scot/privacy/.

1.4.5 Next steps in the process

Where respondents have given permission for their response to be made public, and after we have checked that they contain no potentially defamatory material, responses will be made available to the public at: https://consult.gov.scot/local-government-and-communities/building-regulations-energy-standards-review/. If you use Citizen Space to respond, you will receive a copy of your response via email.

Following the closing date, all responses will be analysed and considered along with any other available evidence to help us. Responses will be published where we have been given permission to do so. An analysis report will also be made available.

The Scottish Government will review responses to the consultation and the issues raised during engagement with stakeholders to inform development of the final version of the proposed changes to published standards and guidance set under Building Regulations.

1.4.6 Comments and complaints

If you have any comments about how this consultation exercise has been conducted, please send them to: buildingstandards@gov.scot.

Building Standards Division
July 2021

Part 2 – Energy, new buildings

2.1 Introduction

This section of the consultation covers the process of demonstrating compliance of a new building with standard 6.1 of Building Regulations via the application of the SAP or SBEM calculation methodology. It addresses the process of setting and meeting performance targets under that standard. Proposed revisions applicable to both new buildings and work to existing buildings are addressed within Section 3 of this document.

Consultees may be familiar with the current approach, under standard 6.1, to setting overall emissions targets for new buildings. This uses one or more example specifications which define a 'notional building' for which energy demand and a 'target emissions rate' are then calculated. The calculated emission for the proposed (actual) building should not exceed this target.

This overall emissions standard is supported by additional standards and guidance within Section 6 (energy) of the Technical Handbooks on the minimum performance of elements of building fabric and services and on the commissioning of systems and provision of information to the building user.

Through revision of standard 6.1, this review presents **two options** to further improve the energy performance of new buildings using the draft amended UK methodologies (SAP 10 and SBEM version 6), whilst retaining a modified 'notional building' approach. In considering this, we also propose amendments to the definition of the notional building to both continue to place an emphasis on low and zero emissions heat systems and offer an effective approach to energy demand reduction.

Work undertaken to define possible amended targets and assess the likely cost of their implementation is set out in published domestic and non-domestic research papers:

- Review of energy and emissions targets set for new domestic buildings.
- Review of energy and emissions targets set for new non-domestic buildings.

The outcomes sought from this research were to:

- establish options for a new notional building specification and illustrate the associated costs and benefits arising from change;
- investigate a new primary energy target to meet a provisions of the 2018 amendment to the EU Energy Performance of Buildings Directive; assess the implications of this to design solutions.
- consider an approach that will also support transition to low and zero emissions heat systems in advance of the proposed 2024 New Build Heat Standard, whilst still retaining viable options for fossil fuel heating systems at this time.

The higher of the two options proposed is intended to illustrate a specification that sets out an achievable but challenging level of ambition in support of the

implementation of the 2024 Heat Standard. However, we seek views on both options as the potential standard for implementation in 2022.

This section sets out the areas of change proposed in relation to the delivery of new buildings, considering the calculation process set out under standard 6.1 and other activities relevant to the design, construction and testing on new buildings.

Following review of standards set for new buildings, consequential changes will be made to section 7 (sustainability) and the guidance to standard 7.1 to reflect the amended baseline performance of new buildings under the revised standards.

Any changes implemented following this consultation will adopt the new version of the UK calculation methodologies, SAP 10 and SBEM version 6, which include a range of improvements and enhancements to each methodology and adopt revised fuel emission factors and primary energy factors.

Research into the level of improvement deliverable by an improved notional building specification was undertaken using the information available on these new editions in 2020. Use of the pending new version of the methodologies and associated data enables us to report only the benefit derived from amendment to target setting via Building Regulations. And not on the benefit derived from amendment of the calculation methodology itself, including the significant revision to factors used in the calculation of emission and primary energy performance.

2.2 Proposals

2.2.1 Introduction of an energy target for new buildings

Standard 6.1 (carbon dioxide emissions) has, since 2007, set an overall performance target for new buildings via the calculation of 'target emission rate' using the SAP and SBEM methodologies; a target which should not be exceeded by the calculated emissions for the actual building.

However, to support a more informed approach to design and to the delivery of buildings which have very low energy demand, we are proposing the introduction of a further target, using calculated energy demand as the metric. This will become increasingly relevant as the decarbonisation of fuels, such as grid supplied electricity, continues and in the context of 2024 heat standard proposals, to require new buildings to use only 'zero direct emissions' heat sources.

As one of our key aims is to further reduce greenhouse gas emissions, it is intended to also retain the current process of setting emissions targets for new buildings. By doing so, we can continue to define a greater challenge in compliance where use of higher emissions fuels is proposed. We will, however, also discuss if there are situations where the emissions metric may no longer be needed to achieve this aim (see section 2.2.11).

A requirement of the 2018 amendment to the Energy Performance of Buildings Directive, set out in Annex 1 of that document, is that Member States adopt primary energy as the principal metric for compliance with minimum energy performance requirements. This is an action which is currently being considered for implementation across the four UK administrations.

Primary energy is defined as “energy from renewable and non-renewable sources which has not undergone any conversion or transformation process”.

The primary energy demand for a building is already reported on Energy Performance Certificates and is derived by the application of primary energy factors to the calculated total delivered energy (that supplied from external sources) for each fuel used at a building. These factors are listed within the SAP and SBEM documentation and information on how they are derived published on the BRE SAP 10 website[15].

We therefore propose that the new energy target be defined in terms of primary energy to reflect the provisions set out in the EU Directive. The introduction of this ‘Target Primary Energy Rating’ (TPER) is noted in the consultation Documents:

- Consultation proposals - Section 6 (Energy) Domestic;
- Consultation proposals - Section 6 (Energy) Non-domestic;

And implemented in our consultation versions of:

- iSAP: https://www.scotland.isap.org.uk/ and
- c-SBEM: https://www.uk-ncm.org.uk/download.jsp?id=17.

Primary energy or delivered energy?

Due to the application of factors calculated for each fuel source, use of primary energy and emissions targets can have differing impacts on specific building solution depending on the fuel types used. For example, as a result of grid decarbonisation, emission factors for electricity are now significantly lower than gas whilst primary energy factors for electricity remain higher than gas. This issue and the implications for specification of new buildings is examined within the published research papers noted in section 2.1 above.

Accordingly, we recognise there may also be views on the benefit of a more direct representation of energy demand, such as the calculated ‘delivered energy’ total for a building.

Delivered energy is the amount of energy that needs to be supplied to the building from external sources. This is the calculated energy demand for the building less any offsetting of that demand from the generation of energy or heat onsite from renewable sources. It is the delivered energy total for each fuel supplied to a building to which primary energy and emissions factors are applied.

In addition to the presentation of a proposed Target Primary Energy Rating, the calculated total for delivered energy for the notional and actual building are also presented in the consultation versions of iSAP and cSBEM. This is to inform discussion on the preferred metric (primary or delivered energy) for the new performance target.

[15] https://www.bregroup.com/sap/sap10/

Question 1 –

Do you support the extension of standard 6.1 to introduce an energy target in addition to the current emissions target? If yes, do you have a view on the metric applied – primary or delivered energy?

Yes, a primary energy target ☐

Yes, a delivered energy target ☐

No ☐

Please provide a summary of the reason for your view below.

2.2.2 Options for uplift in standards for new dwellings

At present, emissions targets for new homes are generated within SAP tools by the application of a published 'notional building' specification describing the energy-related characteristics of the building. These are applied to a building model which matches the form and extents of the proposed dwelling.

Under the 2015 regulations, there are five notional building specifications which are applied based upon the chosen fuel for space heating in the actual dwelling (mains gas, LPG, oil, electricity, biofuel). In addition to the elements described for each heating fuel, a set of standard assertions are also applied for other characteristics and elements of the dwelling. The current notional building specification includes an element of on-site generation (PV) for the three fossil fuel packages and applies a modest efficiency air source heat pump for the electrical package.

In the 2015 standards, the level of reduction in emissions for fossil fuel solutions was approximately twice that of electricity and biofuel solutions, whilst ensuring that such solutions remain practicable. This reflected both the previous review to improve the electricity notional building and Ministers' stated objectives to progressively move away from higher emissions heating solutions. In this current review, we are seeking to continue that trend, in recognition of proposals to decarbonise heat in new homes from 2024. And to respond to evidence that further improvement in building fabric ('fabric first') did not become commonplace as an element in the specification of post-2015 new homes.

Development of proposals

Research was undertaken in 2019-20 to identify the capacity for further improvement in the overall energy and emissions performance of new dwellings. Analysis was based upon a set of six dwelling types/variants: detached home, semi-detached home, mid-terrace house and ground, mid and top floor flats, modelled in a block configuration. These were used, together with analysis of data on recent dwelling completions to provide a national baseline profile from which the impact of the proposed changes can be established.

The building energy modelling was undertaken using a consultation version of SAP 10 (iSAP) with updated emission and primary energy factors; these factors can be found in the consultation version of SAP 10.1 on the BRE website. The

research contractor provided current capital and lifecycle cost data for Scotland and the resultant cost benefit analysis is presented in the research paper and summarised within the accompanying Business and Regulatory Impact Assessment.

These proposals were put to a building standards Working Group comprised of representatives from across the built environment sector in a series of meetings between January and May 2021. The research paper which informs these proposals can be found at https://www.gov.scot/ISBN/978-1-80201-194-4.

The intent was to investigate options for further improvement in calculated building performance and how the current provision of five specifications or 'fuel packages' could be simplified when defining a revised notional building specification.

It was determined that a single notional building set using gas heating would result in a significant benefit from use of an electric heat pump solution which may not be countered by the setting of robust elemental backstops for building fabric. Similarly, setting targets with an electric heat pump solution would make compliance for other fuels challenging, due to the far higher heat generation efficiency typical of such solutions available to the market.

The option to retain more than one notional building can address both these issues, albeit it would result in two sets of energy and emissions outcomes (as is the case with the current approach across five fuels).

It was recognised that it is difficult to seek to compare other solutions directly with an effective heat pump specification. Given that it is not the intent of this review to preclude the use of gas or other fossil fuels, it was considered that two notional building specifications should be employed, one for heat pump solutions and one, based upon mains gas, for all other solutions. This is set out on page 70 of the supporting research report.

Options for implementation

Accordingly, these are applied to two specification options for overall levels of improvement.

Option 1: 'Improved' standard:

- Notional Building 1 - Air Source Heat Pump (ASHP) + improved fabric + natural ventilation ('ASHP improved'), where dwelling is heated by a heat pump.
- Notional Building 2 - Gas boiler + improved fabric + natural ventilation + PV ('Gas improved'), where dwelling is heated by any other means.

Option 1 results in an aggregate emissions reduction of 32% over the 2015 standards assuming no significant change in fuel mix - reducing heat demand by identifying improved building fabric values; glazing achievable with double glazed units; fabric infiltration of 5 $m^3/(m^2.h)$@50Pa and use of intermittent extract fans with trickle vents.

In terms of national outcome, Option 1 (improved) results in:

- An **aggregate 32% reduction** in annual emissions which, when factoring in anticipated changes to emissions factors from 2021 to 2045, equates to a net reduction in emissions for the build over that period of 22%
- The latter is reduced to 18% if an assumed 50% of on-site generation exported to the grid is excluded from calculations (see section 2.2.10).
- An increase in capital cost of construction of between 3% to 4% is identified for this option.
- Savings in fuel costs, assessed for a 60 year period, would accrue but do not offset the initial additional capital cost.

Option 2: 'Advanced' standard:

- Notional Building 1 - Air Source Heat Pump (ASHP) + advanced fabric + MVHR ('ASHP advanced'), where dwelling is heated by a heat pump.
- Notional Building 2 - Gas boiler + advanced fabric + MVHR + PV ('Gas advanced'), where dwelling is heated by any other means

Option 2 results in an aggregate emissions reduction of 57% over the 2015 standards assuming no significant change in fuel mix - reducing heat demand by identifying more stringent building fabric values; glazing achievable with triple glazed units; fabric infiltration of 3 $m^3/(h.m^2)$@50Pa and use of mechanical ventilation and heat recovery.

In terms of national outcome, Option 2 (advanced) results in:

- An **aggregate 57% reduction** in annual emissions which, when factoring in anticipated changes to emissions factors from 2021 to 2045, equates to a net reduction in emissions for the build over that period of 45%
- The latter reducing to 39% if an assumed 50% of on-site generation exported to the grid is excluded from calculations (see section 2.2.10).
- An increase in capital cost of construction of between 5% to 7% is identified for this option.
- Savings in fuel costs, assessed for a 60 year period, would accrue but do not offset the initial additional capital cost.

Both option 1 and 2 apply a similar building services specification, with reduced flow temperatures (<55 ºC) wet heating systems. Wastewater heat recovery and photovoltaic panels are specified for the gas national building. An increased area of photovoltaics is proposed but based upon building foundation area, to reflect available roof space, resulting in a proportionally lower provision being assigned to flats as the height of a block increases. The contribution of on-site generation to the notional building is also capped to reflect the proportion of generation which can be used at the building (see section 2.2.10 for further details).

National outcome – emissions savings

Table 1 - New dwellings – annual abatement compared to 2015 standards – Proposed reduction.

New Dwellings	Option 1 – 'Improved'	Option 2 – 'Advanced'
Annual abatement (%)	**32%**	**57%**
Annual abatement (kT)	7 kt CO_{2e}	13 kt CO_{2e}

The above national outcomes are derived from applying the emission reductions calculated for individual dwelling cases to a national build annual profile. This build profile, which remains based predominantly on mains gas solutions, is set out in section 1.4 of the domestic research report. The reductions for individual dwelling examples are noted in Table 1 below.

Table 2: Emissions reduction against 2015 baseline for Option 1 and 2 notional building specifications (dwellings).

Dwelling Type / Modelled scenario	Detached house (mains gas)	Semi-detached house (mains gas)	Semi-detached house (ASHP)	Mid-terrace house (mains gas)	Flat (average) (mains gas)
Option 1 - Gas 'improved' case	34%	34%	N/A	36%	24%
Option 2 - Gas 'advanced' case	61%	60%	N/A	62%	48%
Option 1 - ASHP 'improved' case	75%*	75%*	39%	74%*	74%*
Option 2 - ASHP 'advanced' case	80%*	80%*	51%	80%*	80%*

* applies only where change of heat source from mains gas boiler to air source heat pump.

The full detail of both specifications are set out in clause 6.1.2 of 'Consultation proposals - Section 6 (Energy) Domestic'.

A consultation modelling tool which implements these two options is available online at https://www.scotland.isap.org.uk/.

We seek your views on both of these options.

Question 2 –

What level of uplift to the 2015 standard for new dwellings do you consider should be introduced as an outcome of this review?

Option 1: 'Improved' standard (32% emissions reduction) ☐

Option 2: 'Advanced' standard (57% emissions reduction) ☐

Another level of uplift ☐

Please provide a summary of the reason for your view.

2.2.3 Options for uplift in standards for new non-domestic buildings

At present, emissions targets for new non-domestic buildings are generated within approved SBEM or DSM tools by the application of a published 'notional building' specification describing the energy-related characteristics of the building. The specification, which is set out in guidance to standard 6.1 and in the 2015 NCM Modelling Guide, is applied to a building model which matches the form and extents of the proposed building.

Under the 2015 regulations, there is a single notional building specification, applied throughout the building on a zone by zone basis, with variant elements – for building fabric (based upon ventilation strategy), infiltration and glazing assertions (based upon glazing location/presence) and the choice of space and water heating solutions (the fuel proposed in the actual building is applied in the notional building, with a defined efficiency). Default assertions for cooling, lighting and auxiliary energy use are assigned.

The 2015 notional building includes an element of energy offsetting via onsite generation of power using PV as a proxy, assigning capacity based upon the lesser of two values derived from gross internal area or roof area.

The 2015 standards saw a move away from use of mains gas (or oil if mains gas is unavailable) as the fuel of the notional building, to application of the same fuel for both setting and meeting the emissions target. This change was made mainly to recognise that inappropriate specification of biofuels could enable compliance to be achieved with far higher level of energy demand than fossil fuel or electric solutions.

In this current review, we are seeking to continue that focus on targets that support the delivery of an energy efficient new building which can utilise the fuel that is most appropriate for its type and location whilst also recognising the intent to regulate for Zero Direct Emissions heat solutions from some point at or soon after 2024[16]. This suggested a similar approach to that taken for domestic buildings in terms of a more consistent approach to notional building options. We sought to investigate whether this, combined with the proposed Primary Energy metric, can be well-aligned with the intended heat policy trajectory.

Development of proposals

Research was undertaken in 2019-20 to identify the capacity for further improvement in the overall energy and emissions performance of new non-domestic buildings. Analysis was based upon a set of seven different building types (shallow plan and deep plan office, hospital, hotel, primary school, retail unit and warehouse), with variant modelling of main heating fuel giving 12 cases. These were used, together with analysis of recent EPC data on building

[16] https://consult.gov.scot/energy-and-climate-change-directorate/new-build-heat-standard/

completions to enable projection of a national profile from proposed changes to specification.

The building energy modelling was undertaken using the current version of SBEM, but with application of projected emission and primary energy factors; these factors are noted within the research report. The research contractor provided current capital and lifecycle cost data for Scotland and the resultant cost benefit analysis is presented in the research paper and summarised within the accompanying Business and Regulatory Impact Assessment.

These proposals were put to a building standards Working Group comprised of representatives from across the built environment sector in a series of meetings between January and May 2021. The research paper which informs these proposals can be found at https://www.gov.scot/ISBN/978-1-80201-192-0.

The intent was to investigate options for further improvement in calculated building performance and whether a more simplified allocation of fuel types within the notional building, with an emphasis on renewable solutions, would be beneficial in driving energy and emission reduction.

The use of an electric air source heat pump (ASHP) was identified as one viable solution and this was assessed against an alternate specification using a gas boiler solution with building performance augmented by on-site generation (with PV as the example solution). The research report also identified practical limitations associated with the use of generating technologies to offset demand and reduce delivered energy. In brief, it also identified that it would not be practical nor desirable to set two such specifications in a way which delivered broadly equivalent outcomes for all buildings. This would require either significant generation capacity (in the gas notional building) or specification of an unrealistically low efficiency for the ASHP building. This is set out from page 64 and page 79 of the supporting research report.

The option to retain more than one notional building can address both these issues, albeit it would result in two sets of energy and emissions outcomes (as is the case with the current approach where the same fuel is assigned to both notional and actual building). Proposals therefore offer a simplified approach in that the notional building is based on only two fuel types, with values assigned to fabric set irrespective of the heating and ventilation strategy applied.

The research did initially investigate three options, including a ‘low’ option which was based upon the most challenging specification currently applied for fabric under the 2015 standards. As this option resulted in relatively low level of further abatement, analysis was not progressed further and it is not offered as a proposal within this consultation.

Options for implementation

Accordingly, two notional building specifications are applied to two specification options for overall levels of improvement.

Option 1: ‘Medium’ standard:

- Notional Building 1 – 400% Air Source Heat Pump (ASHP); improved fabric + ventilation with heat recovery, if building is heated by a heat pump.

- Notional Building 2 - Gas boiler and PV (Gas+PV); improved fabric + ventilation with heat recovery + PV, if dwelling is heated by any other means

Option 1 results in an aggregate emissions reduction of 16% over the 2015 standards assuming no significant change in fuel mix - reducing heat demand by identifying improved building fabric values; glazing achievable with double glazed units; fabric infiltration of 4 $m^3/(m^2.h)$@50Pa.

In terms of national outcome, Option 1 (medium) results in:

- An **aggregate 16% reduction** in annual emissions (without fuel switching) which, when factoring in anticipated changes to emissions factors from 2021 to 2045, equates to a net reduction in emissions for the build over that period of 14%.
- The emissions reduction increases to 60% should electric heat pump solutions be adopted in lieu of mains gas. Again, when factoring in anticipated changes to emissions factors from 2021 to 2045, that equates to a net reduction in emissions for the build over that period of 44%
- The variation in reduction in modelled building types arises from the significant difference in energy profile across those types.
- At present, it is assumed that PV output is used onsite with negligible export. This will be reviewed subject to consultation feedback on section 2.2.10.
- An increase in capital cost of construction of up to 4% is identified for this option.
- Savings in fuel costs, assessed for a 60 year period, would accrue in the majority of modelled examples but do not offset the initial additional capital and renewal costs.

Option 2: 'High' standard:

- Notional Building 1 – 435% Air Source Heat Pump (ASHP) + further improved fabric + ventilation with heat recovery, if dwelling is heated by a heat pump.
- Notional Building 2 - Gas boiler and PV (Gas+PV); further improved fabric + ventilation with heat recovery + PV, if dwelling is heated by any other means

Option 2 results in an aggregate emissions reduction of 25% over the 2015 standards assuming no significant change in fuel mix - reducing heat demand by identifying more stringent building fabric values; glazing achievable with triple glazed units; fabric infiltration of 3 $m^3/(h.m^2)$@50Pa.

In terms of national outcome, Option 2 (high) results in:

- An **aggregate 25% reduction** in annual emissions which, when factoring in anticipated changes to emissions factors from 2021 to 2045, equates to a net reduction in emissions for the build over that period of 21%
- The emissions reduction increases to 62% should electric heat pump solutions be adopted in lieu of mains gas. Again, when factoring in anticipated changes to emissions factors from 2021 to 2045, equates to a net reduction in emissions for the build over that period of 47%

- The variation in reduction in modelled building types arises from the significant difference in energy profile across those types.
- At present, it is assumed that PV output is used onsite with negligible export. This will be reviewed subject to consultation feedback on section 2.2.10.
- An increase in capital cost of construction of between 1% to 5% is identified for this option.
- Savings in fuel costs, assessed for a 60 year period, would accrue in the majority of modelled examples, but do not offset the initial additional capital and renewal costs.

Both option 1 and 2 apply a similar building services specification, with reduced flow temperatures (<55 ºC) wet heating systems. Specification of electric heating and cooling systems is further improved in the 'high' option. An increased area of photovoltaics is proposed but based upon either gross internal area of roof area, whichever option results in the lesser array size. Application of PV within the notional building is omitted where heat is provided via a heat pump. As with new dwellings, the contribution of on-site generation to the notional building is also capped to reflect the proportion of generation which can be used at the building (see section 2.2.10 for further details).

National outcome – emissions savings

Table 3 - New buildings – annual abatement compared to 2015 standards **–** Proposed reduction.

New Non-domestic buildings	Option 1 – 'Improved'	Option 2 – 'Advanced'
Annual abatement (%)	**16%**	**25%**
Annual abatement (kT)	1.7 kt CO_{2e}	2.6 kt CO_{2e}

The above national outcomes are derived from applying the emission reductions calculated for individual building cases to a national build annual profile. This build profile, which reflects the current fuel mix in new development, is set out in section 1.10.2 of the non-domestic research report. The reductions for individual building examples are noted in Table 4 below.

Table 4: Emissions reduction against 2015 baseline for Option 1 and 2 notional building specifications (non-domestic). Modelled scenario for each building type.

Modelled scenario	Deep Office; Gas; AC	Deep Office; Elec; AC	Hospital; Gas; NV	Hotel; Gas; NV	Hotel; Gas; AC	Primary School; Biomass; NV*	Primary School; Gas; MV	Primary School; Gas; NV	Retail; Gas; AC	Retail; Elec; AC	Shallow Office; Gas; NV	Warehouse Distribution; Gas; NV
Option 1 'Gas+PV'	34%	NA	17%	4%	4%	-174%	19%	16%	48%	NA	25%	12%
Option 2 'Gas+PV'	45%	NA	22%	11%	10%	-130%	38%	30%	52%	NA	47%	22%
Option 1 'ASHP'	34%	20%	74%	75%	66%	-27%	44%	61%	47%	42%	66%	67%
Option 2 'ASHP'	36%	23%	76%	78%	68%	-16%	48%	65%	48%	43%	70%	70%

* increase in calculated emissions due to modelling with a higher emissions fuel.

The full detail of both specifications are set out in guidance to standard 6.1 of 'Consultation proposals - Section 6 (Energy) Non-domestic' and in more detail within 'Consultation proposals - NCM Modelling Guide for Scotland'.

A consultation tool which implements these two options is available to download from the UK NCM website at https://www.uk-ncm.org.uk/download.jsp?id=17.

We seek your views on both of these options.

Question 3 –

What level of uplift to the 2015 standard for new non-domestic buildings do you consider should be introduced as an outcome of this review?

Option 1: 'Medium' standard (16% emissions reduction) ☐

Option 2: 'High' standard (25% emissions reduction) ☐

Another level of uplift ☐

Please provide a summary of the reason for your view.

2.2.4 Elements forming the Domestic Notional Building Specifications

For Option 1 and Option 2, the notional building specification is set out in clause 6.1.2 of 'Consultation proposals - Section 6 (Energy) Domestic'.

The purpose of the notional building specification is to set an overall performance target for a new building – in this case the Target Emissions Rating and the proposed Target Primary Energy Rating. The notional building specification is not intended as a construction specification as it will not reflect the cost optimum specification for any given dwelling.

However, each of the elements identified for the notional building should be achievable using current construction techniques and solutions. In that context, your feedback on the level of specification set out is also sought.

Question 4 –

Do you have any comments or concerns on the values identified for the elements which make up the Domestic notional building specification for either option, e.g. in terms of their viability/level of challenge?

Yes ☐

No ☐

If yes, please provide your comments.

2.2.5 Elements forming the Non-domestic Notional Building Specifications

For Option 1 and Option 2, the notional building specification is set out in clause 6.1.4 and 6.1.5 of 'Consultation proposals - Section 6 (Energy) Non-domestic' and in more detail on pages 8 to 22 of 'Consultation proposals - NCM Modelling Guide for Scotland'.

The purpose of the notional building specification is to set an overall performance target for a new building – in this case the Target Emissions Rating and the proposed Target Primary Energy Rating. The notional building specification is not intended as a construction specification as it will not reflect the cost optimum specification for any given dwelling.

However, each of the elements identified for the notional building should be achievable using current construction techniques and solutions. In that context, your feedback on the level of specification set out is also sought.

Question 5 –

Do you have any comments or concerns on the values identified for the elements which make up the Non-domestic notional building specification for either option, e.g. in terms of their viability/level of challenge?

Yes ☐

No ☐

If yes, please provide your comments.

2.2.6 Change to fuel assignment of the notional building – Domestic

At present, the fuel used in the notional building specification is, generally, the same as the proposed building meaning the emissions intensity of the fuel used is not a significant factor in determining the target that must be met. The principle of this approach was to set a challenging target, in energy demand terms, for every building irrespective of the fuel used to heat the building.

A key objective of research to support this review was to explore the option of moving to a single or simplified notional building specification in 2021 which would not vary as greatly by fuel type. The intent being to set a performance target based on a fuel with relatively low emissions and primary energy factors. This could assist in the transition to the mandatory requirement for new dwellings to operate with zero direct emission heating systems that is proposed will take effect from 2024. This is discussed in sections 4.5 and 5.1 of the research report[17].

As noted in section 2.2.2, we propose to move away from the current set of five notional building specifications, determined by the main heating fuel in the actual building, to two specifications, based upon the approach to provision of heating at the building. A specification will be assigned based upon use of a heat pump for space heating or, in recognition of the greater efficiencies achievable by that solution, separately for the use of any combination of fuel and heat source.

It is recognised that the performance targets generated by these two routes will differ significantly due to the difference in efficiency of the two assigned heat generators (air source heat pump and gas boiler). For non-heat pump solutions, targets will be set using an efficient gas boiler specification with energy demand offset by the inclusion of on-site generation (photovoltaics) within the notional building specification.

The intent behind this approach is to recognise the practical limits of each route in reducing energy demand in new homes and reflect that in target setting. Each route defines a challenging specification for the chosen approach to heat provision which should, in all cases, result in a delivered energy total which is less than the calculated energy demand for the dwelling.

Removal of a notional building specification for oil, LPG and biomass recognises the intent set out in proposals for the 2024 New Build Heat Standard to move away from solutions that generate emissions at point of use. This also creates a more challenging target, to reduce overall energy demand where higher emissions fuels are proposed. It is noted that these proposals will increase the challenge to deliver new homes with oil or gas heating in areas without access to mains gas.

The detail of this proposal is set out in clause 6.1.2 of 'Consultation proposals - Section 6 (Energy) Domestic'. The development of the proposal is summarised on page 70 of the supporting research report.

Question 6 –

Do you have any comments on the simplified two-specification approach to defining the Domestic notional building from 2022?

Yes ☐

No ☐

If yes, please provide your comments.

[17] See https://www.gov.scot/ISBN/978-1-80201-194-4

2.2.7 Change to fuel assignment of the notional building – Non-domestic

Whilst the current approach taken in setting emission targets for new non-domestic buildings differs slightly from that for new dwellings, the same general approach is taken.

As noted in section 2.2.3, we propose to move from the current approach to assigning the fuel(s) chosen for the proposed (actual) building to the notional building. As with the new Domestic proposals, we propose to move to just two variant specifications, based upon whether space heating at the proposed building is met by a heat pump or by any other solution. The assignment of on-site generation within the notional building (photovoltaic panels) would be applied proportionately, to the extent that space heating is provided by a non-heat pump solution.

The development of the proposal is summarised on page 70 of the supporting research report[18] and in in clause 6.1.4 and 6.1.5 of 'Consultation proposals - Section 6 (Energy) Non-domestic' and in table 8 of 'Consultation proposals - NCM Modelling Guide for Scotland'.

Question 7 –

Do you have any comments on the simplified two-specification approach to defining the Non-domestic notional building from 2022?

Yes ☐

No ☐

If yes, please provide your comments.

2.2.8 Change to assignment of Domestic Hot Water (DHW) – Non-domestic

The assignment of fuel used for water heating in the Non-domestic notional building is now proposed to be considered separately from space heating. For example, if a zone in the actual building uses electric heat pumps for space heating and natural gas for hot water generation, then the equivalent zone in the notional building will use electric heat pumps for space heating and natural gas for hot water generation.

One additional parameter is considered – whether zones within the building have low or high hot water use.

Where an activity set for a zone has high hot water demand, the approach proposed follows that for assignment of space heating within the notional building, with hot water provided from either a heat pump (if a heat pump is proposed) or from a gas boiler (if any other solution is proposed). Where a zone is assigned low hot water use, the notional building will use electric point-of-use heating.

The change in grid generation mix means that the use of electric point-of-use water heaters is no longer a high-emissions solution compared to natural gas. In

[18] See https://www.gov.scot/ISBN/978-1-80201-192-0

buildings with low DHW demand, point of use water heating can avoid the losses from storage and secondary circulation loops that are associated with a centralised DHW system.

This approach is summarised on pages 62-66 of the supporting research report[19] and in clause 6.1.4 of 'Consultation proposals - Section 6 (Energy) Non-domestic' and in Table 9 and page 16 of 'Consultation proposals - NCM Modelling Guide for Scotland'.

Question 8 –

Do you have any comments on the proposal to separate and provide a more demand-based approach to assignment of domestic hot water heating within the Non-domestic notional building specification from 2022?

Yes ☐

No ☐

If yes, please provide your comments.

2.2.9 Supplied heat connections

Background

Our draft Heat in Buildings Strategy[20] identifies the importance of heat networks as a component in the delivery of low and zero emissions heat in the future. The Heat Networks (Scotland) Act 2021[21] includes statutory targets to ensure that heat networks supply at least 2.6 terawatt hours of heat by 2027 and 6 terawatt hours of heat by 2030.

As heat networks will play an important role in the heat transition, the new regulatory regime set out in the Heat Networks (Scotland) Act aims to build confidence among consumers and attract investment for growth of the sector. The new regulatory regime for heat networks will become operational by the end of 2023.

In order to support the delivery of Scotland's climate change targets, all heat networks will need to be powered using low and zero emissions sources, for example from heat pumps or surplus or waste heat. The regulations to be implemented under the Heat Networks (Scotland) Act will govern the future heat generation and emissions characteristics of heat supplied by networks. This will include provision for the decarbonisation of existing heat networks over time.

The Scottish Ministers will set out how the Act will support the achievement of these targets and greenhouse gas emissions reduction targets in the Heat Networks Delivery Plan which will be published by 1 April 2022. This will include developing an approach to the emissions from existing heat networks.

[19] See https://www.gov.scot/ISBN/978-1-80201-192-0
[20] See https://consult.gov.scot/ energy-and-climate-change-directorate/heat-in-buildings-strategy/
[21] https://www.legislation.gov.uk/asp/2021/9/contents/enacted

It is important, therefore, that standards set under Building Regulations enable the connection of new buildings to existing and new heat networks where this is an appropriate solution. This should be addressed in a manner which takes into account the long lifetime of a heat network; offering solutions that are equitable in relation to other low or zero emissions fuel choices; and provides assurance that energy demand at the building will be limited to a similar extent as for other heat solutions.

It is recognised that even a very efficient new heat network will be subject to losses which are not present when specifying building-based heat generation solutions. Also, over time, changes to the sources of heat generation contributing to the network are likely – an issue which is outwith the control of the developer or the building owner.

Proposals

Following this clear intent to address the characteristics of supplied heat through separate regulatory mechanisms, we propose to refocus the approach to demonstrating compliance with the revised standard 6.1. This will reinforce the need for Building Regulations to focus on actions which can be delivered at a building level, at the point of original construction, to reduce energy demand and therefore associated emissions.

We propose that compliance with standard 6.1 for a building supplied with heat from an external network source will be demonstrated against the 'gas' notional building (as noted in sections 2.2.6 and 2.2.7), but the calculated energy demand totals for the **actual building** will have the primary energy and emissions factors for grid electricity applied rather than the SAP/SBEM default or network-specific values for supplied heat (as modified by the network characteristics).

This recognises that supplied heat can be utilised with 100% efficiency at the building, with adjustment only needed to recognise any standing losses from heat interface units that do not contribute usefully to reduce the heating demand at the building. Application of these factors enables the designer to demonstrate an equivalent outcome in respect of energy demand at the building, for supplied heat solutions compared to on-site heat solutions.

In short, we will amend the approach to demonstrating compliance with standard 6.1 so that Building Regulations will address only the energy performance of the building whilst the characteristics of the supplied heat will be addressed separately under proposed heat network legislation.

The change proposed:

- Provides an equitable approach to the specification of buildings, for both building-based generation and supplied heat solutions.
- Offers assurance that the energy performance of the new building will be addressed to a similar level, regardless of the heat solution proposed.
- Recognises that the characteristics of supplied heat from networks can vary significantly across Scotland, and over time, making it challenging to establish a consistent good practice standard for the construction of new buildings.

There is reassurance that the characteristics of supplied heat to buildings will be improved through the introduction of regulations made using the powers within the Heat Networks (Scotland) Act 2021. This will address issues of performance and greenhouse gas emissions associated with that supply with no or minimal need for intervention at a building level for new build properties.

This proposal is implemented within our consultation versions of:

- iSAP: https://www.scotland.isap.org.uk/ and
- c-SBEM: https://www.uk-ncm.org.uk/download.jsp?id=17.

Please note: this proposal will only apply to the process of demonstrating compliance with standard 6.1 of the Building Regulations. Calculation of, and reporting on, energy and emission performance in the production of Energy Performance Certificates is unaffected and will remain as set out in the published UK methodologies unless subject to separate review.

Question 9 –

Do you support this change in application of targets for supplied heat connections to new buildings, focussed on delivering a consistent high level of energy performance at a building level?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

2.2.10 Limiting benefit from on-site generation of power.

Background

From the adoption of the SAP and SBEM methodologies to set emissions targets in 2007, Building Regulations have assigned a full emissions credit to electricity generated on site, regardless of whether it is consumed at the building or exported to the local grid. The rationale for this was that such small-scale renewable generation contributed, in a small way, to the decarbonisation of the national grid and offset the amount of power needed from large scale generating sources which were more carbon intensive than at present.

The current review of energy standards within Building Regulations is being undertaken in a policy environment which has evolved to consider the need:

- To decarbonise the heat that we use in all our buildings, starting with new buildings (Heat in Buildings Strategy; Heat Standard 2024), taking an energy systems approach; and
- For a stronger focus on effective reduction of energy demand, and delivered energy in particular, at a building level; and
- To place greater emphasis on the end-benefit outcome delivered by the design and specification choices to the developer.

In this context, it is proposed that the current approach to on-site generation does not provide a useful representation of benefit and can therefore skew both design and specification decisions and assessment of the relationship between calculated and actual building performance.

Additionally, the introduction of an energy target within standard 6.1 requires correct representation of solutions that reduce delivered energy totals, without significant uncertainty over that outcome (such as through an export component).

On the principle that this is amended for the energy calculation, it is incumbent upon us to make the same provision in respect of the current emissions calculation. Noting that, for reporting purposes, the total generating capacity can still be reported outwith the Building Regulations compliance calculation.

Proposals

It is proposed that, for the issue of effective use of onsite generation of power to be considered, the following elements should be addressed.

a. Direct connection to the building electrical supply must exist.

If the generating source does not supply power directly to the building, then no credit should be assigned. Such an installation serves no purpose in reducing energy demand from external sources at a building level.

For example, for domestic buildings, a photovoltaic panel array on a block of flats which is connected only to the landlord's supply does not act to reduce delivered energy to any dwelling and should be ignored for the purpose of a dwelling-level calculation.

b. Determine the extent that generated power can be utilised - emissions.

The export component of any generating capacity needs to be more properly assessed and the proportion which is in excess of the building's capacity to use directly or store for future use should be discounted from the building-level emissions compliance calculation. Otherwise a measure which is partially effective in reducing delivered energy is being assigned the same status as a measure that is more effective in doing so.

The exported component can still be reported but would not be counted as part of building-level compliance.

c. Determine the extent that generated power can be utilised - energy.

As noted in section 2.2.1, primary energy is defined as "*energy from renewable and non-renewable sources which has not undergone any conversion or transformation process*". Primary energy reports on the total energy needed, at the point of original generation, to meet the energy demand of the building.

The primary energy demand of the building should be determined from the delivered energy totals of the building, with primary energy factors being applied to the net totals after deduction of utilised on-site generation. Where part of that demand is met by on-site generation of heat or power which

consumes no fuel, each kWh of onsite generation that can be used will reduce the delivered energy total by an equivalent kWh for the relevant fuel.

If generated energy is exported and leaves the building (the 'system boundary' of the SAP or SBEM calculation), it can no longer affect the delivered energy total for the building. Accordingly, the export component of generated electricity should be ignored for the purpose of the building-level compliance calculation for energy, be that reported in terms of delivered energy or primary energy.

It can still be reported separately and that data used to inform aggregated totals of microgeneration export in Scotland or the UK. However, the only effect this component can have is to contribute to the calculation of the network primary energy factor.

As such, BSD propose not to apply the proposed SAP 10 PE factor of 0.501 for 'electricity sold to grid' (fuel code 36/60), setting this value to zero for the purpose of the compliance calculation.

Application in practice:

- For SAP, we propose to use the calculation of the beta (β) value to set the limit of credit from electrical generation for both the emissions and primary energy compliance calculation. Using the amended process set out in Appendix M of SAP 10, this can consider the base electrical demand and the benefit of battery storage or a PV diverter (but not currently both).
- For SBEM, we propose to use the calculated energy demand for grid supplied electricity plus (if deemed a relevant output of the methodology) the calculated value for equipment to set the limit of credit for electrical generation for both the emissions and primary energy compliance calculation.

The granularity of this calculation will be limited by the level of detail available within each methodology (e.g. limits via monthly energy totals).

It is important to stress that this is a limiting action that is applied to both the target rating calculation (PV element) and the actual building rating calculation (all generating solutions). It has the effect of moderating, only where appropriate, the contribution that on-site generation has in lowering the target emission/primary energy rate and the manner in which it can be met.

As the proposed notional building specifications have no element of thermal or battery storage specified, there will be the opportunity for designers to introduce such elements to the actual building to increase the level of utilisation of on-site generation where this is a preferred solution. Enabling benefit from generation that would otherwise be curtailed by the export cap.

In summary, we propose the following:

- The revised target setting approach is to exclude that component of on-site electrical generating capacity which is assessed as exported from the property to the electricity grid.
- Benefit from on-site generation of power will be assigned only to the extent that it can be demonstrated, within the SAP or SBEM calculation, that

generated energy is retained and used at the building, reducing the need for delivered energy, from external sources. Consultation tools will present this option.

- We are proposing introduction of an additional energy target for new buildings (see section 2.2.1). This principle will also apply to that new metric.
- This change is intended to deliver a more representative illustration of the benefit derived from generation solutions. It will also support informed design decisions on how best to apply such solutions to practical effect, further reducing reliance of new buildings on energy supplied from external sources.

This proposal is implemented within our consultation versions of:

- iSAP: https://www.scotland.isap.org.uk/ and
- c-SBEM: https://www.uk-ncm.org.uk/download.jsp?id=17.

Please note: this proposal is only applied to the process of demonstrating compliance with standard 6.1 of Building Regulations. Calculation of and reporting of energy and emission performance in the production of Energy Performance Certificates is unaffected and will remain as set out in the published UK methodologies unless subject to separate review.

Question 10 –

Do you agree with the principle set out, that the benefit from on-site generation within the compliance calculation should be limited by a practical assessment of the extent that generated energy can be used onsite?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Are there any particular concerns you have over this approach, e.g. with regards particular technologies or solutions?

2.2.11 Applying standard 6.1 to buildings with only Low and Zero Emissions Heating Systems.

Background

Our draft Heat in Buildings Strategy[22] defines 'low and zero emissions heating systems as "systems that have zero direct greenhouse gas emissions such as individual electric heat pumps and connections to heat networks, or electric systems such as storage heaters, and systems that have very low emissions such as those that use hydrogen".

[22] See https://consult.gov.scot/energy-and-climate-change-directorate/heat-in-buildings-strategy/

This is further reflected in the proposed 2024 New Build Heat Standard being confirmed and implemented. The strategic consultation on that Standard[23], issued in December 2020, defines acceptable heat solutions as follows:

> "'Zero direct emissions from heating and cooling' will ensure that no greenhouse gas emissions are produced at all from the heating or cooling system contained within a building at the point of use.
>
> We propose that electricity and thermal energy from heat networks would, therefore, be considered 'zero-rated' (i.e. considered to produce zero direct emissions at the point of heat consumption)".

Proposals within this consultation do not prevent the continued use of fossil fuel and other heat solutions which rely upon combustion of fuel at the building. However, revision and simplification of the notional building packages (see sections 2.2.6, 2.2.7 and 2.2.10) are intended to place greater emphasis on the use of such 'zero direct emissions' heat solutions, where practicable.

To support this outcome, prior to the implementation of the 2024 Heat Standard, this consultation investigates a range of options which can promote implementation of low and zero emissions heat solutions. The simplification of the notional building specifications is one such action as is the proposal to 'future proof' heating installations to support simple installation of 'zero direct emissions' heat solutions in the future (see sections 2.2.12).

Proposals

Accordingly, we propose, where the heat and cooling requirements of a new building are met only by solutions which meets the definition of a 'zero direct emissions' heat source, that the emissions target set under Standard 6.1 shall not apply to the building.

This would remove the need to demonstrate that a building meets both an emissions and an energy target where a developer has chosen to using only zero direct emissions solutions, in advance of the 2024 Heat Standard. Such a choice means that action to limit greenhouse gas emissions is already demonstrated in the choice of heat solution.

Calculation to demonstrate that the energy target is met would still be undertaken to confirm that energy demand at the building is limited to the appropriate level.

Calculated emissions for the building will still be reported on the Energy Performance Certificate required for new homes and new non-domestic buildings under Standard 6.9 within section 6 (energy). Reporting will, as at present, apply the factors for both emissions and primary energy set out in the updated calculation methodologies (SAP and SBEM). However this information is informative only and, whilst it must report on the performance of the building, as-constructed, it is only the provision of the EPC itself which is required under standard 6.9.

[23] See https://consult.gov.scot/energy-and-climate-change-directorate/new-build-heat-standard/

Question 11 –

Do you agree with the proposal that new buildings where heat demand is met only by 'zero direct emissions' sources should be exempt from the need for a calculation to demonstrate compliance with the Target Emissions Rate?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

2.2.12 Designing for future retrofit of Zero Direct Emissions heat solutions.

As noted in section 2.2.11, proposals within this consultation do not prevent the continued use of fossil fuel and other heat solutions which rely upon combustion of fuel at the building. This will change with action under the proposed 2024 New Build Heat Standard. There is a similar intent for the for deployment of low and zero emissions heat within our existing building stock by 2040/45.

> "By 2045, emissions of greenhouse gases from heating our homes and buildings will have all but disappeared, with demand for energy reduced and space and water heating provided by zero emissions alternatives."[24]

From 2024, new buildings will be required to use 'zero direct emissions' heat solutions. Until that time, we seek to further reinforce both the consideration of such solutions and to support simple and inexpensive replacement of heat generators such as gas boilers in the future.

Provisions elsewhere in this consultation address the actions needed in the design of a heating system based upon lower temperature heat distribution (see section 3.2.9).

In addition to this, we propose, where a new building is not constructed with a recognised ZDE heat solution meeting all heat needs, that the developer shall provide information detailing the process and work involved to deliver that adaptation, simply and without disruption beyond the immediate vicinity of the current heat source.

Question 12 –

Do you support the need for new buildings to be designed to enable simple future adaptation to use of a zero direct emissions heat source where one is not initially installed on construction. And for information setting out the work necessary for such change to be provided to the building owner?

Yes ☐

No ☐

[24] 'Journey to net zero' - https://consult.gov.scot/energy-and-climate-change-directorate/heat-in-buildings-strategy/

Please provide a summary of the reason for your view.

Do you have any comments on the level of information needed to support such action in practice or on the extent to which alterations other than those at, or very close to, the heat generator can be justified?

2.2.13 Fabric performance of new dwellings – Domestic

Minimum standards for insulation of new dwellings to limit heat loss are addressed through guidance to standard 6.2 (building insulation envelope). Clause 6.2.1 sets maximum area weighted U-values for elements such as walls, roofs, floors and openings.

Analysis of Energy Performance Certificate (EPC) Data for 2016-2020 dwelling completions, with an increasing number of homed built to the 2015 standards, indicate only a slight improvement in the average U-value for walls. This data indicates that new homes are commonly built to closer to backstop values for fabric than to those values within the notional building specification. It is common to augment a lower fabric specification with increased use of on-site renewables, such as photovoltaic panels (the amount of PV installed has more than tripled in the same period). It is noted that such an approach may not offer the same assurance of benefit in reducing energy demand and the energy delivered to the building as the generated energy is not always used within the building.

The issue of building fabric has a higher profile in more recent years following calls by the UK Committee on Climate Change for new homes to be 'ultra-energy efficient' and concerns over increased energy costs associated with the proposed transition to low and zero carbon heat solutions.

Within guidance to Building Regulations, element U-values for the Notional Building are set at an achievable good practice level and it is expected that there must be some 'leeway' in the actual performance specified to enable a flexible approach to building design. If this degree of flexibility is reduced, whilst still citing buildable levels of performance, there is more assurance on the delivery of new homes and new work that is as effective as practicable at reducing heat loss.

Accordingly, it is proposed to introduce more robust backstops, which 'keep pace' with the improved Notional Building fabric values (to a practicable extent) to drive overall improvement in the building fabric of new homes.

In implementing this for new construction, two options are available:

- Maintaining the **elemental approach** set out under standard 6.2 at present, but with improvement of both cited values and the prescription attached to the other aspects of heat loss addressed by the standard (losses through thermal bridging at junctions and through air leakage (infiltration). This approach allows the noted degree of flexibility, departing from the level of specification within the notional building to support implementation of a wider range of construction specifications in practice.

- Use a similar specification to define a calculated **heat demand target** which should be met in the same way as the current emission target. This will encompass U-values, linear thermal bridging, fabric infiltration and also, via the SAP methodology, take into account the design and layout of the building and any beneficial environmental gains that arise. This approach is used in the current definition of the non-mandatory 'useful energy for space heating' aspect of our sustainability standard 7.1 and, in English building regulations, for their Target Fabric Energy Efficiency rating.

Further improvement of standards at this time is moving the level of expected performance beyond that which can be delivered with some older construction solutions, such as use of infill insulation only between a timber frame). Adoption of current good practice for fabric specification (e.g. the better half of all built solutions) would provide improved minimum levels of performance which are achievable as simple backstops. Accordingly, setting minimum standards at the level proposed below would appear to remove the need for an overall fabric performance metric.

It is proposed that a better and more consistent level of fabric insulation is achievable in all new construction. Such a standard can be delivered by the capacity and experience already present in the construction and manufacturing sector in Scotland, recognising also the benefits of a greater use of solutions such as off-site manufacture of components.

We propose to **retain the current elemental approach** to minimum fabric performance and improve recommended maximum area-weighted U-values as set out in the table below. Options are illustrated in clause 6.2.1 in 'Consultation proposals - Section 6 (Energy) Domestic'.

Table 5: Proposed maximum fabric values for new homes.

Fabric Element	Current (2015) Notional Building U-value	Current (2015) Maximum U-value	Option 1 - Improved Notional Building U-value	Option 1- Improved Maximum U-value	Option 2 - Advanced Notional Building U-value	Option 2 - Advanced Maximum U-value
Wall	0.17	0.22	0.15	**0.17**	0.13	**0.16**
Roof	0.11	0.15	0.09	**0.12**	0.09	**0.11**
Floor	0.15	0.18	0.12	**0.15**	0.10	**0.13**
Doors/Windows	1.4	1.6	1.2	**1.4**	1.0/0.8	**1.2**
Rooflights [1]	1.4	1.6	1.7	**1.9**	1.3	**1.7**
Party Wall	0.0	0.2	0.0	**0.0**	0.0	**0.0**
Junctions	0.08	n/a	0.06	**n/a**	0.04	**n/a**
Infiltration	7	n/a	5	**n/a**	3	**n/a**

[1] U-values for rooflights is calculated on the horizontal plane.

A review of the last years' EPC data has informed the development of the above range of performance levels assigned to elements of the insulation envelope. For Option 1 (Improved), the maximum U-values cited are the 50th percentile values from current construction (e.g. achieved by at least half of new construction).

Values for Option 2 (Advanced) option are shown as 33rd percentile (one third of new construction).

Such values are challenging, but achievable, and will result in a significant improvement in levels of fabric performance in all new homes. Application of these amended values would be supported by revised guidance on the principles of reducing heat loss at junctions and through fabric infiltration, reinforcing the need to consider all aspects of the building insulation envelope within design and construction.

To raise awareness of the overall impact of design specification on building fabric performance, we would also seek to report the calculated space heating demand for each dwelling As part of output from SAP tools. This is already an output from the calculation (this is calculated in box 99 of the SAP worksheet) as noted on the previous page.

Where more design flexibility is sought, an alternative solution might be to demonstrate that the overall space heating demand for the dwelling is no more than this calculated total, subject to the use of agreed values for both infiltration and heat loss at junctions – the notional building values are proposed. This provides, in effect, an informal 'space heating demand target', applied where elemental values are not used in full to demonstrate compliance.

Thermal Bridging at Junctions

Please note that it is also the intent to cease to provide a set of 'Accredited Construction Details' (ACDs) for common constructions in support of amended domestic standards from 2021. This is in line with the approach taken in other UK administrations and reinforces the expectation that such information should be produced, as a matter of course, by the construction sector. The introductory section of the current ACD document, which sets out the principles of addressing thermal bridging at junctions and detailing to reduce infiltration, will be updated and remain a reference publication.

Question 13 –

Do you support the retention of the current elemental approach to setting minimum standards for fabric performance in new dwellings, supported by the option to take an alternate approach via calculation of the total space heating demand for the dwelling (as described)?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

In the context of the proposed approach, If you have any comments on the maximum U-values proposed for elements of fabric, in relation to their level of challenge and achievability at a national level, please set them out below.

2.2.14 Increase in airtightness testing – Domestic

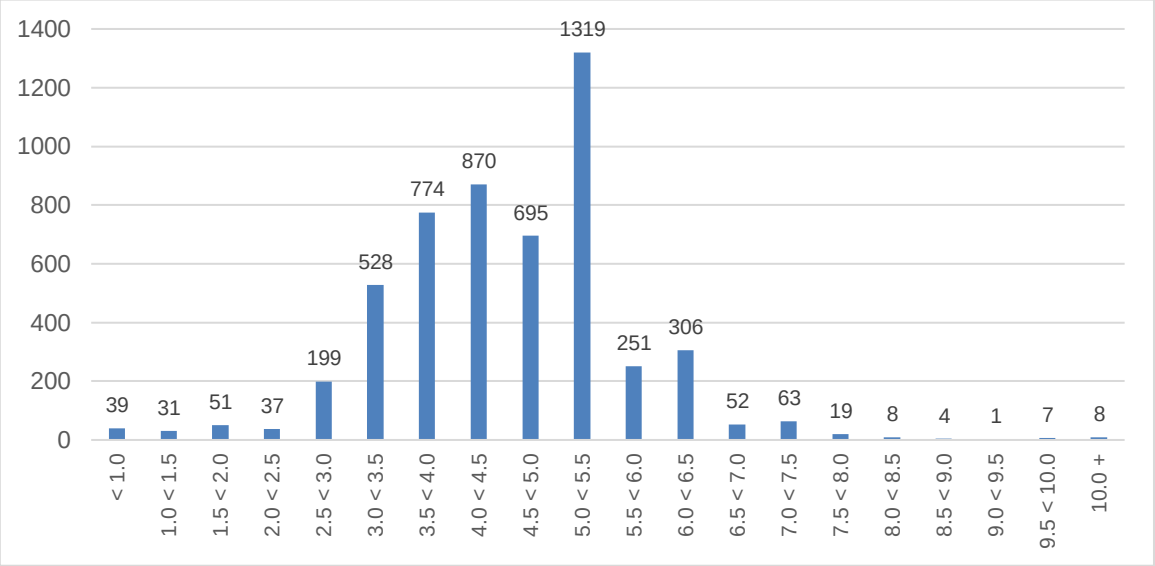
Low air infiltration rates contribute to energy performance of a building by reducing unintended ventilated heat loss. However it can also have an adverse impact on the level of ventilation provision where the infiltration rate is lower than 5 m³/(h.m²)@50Pa and an appropriate ventilation system has not been installed. There is, therefore, a need to establish dwelling performance by test to demonstrate compliance in both these respects.

Air-tightness testing was first introduced to the Technical Handbooks in 2007 as a means to demonstrate that high levels of air-tightness declared at the design stage, were being met at the construction stage and that the ventilation proposed for the dwelling was appropriate for that situation.

Current guidance calls for representative sampling of buildings to be tested at a frequency of at least 1:20. Testing should be carried out by persons who can demonstrate relevant, recognised expertise in measuring the air permeability of buildings. This should include membership of a professional organisation which accredits its members as competent to test and confirm the results of testing.

A review of EPC data for 2020/21 indicates that around one third of new dwellings are subject to an air tightness test and commonly achieving air infiltration rates below 5 m³/(h.m²)@50Pa, with an average test performance of 4.4 - 4.5 m³/(h.m²)@50Pa.

Figure 1 - Tested Infiltration Rates - New Homes 2020/21



Source: Scottish EPC data for new homes completions March 2020 to March 2021 (publication pending). 15,004 records reporting 5,262 tests (35%).

As this level of airtightness requires greater consideration of the ventilation strategy to be adopted for the building, we propose that all new homes should be tested. This would provide greater assurance that the infiltration rate actually achieved in the dwelling is a fair representation to that declared at the design stage. This will assist in closing the performance gap associated with heat loss through infiltration. It will also, more importantly, provide assurance that the ventilation strategy adopted in the building is appropriate for the level of air

infiltration present within the dwelling. See clause 6.2.5 in 'Consultation proposals - Section 6 (Energy) Domestic'.

Current guidance to standard 6.2 includes the option to not test a dwelling where a default air infiltration rate of 15 $m^3/(h.m^2)$@50Pa is declared. Whilst rarely used, this is no longer considered supportable as this is an unrepresentative value, given risk that the dwelling could be constructed to a far tighter level of air infiltration meaning the proposed ventilation strategy is inadequate. It will be removed from guidance.

We intend to strengthen the existing guidance on what level of competence is required from those persons carrying out and reporting on air tightness testing, requiring membership of an appropriate testing organisation.

Question 14 –

Do you support the move to airtightness testing of all new dwellings, by registered members of an appropriate testing organisation?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

2.2.15 Increase in airtightness testing – Non-domestic

Currently, all new non-domestic buildings and large extensions which are subject to Standard 6.1 (carbon dioxide emissions) should be tested on completion, with limited exceptions.

We propose to limit these exceptions further to remove the exception to testing for small multiple units (< 150 m^2) and large extensions and reduce the limit for exceptions for modular buildings to those less than 150 m^2. This is set out in clause 6.2.6 of 'Consultation proposals - Section 6 (Energy) Non-domestic'.

As with the proposals for new dwellings, we intend to strengthen the existing guidance on what level of competence is required from those persons carrying out and reporting on air tightness testing, requiring membership of an appropriate testing organisation.

Question 15 –

Do you support the move to increased airtightness testing of all new non-domestic buildings, by registered members of an appropriate testing organisation?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

2.2.16 Adoption of CIBSE test methodology

Review of building regulations in England by the UK government has proposed and confirmed adoption of an alternative air tightness testing methodology to that currently cited in the Technical Handbooks, produced by the Air Tightness Testing and Measurement Association (ATTMA). The principal reason for this is to ensure that the approved methodology for airtightness testing is independent of all organisations with an associated competent person scheme. The methodology proposed is TM 23 – 'Testing buildings for air leakage' produced by CIBSE, which has recently been revised and updated with such use in mind.

The intent was that the test methodology should be published independently of the approved schemes in England, and that the low pressure pulse method (see section 2.2.17) should also be included in the test method publication

Whilst the building standards system in Scotland does not operate formal competent persons schemes, we would propose to adopt the same methodology to provide consistency of approach to air tightness testing across the UK.

To ensure consistency in process and standards for testing across the UK, we would propose that the updated TM23 also be adopted and cited in Scotland.

Question 16 –

Do you support the adoption of CIBSE TM 23 as the basis for airtightness testing in Scotland?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

2.2.17 Adoption of option to apply 'pulse' test

Currently, airtightness is commonly tested by creating a pressure differential of 50 Pascals (via the blower door method) and measuring how pressure changes once the source of pressurisation is turned off. An alternative means of testing at a lower pressure differential of 4 Pascals now exists, having been developed over a number of years. We are seeking views on the introduction of this Pulse Test as an approved airtightness testing methodology.

It is noted that approval of the use of this method has already been signalled in relation to review of building regulations in England. In support of that review, a number of issues flagged in relation to the application of the test method have been clarified, including the practical limits within which testing can be undertaken and the means of conversion of results for reporting to give assurance of comparability with the higher pressure blower door test method. Amendments to the proposed new test methodology TM 23 are also being completed on that basis and provisions for representing results incorporated within SAP 10.2 (currently unpublished).

It is noted that such a test method does not support diagnosis of building defects in the same way that a continuous pressure test can (e.g. identification if infiltration pathways). We therefore see the introduction of a second method of test as complimenting that which is currently available.

Question 17 –

Do you support the introduction of the pulse test method of airtightness testing as a further means to resting and reporting on the performance of new buildings?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Are there any particular benefits, risks or limitations you would seek to identify?

2.2.18 Modular buildings – Non-domestic

Currently, alternative provisions for new modular buildings are set out within Appendix 6.C of the Non-domestic Technical Handbook. To enable the continued use of existing stocks of building modules and sub-assemblies, subject to fabric insulation meeting limiting U-values, a modifying factor can be applied to increase the Target Emissions Rating (TER) for the new building.

A definition of what constitutes a modular building is provided within that Annex.

This is provided to recognise both the common manufacturing base for UK sub-assemblies and the benefits of reuse of existing sub-assemblies offers in respect of embodied energy savings (subject again to a specified minimum energy performance).

We would propose to maintain an allowance of this type within revised standards, applying it to both the emissions target and the proposed new energy target but with further limitations:

- Allowances within Annex 6.C shall only apply to limited life buildings (those intended to be in place for not more than five years). Buildings that are intended to be permanent shall be subject to standards 6.1 to 6.10 unmodified.
- For limited life buildings subject to standard 6.1, apply a modifier of 1.25 to the calculated emissions and energy targets. This limits the flexibility in the target calculations to a level approximately equivalent to the 2015 standards. A declaration that a limited life building will be on site for not more than two years shall still exempt such a building from standard 6.1 and the compliance calculation.
- Limiting fabric values are set at those applied for all new buildings under the 2015 standards. Noting that these values were not improved in 2015,

meaning that the standards can be met with elemental values which were also set for new buildings in the previous 2010 standards, enabling the potential reuse of sub-assemblies manufactured since 1 October 2010. Older manufactured products would require refurbishment to uplift them to current fabric standards.

We consider this strikes the appropriate balance between reuse of better performing modules and sub-assemblies and the need for refurbishment of older stock to be more aligned with current expected levels of building performance for both new and existing buildings. Whilst also supporting provision of small buildings at short notice in distress situations (e.g. due to an emergency).

The detail of this proposal is set out within Annex 6.C of 'Consultation proposals - Section 6 (Energy) Non-domestic '.

Question 18 –

Do you consider this amended provision provides an appropriate balance between:

- **the requirement to improve building energy performance in new buildings;**
- **enabling the reuse of better performing modular elements; and**
- **enabling use of small units for short term use at short notice?**

Yes ☐

No ☐

Please provide a summary of the reason for your view.

2.2.19 General comments on proposal for new buildings

Question 19 –

We welcome any other comments you wish to make on the proposed changes to the setting of performance targets for new buildings or the application of other amended provisions within Section 6 (energy) which apply to the delivery of new buildings.

Where practical, please with a reference to any particular issue in the context of the Domestic or Non-domestic Handbook (or both if applicable) and cite any standard or revised guidance clause relevant to the topic.

Part 3 – Energy, all buildings

3.1 Introduction

This section of the consultation introduces proposed changes to provisions which apply to new buildings and to new work to existing buildings. These are the provisions sought when demonstrating compliance with Standards 6.2 to 6.8 and 6.10 within section 6 (Energy).

This includes proposals for improved minimum standards for building fabric and a simplification of how these are applied across new and existing buildings.

Revisions to minimum standards for installed building services are identified, noting that, as with the 2015 review, these are aligned with changes proposed elsewhere in the UK to support consistency of application and in recognition of a UK-wide.

The review of standards for energy efficiency in the context of our wider agenda to improve compliance with building regulations is also set out, seeking to increase assurance of process from the design, specification and commissioning of buildings and reduce the potential effect these processes can have on as-built performance compared to design intent.

Note that provisions for energy performance certificates under standard 6.9 are not amended as part of this consultation. Guidance in support of EPC provision for new buildings under building regulations will be updated as part of publication of the revised Technical Handbooks in late 2021 to reflect the exit of the UK from the European Union and note any further review activity arising from implementation of our draft Heat in Buildings Strategy.

3.2 Proposals

3.2.1 Introduction of the term ‘Major Renovation’

At present, Building Regulations apply where building work is undertaken and relate to the extents of that work. This relates to both physical work to create a building or alter an existing building and to conversion of a building (specific changes in the occupation or use of a building that cause the regulations to apply).

We are proposing to introduce the term ‘major renovation’ into the regulations to provide a further means of defining a level of work to an existing building that is considered significant enough to trigger certain other activity. Be that a requirement for assessment or to seek specific additional works, which may not be part of action already intended by the building owner.

The premise of such a trigger is that the undertaking of significant construction work provide the opportunity to make other beneficial changes to the building at a lower cost than would be encountered if such works were done separately. Making such improvements more economically viable.

A similar principle is already applied for non-domestic buildings where specific ‘consequential improvements’ are sought in guidance to standards 6.3 to 6.6. where work to an existing building includes the provision of new fixed building

services or alters or extends the capacity of existing fixed building services. The opportunity should be taken to review and improve the performance of fixed building systems. The approach taken is set out in Annex 6.D to the current standards.

At present, 'major renovation' is already defined within the legislation of other UK administrations, adopting one of the two definitions provided in the recast EU Energy Performance of Buildings Directive, 2010/31/EU as amended by 2018/844.

> 'major renovation' means the renovation of a building where:
>
> (a) the total cost of the renovation relating to the building envelope or the technical building systems is higher than 25 % of the value of the building, excluding the value of the land upon which the building is situated; or
>
> (b) more than 25 % of the surface of the building envelope undergoes renovation;

We propose that the term 'major renovation' become a defined term within Building Regulations, adopting the same definition as elsewhere in the UK to support simplicity of understanding and consistency in application. As follows:

> **'major renovation' means the renovation of a building where more than 25 % of the surface of the building envelope undergoes renovation.**

Initially, we propose to introduce this to support action, as detailed within Section 7 of this consultation, on the provision of electric vehicle charging infrastructure or facilities (see section 7.5.3). Any broader application of the term as a trigger for works would be the subject of separate consultation.

Question 20 –

Do you agree with the proposed introduction of the term 'major renovation' as defined above as an additional means of identifying when aspects of building regulations shall be applied to an existing building?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

3.2.2 Revision of minimum performance for building fabric – Domestic

Section 2.2.13 discusses proposals to retain the current elemental approach to setting limits on the performance of building fabric for new homes. It sets out proposed maximum area-weighted U-values for elements of fabric for the two levels of overall energy improvement proposed.

As reviews of standards continue to increase the level of fabric specification sought from work to existing buildings, it becomes more challenging to set or justify more than one set of such elemental standards. The intent is therefore to set a simple and robust set of elemental standards for all work to buildings – extensions, alterations and conversions.

We propose to apply the same recommended maximum area-weighted U-values to all work to existing dwellings, as set out in the table below.

Table 6: Proposed maximum area-weighted average U-values - new work to domestic buildings

Element	Current (2015)	Option 1 - Improved	Option 2- Advanced
Wall	0.22	**0.17**	**0.16**
Roof	0.15	**0.12**	**0.11**
Floor	0.18	**0.15**	**0.13**
Doors, windows and roof windows	1.6	**1.4**	**1.2**
Rooflights [1]	1.6	**1.9**	**1.7**
Party Wall	0.2	**0.0**	**0.0**
Junctions	n/a	**n/a**	**n/a**
Infiltration	n/a	**n/a**	**n/a**

[1] U-value for rooflights is calculated on the horizontal plane

This is set out in clause 6.2.1 and 6.2.6-8 of 'Consultation proposals - Section 6 (Energy) Domestic'.

As noted in Section 2.2.13, these values are currently being achieved in more than 50% of new construction (for 'improved') and 33% of new construction (for 'advanced'). The values proposed for Option 1 are similar to those applied, since 2015, for extensions to poorer performing dwellings.

Question 21 –

Do you support the improvement in maximum U-values for elements of building fabric for Domestic buildings, as set out above?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We would also welcome your views on the proposed simplification achieved by setting of a single set of values for all building work to new and existing buildings.

3.2.3 Revision of minimum performance for building fabric – Non-domestic

For many non-domestic buildings, it is noted that energy demand for space heating forms a smaller part of overall energy demand than in dwellings. And that the level and disposition of that demand across energy uses will vary across building type.

As reviews of standards continue to increase the level of fabric specification sought from work to existing buildings, it becomes more challenging to set or justify more than one set of such elemental standards. The intent is therefore to set a simple and robust set of elemental standards for all work to buildings – extensions, alterations and conversions.

Accordingly, we propose a review and improvement to maximum fabric values for work to non-domestic buildings as set out below:

Table 7: Proposed maximum area-weighted average U-values - new work to non-domestic buildings

Element	Current (2015)	Option 1 (Medium)	Option 2 (High)
Walls	0.25	0.23	0.18
Floors	0.20	0.18	0.13
Roofs	0.15	0.18	0.15
Windows / roof windows	1.6	1.6	1.2
Rooflights [1]	1.6	2.1	1.9
Junctions	n/a	TBC	TBC

[1] U-value for rooflights is calculated on the horizontal plane

This information is set out in clause 6.2.1 & 6.2.7-9 of 'Consultation proposals - Section 6 (Energy) Non-domestic'.

Whilst there is less useful data to inform the definition of backstop values for non-domestic building fabric, it is noted that the values presented above can be achieved using common construction practice currently in use. The 'Medium' option values represent a small improvement on current values cited for extensions, noting that the backstop for roofs for the 'medium' option is relaxed slightly to reflect the revised notional building specification for this option. The wall value is the same as currently specified as a backstop for shell buildings where there is an expectation that fabric elements will be emphasised, to simplify subsequent fit-out.

Shell buildings

Note also that we no longer propose to set more challenging maximum U-values for shell buildings in guidance to standard 6.2. Revision of guidance on 'shell and fit-out' buildings under standard 6.1 (clause 6.1.8) will instead reinforce the need to for a considered specification at shell stage to optimise opportunities for compliance at fit out stage.

Question 22 –

Do you support the improvement in maximum U-values for elements of building fabric for Domestic buildings, as set out above?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We would also welcome your views on the proposed simplification achieved by setting of a single set of values for all building work to new and existing buildings.

3.2.4 Conversions and extensions

Conversions

There are specific changes in the use or occupation of a building which constitutes a conversion as defined in schedule 2 to regulation 4 of the Building (Scotland Regulations 2004. A conversion also occurs where a previously unoccupied part of a dwelling becomes habitable, such as extending into the attic space. Where work is defined as a conversion, current standards are applied to it, either in full, or to the extent reasonably practicable. The latter applies to standard 6.2 (building fabric).

It should be noted that the standard and guidance for conversions also apply where a defined conversion does not occur but heating is introduced to a building that was previously un-heated.

Standard 6.1 does not apply to conversions and the primary means of reducing heat demand in conversion remains the performance of the building fabric, supplemented by effective services and controls installed therein to meet that demand most effectively.

We propose that work to introduce heating to a building or part of a building and conversions are subject to the same limiting U-values for building fabric as noted in Table 6 and 7 in Section 3.2.2 and 3.2.3, subject to the application of an assessment of what is 'reasonably practicable'.

For situations where standards can be met as far as is 'reasonably practicable', be this for a conversion or where avoidance of technical risk from improvement is an issue, we will seek to reinforce the need for robust assessment to determine the optimal level of specification for a given situation. A more evidence-led assessment to optimise improvement also aligns with the intent set out within our draft Heat in Buildings Strategy and the Building Standards Compliance Plan approach (see section 3.2.11) being developed for implementation.

Extensions

Standard 6.1 applies only to larger extensions to non-domestic buildings. Outwith this case, the primary driver for reducing energy demand and emissions in extensions is the performance recommended for new building fabric and, where applicable, installed building services.

The guidance on extensions under standard 6.2 indicates elemental area weighted average U-values that the extension should be built to. The weighted average U-value approach allows areas of the same building element to have a poorer average performance that the other parts of the element, however, this will require to be compensated for by improved average performance for the other parts of the element. As part of this, the maximum area of openings is defined to assist in

limiting heat loss, though this can be varied if compensated for by improvement to the performance of elements.

We propose that work to extend a building shall be subject to the same limiting U-values for building fabric as noted in Table 6 and 7 in Section 3.2.2 and 3.2.3

For domestic extensions, this will remove the current approach where more challenging U-values are applied to extensions of poorer performing buildings. Again noting that, as reviews of standards continue to increase the level of fabric specification sought from work to existing buildings, it becomes more challenging to set or justify more than one set of such elemental standards.

Shell buildings

As noted in section 3.2.3, we will no longer set different maximum U-values for shell buildings.

All of the above proposals are set out in guidance to Standard 6.2 within 'Consultation proposals - Section 6 (Energy) Domestic' and 'Consultation proposals - Section 6 (Energy) Non-domestic.

Question 23 –

Do you support the standardisation of values and approach for conversions, extensions and shell buildings, as set out above and in sections 3.2.2 and 3.2.3?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

3.2.5 Presentation of information on building services

Consultation proposals are presented as highlighted changes within the current document format introduced for the 2015 review of energy standards. This is the Domestic and Non-domestic building Services Compliance Guides, two volumes which are separate but have the same status as the main Technical Handbooks.

We are aware that, as part of rationalising and improving the presentation of information, to support both designers and verifiers, proposals have been made in other UK administrations to re-integrate information back into the appropriate section of the relevant technical document, together with removal of any information that is not directly relevant to the delivered specification sought (e.g. optional good practice advice).

We would welcome your views on the future format of guidance on building services. We have identified three options:

- Retain the current format and separate documents for building services (as presented in the consultation)
- Retain the current format but include the guides as a single section within Section 6 of each Technical Handbook

- Re-integrate the current guidance into guidance under each relevant functions standard (e.g. 6.3 to 6.8)

Question 24 –

If you have a view on the preferred format for presentation of information on compliance of building services, what would be your preference?

Retain current separate Compliance Guides ☐

Move Compliance Guides into Section 6 as an Annex ☐

Re-integrate into guidance to the relevant standard ☐

Other (please specify in summary box below) ☐

Please provide a summary of the reason for your view.

3.2.6 Changes to minimum standards for building services – Domestic

As is the case with the 2015 and previous guidance on minimum standard for fixed building services, provisions set for Scotland are proposed to reflect those set elsewhere in the UK.

This recognises that products are developed and made available at a UK level and the solutions deliverable by combining individual components should reflect a consistent standard for those components across the UK administrations, supporting consistency of understanding and implementation of solutions where practicable.

The compliance guides, which applies to both new and existing buildings, provides guidance on the following aspects of building services addressed under standards 6.3 to 6.8:

- System efficiencies
- Controls
- Limiting heat loss
- Commissioning

To a large extent much of the proposed guidance on services developed for review elsewhere in the UK remains unchanged for the aspects relating to controls, commissioning and written information. However, the following changes are flagged, in summary, for the awareness of consultees. Further information, with all changes in highlighted text, is provided within 'Consultation proposals - Domestic Building Services Compliance Guide'.

Table 8: Summary of key changes to minimum standards for fixed building services:

System/element	2015 Guidance	Proposed Guidance
Gas Central Heating Boiler	88% SEDBUK 2009	92%ErP[1]
Oil Central Heating Boiler (Regular)	88% SEDBUK 2009	91% ErP[1]
MVHR (heat recovery efficiency)	70%	73%
Warm water and hot water heat pumps	Air-to-air <12kw, SCoP of D or better Space heating (new dwellings), SCoP of 2.5 or better Space heating (existing dwellings), SCoP of 2.2 or better Domestic hot water, SCoP of 2.0 or better	No change Space heating (new dwellings), SCoP of 3.0 or better Space heating (existing dwellings), SCoP of 3.0 or better No change
Air / water cooled air conditioners	SEER 2.4/2.5	SEER 4.0
Internal Lighting	Luminous efficacy greater than 45 lamp lumens /circuit watt for 3 out of 4 fittings	All fittings to have efficacy more than 75 lamp lumens/circuit watt
External lighting	Either: Lamp capacity < 100 lamp watts per fitting, and auto control to switch off where area unoccupied and all lamps switch of in daylight Or: Lamp efficacy >45 lumens/circuit watt, and All lamps switch off in daylight	Where lamp efficacy <75 lumens/circuit watt, auto control to switch off where area unoccupied Auto controls to switch off in daylight

[1] The Eco-design Regulation 2009/125/EC introduced a new standardised calculation method to determine the seasonal efficiency of heating appliances. In 2015 this metric was adopted in the UK replacing the UK-specific SEDBUK rating other than within SAP calculations.

The following additional changes are noted:

- Replacement of fixed building services – in addition to meeting the recommended performance and specification provisions set out for a particular system, proposal that replacement of a heat generator that involves a change in fuels should not result in an increase in building emissions or an increase in overall energy demand at the building - see section 1.8 of the Guide.

- Self-regulating devices – see Section 3.2.10 of this document.
- Insulation of pipes and ducts – simplified guidance on insulation requirements, citing example and referring to BS 5422 for other cases - see section 2 (Table 5) of the Guide.
- Heat losses from storage vessels – proposed guidance to be updated with a table that confirms the maximum daily heat loss for hot water cylinders - see section 2 (Table 2) of the Guide.
- Continuous supply input and extract ventilation – proposal that ventilation systems that provide supply and extract ventilation should be fitted with a heat recovery system, summer bypass and variable speed control - see section 8 of the Guide.
- Improving system efficiency on replacement of heat source – proposal to call for additional energy efficiency measures to be introduced when a gas combination boiler is replaced - see section 2 (Table 4) of the Guide.
- Commissioning of installed systems – proposal to call for the extent of services that will be commissioned to be confirmed at design stage with confirmation of commissioning provided on completion of the building - see Section 1 (2.0) of the guide and section 6.1.5 and 6.1.6 of this document.
- System sizing – proposal for guidance to call for space heating, domestic hot water and cooling systems to be sized appropriately. In addition space heating systems to be sized to allow it to operate effectively at a low distribution temperature (55 °C or lower).
- New section on Building Automation and Control Systems (BACS) – new guidance introduced for BACS where installed in new or existing dwellings - see Section 13 of the guide.
- New section on On-site electricity generation – new guidance introduced for on-site electricity generating systems.

Question 25 –

Do you support the continued alignment of minimum provisions for fixed building services at a UK level within the Domestic Building Services Compliance Guide?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Are there any issues you wish to raise in relation to the amended or retained specifications set out within the draft Guide?

3.2.7 Changes to minimum standards for building services – Non-domestic

As is the case with Domestic buildings, the majority of the guidance supporting building standards 6.3 through to 6.8 is contained within the current Non-domestic Building Services Compliance Guide (NDBSCG). For the amendments to the energy standards in 2010 and 2015 the guidance provided aligned with the approach to services adopted throughout the rest of the UK. We intend to replicate this approach for the new standards.

The compliance guides, which applies to both new and existing buildings, provides guidance on the following aspects of building services:

- System efficiencies
- Controls
- Limiting heat loss
- Commissioning (though mostly addressed within standard 6.7)

To a large extent much of the proposed guidance on services remains unchanged for the aspects relating to controls, commissioning and written information. However, the following changes are flagged, in summary, for the awareness of consultees. Further information, with all changes in highlighted text, is provided within 'Consultation proposals - Non-domestic Building Services Compliance Guide'.

- General – expanded text on heating system design and sizing; reference to low temperature distribution systems (<55 ºC).
- Heating efficiency (Section 1.7) - summary of recommended minimum energy efficiency standards - boiler seasonal efficiency values improved for most fuel types.
- Removal of the facility to define 'effective heat generator seasonal efficiency' via 'heating efficiency credits'. See Section 3.2.8 of this document.
- Replacement of fixed building services – in addition to meeting the recommended performance and specification provisions set out for a particular system, proposal that replacement of a heat generator should also not result in an increase in building emissions or an increase in overall energy demand at the building.
- Self-regulating devices – see Section 3.2.10 of this document.
- Domestic hot water systems in new and existing buildings (Section 8.4) – heat source seasonal efficiency values defined/improved for most fuel types (typically 91%).
- Comfort cooling in new and existing buildings (Section 9.4) – improved SEER values cited, additional system classes added (water-to-water). Further advice on VRF systems.
- Air distribution systems in new and existing buildings (Section 10.4) – improved SFP for a number of system options; additional advice on controls; expanded advice on air leakage to include summary advice on leakage limits from DW/143(144) and clarity on test procedures.

- Proposal that ventilation systems that provide supply and extract ventilation should be fitted with a heat recovery system, where technically feasible.
- Insulation of pipes and ducts in new and existing buildings (Section 11.3) – simplified guidance on insulation requirements, citing example and referring to BS 5422 for other cases.
- Lighting in new and existing buildings (Section 12.4) – advice on lighting design and avoidance of over-illumination; revised average luminaire efficacy (95 LL/cW proposed).
- New section on Building Automation and Control Systems (BACS) – see Section 3.2.11 of this document.

Question 26 –

Do you support the continued alignment of minimum provisions for fixed building services at a UK level within the Non-domestic Building Services Compliance Guide?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Are there any issues you wish to raise in relation to the amended specifications set out within the draft Guide?

3.2.8 Removal of heating efficiency credits – Non-domestic

The current Non-Domestic Building Services Compliance Guide 2015 includes an option where heat generators installed in existing buildings may have a reduced seasonal efficiency provided this is compensated for through the addition of other energy efficiency measures such as additional heating controls or other system enhancements. These allowances are known as 'heating efficiency credits' and are referenced in sections 2.7, 3.5, 4.5, 5.5 & 8.6 of the document.

We are proposing to no longer provide this alternative approach and instead focus on the minimum efficiency of the heat generator. We consider that the level at which standards are set for heat generators can be met in full due to improvements in the energy efficiency of appliances over recent years and that such a 'trade off' is no longer justified. Particularly as many of the options which are cited as relevant to achieving a 'credit' are either also expected or recognised good practice.

We propose that there will be no published mechanism to assign heating efficiency credits for installations to existing buildings from 2022. Accordingly, references to this process are removed from the relevant sections of 'Consultation proposals - Non-domestic Building Services Compliance Guide'.

Question 27 –

Do you agree with the proposal that the option of installing a less efficient heat generator and compensating for this using heating efficiency credits in existing buildings should be withdrawn from the Non-domestic Building Services Compliance Guide?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

3.2.9 Limiting distribution temperature for wet heating systems

It is already recognised that lower temperature heating systems offer the benefit of improved efficiency in the operation of the heat generator, be this a combustion appliance or a heat pump. Lower temperature distribution of heat within a building also supports the delivery of heat from lower temperature external networks.

We consider that limiting distribution temperatures in wet central heating systems to be an essential element in optimising the efficiency of future low and zero carbon heat solutions, as proposed within the recent strategic consultation on a 2024 Heat Standard.

We propose that, where a wet heating system is being installed in a new building or replaced in an existing building (including both heat generator and emitters) the system should be designed and emitters sized to allow the space heating system to operate effectively and meets the heating needs of the dwelling with a mean water temperature of not more than 55 °C. Proposals are set out in relation to wet heating systems within:

- 'Consultation proposals - Domestic Building Services Compliance Guide' and
- 'Consultation proposals - Non-domestic Building Services Compliance Guide'.

Question 28 –

Do you agree with the proposal to limit distribution temperatures in wet central heating systems to support effective implementation of low and zero carbon heat solutions and optimise the efficiency of heat generation and use?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

3.2.10 Self-regulating devices

A self-regulating device is a device or system that automatically controls the output of heating (or cooling) emitters to independently control the temperature in each

room or zone. Such control is usually achieved by a thermostat fitted to the emitter (e.g. thermostatic radiator valve) or within the room or zone (e.g. electronic wall thermostat linked back to the device controlling the heat generator).

The 2018 amendment of the EU Energy Performance of Building Directive sought, under Article 8(1), the presence of such devices to all emitters, where technically and economically feasible, where a heat generator (e.g. boiler or heat pump) is replaced.

At present, the provision of such control devices is sought for all emitters or rooms/zones in new buildings and where a new heating system (including emitters) or new emitters are installed in an existing building. However, there is no requirement to install self-regulating devices where only the heat generator is replaced. Though it is noted this frequently occurs as a good practice measure.

We propose to extend the provision of self-regulating devices to include installation (where absent) at the point a heat generator is replaced. Detailed proposals, including notes on feasibility and control at a room/zone level are set out in:

- Tables outlining the recommended minimum standards for control of heating systems within 'Consultation proposals - Domestic Building Services Compliance Guide' and
- Tables outlining recommended minimum controls package for heating systems in 'Consultation proposals - Non-domestic Building Services Compliance Guide'.

We consider that the addition of such devices on replacement of a heat generator is an appropriate intervention point, enabling a cost-effective means of further improve the performance and controllability of a heating system.

Question 29 –

Do you agree with the proposed extension to the provision of self-regulating devices to include when replacing a heat generator?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Do you have any comment on issues of technical feasibility or determining when installation should be at a room/zone level?

3.2.11 Building Automation and Control Systems – Non-domestic

A Building Automation and Control System (BACS) is a centralised system used to monitor and control a building's environment and services (i.e. heating, ventilation, air conditioning, lighting and other systems). There is currently no requirement for installing BACS in new buildings.

The 2018 amendment of the EU Energy Performance of Building Directive sought, under Articles 14(4) and 15(4) the introduction of such systems in all existing buildings by 2025. The Directive recognised that automated monitoring and control systems offered an effective alternative to inspection of building systems and can be very effective in assisting building operators reduce energy use and costs. Analysis undertaken by the UK Government in response to the Directive also suggests that BACS are a cost-effective way of saving energy in buildings.

We propose that new non-domestic buildings that have a heating system or systems for combined space heating and ventilation (with or without air-conditioning) with an effective rated output over 290 kW, should be equipped with a BACS.

The details of the specification of these systems are set out in section 14 of 'Consultation proposals - Non-domestic Building Services Compliance Guide'. This proposes the specification of BACS as a 'Class A' system to EN 15232 which provides a high level of control, with the cited UK analysis suggesting it is cost-effective.

Question 30 –

Do you agree with the proposed introduction of a requirement for building automation control systems, of the type specified, in larger non-domestic buildings with systems with an effective rated output over 290kW

Yes ☐

No ☐

Please provide a summary of the reason for your view.

3.2.12 General comments

Question 31 –

We welcome any other comments you wish to make on the above topics and broader changes to the setting of minimum standards for all buildings.

Where practical, please with a reference to any particular issue in the context of the Domestic or Non-domestic Handbook (or both if applicable) and cite any standard or revised guidance clause relevant to the topic.

Part 4 – Ventilation

4.1 Introduction

Following the commissioning of research into the impact of previous 2015 ventilation amendments to ventilation standards for new homes earlier this year, it is the intent to undertake a fuller review of ventilation provision for both domestic and non-domestic buildings from 2022.

Accordingly, changes proposed at this time are focussed on domestic ventilation and limited to those which are considered to be directly relevant to the introduction of improved energy standards or (in response to published research[25]) can better address the delivery of expected levels of ventilation and good indoor air quality:

- The expectation of further trends on reducing infiltration rates and increasing application of mechanical extract or supply/extract systems in lieu of natural ventilation.
- Reinforcement of the need for ventilation design to be properly considered and evidenced, systems designed and performance verified and recorded, post-commissioning.
- For dwellings, action to support proposals to require assessment and response to overheating risk in new residential buildings.

4.1.1 Background

At present provision for building ventilation to address air quality for occupants is addressed through standard 3.14 and associated guidance in the Domestic and Non-domestic Technical Handbooks. Further guidance on domestic ventilation is provided in a companion Domestic Ventilation Guide.

Guidance on the energy performance of ventilation systems is addressed under standard 6.6 and supporting guidance within the Building Service Compliance Guides. Updating of these provisions form part of the review of building services for Section 6 (energy).

For dwellings, a means of providing ventilation is required, by natural (background and intermittent extract) or mechanical (continuous extract) means.

As a basic provision, the following is identified:

- A manually openable ventilator and background ventilation is sought in every apartment.
- Intermittent mechanical extract (or passive extract) and background ventilation in each apartment and in kitchen/utility rooms and sanitary accommodation.

[25] Such work includes: The effect that increasing air-tightness may have on air quality within dwellings (BRE, 2012); Research Project To Investigate Occupier Influence On Indoor Air Quality In Dwellings (MEARU/ABC/ASSIST/ESRU, 2014); Ability of decentralised mechanical ventilation to act as 'whole-house' ventilation systems in new-build dwellings (MEARU/JGA/ABC/ESRU, 2018); and Ventilation and Indoor Air Quality in New Homes (AECOM Ltd, 2019).

This simple prescriptive approach is deemed adequate to maintain indoor air quality in a typical dwelling where a reasonable ventilation component from fabric infiltration is present (equating to a building infiltration rate of not less than 5 $m^3/(h.m^2)$@50 Pa). At present, guidance is not provided to explain the basis for the provision of ventilation to achieve specified levels of air change.

For infiltration rates lower than this, the need for a continuous mechanical system is identified. Options identified in guidance are:

- mechanical extract ventilation (MEV) and decentralised mechanical extract ventilation (dMEV) if design air infiltration rate is not less than 3 $m^3/(h.m^2)$@50Pa.
- balanced supply and extract mechanical ventilation systems, with or without heat recovery, for very low infiltration dwellings (below 3 $m^3/(h.m^2)$@50Pa).

Guidance identifies provision of a means of monitoring and reporting on air quality, using CO_2 levels as an indicator (sought in one apartment used for sleeping).

The companion Domestic Ventilation Guide expands on the basic guidance in the Technical Handbooks to assist designers in choosing an appropriate solution for a given dwelling. It also provides detailed guidance on the component elements of a given solution that are needed to support effective ventilation. Guidance on the commissioning, testing and reporting of mechanical elements of systems is also provided.

It is noted that current guidance for dMEV is not focussed on use as a 'whole dwelling' system. Nor is a need to consider the dwelling layout and location/exposure identified in the design of the system.

For non-domestic buildings, again a means of providing ventilation to occupied spaces is required, by natural (background and intermittent extract) or mechanical (continuous extract) means. Where applying natural ventilation to buildings with infiltration no lower than 5 $m^3/(h.m^2)$@50Pa, a manually openable ventilator and background (trickle) ventilation is sought in every room. Background ventilation area is subject to infiltration rate limits. Mechanical extract ventilation is sought in toilets/wet areas. Alternative provision by use of BS 5925, or CIBSE Guide A or AM10. Options for the design of mechanical ventilation systems are identified, referencing BS 5720 and CIBSE Guide B2.

4.1.2 Issues to address:

A review of data on recent dwelling completions confirms that new homes are being constructed with lower levels of fabric infiltration. Out of just over 5,000 test undertaken last year, 7% of homes had a tested infiltration rate below 3 $m^3/(h.m^2)$@50Pa, 58% were between 3 and 5 $m^3/(h.m^2)$@50Pa and 35% at 5 $m^3/(h.m^2)$@50Pa or above, with the majority within 1 m^3 of that value.

This indicates that the area of focus of this review should be on properties in the range of 3 to 5 m^3, as a rate easily achieved via current construction. Noting that it should be anticipated that a move to improved fabric values, particularly for walls, will result in further reductions in infiltration due to increased layering and

consistency of the insulation envelope and an increase in properties with infiltration rates below 3 $m^3/(h.m^2)$@50Pa.

The following areas of change are proposed as part of this consultation and are discussed in more detail in the next section:

- Clarification in guidance of the overall level of ventilation sought in new dwellings to reflect normal occupancy and use.
- Review of provision and citation of function of openable windows as purge ventilation.
- Greater clarity on design choices for dwellings where infiltration rates between 5 m^3 and 3 m^3 and below 3 m^3 are proposed.
- Revision of advice on dMEV systems to reflect only 'whole dwelling' use as opposed to current provisions which recognise ventilation of individual rooms.
- Views on the application of mechanical supply and extract systems, including the presence of heat recovery.
- Relocation of guidance from Domestic Ventilation Guide into the Domestic Technical Handbook.
- Emphasis on commissioning and providing information is provided for air flow rate testing and, linking to commissioning of ventilation systems for energy efficiency under standard 6.6.

4.2 Proposals

4.2.1 General revision expansion of core guidance on ventilation provision

We propose to reconfigure how guidance on ventilation is presented for new buildings to emphasise the need to consider solutions in the context of low or very low infiltration buildings. This will emphasise that there are three options available to designers – an approach that will work with any dwelling, regardless of the design intent for infiltration and two approaches that will generally only be viable above a specific infiltration threshold.

Solutions based upon the presence of continuous mechanical extract must be designed to suit the building and its environment, regardless of the approach taken to both extract (centralised/decentralised) or air supply (background ventilators or balanced supply).

Table 9 – Ventilation solutions for design infiltration levels.

Ventilation type	Suitable for infiltration rate:
Natural ventilation (with intermittent mechanical extract)	≥ 5 $m^3/(h.m^2)$@50Pa
Continuous mechanical extract ventilation	≥ 3 $m^3/(h.m^2)$@50Pa
Continuous mechanical supply & extract ventilation	Any

To aid understanding of objectives and to inform system design, guidance will also more clearly explain, in concise terms, what level of ventilation is sought to provide adequate indoor air quality in dwellings. Including information on minimum supply rates that are to be achieved in dwellings with continuous extract, which are also deemed to be achieved by the prescriptive specification offered for naturally ventilated dwellings (infiltration rate not less than 5 $m^3/(h.m^2)$@50Pa) which formed 39% of recent dwelling completions, based upon test data.

The proposed supply rates follow the recent review, elsewhere in the UK, of the assignment of whole dwelling ventilation rates based upon both floor area and the number of apartments (habitable rooms). This makes a standard assumption on occupancy and assumes a base supply rate of 13 litres per second plus an additional 6 litres per second for each additional apartment. Subject also to the supply rate being not less than 0.3 litres per second per square metre of the dwelling internal floor area.

It is also proposed to remove detailed information on passive stack ventilation, as a little used solution, whilst still noting it as an alternative to the use of intermittent mechanical extract.

These changes are illustrated in 'Consultation proposals - Standard 3.14 (Ventilation) Domestic'.

Question 32 –

Do you support the proposed revisions to the presentation of guidance on ventilation and the incorporation of the 'domestic ventilation guide' into the Technical Handbooks?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

4.2.2 Revision of guidance on purge ventilation

Current guidance sets a minimum recommended opening area for rooms within a dwelling, including for apartments. Provision is set at $1/30^{th}$ of the floor area of the room. The purpose of this provision, to enable intermittent increase in ventilation to remove pollutants created by occasional activities, or indeed, assist in ventilation to reduce overheating, is not explained further.

Designers working in other UK administrations will be aware that provisions are already made within Approved Document F on this topic. To assist in greater understanding of the role of ventilation elements and to underpin proposed work on summertime overheating risk, it is proposed to align provisions in Scotland with this established practice.

Guidance will explain the function of 'purge' ventilation as a component of ventilation provision and as a prescriptive solution deemed to support a nominal ventilation level of 4 air changes per hour. We propose to align the basic provision

of openable ventilators from 1/30th to 1/20th of the floor area of the room served to align with practice elsewhere in the UK, noting how the degree of opening of ventilators has on effective purge ventilation.

Note: the role of purge ventilation in reducing heat gain in summer is also discussed under section 5.2.4.

Question 33 –

Do you agree with the revision of guidance to clarify the function of purge ventilation and increase provision to align with that applied elsewhere in the UK?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

4.2.3 Clarification on ventilation solutions in low infiltration new dwellings

As improvements to energy standards have led to greater levels of air tightness in buildings to reduce space heating demand, a consequence is that the ventilation provision in modern homes now has to more commonly be designed to reflect lower levels of fortuitous ventilation through the building envelope.

Low infiltration is defined as a design intent of not less than 3 $m^3/(h.m^2)$@ 50Pa and less than 5 $m^3/(h.m^2)$@50 Pa which is realised on construction. The majority of recent dwelling completions with airtightness tests (58%) are within this category.

In current building regulations guidance, airtight buildings (below 5 $m^3/(h.m^2)$@50 Pa) should be provided with a continuous mechanical ventilation solution. The revised 2015 domestic handbook guidance included the option of decentralised or centralised Mechanical Extract Ventilation (dMEV) for dwellings with an air-tightness of between 3 and 5 $m^3/(h.m^2)$@50 Pa.

Following on from this change in guidance, we engaged with the Mackintosh Environmental Architecture Research Unit (MEARU) to carry out research into the effectiveness of dMEV to act as 'whole-house' ventilation in new build dwellings.

The research, published in 2018[26], highlighted that there were a number of variables that affected performance of the dMEV system. These included the nature of the trickle vents, the window coverings, the path between the room and the dMEV (including the door opening or 'undercut', and the arrangement of the home) and the installation and performance of the system. Essentially homes with shorter, more open paths for air movement performed better, but rooms which relied on more remote dMEV systems frequently had poor ventilation. Whilst there are some situations where a dMEV system can assist with the ventilation provision

[26] Ability of decentralised mechanical ventilation to act as 'whole-house' ventilation systems in new-build dwellings (MEARU/JGA/ABC/ESRU, 2018)

of modern airtight homes, the ability to act as a whole house system is limited, particularly in larger more complex layouts, and where ventilation loads are high.

As such, such solutions as a whole requires the same level of care in design as a centralised mechanical extract system, taking into account the house layout, paths for air movement (including 'undercuts' and pass vents), the nature of the mechanical system, and consideration of remote rooms. The system will only be effective in operation where these are optimised.

On that basis, it is proposed, for design infiltrations rates of not less than 3 $m^3/(h.m^2)$@50 Pa, to be presented on the basis of a whole dwelling continuous mechanical extract system which may operate via a central fan or through a number of separate room extract fans. The solution - **continuous mechanical extract ventilation** - must be applied and controlled to the dwelling as a whole.

Such a system must be designed to deliver the required air supply in habitable rooms, taking into account the location of extract terminals and the sizing of background ventilators. This has to be demonstrated on commissioning of the completed system. In both cases, the rate of extract at each terminal and other relevant elements will need to be reviewed to support the effective draw of air though the dwelling.

Question 34 –

Do you support reference to a single option for continuous mechanical extract ventilation which can have centralised or decentralised fans, with the same design parameters being applied to the system in each case?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

If you have any further views on the use of continuous mechanical extract to deliver effective ventilation in both low infiltration (3-5 m^3) or higher infiltration (5 m^3+) buildings, we would also welcome your comments.

4.2.4 Background ventilators in continuous mechanical extract solutions

Current guidance gives no information on the sizing of background ventilators in continuous mechanical ventilation solutions. This has led to designers citing CIBSE guidance which in turn references information published within English building regulations. Such solutions, principally for whole dwelling decentralised mechanical extract ventilation, are now common.

We therefore propose to introduce guidance on background ventilator sizing to support such systems and the solution proposed reflects research undertaken for review elsewhere in the UK, including the sizing of ventilators to avoid excessive air movement rates. This proposes that the minimum equivalent area of background ventilators in each habitable room should be not less than 5000 mm^2.

Question 35 –

Do you support introduction of proposed guidance on default minimum size of background ventilator for continuous mechanical extract systems?

Yes ☐

No ☐

Please provide a summary of the reason for your view and on any specific concerns which may arise from the proposed level of background ventilation or its application in the design of systems.

4.2.5 Ventilation solutions in very low infiltration new dwellings

Very low infiltration is defined as a design intent of less than 3 $m^3/(h.m^2)$@50Pa which is realised on construction. A small proportion (7%) of recent dwelling completions with airtightness tests are within this category.

Current guidance does not offer a usefully clear recommendation on the use of continuous mechanical extract ventilation (MEV) in such situations. Guidance within section 9 of the 'Domestic Ventilation Guide' recommending that MEV is not suitable for very low infiltration dwellings. This is based upon concerns over the efficacy of background ventilation in dwellings which can be designed and delivered with potentially very little infiltrative ventilation component.

This leaves the advised solution for ventilation systems for very low infiltration buildings as **continuous mechanical supply and extract ventilation**, with or without heat recovery.

We are interested in your views on the continued prescription on the need for continuous mechanical supply and extract in very low infiltration dwellings (less than 3 $m^3/(h.m^2)$@50Pa) and whether solutions without a mechanical supply component can be as effective.

Whilst not directly material to the provision of ventilation, we are also keen to hear you views on whether the presence of heat recovery should be prescribed for all packaged supply/extract systems in new homes, where the declared design infiltration rate will being significant benefit in reducing overall ventilate heat loss.

Question 36 –

Should continuous mechanical extract systems be considered a viable solution in very low infiltration dwellings and, if so, under what circumstances?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We would also like to hear your views on whether heat recovery should be mandated for packaged supply/extract systems

4.2.6 Incorporation of secondary guidance into the Handbook

The fragmentation of guidance on ventilation, particularly in respect of supporting advice for domestic installations has been noted by commentators. We intend to present a revised version of the current 'domestic ventilation guide' as an Annex to section 3 of the Domestic Technical Handbook.

These changes are illustrated in 'Consultation proposals - Standard 3.14 (Ventilation) Domestic'.

In bringing the Domestic Ventilation Guide into Section 3 (environment as an annex), this review therefore emphasises:

- Design of ventilation that assesses the dwelling layout and components of the system and accounting for other key issues such as extract outlet positions and exposure/prevailing winds.
- Reinforcing the need for pass vents between rooms, fire protected where required, ideally at higher levels.
- Consistent application of cited standards for commissioning, testing in use and reporting to demonstrate the system functions as intended.
- Reinforcing advisory standards for noise from installed fans.
- Better design of occupant interfaces of mechanical systems, in particular boost modes as an occupant control element.
- Better advice and information for occupants about the ventilation system, its optimal use, and requirements for maintenance.

Question 37 –

Do you support the incorporating of this additional guidance into the Technical Handbooks?

Yes ☐

No ☐

We would be grateful for comment on the content of the proposed Annex and whether there are elements absent from guidance or which would be better presented within guidance to standard 3.14 itself.

4.2.7 Emphasis on design, commissioning and testing

Sections 6 to 8 of the proposed domestic ventilation annex set out the expected action to test and commission installed ventilation equipment. A summary note on expected action is also set out in clause 3.14.7, making reference to the new Annex text.

This includes verifying that the installed components are as specified, installation is complete and components are operational; controls are accessible and clearly marked; each mechanical supply or extract unit or terminal is tested for airflow at both normal and boost operation and results recorded; for supply/extract system, system balancing of airflow to achieve intended rates in each room.

These changes are illustrated in 'Consultation proposals - Standard 3.14 (Ventilation) Domestic'.

It is proposed that reporting on such matters will be further collated as part of the Compliance Plan approach which will be consulted on later this summer. The intent being that this information is presented to the verifier. One output from this approach is a summary document, passed on to the building owner/occupier, that presents evidence of compliance with the requirements set by building regulations.

It is noted that advice is provided on limiting noise from mechanical ventilation systems but that this is not prescribed as a compliance test. It is expected that this will inform design and specification decisions.

Question 38 –

Are there other elements of the commissioning of ventilation systems that you consider are both practical to implement and useful in providing additional assurance of performance in practice?

Yes ☐

No ☐

If yes, please provide a summary of the topics which should also be considered.

4.2.8 Domestic and Non-domestic ventilation – intent and further review

As noted in section 4.1, a further review of standards and guidance on ventilation in buildings is programmed to commence later this year, with the intent to develop proposal for consultation in 2022/23. Topics identified for this review include:

- Subject to current research, review of CO_2 monitoring provisions introduced in 2015.
- Advice on ventilation assessment and installations as part of planned building retrofit.
- Guidance on minimising ingress of external pollutants.
- Guidance on the wider design and installation to minimise noise from mechanical ventilation systems.
- Consideration of guidance, post-COVID, on evolving good practice on enhanced ventilation provision and use of air recirculation in non-domestic buildings.

Question 39 –

We welcome your thoughts on these or broader topics which would merit consideration as part of the planned review. Please set out your thoughts below, including citation of relevant supporting evidence, where relevant.

4.2.9 General comments

Question 40 –

We welcome any other comments you wish to make on proposed changes to ventilation standards for domestic buildings.

Where practical, please with a reference to any particular issue in the context of the Domestic or Non-domestic Handbook (or both if applicable) and cite any standard or revised guidance clause relevant to the topic.

Part 5 – Overheating risk in new dwellings and other new residential buildings

5.1 Introduction

5.1.1 Background

Overheating in homes occurs when conditions in excess of those acceptable for human thermal comfort or those that may adversely affect human health occur in the internal building environment. Overheating in buildings has been highlighted as a key concern for the health and welfare of people across the UK.

Whilst overheating risk may generally be considered an issue principally for southern regions of the UK, previous research carried out by the Mackintosh Environmental Architecture Research Unit, Glasgow School of Art *et al* assessed 26 new homes in 2013[27] and found overheating instances in over half of the homes (based on the Passivhaus approach to determining overheating criteria).

Within the Climate Change Committees (CCC) report 'UK Housing: Fit for the future'[28] reference is made to there being around 40 heat related deaths per year in Scotland which is projected to potentially rise to between 70 – 280 deaths. The CCC recommend that the Scottish Government, along with the rest of the UK, introduce a new standard that requires the overheating risk to be assessed for new housing and ensure that passive cooling measures are installed at build stage where a risk of overheating is identified.

There is no direct requirement within schedule 5 of the Building (Scotland) Regulations 2004 for buildings to be designed and constructed to avoid the risks of overheating. Standard 6.6 of the energy standards of the building regulations aims to reduce the need for buildings to have active cooling/ventilation systems installed to address periods of high internal temperatures. However, this is set in the context of minimising energy use within the building as opposed to protecting the occupants from the health risks associated with overheating which occurs in buildings.

Standard 6.6 calls for dwellings with little or no cross ventilation, or a high proportion of glazing, to be assessed for high internal temperatures using the calculation methodology within Appendix P of SAP 2012. Where the results confirm that the likelihood of a high internal temperature in hot weather is slight, not significant or medium then this should avoid the occupier installing a mechanical cooling or air conditioning system at a later date. However, this provides only a simplified check of whether the home will have an overheating problem. The SAP methodology does not predict the severity of the overheating risk and the effectiveness of remedial solutions. Furthermore, the whole house / volume approach fails to identify individual rooms at higher risk from overheating. Therefore, it is considered a more robust assessment is needed.

[27] Summary published at https://core.ac.uk/download/pdf/148017305.pdf
[28] https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/

5.1.2 Recent research to support proposals

Over-heating research commissioned in 2019 to support review of standards for new homes and residential buildings in England[29] demonstrated that during warm years, overheating will occur in most new homes in most locations in England, particularly in London. As a consequence of the research a new mandatory requirement has been consulted upon which, if implemented, will require all new homes and residential buildings, to meet a new overheating requirement. The requirement can be met by a simplified method or by demonstrating that the overheating risk has been mitigated through dynamic thermal analysis following the CIBSE TM59 (2017) methodology. The simplified method identifies options for solutions which mitigate solar heat gains plus adequate purge ventilation to disperse the heat.

Similar research, looking at a subset of dwelling conditions, was carried out for the parallel review in Wales with prevalence of overheating found to occur in flats. As a consequence, similar provisions are being proposed for inclusion in the Welsh building regulations, that will apply to flats and houses that cannot be cross ventilated.

To understand the potential risk of overheating in Scotland the same risk assessment was carried out for 5 of the typologies that were found to be prone to a range of overheating in the English and Welsh research. This research paper is published at https://www.gov.scot/ISBN/978-1-80201-193-7.

Table 10 - Dwelling typologies modelled for overheating risk.

Ref.	Dwelling Form	Size	Aspect	Ventilation Strategy	Heating System	Construction Type
1.	Apartment/ Flat	2b4p	Single	Natural ventilation	Individual	Mid-rise
1b.	Apartment/ Flat	2b4p	Single	MEV	Individual	Mid-rise
2.	Apartment/ Flat	2b4p	Dual	Natural ventilation	Individual	Mid-rise
2b.	Apartment/ Flat	2b4p	Dual	MEV	Individual	Mid-rise
3.	Semi-detached house	3b5p	Triple	Natural ventilation	Individual	Timber frame

The models were based on timber frame construction and adopted the 'advanced' specification (Option 2) proposed by this consultation. The floor plans, elevations, fabric specification and building geometry of the dwellings modelled are noted in the research paper.

CIBSE TM59 sets two compliance criteria for dwellings, both of which need to be met to demonstrate an acceptable risk of overheating:

- Criterion A applies to living rooms, kitchens and bedrooms. It requires that the internal temperature does not exceed a defined comfort temperature by 1°C or

[29] https://www.gov.uk/government/publications/research-into-overheating-in-new-homes

more for more than 3% of occupied hours over the summer period (1 May to 30 September).

- Criterion B applies to bedrooms only and requires that the internal temperature between 10 pm and 7 am shall not exceed 26°C for more than 1% of annual hours.

To assess the risk of overheating over the lifetime of new homes, the analysis of internal temperatures should be based on predicted future weather data. The CIBSE TM59 methodology requires the assessment to be carried out using DSY1 weather data (Design Summer Year) for the 2020s. DSY1 (Design Summer Year 1) is intended to represent a moderately warm summer intended to represent 2011 to 2040. CIBSE has published DSY1 weather data for two Scottish locations; Glasgow and Edinburgh. A sample simulation of a dwelling established that the Glasgow weather file resulted in a higher overheating risk. Further analysis of weather data for other locations in Scotland found that mitigation measures proposed for Glasgow should be suitable for controlling the risk of overheating for at least most other locations in Scotland.

The overheating risk has been assessed based on 'Category II buildings', which assumes that the dwellings have a normal level of expectation of being occupied by vulnerable and fragile persons.

Outcome

The results show the semi-detached house and the two single-aspect flats all passed both Criteria A and B of CIBSE TM59. Both dual-aspect flat typologies passed Criteria B of CIBSE TM59 (bedrooms), but both living rooms failed Criteria A albeit to a limited extent.

For the sample dwellings used in the analysis, the greater glazed area of the dual-aspect flat increased the solar gains to the extent that the net effect was to increase the risk of overheating compared to single-aspect flats. It is noted from experience that, depending on the design and location, dual-aspect flats can be at lower risk of overheating than single-aspect flats because the dual-aspect provides the potential to benefit from cross-ventilation (where wind drives greater ventilation rates through the dwelling).

Further analysis explored the impact of providing poorer performing glazing (both U-value and G-value) and being based on Category I occupancy where there is a high level of expectation the dwelling will be occupied by vulnerable and fragile persons. This identified a moderate increase in risk but no further failure.

5.2 Proposals

5.2.1 Scope of application

We propose that any new provision to assess and mitigate against the risk of summertime overheating should apply to all new dwellings, subject to the application of a set of trigger criterion (see section 5.2.2) that determine the need to consider the design and specification of the dwelling further to mitigate such risk. Detail of proposed new provisions are set out in 'Consultation proposals - Addressing Overheating Risk in New Dwellings'.

We would also propose that the same assessment be applied to non-domestic residential buildings where the built form and occupancy is similar to dwellings (e.g. self-contained student flats accessed off a common area).

We would seek views on the broader application of such an assessment to residential buildings where such self-contained living units are not provided and the building offers a managed living environment (e.g. buildings providing residential care for vulnerable persons).

Question 41 –

Do you agree with the proposed introduction of a requirement to assess and mitigate summertime overheating risk in new homes and new non-domestic buildings offering similar accommodation?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

If you consider that proposals should be extended to non-domestic buildings which provide other forms of residential accommodation (which are not 'self-contained residential units'), we welcome your views on such provisions, including if the same or an alternate approach to assessment is recommended?

5.2.2 Application of criteria for assessment

The limited analysis presented in the referenced 2021 research suggests that, whilst risk may be low in Scotland compared to other parts of the UK, overheating can still occur and reasonable steps can and should be taken to assess and mitigate such risk.

Whilst analysis has identified that the greatest risk of overheating is found in flats and buildings with less scope for cross-ventilation, we propose that initial assessment should be undertaken on every new dwelling to identify relevant characteristics and also assist in embedding awareness of the issue of overheating risk. This will provide opportunities to avoid not only peak overheating but also improve summer comfort in new dwellings by understanding risk and how it can be mitigated by design choices and passive solutions.

Action to mitigate summer overheating risk must be considered against the desirability of good levels of daylight to new homes and the benefits derived from useful solar gain outwith the summer months in reducing space heating demand. Proposals are drafted with this intent in mind.

For the purpose of risk assessment, we propose that geographical location of a development in Scotland is not be considered a material factor.

Where any trigger elements are present, it is expected that either mitigating measures are put in place or that further modelling is undertaken to identify

whether overheating risk, as defined in the context of TM 59 is present. Trigger elements proposed relate to:

- Extents of glazing on building elevations oriented between east, south and west (impact of solar heat gain).
- Number and adjacency of external elevations (impact of cross-ventilation on heat removal).

This enables either a simple elemental process without any additional modelling or, should the developer choose to, the flexibility of demonstrating compliance through the use of dynamic thermal modelling.

Detail of proposed new provisions are set out in 'Consultation proposals - Addressing Overheating Risk in New Dwellings'.

Question 42 –

Do you agree with the proposal that an initial assessment of dwelling characteristics should be undertaken to help inform design choices and the delivery of new homes which provide better thermal comfort in the summer months?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We would also seek the views of respondents on other sources of good practice guidance which have been implemented by developers and the outcome (no reports of significant summertime overheating) evidenced through feedback from residents.

5.2.3 Options for mitigation

As noted above, two approaches to demonstrating compliance are proposed:

A. Simple elemental approach.

Where triggered by building characteristics, measures are implemented which limit unwanted solar gain in summer months and provide the means of removing heat build-up from the building. This is discussed in section 5.2.4.

B. Dynamic thermal analysis

The dynamic thermal analysis method uses CIBSE TM59 'Design methodology for the assessment of overheating risk in homes' (noted in section 5.1.2) to demonstrate that any risk of overheating, assessed against the criteria defined by the methodology, are addressed. This approach uses the dwelling location, detailed information on the building form and specification and prescribed occupancy scenario to calculate the risk of overheating. It allows for greater

flexibility in the selection of risk mitigation measures to meet the overheating criteria, while prioritising passive measures.

Those undertaking such modelling should be able to demonstrate competence in the application of the methodology, the underlying principles of overheating and in building construction.

The purpose of the proposed process is to address overheating risk through design choices, specification and passive measures. Active measures such as air-conditioning should only be proposed where it can be demonstrated that design changes and passive measures fail to adequately mitigate overheating risk or are impractical for the development location. This would require the applicant to demonstrate the options investigated were found, through modelling, to be insufficient.

Question 43 –

Are there circumstances where you consider specific characteristics of a dwelling should trigger a need for TM59 assessment rather than application of a simple elemental approach?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

5.2.4 Scope of simple mitigating measures proposed

Detail of proposed new provisions for the simple assessment option are set out in 'Consultation proposals - Addressing Overheating Risk in New Dwellings'. These are:

A. Limiting solar gain through glazed openings.

Assessment should be undertaken on all building elevations which are oriented between east (90º), through south (180º) to west (270º).

Except single aspect dwellings or those with adjacent aspect, both oriented outwith the described orientation, this will require the assessment of at least two elevations.

It is proposed assessment will be at room level rather than be based upon the total areas of glazing and the dwelling. This provides greater assurance of thermal comfort in individual apartments and other habitable spaces. Assessment should consider the area of glazed opening based upon the room or space each opening serves.

- **Action:** If the area of glazed opening is greater than 25% of the area of the room or space served, then provide shading or revise glazing g-value to reduce solar gain in proportion to the increase in glazing area above 25%. It is proposed that this should be based upon the assumption of equivalence with an unshaded 25% opening with a g-value of 0.6

It is not the intent of assessment to preclude larger areas of glazing, simply to recognise that increased areas of glazing which can contribute to excess solar gain in summer months. Solutions should mitigate such gain, either through a revised glazing specification (lower g-value) or by the fitting of shading such as louvres or shutters. Specification of glazing should, where practicable, seek to retain a high light transmittance value to minimise adverse impact on daylighting.

B. Ventilation to assist in cooling.

Assessment should be undertaken on all dwellings based upon their number of exposed facades which incorporate openings which provide ventilation to apartments or other habitable spaces.

- **Action:** Where a building has only one elevation with ventilation openings (single aspect) or two adjacent elevations with ventilation openings, the minimum area of ventilation openings in apartments should be increased from 1/20th (5%)– as proposed in Section 4.2.2 of this document - to 1/10th (10%) of the floor area in each room or space.
- **Action:** Where a building has two or more elevations, including two parallel elevations, with ventilation openings, no further action is required to support ventilation for heat removal. This will be addressed by provision of ventilation openings which provide the level of air change sought under standard 3.14 (4 air changes per hour),

Question 44 –

Recognising the level of risk identified in the published research paper, do you agree with the above proposals as a suitable means of mitigating summertime overheating in new homes through prescriptive actions?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

5.2.5 Practicality of solutions

Where measures are implemented to mitigate overheating risk, they should be achievable in use. This will commonly require consideration of the environment within which the building sits.

This is particularly relevant to the use of ventilation to reduce levels of overheating. Issues arising from both noise from the immediate environment and air pollution should be considered. Such matters are usually material considerations in the granting of planning permission for development and any proposed mitigation measures should be compatible with issues already identified at the development (for example location of a façade adjacent to a busy road). Such issues are likely to influence other aspects of project design, including the ventilation strategy.

Similarly, where issues such as security are a concern and it is not considered practical to simply open windows to assist in cooling, further assessment of overheating risk or alternative solutions may need to be considered.

Where conflicting objectives are identified, this may make the case for dynamic thermal analysis more relevant as a means of demonstrating risk is assessed and managed.

Similarly any mitigation should not require occupants to circumvent measures intended to deliver a safe environment in respect of issues such as the risk of a fall from height through openings.

It is proposed that an assessment and statement on how these matters are considered as part of mitigating any identified overheating risk will be sought as part of the building warrant application. This should reference any relevant conditions set under the Planning regime for the development. As is the case with information on building services under the current standard 6.8, such information should be included within written information provided to the building occupant to assist in understanding how the issue of summer overheating is addressed at the building. Detail of proposed new provisions are set out in 'Consultation proposals - Addressing Overheating Risk in New Dwellings'.

Question 45 –

Do you consider that such an approach will provide adequate assurance that ventilation measures provided to mitigate summer overheating can be used safely and conveniently in practice?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

5.2.6 General comments

Question 46 –

We welcome any other comments you wish to make on these proposal to introduce provisions to mitigate the risk of summer overheating new homes and new residential buildings.

Part 6 – Improving and Demonstrating Compliance

6.1 Introduction

6.1.1 Background

There is already a significant body of research into the gap between designed and as-built energy performance of buildings. Improving performance and compliance was identified as one of five themes by the UK Committee on Climate Change in their 2019 report on UK housing[30].

There are a number of factors which can influence a 'performance gap between design intent and energy consumption in use.

- It is recognised that overall building performance, as illustrated by the SAP or SBEM calculation, is based upon a standardised set of assertions on building operation and use. Developing a greater understanding of how calculated and actual performance can be referenced and compared is noted as a topic for future discussion and development.
- Occupant behaviour is also a significant variable. Not one which can readily be addressed through regulation but through education and the provision of the means to understand and use our buildings more effectively, including clear information on the building and its systems and smart or simple and intuitive controls for building services.
- Unconsidered design or poor implementation on construction ('build quality') is generally recognised to be a major factor in issues with building performance. This is a an aspect of the equation which can be addressed, to a degree, through building standard processes through an improved and more evidenced compliance regime. But it is also reliant upon wider application of good practice across the construction sector.

Issues can arise from poorly considered specification or detailing, product substitution, poor installation or failures in commissioning and also the provision of inadequate information to end users. At best, this results in increased energy use; at worst, risk of building elements degrading or creation of a less healthy internal environment.

There is a recognised need to develop and implement proposals which provide greater assurance that that energy efficiency requirements specified through standards and guidance are properly considered at design stage and, on construction, delivered in practice.

The focus of this review is on simple steps which can be taken to increase assurance that the design intent for a building is delivered effectively. Though evidence of design risk assessment and robust quality assurance, supported by performance testing, the intent is to remove common deficiencies in the design or construction process as major contributors to adverse performance.

As part of this review and ongoing development of the Compliance Plan approach (see section 6.1.2 and 6.1.3 below), we seek to identify the extent to which

[30] https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/

prescription within building regulations can support a more consistent and better outcome from an energy use perspective and provide more assurance on both design and construction processes. This paper discusses two components that contribute to that outcome:

- The current development of the Compliance Plan approach to provide more assurance on both process and outcome.
- Specific issues which can be addressed within amended standards and guidance to section 6 (energy).

6.1.2 Improving compliance with building regulations generally.

The Scottish building standards system is pre-emptive. Other than for limited scope of works where a building warrant is not required (covered in schedule 3 to regulation 5)[31], it is designed to provide assurance that proposed building work meets standards through verification of the proposed design and the subsequent issue of a building warrant prior to works commencing; and oversight by the verifier, to the extents required through their duty of 'reasonable inquiry' to support consideration of the completion certificate submitted by the applicant.

It is important to note that verifier inquiry does not provide a system to control work onsite. That is a matter for contractual arrangements put in place by the person ultimately responsible for the work (who has the duty to deliver a compliant building) and the other parties engaged to design and construct the building.

The current building standards system places the requirement to comply with the building regulations on the Relevant Person (normally the owner or developer). The Procedural Handbook, which provides clarification on the processes underpinning the Scottish building standards systems, clarifies that inspections (and other checks) made by verifiers during construction and on completion are intended to protect the public interest, specifically in relation to compliance with building regulations and to discourage the avoidance of legislation.

In his report on Compliance and Enforcement (2018) Professor John Cole noted that this responsibility would benefit from reinforcement through evidenced process:

> "It must be made clear that it is the legal responsibility of clients for all buildings that will be occupied, used, worked in or visited by members of the public to ensure that these buildings are compliant with the regulations. This responsibility should include a requirement on the client and appointed agents to the client to provide Building Standards services with the necessary evidence to demonstrate compliance."

The proposed Compliance Plan approach seeks to define and implement an appropriate and robust assurance regime to demonstrate that the duty imposed on the Relevant Person is being managed robustly at both design and construction stage. This will give greater, and better evidenced, assurance that the outcome of works will be a compliant building. From the perspective of energy performance,

[31] See here for the current regulation, commentary and schedule.

this means greater assurance that the declared performance will be achieved in practice.

6.1.3 The Building Standards Futures Board

The Scottish Government, through Building Standards Division (BSD), is developing a national Compliance Plan approach to provide greater assurance that compliance with building regulations is achieved from design to completion.

Following the tragic fire at Grenfell Tower in 2017 a Ministerial Working Group[32] was set up to review building and fire safety regulatory frameworks. The Group commissioned two review panels for building standards; Compliance and Enforcement and Fire Safety that subsequently published their own recommendations. As part of the Compliance and Enforcement review[33], consideration was given to issues and findings from the independent inquiries into the construction of both Edinburgh Schools (Cole Report) and the 'DG One' leisure complex in Dumfries. This included the importance of site inspections and supervision and the role, responsibilities and competence of different persons involved in building projects.

A public consultation 'Building Standards Compliance and Fire Safety – a consultation on making Scotland's buildings safer for people'[34] was carried out between July and September 2018. The responses were supportive of change to strengthen current building standards guidance to improve building quality, compliance and enforcement. Eighty two percent of respondents agreed that a 'Compliance Plan' should be provided to demonstrate compliance with the building regulations from concept to completion.

As a result, the Building Standards Futures Programme Board[35] was set up to provide guidance and direction on the development and implement of the recommendations made by the Review Panels on Compliance and Enforcement and Fire Safety.

The Board's remit is to strategically advise and direct a broad programme of work aimed at improving the performance, expertise, resilience and sustainability of the Scottish building standards framework and services across Scotland. Recommendations are being taken forward through seven work streams which are interlinked and collectively aim to drive transformation of the building standards system in Scotland

This includes a current Working Group focussing on the development of a new, extended and strengthened 'Compliance Plan' approach to the delivery of projects subject to the building regulations. The aim being to deliver greater assurance, through evidenced process, that buildings are compliant during both the design and construction stage.

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[32] https://www.gov.scot/groups/ministerial-working-group-building-and-fire-safety/
[33] https://www.gov.scot/publications/building-standards-compliance-and-enforcement-review-panel-minutes-index/
[34] https://www.gov.scot/publications/building-standards-compliance-fire-safety-consultation-making-scotlands-buildings-safer/
[35] https://www.gov.scot/groups/building-standards-futures-board/

6.1.4 The Compliance Plan Approach.

Following significant review and research into other quality assurance schemes, including that implemented in support of the Construction, Design and Management Regulations and initiatives to improve building regulations in other administrations (including a study of recent work in Ireland), a Compliance Plan Working Group was convened and held its first meeting on 28 October 2020.

The remit of the group was set out as follows:

- To undertake a comprehensive and open discussion around the reality of why non-compliance occurs, something which has been described as a systemic issue within the construction industry.
- To make recommendations for a system which would provide greater assurance that the need, and legal responsibility, to comply has been understood by building owners, designers, contractors and then supported by verifiers from concept to completion.
- To review the existing approach to compliance, identifying strengths and weaknesses, to identify and recommend potential changes that could strengthen the compliance system.
- To consider the roles and responsibilities of those involved in the process, including skills needed to undertake particular roles or new roles, including the independence and reliability of oversight during construction.
- To consider whether a strengthened approach to compliance should focus on high risk projects and safety critical elements or whether the approach should be tailored to apply to all. (note: the intent is the latter)
- To develop and make recommendations for a potential new Compliance Plan approach, including on the status needed within the building standards system to deliver the most effective outcome.
- To consider and recommend the best way of implementing a new Compliance Plan to have maximum effect, including associated procedures and enforcement.
- To consider what should be done in Scotland to embed a stronger culture of compliance throughout the construction industry?

To date, the main group has met three times. There are also three themes sub-groups examining core aspects of the compliance process. These are noted below.

Compliance and Enforcement

How the proposed new process and role would integrate into the current building standards system, retaining but expanding the current Construction Compliance and Notification Plan (CCNP) regime. It would also consider pre-application discussions for high risk buildings and establish the required evidence and documentation that will be collected and submitted to demonstrate compliance with the building regulations. Both as part of a recommended process to support a more informed approach to verification and also identify the potential to mandate

specific actions through amendments to legislation where necessary. We anticipate that some changes can be made without changes to legislation and will be deliverable through updated guidance and established processes.

Considering resourcing from a verification perspective and the need to consider enforcement and penalties arising from failure to implement due process when demonstrating compliance.

Considering how related aspects of process may require to be amended to support an effective 'gateway' approach and validation of activity at key points in the design and construction process.

Quality of Applications

Work to support the development of best practice guidance for applicants to improve the quality and consistency of information submitted in support of a building warrant application. Action based upon clear knowledge and understanding of the building standards system, the requirements for an application and the responsibilities of a building owner/applicant, directly or via their agent.

Consider the key attributes which make a quality building warrant application and recurring quality issues with applications. A survey of verifiers in such matters was commissioned recently and is being analysed to report to the group.

Reflect on the need for consistency in analysis and reporting from verifiers as well. A consensus on the benefits of standardised national guidance on the level of quality expected of a building warrant application, avoiding the need for guidance by each verifier. Examples of topics under discussion include:

- Reinforcing the responsibility and duty of owner/applicant.
- Encourage the use of a professional should the applicant not have the knowledge and understanding required, linking to Compliance Plan Manager.
- Noting the role of Certification of Design to assist in the quality of applications.
- Guidance to be appropriate for the lay person as well as the professional, not be overly prescriptive. Investigate formats that promote informed action beyond simple checklists.

The Compliance Plan Manager Role

Creating the role of Compliance Plan Manager to oversee compliance with building regulations from concept to completion on behalf of the Relevant Person and be the verifier's point of contact to support the verification process. The Compliance Manger's role would be to support the building owner and assume responsibility for managing the actions of others which are needed to provide assurance that work is completed in accordance with building regulations and all agreed verification compliance requirements are met and documented.

Any new compliance system will need to re-establish full awareness of the role of building standards and that of the Relevant Person. Setting out the requirements of this role which may include the need to appoint a separate Compliance Plan Manager to oversee the project on high risk building types, from concept to completion.

The proposal is to strengthen the building standards system for all users and therefore we are considering similar provisions for lower risk building types. Where the Relevant Person does not have the requisite skills, knowledge or experience to undertake the role, they would need to declare at the outset who would be acting as their duly authorised 'compliance' agent.

Action at early design stage

The current verification and construction process would benefit from being 'bookended' by a more informed and evidenced approach to the initial design, from a compliance risk perspective and the provision of key summary information on the delivery of a compliant building on completion, in support of both the verifier and the relevant person and subsequent users of the building.

Investigating action which can be prescribed prior to submission of a building warrant. From the perspective of an informed and complete building warrant application, action early on at the start of the design stage is needed, including identifying how compliance has been approached. The Construction Design and Management (CDM) Regulations requires that the 'Principle Contractor' completes a 'Construction Phase Plan' prior to work commencing on site. Feedback at workshops with designers confirmed that the majority of practices already carry out building regulation compliance checks internally. However, this is not recorded on a formal document that is submitted with the warrant package to the Local Authority verifier. The consensus was that submitting this information would reduce enquiries from LA verifiers and assist the verification process. Verifiers have agreed that receiving a document like this with the warrant submission would be highly beneficial.

On completion - construction compliance evidence documents

The collation of this documentation will improve the robustness of the completion process by delivering evidence of compliance above and beyond that gathered by the verifiers during their undertaking of reasonable inquiry.

The Cole Report on Compliance and Enforcement[36] recognised that due to the limited number and level of detailed inspections that can practically be undertaken by Building Standards services, more onus must be placed on owners and developers to provide specific and documented evidence of the build process to show buildings having been constructed in compliance with the approved design warrants.

Such evidence of competent process can, in summary, also provide greater assurance and, if necessary, redress for those that subsequently take on responsibility for a completed building or building works.

Current position and timetable

The intent is to develop proposals for consultation in late summer 2021. In parallel with that process, Building Standards Division (BSD) is seeking to partner with selected verifiers and developers to trial some of the key elements of the Compliance Plan process to understand better how it can be integrated into the

[36] https://www.gov.scot/publications/report-review-compliance-enforcement/

current activity of designers, contractors and verifiers. At this point, a timetable for potential implementation of the new regime has yet to be set out but it is anticipated that following the required process of consultation, analysis and finalisation, along with a lead in time for industry, this would likely result in an in-force date in 2023/24.

Again, to restate that, whilst this workstream arose from a need to address the most significant risks from non-compliance, those relating to life safety, it is intended that the Compliance Plan Approach will be applied to all mandatory requirements for buildings set under the building regulations and verified where a building warrant application is required.

6.1.5 Improving compliance with energy standards - themes.

In late 2019, BSD commissioned a short research project to assist in understanding the issues that arise in the delivery of low energy buildings and how greater assurance of process could be delivered, focussing primarily on building fabric issues. The output of the project was not intended to be a guide for designers and contractors but to inform the later development of such a resource.

It is intended to now progress this agenda, extending scope to include the design, installation and commissioning of building services, in the context of the Compliance Plan approach. We are commissioning the development of a 'compliance manual' to support effective delivery of compliance with Section 6 (energy) in a format which would be compatible with the Compliance Plan approach and supporting core guidance.

Question 47 –

Do you have any experience of successful design or construction quality assurance regimes which you consider may be useful to consider in the context of this 'Compliance Plan manual' work for section 6 (energy)?

Yes ☐

No ☐

If yes, please share any relevant information.

As this point in time, further detail on the timetable and format needed for such information to support this approach is still in development. But we would anticipate the following themes:

- **Informed design**

  The need for the party intending to commission building work to engage at an early stage with consultants who can demonstrate (to the satisfaction of the applicant) competence in the design and delivery of low energy buildings. Applying the basic professional principle of not operating outwith the scope of ones' competence.

- **Risk assessment**

  The need to investigate and set out how compliance with the requirements of section 6 (energy) will be achieved; identifying key risks arising from design or specification choices, the approach taken and how they will be managed/mitigated.

  Avoidance of declaring design values without demonstrating an understanding of how these will be achieved in practice.

  To prepare a summary of this process in support of proposals submitted for building warrant to aid interrogation of proposals by the verifier as part of the Compliance Plan approach.

- **Calculation**

  Following action initiated by other UK administrations to review the benefits that can be derived from improved compliance reporting output from SAP/SBEM calculation software.

- **Communication**

  Advice on good practice to support clear cross referencing of calculated values and source of data (U-values and psi values) with elements presented in drawings and specification. Improving the clarity and presence of statements in guidance that set out the expectation for the design and construction and testing/commissioning of building elements.

- **Competence**

  In the context of an improved and better evidenced process, discussion on the benefits of defining competence of actors involved in various aspects of the energy design and construction process. Including, but not limited to, the correct use of calculation software, determination of thermal performance, design and specification of building systems and controls.

- **Commissioning**

  A more comprehensive and standardised approach to summarising the commissioning and performance testing of installed building services. Supported, at design or pre-construction stage, by a clear scheduling of specified services and their declared performance to assist in validation, post-commissioning.

- **Defining appropriate quality assurance of construction**

  Engaging with the verifier to develop and agree the inspection, reporting and quality assurance regime which will be implemented on construction (where the Compliance Plan will expand upon the current Construction Compliance Notification Plan (CCNP).

- **Performance testing**

  A discussion on the range of diagnostic tools which may be beneficially employed to verify the performance of particular aspects of construction, during or at the end of the construction process.

This might include action such as proactive use of additional airtightness testing at an earlier point in the construction process or the use of thermography to support/augment visual inspection of fabric installations.

- **Use of data**

  For ease of validation - better and more consistent recording of the sources cited for declaration of performance, reporting on commissioning and the outcomes of testing; adopting facilities already in place by industry bodies where available.

We consider it is important to emphasise that provisions introduced into guidance should reference current good practice and are intended to reinforce the need for this, not create new obligations. Noting that some expansion of provisions specific to the building standards system, such as the wider regime for airtightness testing, will attract some small additional on-costs.

It is not, therefore, expected that a more informed and evidenced approach to the delivery of energy efficiency in buildings should result in significant additional capital cost to development (compared to expected practice), beyond the need to engage a coordinating individual to manage the process.

Question 48 –

Do you have any comments on the above themes and any other actions you consider would be useful in supporting improved compliance with requirements for energy and emission performance.

Yes ☐

No ☐

If yes, please provide a summary of your views.

6.1.6 Improving compliance with energy standards – topics of interest.

There are existing elements describe elsewhere in this consultation which are emphasised to support improved outcomes, including enhanced airtightness testing (section 2.2.14 and 2.2.15) and reinforcing the need for effective design and commissioning of ventilation systems (section 4.2.7)

Specific further issues to consider and address are summarised below.

Evidence of compliance

- Installation QA – not to be specified within Section 6 guidance but will form part of the Compliance manual developed to support the proposed Compliance Plan process. This would include (it is proposed) documentary and pictorial evidence of installations at key stages to show the correct application of construction practice. Suggestion that this body of evidence is retained by the developer and a summary prepared and issued to both the verifier and client on completion, to inform occupation and future maintenance of the building.

- Verification of installed products and services against the declared building warrant specification, including confirmation of specific products used where a performance specification was approved; and recording of any changes in specified products to confirm declared performance/function in not adversely affected.
- Full documentation of any changes made from the issued building warrant, during construction including confirmation of products used where only a performance specification was included at warrant stage. More effective use of the Amendment to Warrant process to record such changes.
- Submission of an as-built compliance calculation (SAP compliance check) to reflect any changes made during construction, to confirm design intent is achieved.

Building fabric, design stage

- Emphasis at design stage on defining a deliverable approach to the continuity of the insulation envelope. Air and vapour control layer (AVCL) – location and continuity, penetrations and critical junctions.
- Thermal Bridging at junctions – buildable details with deliverable sequencing. Visual representation (e.g. wire frame) of all junctions and linear bridging with dimensions, key to relate to schedule of values used, including source of data.
- An understanding of achievable infiltration rates for a specified construction and specification of ventilation accordingly.

Building fabric, construction stage

- Fabric insulation – correct and complete installation, avoiding loose fitting of insulation and gaps which will provide unwanted air pathways. Airtightness testing at key stages – benefit of checking on completion of AVCL at first fix, prior to sheathing? On larger projects, use of thermography on early completions once heating is available to validate implemented QA regime?
- Per section 2.2.14 and 2.2.15, mandate airtightness testing of each building (review of EPC data indicates 1 in 3 dwellings tested), noting that partial testing of large ND buildings may be the only practicable solution. Move to use only testers registered with a supervising body who provides central registration of all test certificates and QA of tester output.

Building services, design stage

- The need for an informed approach to system design to suit building characteristics; issues such as plant sizing and the interaction and control of systems.
- Ventilation - clarity on the expectation at design stage, system design recognising need for testing and commissioning to confirm design intent.
- Commissioning Plan forms part of building warrant application and is carried into Construction Compliance Notification Plan / Compliance Plan.

Building services, construction stage

- Review of specification and how it will be implemented to identify any risks that may impair operational performance (routes, sequencing, materials and installation standards). Incorporation into overall construction quality assurance plan.
- Commissioning – must provide validation of the declared performance, for both function (measurable output/effect) and energy consumption associated with that function (efficiency). Inclusion of commissioning information within Compliance Plan summary.
- Review of documentation on installed systems provided to end user to confirm clarity and completeness; to inform operation and maintenance.

Question 49 –

Are there particular aspect so building design and construction which you consider should be prioritised as part of the development of a detailed compliance manual for section 6 (energy)?

Yes ☐

No ☐

No view ☐

If yes, please provide further details, including any evidence you are aware of that supports such emphasis.

6.1.7 General comments

Question 50 –

We welcome any other comments you wish to make on these topic of improving compliance of building work with the provisions within section 6 (energy) to better align designed and as-built performance.

Part 7 – Electric Vehicle Charging Infrastructure

7.1 Introduction

The Scottish Government is committed to the decarbonisation of transport and with demand for Electric Vehicles (EVs) expected to grow rapidly, enabling people to switch to zero emission vehicles, will require ready access to convenient and reliable EV charging infrastructure.

This part of the consultation is seeking views on our preferred policy options relating to the installation of EV charge points and enabling infrastructure (namely accessible trunking, conduits or cable trays for electricity cabling) to facilitate the future installation of EV charge points in the car parks of residential and non-residential buildings.

7.2 Policy and strategic context

The transport sector is the largest emitter of greenhouse gases in Scotland, accounting for 29% of all emissions in 2019[37]. Road transport accounted for 66% of overall transport greenhouse gas emissions in that period, with cars accounting for 38% of that total.

The Scottish Government's Climate Change Plan update (CCPu), published last December, set out the pathway to meet Scotland's statutory greenhouse gas emission reduction targets by 2032[38]. This includes an aim to phase out the need for new petrol and diesel cars and vans by 2030.

Both the CCPu and the National Transport Strategy 2 recognise that, whilst there is an ambition to significantly reduce car demand through support for public transport and active travel, supporting the uptake of EVs will play an important part in addressing the climate emergency[39]. In addition, EVs will improve air quality in our towns and cities and play a key role as part of a sustainable transport system. Therefore, our aim is to ensure a transformative shift to sustainable, zero emission mobility in Scotland that delivers three outcomes:

- People and places benefit fairly from the shift to sustainable, zero emission mobility.
- Scotland at the forefront of markets for zero emission mobility.
- Scotland as a global destination for innovation and investment in sustainable, zero emission mobility.

To incentivise early-stage uptake of EVs, we have invested over £45 million in ChargePlace Scotland, Scotland's largest public EV charging network, which now has more than 1800 publicly available charge points throughout Scotland. This investment means that there are more rapid EV charge points per 100,000 in

[37] Scottish Greenhouse Gas statistics: 1990-2019 - gov.scot (www.gov.scot)
[38] Securing a green recovery on a path to net zero: climate change plan 2018–2032 - update - gov.scot (www.gov.scot)
[39] National Transport Strategy 2

Scotland than anywhere else in the UK (and in overall charge points Scotland is second only to London)[40].

We have also made available over £85 million through the Low Carbon Transport Loan to help consumers and businesses meet the upfront cost of purchasing an EV and, in 2020, this was extended to the second hand market. In addition, funding has also been provided to almost 10,000 households and businesses seeking to install charging infrastructure at home or work premises.

We are focused upon ensuring that all consumers and businesses benefit from affordable, reliable and accessible charging infrastructure in Scotland. Through our Strategic Partnership with the electricity Distribution Network Operators (DNOs), for example, we have evidenced the benefits and efficiencies of a coordinated approach to the planning and delivery of electricity infrastructure to enable EV charging[41].

In addition, our work with Scottish Futures Trust aims to create the conditions to enable more private sector financing and delivery of Scotland's public EV charging infrastructure. Therefore, whilst the focus of this consultation is on the EV infrastructure requirements for car parks of buildings, it complements a wider body of work that is seeking to meet the future demand for EV charging.

We recognise that we cannot treat the electrification of the transport system in isolation. The CCPu also sets out how we are committed to developing regulations requiring new homes from 2024 to use zero direct emissions heating systems – with similar requirements for new non-domestic buildings to be phased in from 2024 – through a New Build Heat Standard. While it is envisaged that the Standard will be technology neutral, there is a strong likelihood that the electrification of heat will increase substantially through the use of technologies such as heat pumps in new developments. The combination of electrification of heat and EV charging has the potential to place additional demands on the electricity requirements of buildings and on local electricity networks.

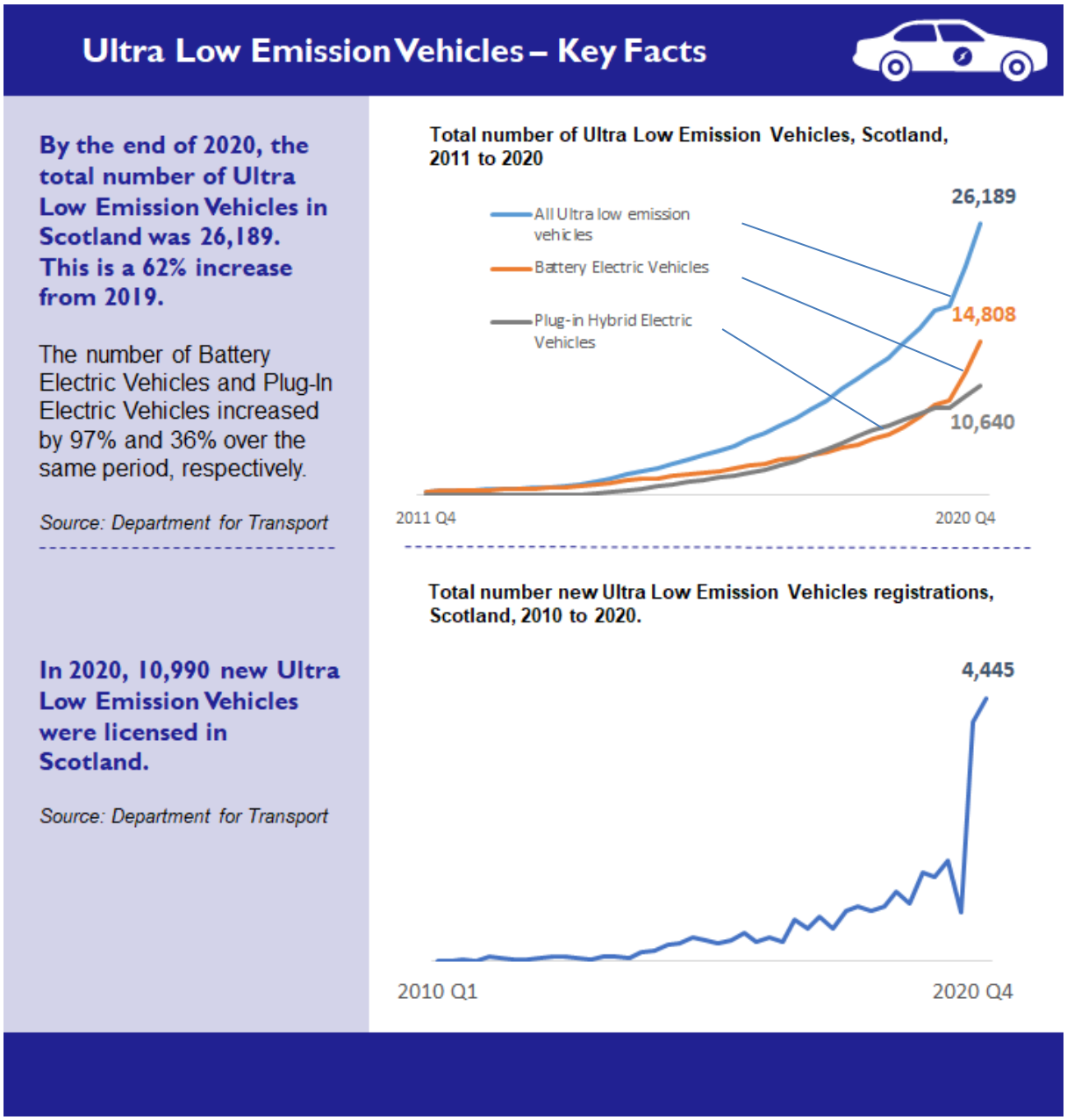
We continue to work with the DNOs, Transmission Operators and Ofgem to ensure that the electricity system is ready to meet this additional demand and that required investments align with our pathway to Net Zero.

7.3 Scotland's progress in uptake of EVs

Data from the Department for Transport (set out in the graphic below) demonstrates that Scotland is experiencing a growth in uptake of Ultra Low Emission Vehicles (ULEVs) that has risen steeply over the last few years[42]. The number of new registrations of ULEVs rose to 10,990 in 2020, representing an almost 117% increase in numbers compared to 2019[43].

[40] Electric vehicle charging device statistics: April 2021 - GOV.UK (www.gov.uk)
[41] Scottish and Southern Electricity Networks and SP Energy Networks
[42] Defined by the Department for Transport as a vehicle reported to emit less than 75g of CO_2 from the tailpipe for every kilometre driven; Department for Transport Vehicle Licensing Statistics – VEH0132 Licensed Ultra-Low Emission Vehicles by Local Authority: United Kingdom
[43] Department for Transport Vehicle Licensing Statistics – VEH0172 Ultra-Low Emission Vehicles registered for the first time by region: United Kingdom

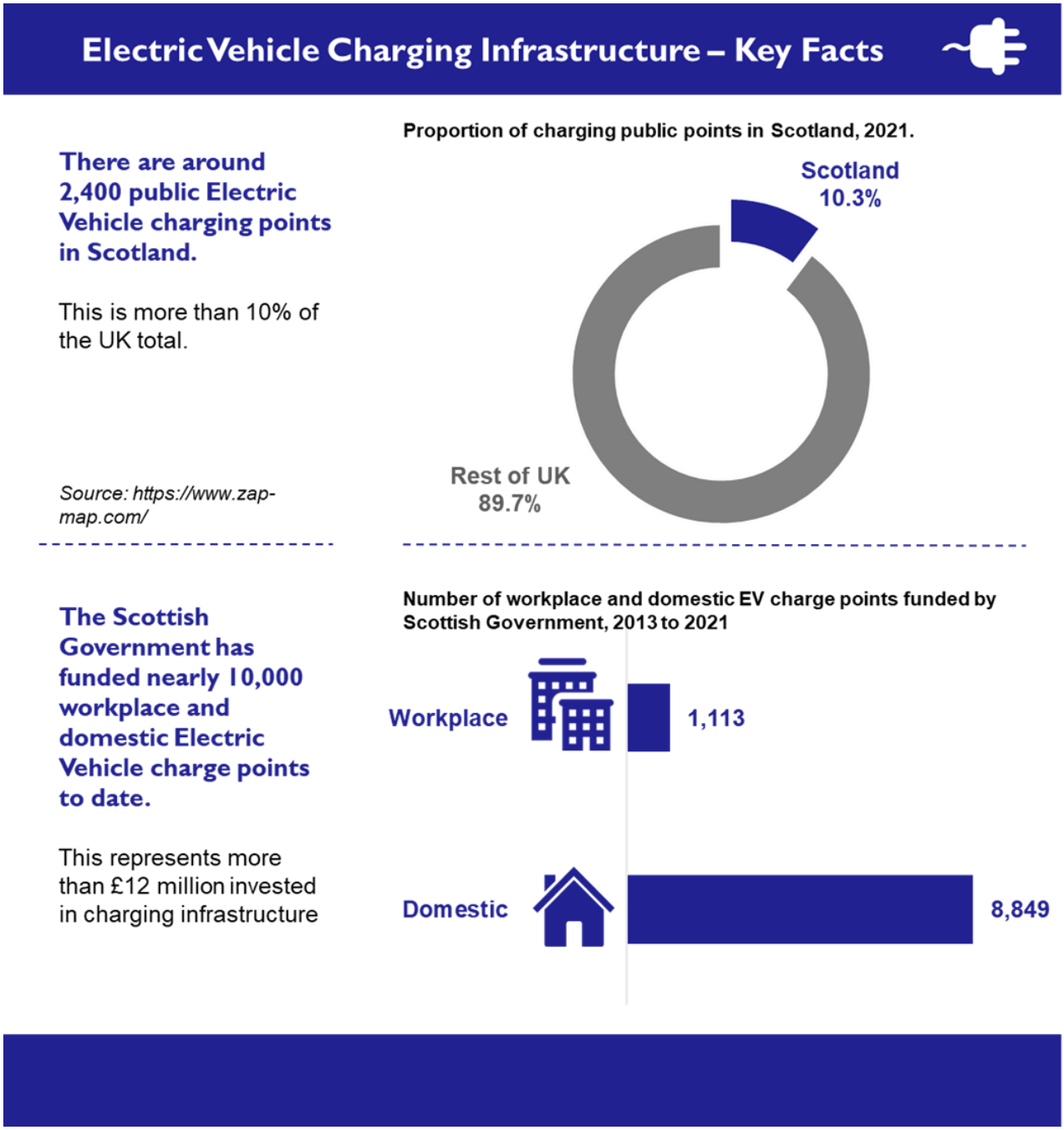
Figure 2 – Ultra Low Emission Vehicles – Key Facts



Over the next 5 to 10 years, we will see technology advances (particularly in battery efficiency and range) and the likely corresponding reductions in battery costs will rapidly drive increased ownership of ULEVs. In addition, major investment by the automotive sector to bring a wide choice of EVs to market (with a number of manufacturers committed to producing only fully electric new vehicles by 2030), alongside both our and the UK Government's 2030 'ban' on the sale of new petrol and diesel vehicles, will also be significant drivers to this change. Therefore, this expected rapid growth must be matched with corresponding growth in the availability of comprehensive and convenient EV charging infrastructure.

7.4 EV charging infrastructure – meeting future demand

Figure 3 – Electric Vehicle Charging Infrastructure – Key Facts



7.4.1 Introduction

Availability and convenience of EV charging infrastructure is frequently cited as an negative factor impacting an individual's decision to purchase an EV[44]. To overcome this barrier, growth in EV uptake will need to be matched with growth in reliable and convenient charging infrastructure that puts consumer needs first. Overnight charging of an EV at home, for example, provides a convenient opportunity for many households. Similarly, opportunities to charge at other locations, including at workplace and leisure destinations, will be important for

[44] As reported in Transport and Travel in Scotland 2019: Results from the Scottish Household Survey

those without a dedicated driveway and to meet charging needs on longer journeys.

7.4.2 Public EV charging infrastructure

Scotland currently benefits from having around 43 publicly available EV charge points per 100,000 population and there are more rapid EV charge points per 100,000 in Scotland than anywhere else in the UK (and in overall charge points Scotland is second only to London)[45]. This is reflective of our commitment to invest in EV charging infrastructure ahead of need, in order to support and encourage uptake.

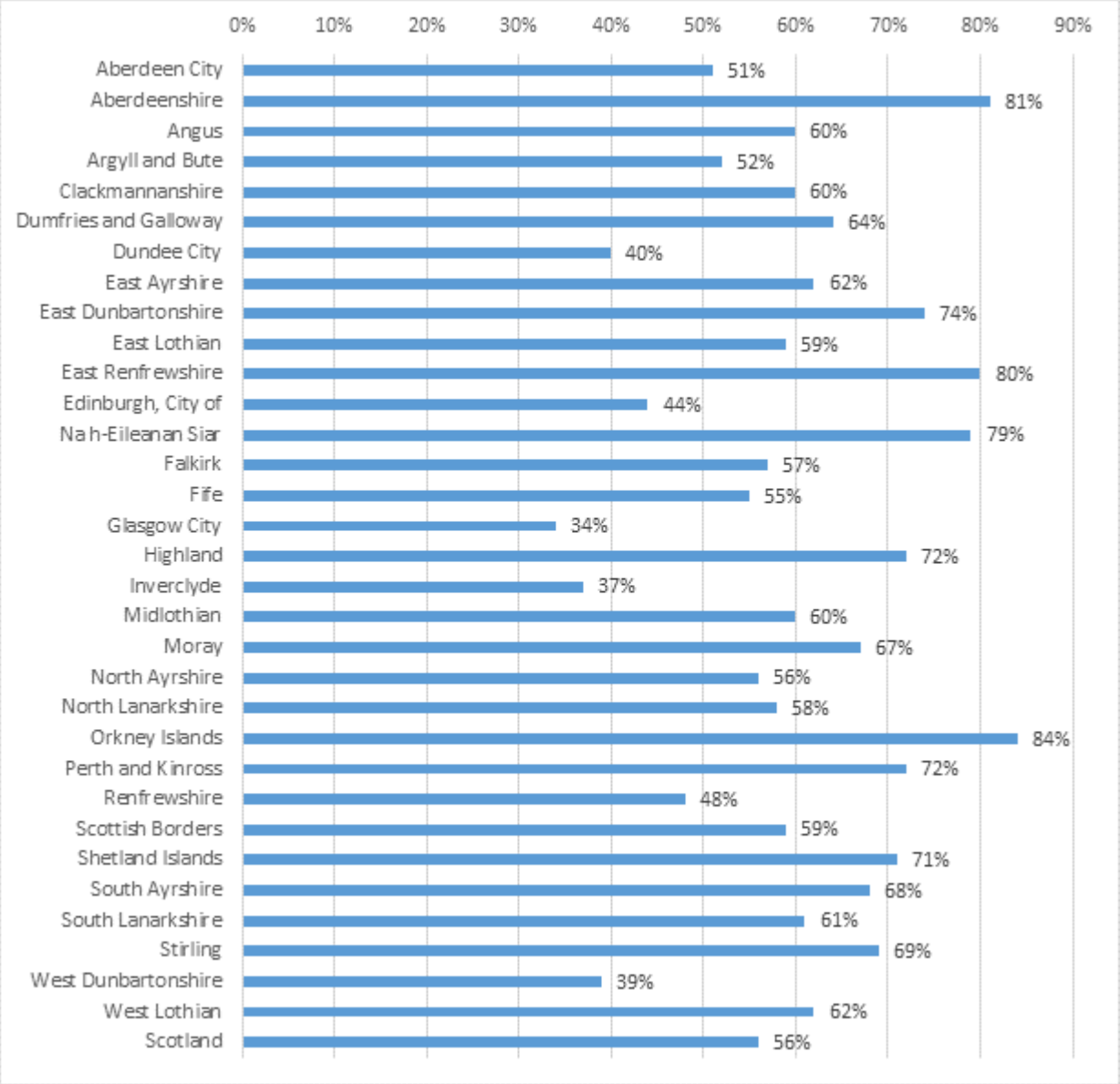
It is challenging to make an accurate assessment of the amount of charging infrastructure that will be required in the future as this will be subject to a number of variables, including advancement in battery and charging technologies. The Committee on Climate Change has estimated that there will need to be an overall investment of £280 million in Scotland (up to 2030) in public EV charging infrastructure, in addition to investment in EV charge points in homes and at workplaces[46]. Therefore, there is still much to do to ensure that Scotland will meet the future demands of a mass EV market, and the legislative measures that we are proposing in this consultation are important to our overall approach to addressing this.

7.4.3 Households with off-street parking – a proxy for EV charging opportunities

Data from the Scottish House Condition Survey indicates that approximately 56% of dwellings (i.e. a unit of occupied residential accommodation) in Scotland have access to dedicated parking other than on-street (**Figure 3**)[47]. This varies across Scotland with availability much lower in urban areas (e.g. Glasgow at 34%) than in some rural areas (e.g. Orkney Islands at 80%). There is therefore a significant proportion of Scotland's population that do not have access to off-street parking at home, and will therefore have to rely upon accessing an EV charge point at their workplace and/or at other public, semi-public or private locations.

[45] Electric vehicle charging device statistics: April 2021 - GOV.UK (www.gov.uk)
[46] Reducing Emissions in Scotland (December 2019) – Climate Change Committee 8th Annual Progress Report to Scottish Parliament
[47] Scottish House Condition Survey averaged from 2016, 2017 and 2019 data.

Figure 4 Proportion of dwellings by local authority with dedicated parking provision other than on-street.



7.5 Requirements for EV charging infrastructure in car parks of buildings

7.5.1 Introduction

Deployment of EV charge points, including the infrastructure to facilitate their ease of installation at a future date, in car parks of buildings presents a significant opportunity to support the transition towards a mass market of EVs over the next decade.

If requirements for installing EV charge points and ducting infrastructure (namely accessible trunking, conduits or cable trays) are targeted at car parks of buildings when they are built, or when major renovations are taking place, then there will almost certainly be significant cost (and convenience) benefits compared to retrofit options. Whilst installing infrastructure will come at a cost, it also has the potential to deliver significant economic benefits across Scotland's supply chains.

For requirements relating to new buildings or buildings undergoing major renovation, the intention is to introduce legislative provisions through the Building (Scotland) Regulations 2004. In addition, we plan to introduce requirements in the car parks of certain non-residential buildings where no construction work is planned through powers available in the UK Withdrawal from the EU (Continuity) (Scotland) Act 2021.

7.5.2 Directive 2018/844 and keeping pace with the EU

In July 2018, the revised EU Energy Performance of Buildings Directive (EU directive 2018/844) came into force. This amended EU Directive 2010/31 requires member states to transpose new obligations in relation to the energy performance of buildings into national law, recognising the crucial role of the building sector in meeting environmental goals.

Whilst the UK has formally left the EU, Scottish Ministers have stated that it is in Scotland's national interests to align with the EU's approach to legislation and policy. Our approach to the options that we are consulting upon is therefore framed within the context of EU Directive 2010/31, as amended by EU Directive 2018/844. This Directive sets out a number of requirements for the installation of EV charge points and ducting infrastructure in residential and non-residential buildings (**Table 11**).

Table 11. EV infrastructure requirements of Directive 2010/31 as amended by Directive 2018/844

Scope	Category	Requirement
New buildings and buildings undergoing **major renovation**	**Non-residential** buildings[48] with more than 10 parking spaces	Ensure the installation of at least **1 recharging point** Ensure the installation of ducting infrastructure for at least 1 in 5 parking spaces
	Residential buildings with more than 10 parking spaces	Ensure the installation of ducting infrastructure for every parking space
Existing buildings	**Non-residential** all buildings with more than 20 parking spaces	Lay down requirements for the **installation of a minimum number of recharging points** – applicable from 2025

7.5.3 Preferred options and scope of coverage

[48] This section uses the terminology applied by Directive 2018/844 rather than that what is used within Scottish building regulations so, for clarity, 'dwellings' or 'domestic buildings' fall under the umbrella of *residential buildings* and 'non-domestic buildings' are under *non-residential buildings*.

A summary of the Scottish Government's preferred options are provided in **Table 12** below. A further explanation of how these would be applied is provided in Section 7.9.

Table 12: Summary of Scottish Government preferred options for EV charge points and enabling infrastructure in buildings.

Building Type	Scottish Government preferred options
New residential buildings	All dwellings with a parking space to have at least one EV charge point socket with minimum 7kW output power rating. Exemption to requirement to install EV charge point if additional cost of electricity grid connection exceeds £2,000. If exemption applies ducting infrastructure to be installed in each car parking space.
Residential buildings undergoing major renovation	For buildings with more than 10 car parking spaces, ducting to be installed in each residential car parking space to support the future installation of an EV charge point. EV charge points sockets to be installed, with minimum 7kW output power rating, in as many residential car parking spaces as the electrical capacity of the building post-renovation allows. Exemption applies if the cost of installing recharging and ducting infrastructure exceeds 7% of total major renovation cost.
New non-residential buildings	For buildings with more than 10 non-residential car parking spaces, 1 in every 2 non-residential parking spaces to have ducting installed and 1 in every 10 non-residential parking spaces to provide an EV charge point socket with minimum 7kW output power rating.
Non-residential buildings undergoing major renovation	For buildings with more than 10 non-residential car parking spaces, 1 in every 2 non-residential parking spaces to have ducting installed and 1 in every 10 non-residential parking spaces to provide an EV charge point socket with minimum 7kW output power rating. Exemption applies if the cost of installing recharging and ducting infrastructure exceeds 7% of total major renovation cost.
Existing non-residential buildings	By 1 January 2025, for buildings with more than 20 non-residential car parking spaces, 1 in every 2 non-residential parking space to have ducting installed and 1 in every 10 non-residential parking space to provide an EV charge point socket with minimum 7kW output power rating.

For both residential and non-residential buildings we are seeking to apply requirements where:

- The car park is located inside the building and, for major renovations, renovation measures include the car park or the electrical infrastructure of the building; or
- The car park is physically adjacent to the building, on land under the same ownership and, for major renovations, renovation measures include the car park or the electrical infrastructure of the car park.

Application within the scope of Scottish building regulations

The requirements for new buildings, and those undergoing major renovation, will apply to all car parking spaces associated with buildings to which the Building (Scotland) Regulations 2004 apply. There are some limited building types that are exempt from the building regulations, such as a building where explosives are manufactured or stored. Those exemptions, defined in regulation 3 and schedule 1 of the building regulations, will be out of scope of the new requirements[49].

As outlined above, the requirements for EV charge points and/or enabling infrastructure will also apply where an existing building undergoes a major renovation. The introduction of this as a 'defined term' within building regulations, (following the definitions previously set out in the Energy Performance of Buildings Directive[50]) is proposed in section 3.2.1 of this consultation under question 20.

Scottish building regulations apply a term - 'conversion' - to a specified range of actions which change the way in which a building is used or categorised, and which triggers the application of current standards to the building as a consequence of the proposed change. We propose that the conversion of a building, as defined by regulation 4 and schedule 2 of building regulations would trigger the application of EV provisions, subject to the same conditions in respect of the extent of works as a major renovation.[51]

7.5.4 EV charge point minimum standard

EV charging can happen at different speeds depending upon the type of vehicle, usage pattern of the location and the type of charge point. **Table 13** summarises key charging types, where they are normally found and an indicative charging time, and **Table 14** provides a further description of charge point definitions.

Table 13. Summary of key charging types.

[49] See section 0.3 - Building standards technical handbook 2020: domestic - gov.scot (www.gov.scot)
[50] 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 (Text with EEA relevance) (legislation.gov.uk)
[51] See section 0.4 - Building standards technical handbook 2020: domestic - gov.scot (www.gov.scot)

Charge point Power	Current	Connector	Mode	Typical location	Example charging time
3.6kW	AC	Type 1/ Type 2	Mode 3	Homes, on-street locations, destinations	c. 11 hours
7kW	AC	Type 1/ Type 2	Mode 3	Homes, on-street locations, destinations	c. 5 - 7 hours
22kW	AC	Type 1/ Type 2	Mode 3	Destinations	c. 2 hours
50kW	DC	CCS/ CHAdeMO	Mode 4	Motorway Services Areas / destinations	< 1 hour
150kW+	DC	CCS/ CHAdeMO	Mode 4	Motorway Services Areas / destinations	< 30 minutes

Table 14. EV charge point definitions

EV charge point definitions
Current: Charging can be AC, where alternating current (AC) is supplied to the vehicle and vehicle converts the current to direct current (DC) to charge the battery. Or the charging current can be DC, where the alternating current is converted to DC within the charge point before it is supplied to the vehicle.
Connector: The type of connector varies from vehicle to vehicle and charge point type also depends on whether they are for low (AC) or high (DC) power use. The CHAdeMO and CCS connectors are both DC, and the Type 1 and Type 2 chargers are AC. On the vehicle side, European models usually have a CCS connection, whereas Asian models usually have a CHAdeMO connection.
Mode: BS EN 61851-1 standard defines the different modes for EV charging. Mode 3 and 4 are specialised systems for EV charging running from a dedicated circuit. Mode 1 and 2 use non-specialised infrastructure (e.g. a domestic socket). Mode 1 provides no residual-current device (RCD) protection and is not considered safe, whilst Mode 2 provides RCD protection but charging will often be limited by vehicle protocols to charging at 1.4kW to 2.3kW.

For the purposes of establishing requirements for car parking spaces associated with residential and non-residential buildings, our preferred option is for Mode 3 AC charging, with a power output of 7kW at each connector socket, as the minimum standard for the EV charge point sockets and ducting infrastructure for cabling.

Whilst car parking spaces associated with buildings serve a diverse range of functions, we consider 7kW charging to provide a sufficient charging power for the majority of needs. This would not preclude building owners from installing EV charge points with higher power outputs if they wished to do so. Charging powers

below 7kW (e.g. 3.6kW) are likely to become more obsolete as battery technology evolves.

Table 15 highlights a range of different makes and models of EVs and the length of time taken to recharge their batteries to an 80% state of charge using an EV charge point with a 7kW output power rating. This demonstrates that for most of those vehicles, over 25 miles of range can be added per hour.

Table 15. Summary of EV make and model and battery recharging times from 0% to 80% State of Charge using a 7kW EV charge point[52]

Make / model	Real world electric range (est.) (miles)	Kwh added	Charging time (hours)	Miles added per hours
Jaguar I PACE EV 400 S 90kWh 400 PS Auto	277	72	10.3	21.5
Kia Soul EV 64kW First Ed. Auto	266	51	7.3	29.2
Nissan Leaf 40kwh Acenta Auto	160	32	4.6	27.8
Tesla Model 3 Standard Range Plus	241	48	6.9	28.0
Renault Zoe ZE 50 Play R110 80kW Auto	233	42	5.9	31.5

7.5.5 New residential buildings

For new residential buildings (and buildings undergoing conversion) our preferred option is to require each dwelling to have access to at least one EV charge point socket. This will require the number of available EV charge point sockets in the car park of a building to either match the number of dwellings or the number of parking spaces, whichever is the lesser. This option is intended to provide each dwelling with access to a charge point socket, although the ability to achieve this will ultimately be determined and/or constrained by the number of car parking spaces associated with the building in question.

Draft impact assessment data published by the UK Government in 2019 highlighted that the cost of installing EV charge points at the time of construction of a building is significantly lower than the costs associated with retrofitting at a later date. **Table 16**, for example, shows unit costs of installing a 7kW EV charge point in a new residential building across different car parking type scenarios compared to the cost of retrofitting, taking into account the costs of cabling, ducting, grid connection, civil works and hardware costs. This provides a clear indication of the cost benefits of installing EV charge points during the construction phase of a building and its car parking compared to doing this retrospectively.

[52] Data derived and adapted from Zap Map Home Charging Calculator: https://www.zap-map.com/tools/home-charging-calculator/

Table 16. Per-unit cost for full EV charge point provision in residential buildings (based upon 100 EV charge points)[53]

Parking Type	Cost - New (Low)	Cost - New (High)	Cost - Retrofit (Low)	Cost - Retrofit (High)
Off-street private	£615	£1,115	£982	£2,415
Multi-occupancy surface	£975	£2,947	£2,230	£8,210
Multi-occupancy underground	£812	£2,652	£1,640	£6,290
Multi-occupancy multi-storey	£812	£2,652	£1,640	£6,290

Scottish Government Housing Statistic data showed that in 2018-19, 22,273 new homes were supplied in Scotland[54]. Of these, 21,292 new build homes were completed, 316 were brought back into use through refurbishment and 665 were supplied through conversion. Whilst the data does not provide information on car parking provision, it provides a proxy for the potential annual number of new residential buildings that could fall within scope of our policy option.

Our policy option also reflects the fact that, based on current ownership trends and vehicle use, EV drivers are likely to have a strong preference for charging their vehicles at home if possible. EV charging at home is also beneficial for managing local electricity networks.

Whilst the need for home charging will continue, there will also be an increasing need for wider charge point availability as more EVs are used as a main vehicle for daily commutes and longer journeys necessitating charging at other locations. In addition to this, those drivers who do not have access to a residential parking space will require charge point availability in the wider public charging network (at non-residential buildings for example).

We therefore believe that our policy will not only act as an incentive for people to switch to an EV but, by implementing the requirements to install EV charge points at the stage of a building's construction, will provide a more cost effective way of doing so. Furthermore, by installing EV charge points at the point of build, we believe this could also avoid potential challenges experienced by residents of multi-occupancy dwellings (e.g. flats) who may find it difficult to obtain the necessary permissions for retrofitting a charge point.

We are aware that in some situations the additional costs of connecting EV charge points to the electricity grid may be high. To address this we are proposing to apply an exemption to the EV charge point installation requirement in situations where the additional cost of connecting each EV charge point to the electricity grid is greater than £2,000. We believe this to be a sufficiently high threshold to enable the deployment of EV charge points in the majority of circumstances but also a fair cost so as not to inadvertently impact on the viability of a building development. Should this exemption apply, there will still be the requirement to install ducting

[53] UK government Draft Impact Assessment Residential Charging Infrastructure Provision 24 June 2019
[54] https://www.gov.scot/publications/housing-statistics-scotland-2019-key-trends-summary/

infrastructure in each car parking space as we believe this measure would facilitate the future installation of charge points and associated cost.

7.5.6 Residential buildings undergoing major renovation

For residential buildings undergoing major renovation we intend to apply a threshold whereupon requirements would apply if a car park has greater than 10 parking spaces. Moreover, the requirements will only apply to a major renovation under particular circumstances as described in section 7.5.3.

Our preferred option is for ducting infrastructure to be installed in each car parking space serving dwellings and for EV charge points to be installed up to the point where they can be safely accommodated within the post renovation electricity capacity of the building. We believe this option to be a fair and cost efficient approach that takes advantage of the opportunity presented when major building work is being undertaken. By doing so, we are of the view that this will simplify the ease and convenience of installing EV charge points at a future date. The requirements for the installation of EV charge points will also not preclude building owners from going further in terms of installing more charge points and upgrading the electricity capacity of the buildings if they chose.

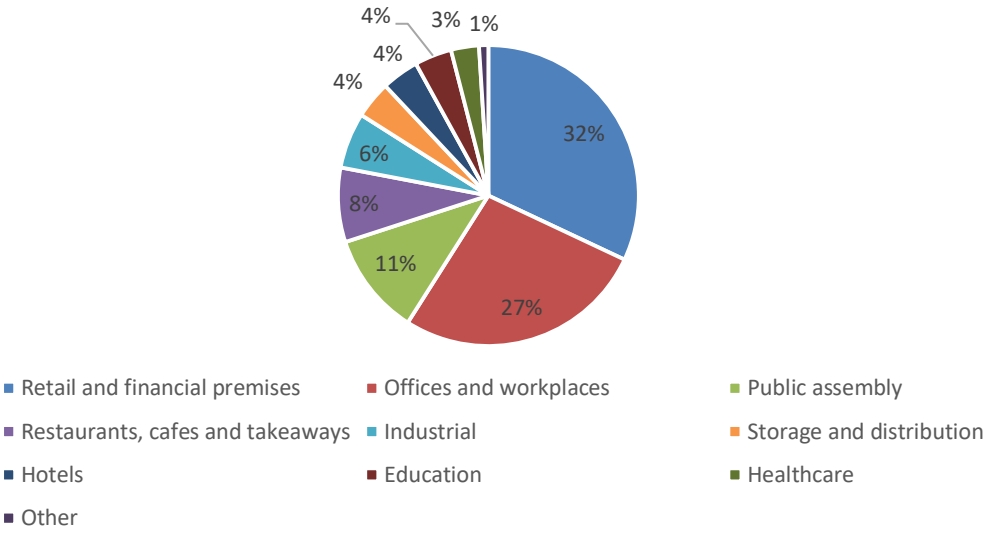
7.5.7 New non-residential buildings and non-residential buildings undergoing major renovation

For new non-residential buildings and non-residential buildings undergoing major renovation, our preferred option is to require ducting infrastructure to be installed in 1 in every 2 parking spaces and for 1 in every 10 parking spaces to provide an EV charge point socket. These requirements will only apply to those building car parks with more than 10 parking spaces.

Scotland's non-domestic energy efficiency baselining report published in December 2018, estimated there are 196,000 non-domestic heat controlled premises in Scotland, excluding military and agricultural buildings[55]. **Figure 5** shows that of these, retail and financial premises followed by offices and workplace premises made up the greatest proportion of these buildings.

[55] https://www.gov.scot/publications/scotlands-non-domestic-energy-efficiency-baseline/

Figure 5. Estimated number of non-domestic heat controlled premises in Scotland.



Although this data gives an insight into the amount of non-residential heat-controlled building stock in Scotland, data on the number of new non-residential buildings or those undergoing major renovation is limited.

Scottish House Condition Survey data indicates that up to 44% of households in Scotland might not have adequate access to off-street parking. Giving those households the confidence to switch to an EV will require a significant upscaling of EV charging opportunities in public, at work and/or at other convenient locations.

As highlighted above, Scottish House Condition Survey data indicates that up to 44% of households in Scotland might not have adequate access to off-street parking. To give those households the confidence to switch to an EV will require a significant upscaling of EV charging opportunities in public, at work and/or at other convenient locations.

We, therefore, consider that our policy option for new non-residential buildings and new non-residential buildings undergoing major renovation is proportionate but also reflective of the scale of action required to support a high volume uptake of EVs. Similar to residential buildings described above, published data also highlights the cost-benefit of installing ducting and EV charge point infrastructure where construction works are being undertaken. **Table 17**, for example, taken from the 2019 draft UK Government impact assessment, shows that the additional unit cost of retrospectively installing an EV charge point in comparison to installing at point of build could be significantly greater.

Table 17. Per-unit cost for full EV charge point provision in non-residential buildings (based upon 100 EV charge points)[56].

Parking Type	Cost - New (Low)	Cost - New (High)	Cost - Retrofit (Low)	Cost - Retrofit (High)
EV Charge point	£1,182	£6,463	£1,640	£8,210

7.5.8 Existing non-residential buildings

In keeping with the approach set out above, our preferred options for existing non-residential buildings seeks to require the installation of ducting infrastructure in 1 in every 2 parking spaces and for 1 in every 10 parking spaces to provide an EV charge point socket. A crucial difference to our approach for new non-residential and major renovations, however, is that we only intend to apply these requirements to existing non-residential buildings with more than 20 parking spaces. In line with the timescales set out in the Directive 2018/844, we intend the requirements for building owners to install ducting infrastructure and EV charge points to apply from 1 January 2025.

7.5.9 Enforcement of requirements for car parks of existing non-residential buildings

We are exploring options for enforcing the requirements associated with existing non-residential buildings as set out in section 7.5.8, given that the Building (Scotland) Regulations will not apply in this scenario. This might involve use of powers available through the UK Withdrawal from the European Union (Continuity) (Scotland) Act 2021 with enforcement being undertaken by a Scottish Public Authority, so long as such a function is broadly consistent with the general objects and purposes of the authority.

We are keen to gather feedback on how enforcement might be achieved particularly in terms of what body or bodies may be best placed to undertake this function. We are also keen to gather feedback on potential incentives and penalties and how these might be applied fairly, taking into account potential variation in the costs of infrastructure across different building car parks types and geographies.

7.6 Exemptions

7.6.1 Introduction

In addition to our option to apply an exemption to the requirement to install EV charge points in car parking spaces of new residential buildings, where the additional electricity grid connection cost for each EV charge point exceeds £2,000 (section 7.5.5), we have also considered the use of the exemptions inserted in 8 of Directive 2010/31/EU by Directive 2018/844. These exemptions along with the Scottish Government's preferred options are summarised in **Table 18**.

[56] UK government Impact Assessment Non-Residential Charging Infrastructure Provision 24 June 2019

Table 18. Summary of Scottish Government preferred options in relation to the application of exemptions from requirements.

Article	Exemption	Scottish Government preferred options
Article 4	Buildings owned and occupied by SMEs.	No intention to apply.
Article 6(a)	Building permit applications or equivalent applications have been submitted by 10 March 2021.	Not applicable as date of exemption has passed.
Article 6(b)	If ducting infrastructure required would rely on micro-isolated systems and if this would lead to substantial problems for local energy system operation and endangering grid stability.	No intention to apply.
Article 6(c)	Cost of recharging and ducting infrastructure exceeds 7% of total major renovation cost.	Apply to both residential and non-residential buildings undergoing major renovations.
Article 6(d)	A public building is already covered by comparable requirements according to transposition 2014/94/EU.	No intention to apply.

7.6.2 Buildings owned and occupied by Small and Medium Enterprises

As of March 2019, there were an estimated 356,550 private sector businesses operating in Scotland of which the majority (99.3%) were Small and Medium enterprises (SMEs)[57].

We are not proposing to exempt SMEs from requirements associated with non-residential buildings. SMEs will realise both cost and convenience benefits of installing ducting infrastructure and EV charge points at the time of construction or during the major renovation of the building they own and occupy. We consider that the cost of provision is justifiable in proportion to the cost of the triggering building works, regardless of the organisation characteristics of the owner/developer.

We are also of the view that if SMEs own and occupy existing buildings with more than 20 car parking spaces, then car parks of this scale should be adequately equipped with EV charge points and/or the enabling infrastructure to facilitate convenient deployment of EV charging infrastructure in the future.

[57] https://www.gov.scot/news/business-survey-2019/

7.6.3 Micro-isolated systems

The Directive provides for an exemption where ducting infrastructure required would rely upon micro-isolated systems or the buildings are situated in the outermost regions within the meaning of Article 349 of the Treaty on the Functioning of the European Union, if this would lead to substantial problems for the operation of the local energy system and endanger the stability of the local grid.

Whilst no parts of Scotland fall within an 'outermost region', there are parts of Scotland that are not connected to the main GB electricity system, and which could have an annual energy consumption of less than 500 GWh and be classed as a micro-isolated system[58]. These might include for example: Canna, Eigg, Fair Isle, Foula, Knoydart, Muck, Rum and Shetland.

Our preferred option is not to seek to apply an exemption for buildings within micro-isolated systems as we want to ensure that everyone benefits from the transition to EVs and that no communities are left behind. We believe that it is unlikely that for areas of Scotland that might fall into the category of having a micro-isolated energy system that there would be buildings and car parking development of the scale that would endanger the stability of the local electricity grid. We are interested to hear further views on this.

7.6.4 Cost of ducting and EV charge points in major renovations

The Directive provides an exemption where the cost of installing EV charge points and ducting infrastructure exceeds 7% of the total cost of the renovation. This threshold is based upon the minimum requirements for ducting and EV charge points that the Directive sets out for residential and non-residential buildings undergoing major renovation.

We are sensitive to the cost impact that requirements for installing EV infrastructure may have on the financial viability of a building's major renovation. Equally, however, we see the opportunities and benefits of installing EV charge points whilst this work takes place.

Our intention would be to apply a 7% exemption, in terms of the cost of ducting and EV charge point infrastructure, both for residential and non-residential buildings undergoing major renovation. Where this exemption applies, we would expect infrastructure to be installed up to the point that it can be accommodated with the overall 7% cost threshold. We welcome views on this or an alternative approach.

7.6.5 Public buildings already covered by comparable requirements

There are no comparable requirements currently in place for public buildings other than those which may have been imposed as a result of conditions of planning. Therefore, we do not intend to exempt public buildings from the requirements that we aim to establish.

[58] A micro-isolated system needs to have an annual energy consumption of less than 500 GWh in 1996 as per paragraph 27 of Article 2 of EU Directive 2009/72

7.7 Other Considerations

7.7.1 Accessibility

Scottish Planning Policy provides minimum provision standards for new developments in relation to accessible parking[59]. For retail, recreation and leisure developments the minimum provision should be:

- 3 spaces or 6% (whichever is greater) in car parks with up to 200 spaces; or
- 4 spaces plus 4% in car parks with more than 200 spaces.

Employers also have a duty to consider the disabilities of their employees and visitors to their premises. The minimum number of accessible parking spaces at places of employment should be:

- 1 space per disabled employee plus 2 spaces or 5% whichever is greater in car parks with up to 200 spaces; or
- 6 spaces plus 2% in car parks with more than 200 spaces

Scottish building regulations do not require car parking at new developments but, where parking is provided, seek provision of accessible parking spaces and associated means of access. For parking to blocks of flats[60] and non-domestic buildings[61], accessible spaces should be provided at a ratio of 1:20 or part thereof.

Therefore, to ensure that those using accessible parking spaces have sufficient access to charge point sockets, we are considering proposing that at least 1 accessible parking space should have access to an EV charge point socket for every 4 accessible parking spaces. If a car park has less than 4 accessible parking spaces then at least one of those spaces should have access to an EV charge point socket. These requirements would be additional to those laid out in section 7.5.3.

7.7.2 Safety within the Built Environment

As EVs are a relatively new and an evolving technology, increasing our understanding of their safety within the built environment is important. For example, given the different fuel/power sources between EVs and petrol/diesel vehicles, do EVs, and the accompanying infrastructure, carry specific risks that may require different measures to be considered in the safety design of buildings (additional fire prevention measures for example).

We are building up our understanding and evidence-base to inform our overall approach. Therefore we welcome responses that also address any potential safety issues.

[59] https://www.gov.scot/publications/scottish-planning-policy/pages/10/
[60] See clause 4.1.1 at Building standards technical handbook 2020: domestic - gov.scot (www.gov.scot)
[61] See clause 4.1.1.at Building standards technical handbook 2020: non-domestic - gov.scot (www.gov.scot)

7.8 EV consultation questions

Question 51 –

What are your views on our policy goal to enable the installation of Electric Vehicle (EV) charge points and ducting infrastructure (to facilitate the future installation of EV charge points) for parking spaces in new residential and non-residential buildings parking?

Question 52 –

What are your views on our preferred options for:

Building Type	Scottish Government preferred options
New residential buildings	All dwellings with a parking space to have at least one EV charge point socket with minimum 7kW output power rating. Exemption to requirement to install EV charge point if additional cost of electricity grid connection exceeds £2,000. If exemption applies ducting infrastructure to be installed in each car parking space.
Residential buildings undergoing major renovation	For buildings with more than 10 car parking spaces, ducting to be installed in each residential car parking space to support the future installation of an EV charge point. EV charge points sockets to be installed, with minimum 7kW output power rating, in as many residential car parking spaces as the electrical capacity of the building post-renovation allows. Exemption applies if the cost of installing recharging and ducting infrastructure exceeds 7% of total major renovation cost.
New non-residential buildings	For buildings with more than 10 non-residential car parking spaces, 1 in every 2 non-residential parking spaces to have ducting installed and 1 in every 10 non-residential parking spaces to provide an EV charge point socket with minimum 7kW output power rating.
Non-residential buildings undergoing major renovation	For buildings with more than 10 non-residential car parking spaces, 1 in every 2 non-residential parking spaces to have ducting installed and 1 in every 10 non-residential parking spaces to provide an EV charge point socket with minimum 7kW output power rating. Exemption applies if the cost of installing recharging and ducting infrastructure exceeds 7% of total major renovation cost.
Existing non-residential buildings	By 1 January 2025, for buildings with more than 20 non-residential car parking spaces, 1 in every 2 non-residential parking space to have ducting installed and 1 in every 10 non-residential parking space to provide an EV charge point socket with minimum 7kW output power rating.

Question 53 –

Do you agree with the Scottish Governments preferred options for the exemptions as set out in section 7.6.1?

Exemption	Scottish Government preferred options
Buildings owned and occupied by SMEs.	No intention to apply.
If ducting infrastructure required would rely on micro-isolated systems and if this would lead to substantial problems for local energy system operation and endangering grid stability.	No intention to apply.
Cost of recharging and ducting infrastructure exceeds 7% of total major renovation cost.	Apply to both residential and non-residential buildings undergoing major renovations.
A public building is already covered by comparable requirements according to transposition 2014/94/EU.	No intention to apply.

If you disagree, please explain why?

Question 54 –

What are your views on how our preferred option relating to existing non-residential buildings with car parks with more than 20 spaces could be properly monitored and enforced, given that the Building (Scotland) Regulations will not apply?

Question 55 –

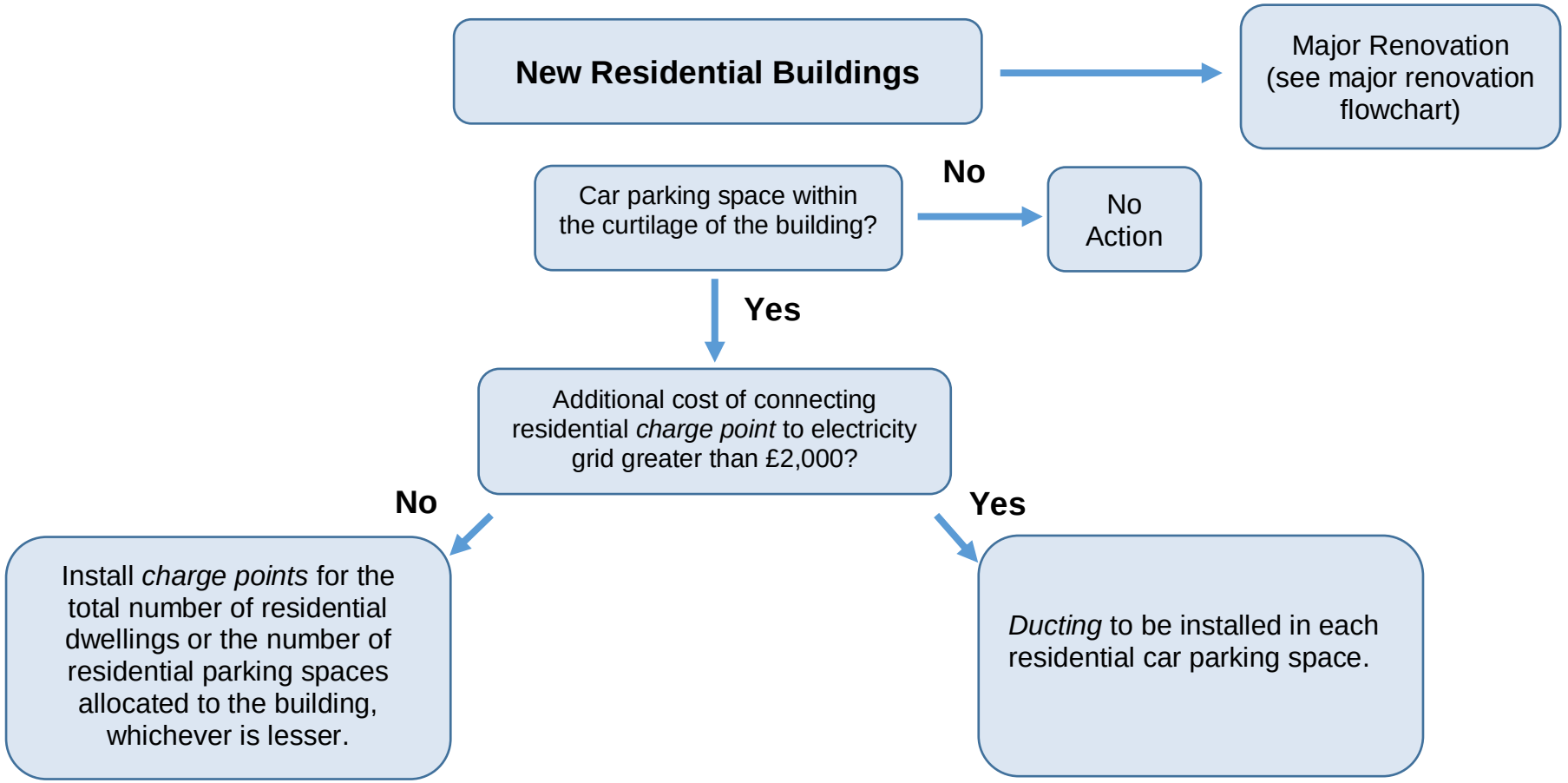
What are your views on the proposed provision for charge points for accessible parking spaces? Do you have examples of current best practice for the provision of charge points for accessible parking spaces?

Question 56 –

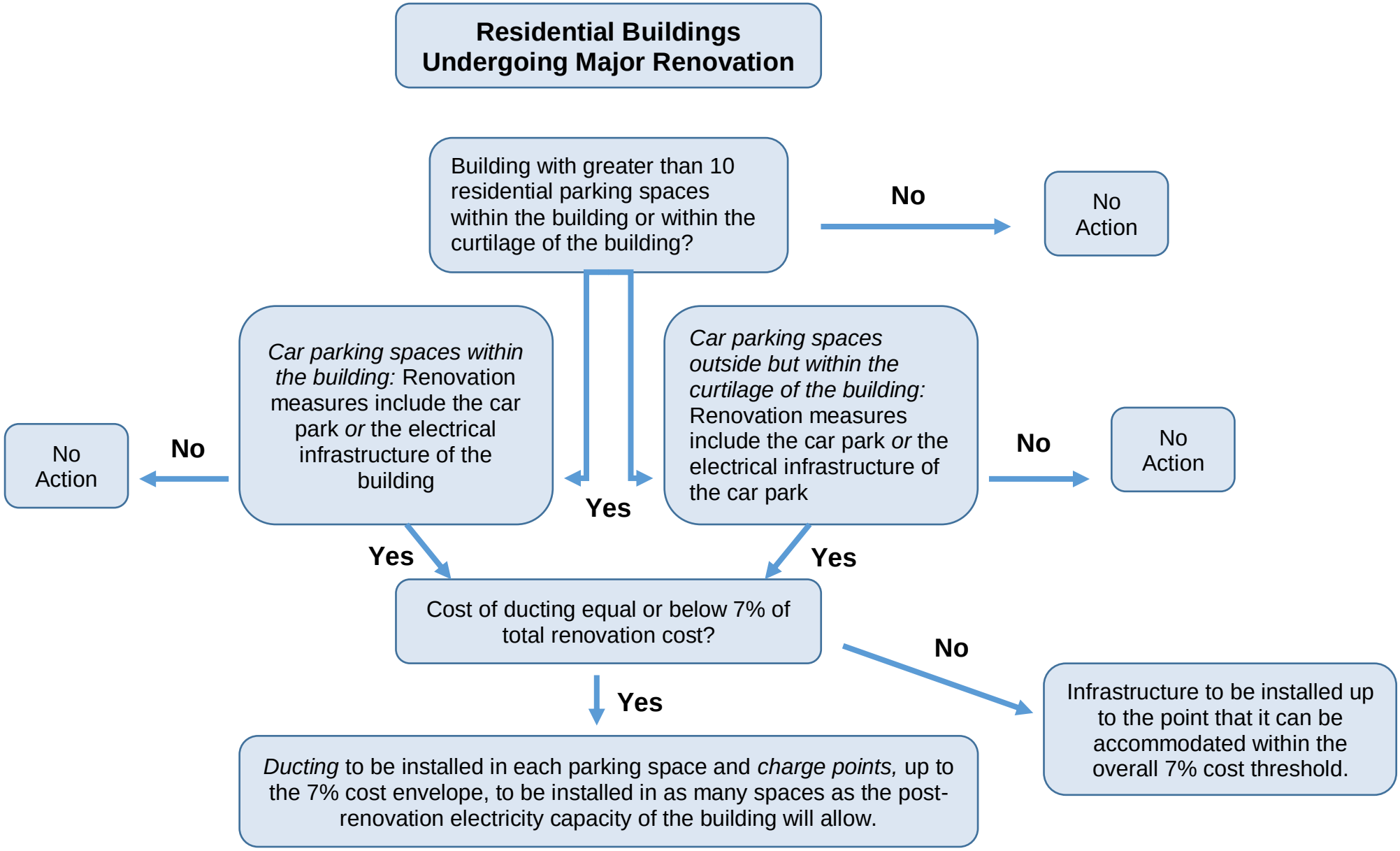
Do you have any other views that you wish to provide on the EV section of the consultation (e.g. the minimum standard of EV charge point or safety within the built environment)?

7.9 Flow charts of policy proposals.

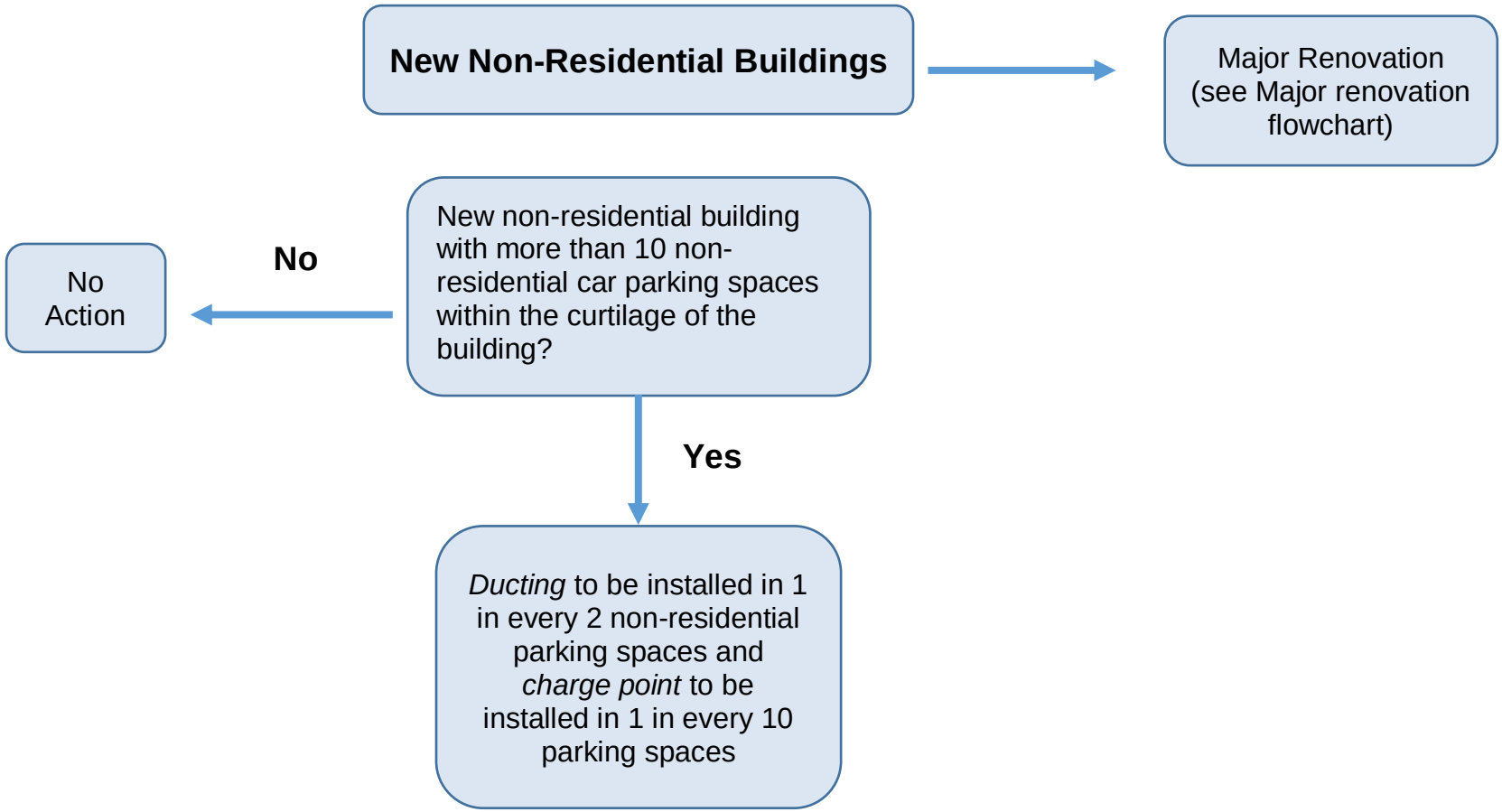
7.9.1 New Residential Buildings



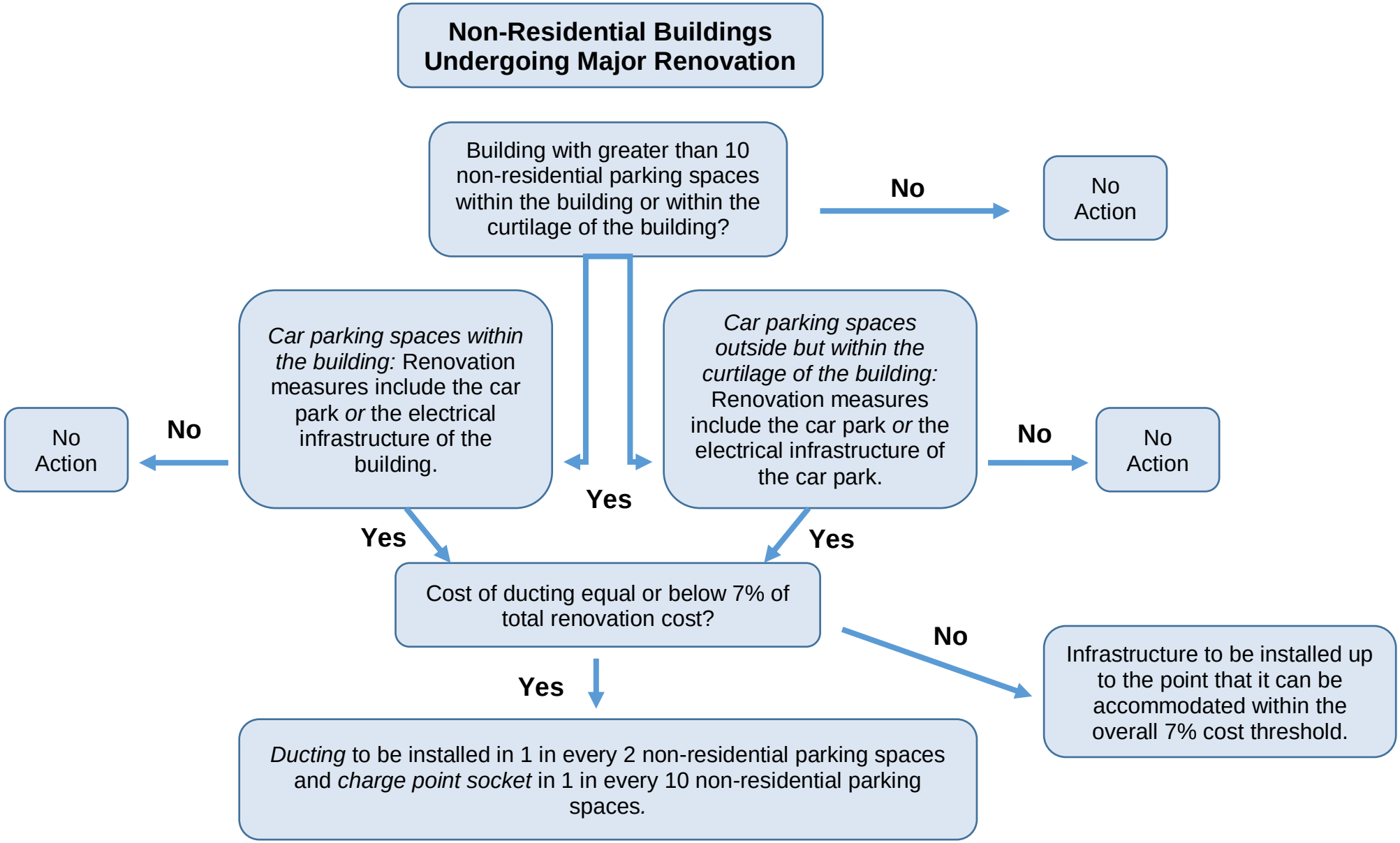
7.9.2 Residential Buildings (major renovation)



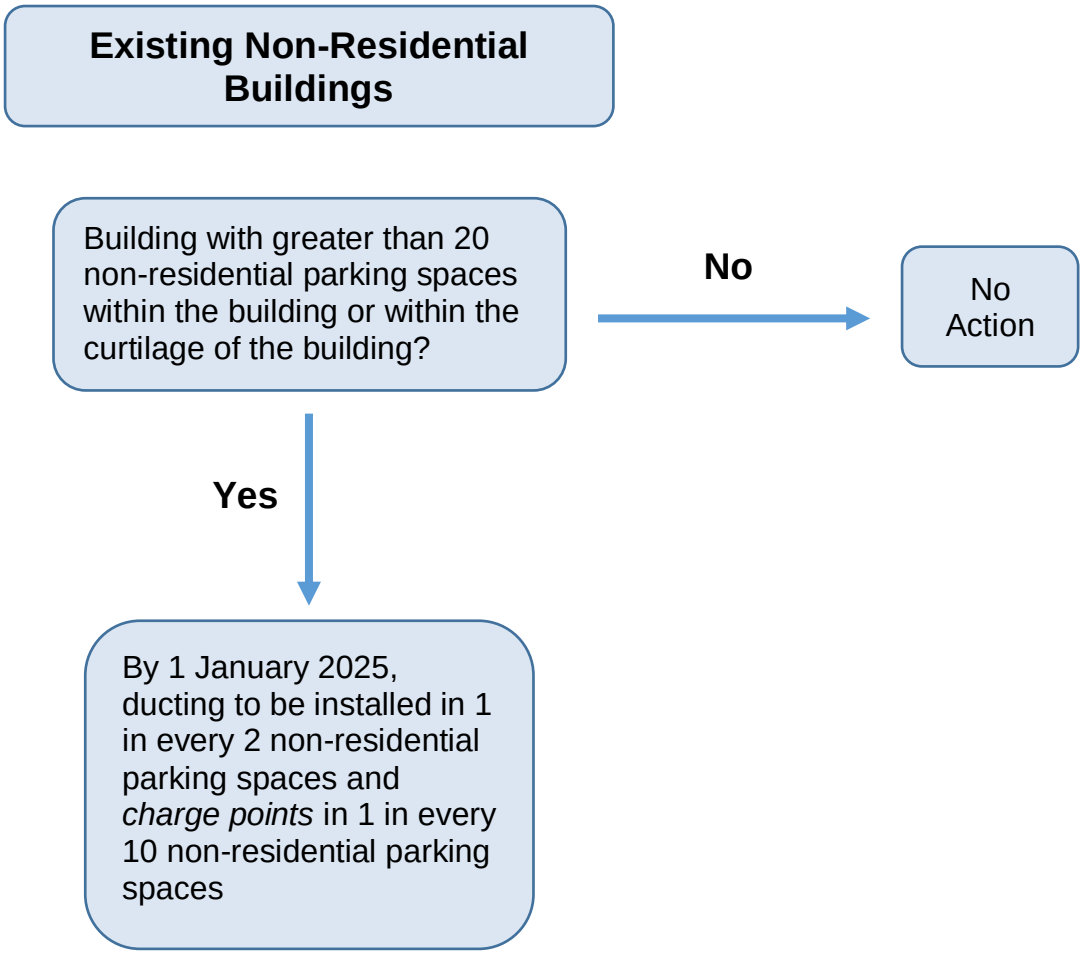
7.9.3 New Non-Residential Buildings



7.9.4 Non-Residential Buildings (major renovation)



7.9.5 Existing Non-Residential Buildings



Annex A – Partial Business and Regulatory Impact Assessment

1.0 Title of Proposal

Amendments to the Building (Scotland) Regulations 2004 and Technical Handbook Guidance to introduce proposed changes to energy standards and associated topics, including review of domestic ventilation and overheating risk.

Note: the current consultation also seeks views on the provision of electric vehicle charging points and infrastructure in buildings as a separate future implementation.

2.0 Purpose and Intended Effect

2.1 Objective

Buildings have significant implications for health, safety, the environment and our communities. Through the appropriate application of minimum building standards, set by regulations and supported by published guidance, the design and construction of Scotland's built environment can benefit all owners, users and people in and around our buildings.

The aim of these proposals is to investigate the potential for amendment of energy standards set by building regulations to contribute to the Scottish Government's Climate Change Programme[62]. This would be achieved through the introduction of revised standards and guidance to reduce greenhouse gas emissions and improve energy performance of new buildings and new building work, where such work is subject to building regulations.

In achieving the above, the following objectives are identified:

- To deliver levels of performance in new buildings and from new building work to existing buildings which results in buildings which have lower greenhouse gas emissions and are more economical to operate due to a reduced energy demand for heating, hot water, lighting, ventilation and other fixed services.
- To encourage the development and uptake of low carbon construction solutions, including improved building fabric insulation, efficient building services with effective controls and effective use of on-site generation of heat and power from renewable sources. All of these solutions will further the delivery of buildings with lower emissions and energy demand.
- To address risks associated with the delivery of better insulated new buildings and new homes in particular.

2.2 Background

Scottish building regulations[63] are made under The Building (Scotland) Act 2003[64].

[62] https://www.gov.scot/policies/climate-change/
[63] https://www.gov.scot/policies/building-standards/
[64] https://www.legislation.gov.uk/asp/2003/8/contents

They set national mandatory building standards for the health, safety, welfare and convenience of persons in and around buildings, furthering the conservation of fuel and power and the achievement of sustainable development. These building standards are supported by guidance contained in the Building Standards Technical Handbooks[65]. The building regulations apply to new buildings and to buildings being converted, altered or extended.

Building Standards are expressed in functional terms and do not dictate the methods that should be used to meet requirements. The choice of how to comply with the standards lies with building owners and for this purpose Scottish Ministers issue 'Technical Handbooks' containing practical guidance illustrating how the requirements of the Building Standards may be met. The guidance may be relied upon in any proceedings as tending to negative liability for an alleged contravention of the Building Regulations. This does not however preclude the use of alternative approaches provided the designer can satisfy the local authority Verifier that the aim of the Building Regulations is being fulfilled.

The Building (Scotland) Regulations 2004 (as amended)[66] set minimum energy standards applicable to the construction of new buildings and where building work is carried out to existing buildings. Regulation 3 identifies the range of buildings to which the regulations do not apply. Where regulations apply, regulation 5 identifies both the need to comply with current standards and also where a building warrant is required before commencing work. Regulation 9 sets out the functional standards applicable to construction, including standards 6.1 to 6.10 which address the energy performance of buildings, with standard 6.1 also setting carbon dioxide emissions targets for new buildings.

Over recent years, staged improvements in energy standards within building regulations have been introduced in 2007, 2010 and, most recently, in 2015. Improvement to standards are delivered through amendment of the functional standards and technical guidance on energy within the Building (Scotland) Regulations 2004 and Section 6 (energy) of the supporting Technical Handbooks.

Following the 2007 changes to energy standards, Scottish Ministers appointed an expert panel to review the way forward if buildings are to continue to contribute positively to Scottish and UK targets to reduce greenhouse gas emissions and respond to the risk posed by Climate Change. The recommendations of this expert panel were published in December 2007 as The Sullivan Report – 'A Low Carbon Building Standards Strategy for Scotland'[67].

This report made a range of recommendations to reduce carbon dioxide (CO_2) emissions from new and existing buildings. A key recommendation was the staged improvement of energy standards for new buildings, where the following proposals are made:

- for 2010, a reduction in CO_2 emissions, from 2007 levels, of 30% for domestic buildings and 50% for non-domestic buildings;

[65] https://www.gov.scot/policies/building-standards/monitoring-improving-building-regulations/
[66] https://www.legislation.gov.uk/ssi/2004/406/contents
[67] https://www.gov.scot/publications/a-low-carbon-strategy-scotland-sullivan-report/

- for 2013, a reduction in CO_2 emissions, from 2007 levels, of 60% for domestic buildings and 75% for non-domestic buildings;
- delivery, in 2016/17 of net zero carbon buildings (emissions from heating, hot water, lighting and ventilation), if practicable; and
- the aspiration of total life zero carbon buildings by 2030.

The original report was reviewed and updated in 2013[68].

Following investigation into the recommendations of The Sullivan Report for 2010 and 2013 building standards, challenging new targets for limiting emissions were introduced in October 2010 and October 2015. These delivered a 30% reduction in emissions for both new domestic and non-domestic buildings in 2010, and a 45% reduction for new domestic buildings and 60% reduction in non-domestic buildings.

When compared to buildings constructed to 1990 standards, the baseline year for CO_2 emissions reporting, collective revisions to energy standards to date have delivered an aggregate reduction in building emissions of around 75% for new dwellings and 80% for new non-domestic buildings.

2.3 Rationale for Government Intervention

The Scottish Government is committed to reducing greenhouse gas emissions. The Climate Change (Scotland) Act 2009[69] introduced the most ambitious climate change legislation anywhere in the world. The Scottish Government has committed to stop contributing to climate change within a generation. The Climate Change (Emission Reduction Targets) (Scotland) Act 2019[70] includes a legally binding target of net zero greenhouse gas emissions by 2045 and interim targets to reduce emissions by 75% by 2030 and 90% by 2040.

Our recently published Climate Change Plan 2018-2032 Update[71] includes the commitment to investigate the potential for further, significant improvement on 2015 energy standards and also how building regulations can support other carbon and energy policy outcomes, including our decarbonisation of heat agenda.

The Update also sets out more detail on the 2019-20 Programme for Government[72] commitment to introduce a New Build Zero Emissions from Heat Standard, to commence from 2024. A scoping consultation[73] on this topic was launched in December 2020 and closed on 3 March. Review of building regulations at this time will support the intended action in 2024 by further reducing heat demand in new buildings and introducing provisions aligned with the future wider scale adoption of low or zero emissions heat solutions.

[68] https://www.gov.scot/publications/low-carbon-building-standards-strategy-scotland-sullivan-report-2013-update/
[69] http://www.opsi.gov.uk/legislation/scotland/acts2009/pdf/asp_20090012_en.pdf
[70] https://www.legislation.gov.uk/asp/2019/15/contents
[71] https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/
[72] https://www.gov.scot/publications/protecting-scotlands-future-governments-programme-scotland-2019-20/
[73] https://consult.gov.scot/energy-and-climate-change-directorate/new-build-heat-standard/

Ministers set out a clear, long term vision and policy direction for heat in buildings in the draft Heat in Buildings Strategy[74]. A consultation was published on 5 February 2021 and sets out actions and proposals for transforming our buildings and the systems that supply their heat, ensuring all buildings reach zero emissions by 2045.

Scotland's commitment to reach net-zero greenhouse gas emissions by 2045 means a fundamental transformation of our economy. The document, 'A National Mission for a fairer, greener Scotland'[75] was published on 23 March 2021. The Report provides practical advice to Scottish Government Ministers, through 24 recommendations, on how to deliver on a Just Transition to a net zero future.

Scottish Ministers have expressed a desire to 'keep pace' with EU law within areas of devolved responsibility, where this is practicable. The Energy Performance of Buildings Directive (2010/31/EU)[76] (EPBD) commits member states to review the energy performance requirements for buildings at intervals not exceeding 5 years. The 2018 amendment to EPBD (2018/844/EU)[77] introduced new requirements on Member States, some of which are still to be introduced in Scotland and are discussed within this consultation document.

2.4 Building Regulations

As noted in section 2.2, Scottish building regulations address the health, safety and welfare of persons in and around buildings and further both the conservation of fuel and power and the achievement of sustainable development. Building regulations set minimum standards for new buildings and where existing buildings are altered, extended or converted. Whilst buildings can be designed and built to higher standards, in the majority of cases, the mandatory minimum standards set through building regulations are adopted. Accordingly, it is important that these minimum standards are robust enough to address both the needs of Scotland's people and to support the wider policy objective of addressing Climate Change.

Experience has shown that voluntary 'best practice' measures cannot be relied upon to deliver greenhouse gas emissions reductions in the development of buildings except in situations where market forces either do not apply, or are moderated by additional conditions of development. For Government to reduce greenhouse gas emissions from the use of new buildings and from new building work, national energy standards have to be set at a sufficiently demanding level. Scottish Ministers have therefore committed to periodic review of these standards.

2.5 The Risks to be addressed

The action proposed within this review is the reduction of energy demand and greenhouse gas emissions from new building and new building work, to assist with the mitigation of Climate Change. Accordingly, the effect of building-related greenhouse gas emissions on Climate Change is the primary risk identified.

[74] https://consult.gov.scot/energy-and-climate-change-directorate/heat-in-buildings-strategy/
[75] https://www.gov.scot/publications/transition-commission-national-mission-fairer-greener-scotland/
[76] https://www.legislation.gov.uk/eudr/2010/31/contents
[77] https://www.legislation.gov.uk/eudr/2018/844/contents

The reduction of emissions from new development continues to be an essential element in the development of the Scottish and UK Governments' Climate Change Programme. Failure to achieve improvements to energy standards for new buildings will have an adverse effect on these programmes.

In addressing this primary risk, there are subsidiary risks that must also be considered. Minimum energy standards applicable to new buildings should still:

- be proposed with an understanding of the potential cost of improvement to the delivery and operation of buildings;
- remain technically feasible;
- offer flexibility in the ways which standards can be achieved, to allow best value;
- ensure proposals do not conflict with or duplicate other regulatory requirements; and
- be implemented with consideration of wider societal issues related to the occupation and use of buildings.

3.0 Consultation

3.1 Development Phase

Before making or amending the building regulations, Scottish Ministers are required, under section 1(2) of the Building (Scotland) Act 2003[78], to consult "such persons as appear to them to be representative of the interests concerned".

Prior to public consultation on proposed changes to regulations, this duty is discharged through the development of proposals by a Departmental Working Group, comprising of officials and representatives of industry, together with communication with other parts of Government and bodies representing organisations of the construction industry. This is intended to provide assurance that proposals are proofed against the considerations identified in item 2.4 above.

In 2020, Scottish Ministers approved a Departmental Working Group to consider amendments to building regulations in respect of energy[79]. Along with government officials the Working Group included members from local authority verifiers, designers, building services engineers, building physicists, energy modellers, academia and private sector organisations representing the commercial and domestic sector, manufacturing industry and those with a direct interest in energy conservation.

Over five meetings between January and May 2021, this group shaped the development of proposals for consultation and discussion with Scottish firms and other stakeholders.

3.2 Within Government

Building Standards Division has a network of stakeholder organisations with an interest in building regulations. Government organisations and departments with a

[78] https://www.legislation.gov.uk/asp/2003/8/contents
[79] https://www.gov.scot/publications/building-standards-energy-review-2021/

policy interest in proposals are contacted in respect of these proposals and consultation documents made available to these bodies.

This includes direct contact and discussion with the following Divisions and Agencies during the development phase. This ensures that the implications of options on other policy areas is clearly understood and that proposals are developed with an awareness of similar work elsewhere within the UK.

- SG Planning and Architecture Division;
- SG Directorate for Housing and Social Justice;
- SG Directorate for Energy and Climate Change;
- SG Innovation, Investment and Industries Division;
- Historic Environment Scotland;
- Climate Change and Sustainable Buildings, Department for Communities and Local Government;
- Properties Division, Department of Finance, Northern Ireland; and
- Building Regulations, Ministry for Housing Communities and Local Government.

3.3 Business consultation

Whilst changes to building regulations affect any party who chooses to build a new building or carry out new building work to an existing building, such changes have the most significant impact on parties involved in the delivery of such building work - designers, developers, contractors and manufacturers of building products.

From July 2021, discussions will take place with between 6-12 businesses that might be affected by the proposals set out in Options 2 and 3 (which would impose regulatory change).

It is considered essential that this is undertaken only once proposals are published for consultation, to enable full discussion on the technical and financial implications of proposed changes on Scottish firms. In addition, a series of stakeholder events with industry will be undertaken to reach a wider selection of affected and interested parties.

3.4 Public consultation

This Partial Impact Assessment forms part of a package issued for public consultation. Consultation seeks general comment on detailed proposals which include the option of amending building standards and guidance within section 6 (energy) of the Building Standards Technical Handbooks, to reduce energy demand and associated emissions from use of buildings.

In June 2018 the current review of energy standards commenced and a ‘Call for Evidence’ consultation was published. This consultation sought views from stakeholders on the impact the 2015 energy standards in designing and constructing buildings to meet the Scottish building regulations. The consultation also sought views on practical opportunities to further improve the energy

performance of buildings. The consultation and published responses can be viewed at https://consult.gov.scot/local-government-and-communities/building-standards-energy/

The full current consultation package outlining changes to energy standards in building regulations is published on the Scottish Government website at https://consult.gov.scot/building-standards/building-regulations. The consultation period will run from July to October 2021. Requests for printed copies of consultation papers, issued without charge, may be made direct to the Building Standards Division of the Scottish Government.

4.0 Options

4.1 Option Development

The main subject of this consultation is change to requirements for the energy performance of new buildings and new building works, as set out in the mandatory standards and guidance in Scottish building regulations.

A series of further changes are also proposed and these are set out under item 4.9

Research was commissioned to assess and identify potential improvements in energy and emissions performance for new domestic and non-domestic buildings and to evaluate the costs of improvement measures[80]. This was to inform the setting of targets within the next set of energy standards and introduce Primary Energy as a new metric for target setting whilst also maintaining the current emissions target.

Domestic Buildings

Cost and energy models were developed based on seven building sub-types derived from an analysis of an extract of the Energy Performance Certificate (EPC) database for new domestic buildings. Just under 54,000 EPC records were included in the analysis[81].

In the current guidance a specification for the notional building is provided for each of the 5 main space heating system fuels; where the fuel for the actual building is the same as the notional building. The proposals for the next revision to energy standards simplify as well as tighten the requirements developing options for the revised notional building based on two fuel types; natural gas and electric (heat pump).

Following the identification of baseline levels of performance, options for the specification of a revised notional building were investigated, looking at delivering emission reductions and two potential levels of improvement, based upon a good and very good notional specification, drawing from available information on current construction solutions.

Options were developed on the basis of a range of achievable elemental specifications to deliver initial abatement, augmented, where necessary with the

[80] Publications listed at https://www.gov.scot/publications/building-standards-energy-review-2021/
[81] Scottish domestic EPC is published at https://statistics.gov.scot/data/domestic-energy-performance-certificates

addition of low carbon equipment, in the proxy form of photovoltaic panels, as a means to usefully offset energy demand and further reduce emissions. Two notional building specifications were identified and consultation proposals are being taken forward using the two identified specification options. These specification options, when aggregated to a national profile as assessed at delivering a 32% and 57% reduction in initial annual greenhouse gas emission respectively.

Non-domestic Buildings

Cost and energy models were developed for a range of archetypes comprising of seven building types, three heating fuels and three heating/ventilation strategies resulting in 12 sample buildings derived from an analysis of the EPC database for new non-domestic buildings[82]. These examples buildings are based upon the range of models used elsewhere in the UK for evaluation of energy standards within building regulations.

In current guidance, there are two specification categories for the notional building, determined by the zone conditioning strategy for the actual building; heated and naturally ventilated or heated ventilated/cooled. The heating fuel(s) for the notional building is based on the heating fuel(s) specified for the actual building. The proposals for the next revision to energy standards simplify as well as tighten the requirements developing options for the revised notional building based on two fuel types; natural gas and electric (heat pump) but no variation in specification in relation to the conditioning strategy.

Following the identification of baseline levels of performance, options for the specification of a revised notional building were investigated. Options were developed on the basis of a range of achievable elemental specifications to deliver initial abatement, augmented, where necessary with the addition of low carbon equipment (in the form of photovoltaic panels) as a means to offset energy demand and further reduce emissions. Three notional building specifications were identified and consultation proposals are being taken forward for the better two. These specification options, when aggregated to a national profile are assessed at delivering a 16% and 25% reduction in initial annual greenhouse gas emission respectively. The lower option investigated was discounted as it resulted in a low level of further abatement (<10%).

In considering the risk to be addressed (see item 2.5), three options are identified:

Option 1 – Do nothing.

Option 2 – Reduce energy demand and associated greenhouse gas emissions through building regulations, with revised performance measures for new buildings. Within this option, an ‘improved/medium’ range of measures is considered.

[82] Scottish non-domestic EPC is published at https://statistics.gov.scot/data/non-domestic-energy-performance-certificates

Option 3 – Reduce energy demand and associated greenhouse gas emissions through building regulations, with revised performance measures for new buildings. Within this option, an 'advanced/high' range of measures is considered.

4.2 Sectors and groups affected

Sectors and groups affected can be categorised as:

- Persons procuring or occupying new buildings or building work, who may need to bear any additional costs associated with delivering buildings which have improved energy performance. Whilst this relates to a specific activity, the group who may be affected at one time or another can be considered to be the majority of the population.
- Developers who, in addition to the above, would have to review existing building specification, construction detailing and, potentially, methods of working. This might include, where relevant, seeking amended Scottish type approvals[83] for standard constructions, possibly sooner than otherwise intended.
- Building materials and component manufacturers, who may need to review and introduce changes to products and literature to address revised performance standards.
- Those involved with the energy aspects of building design and construction, who would have to familiarise themselves with any revised standards and methodologies.
- Building services contractors, who may need to invest to increase the capacity for commissioning and testing of buildings and engineering services.
- Local authority verifiers, who may need to arrange training of staff on changes to energy standards and guidance, to ensure these can be verified at design submission and during construction where necessary.

4.3 Benefits

Benefits arising from policy objective

A reduction in energy demand and associated greenhouse gas emissions from new buildings and new building work:

- supports the Government's agenda to tackle Climate Change and reduces the adverse effect of greenhouse gas emissions on the environment;
- as a sector where improvements are relatively straightforward to implement and to measure, provides a significant and positive contribution to Government targets set for the reduction in greenhouse gas emissions;
- reduces use of finite natural resources and promotes development and adoption of systems that incorporate renewable energy sources; and
- reduces energy costs arising from the operation of new buildings.

[83] The Scottish Type Approval System (STAS) operated by Local Authority Building Standards Scotland (LABSS, www.sabsm.co.uk) allows approved building types to be used throughout Scotland.

As is the case with current building regulations, improvements will also result in an increased benefit where buildings are altered, extended or converted and also where existing building elements and equipment are replaced, where this must be to current standards. It is considered that the costs and benefits arising from such work will be proportionate to those for new buildings.

Reducing Greenhouse Gas Emissions

Today's new buildings are tomorrow's existing buildings. The number of new buildings per annum may account for a change in less than 1% of the entire stock, but by the year 2050, buildings built from this point onwards will account for a substantial percentage of our total building stock. It is therefore vital that new buildings continue to make a contribution to further reductions in energy demand and emissions. The Scottish Government's commitment to net zero emissions by 2045 means that future energy performance improvements to buildings, new and existing, will remain a strong review agenda.

Reduced use of resources

Reducing emissions and energy demand in buildings are only two measures amongst many that can be considered to contribute to the delivery of more sustainable communities. Where persons elect to carry out new building work, the outcome ought to place reasonable limits on emissions and energy demand when the building is in use to ensure that resources are used effectively. Adoption of renewable heat solutions and effective use of renewable generation on site can further assist in limiting use of resources. As energy standards are improved, the need to consider and implement such solutions is strengthened.

Other than in the case of conversion of buildings (where the use of a building is changed), current standards for construction are applied only to new building work and not to the remainder of a building. Separate measures to improve the performance of existing buildings, outwith the building standards system, are presently under development in response to sections 63 and 64 of the Climate Change (Scotland) Act 2009[84].

Reduced fuel bills

It is recognised that gains from reduced heating costs and attendant potential welfare savings can be relatively small given that current building standards already place significant limits on energy demand. However, gains are possible in many building types, dependent upon energy load profile, where good practice is adopted. Savings from reduced energy demand are identified, in summary within section 5.

However, it is noted that savings in energy costs made through improvement do not, in most cases, offset the additional cost of construction and maintenance of these buildings.

[84] https://www.legislation.gov.uk/asp/2009/12/contents

4.4 Option 1 – Do nothing

As noted under item 2.3, the Scottish Government is committed to the delivery of net-zero greenhouse gas emissions by 2045, with intermediate targets of at least 75% by 2030 and 90% by 2040. Whilst building regulations have reduced emissions from new buildings by approximately 75% since 1990, doing nothing offers no further contribution towards meeting national targets for emissions reduction. Accordingly, no benefits are identified which relate to the intended objective.

Doing nothing would result in new buildings which continue to produce emissions at current levels, creating a greater challenge for the future. This option would not support delivery of climate change targets and may lead to buildings requiring expensive work at a later date to improve their energy performance. Given the Scottish Government commitment to reducing greenhouse gas emissions, a potential reputational risk may also arise if this option was adopted.

4.5 Option 2 – Reduce energy demand and associated greenhouse gas emissions through building regulations, with revised performance measures for new buildings. Within this option, an 'improved/medium' range of measures is considered.

Options 2 offers meaningful benefit in respect of the objective of this review – to reduce CO_2 emissions and energy demand arising from new buildings and new building work whilst also introducing limited measures to improve existing building performance.

Research was undertaken on the basis of delivering a reduction in emissions against a 2015 baseline. These were:

- **Domestic 32%**
- **Non-domestic 16%**

Benefits in adopting the improved range of measures proposed in Option 2, to reducing energy and emissions include:

- An established delivery method - setting standards within Scottish building regulations to limit emissions and energy demand has proved to be an equitable and robust way of improving the energy performance of new buildings. All new buildings which are to be heated (or cooled) or new building work within existing buildings will attract application of revised minimum standards.
- For both domestic and non-domestic buildings the proposals simplify as well as tighten the requirements for new buildings set via the Notional Building approach. Therefore, the proposed range of improvement applies across all building types regardless of servicing strategy, floor area and activity type.
- Certainty that reductions can be achieved - this approach is that, in addressing the performance of buildings, building regulations offer an established and proven delivery method which offers certainty that all new building work to new and existing buildings will result in improved performance, requiring that all new building work delivers reduced emissions with an associated reduction in

energy demand. This allows a quantitative assessment of improvement, which will assist the Government in meeting its targets for carbon emission reductions.

- Delivering the most cost-effective solutions - where subject to building regulations and a mandatory need to address improved building performance, those persons commissioning building work have the incentive to meet the regulations in the most cost effective manner possible. This is supported and encouraged by the use of functional standards and supporting guidance within building regulations, which allows flexibility in solutions and value engineering.

4.6 Option 3 – Reduce energy demand and associated greenhouse gas emissions through building regulations, with revised performance measures for new buildings. Within this option, an 'advanced/high' range of measures is considered.

Options 3 offers significant benefit in respect of the objective of this review – to reduce CO_2 emissions and energy demand arising from new buildings and new building work whilst also introducing limited measures to improve existing building performance.

Research was undertaken on the basis of delivering a reduction in emissions against a 2015 baseline. These were:

- **Domestic 57%**
- **Non-domestic 25%**

Benefits in adopting the improved range of measures proposed in Option 3, to reducing energy and emissions are the same as set out for Option 2. Noting that increased specification does affect the cost/benefit reported for the implemented change.

4.7 Emissions reduction

Based upon the range of emissions reductions identified in options 2 and 3, the potential annual abatement associated with the occupation and use of new buildings is assessed as follows:

Table 1 - New buildings – projected annual emissions abatement - Proposed reduction.

New Dwellings	**Improved 32%**	**Advanced 57%**
Annual abatement	7 kt CO_{2e}	13 kt CO_{2e}
New Non-domestic	**Improved 16%**	**Advanced 25%**
Annual abatement	1.7 kt CO_{2e}	2.6 kt CO_{2e}

- Assessment based upon projected build of 18,207 new homes per annum and projected non-domestic build of 672,000 m^2 per annum. Overall abatement is directly proportional to level of development occurring.
- Abatement is calculated as savings in CO_{2e} (carbon dioxide equivalent). The UK calculation methodologies reports using emissions factors which include the impact of CH_4 and N_2O in addition to CO_2. Annual abatement of life of policy is lower due to projected changes in fuel emission factors.

The above figures are single year annual savings which will occur each year following the construction of a new building based upon emissions factors proposed for fuels within the UK energy assessment methodologies, SAP[85] and SBEM[86].

In assessing overall cost/benefit (see items 5.4. and 5.5), for both Domestic and Non-domestic buildings the appraisal time period for estimating the impact of the policy is 10 years and an assumed 60 years building life from the year of construction, resulting in a total model period of 70 years.

4.8 Monetised Benefits

Potential savings achievable through implementation of options 2 and 3 are categorised as direct savings to building users and costs to Government from not taking action, as follows:

- Direct savings to building users through reduction in energy demand and reduced fuel costs.
- Emissions reductions from reduced fuel consumption are valued using the guidance provided by HM Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions

The annual value of reduced emissions or energy use is calculated over 70 year period for both dwellings and non-domestic buildings, discounted at 3.5% for the first 30 years and at 3% thereafter to represent net present value. A summary of these benefits is given in the cost/benefit analysis table in items 5.4 and 5.5.

5.0 Costs

This section quantifies the costs of each of the options identified. The three options identified are as follows:

5.1 Option 1 - 'Do nothing'.

This option presents no implementation costs

5.2 Option 2 – Reduce energy demand and associated greenhouse gas emissions through building regulations, with revised performance measures for new buildings. Within this option, an 'improved/medium' range of measures is considered.

See reporting for Option 3 in 5.3 below.

[85] https://www.bregroup.com/sap/sap10/
[86] https://www.uk-ncm.org.uk/

5.3 Option 3 – Reduce energy demand and associated greenhouse gas emissions through building regulations, with revised performance measures for new buildings. Within this option, an 'advanced/high' range of measures is considered.

Cost for options 2 and 3 include capital construction costs, ongoing maintenance costs and lifecycle replacements over their lifetime. Costing research which informed this review and which forms part of the consultation package is published online and can be found at:

- Domestic research
- Non-domestic research

This research was commissioned to assess the additional costs arising from the construction of buildings to improved energy standards, based upon the range of percentage emissions reductions. These were:

- **Domestic 32% and 57%**
- **Non-domestic 16% and 25%**

The following cost/benefit assessment is based upon the findings within these reports. Costs identified are non-recurring construction costs, incurred where a new building is created. Accordingly, emissions savings will accrue during the life of the building with no further cost aside from those associated with building and system maintenance.

Any assessment of additional capital cost must be necessarily broad and approximate, resulting in a range. It is proposed that potential costs specific to redesign of building to revised standards should be recognised but not quantified as addition of these costs will not significantly affect the range identified. These costs are minimised by the practice of only reviewing building standards at regular, defined intervals and introducing all changes arising at the same time.

The potential for improved energy standards resulting in a small increase in building footprint, particularly in housing development, is recognised. The cost of construction is assessed within published research. However, any effect on site layout and the potential reduction in the number of units that can be accommodated is not quantified as this is dependent upon solutions employed.

Life cycle costing and payback periods

Research identifies that most of the improvement scenarios investigated have a very long payback period in terms of annual energy cost savings and some, due to the high capital costs or short replacement cycles, may not pay back the original investment. However, reduction of running costs is only one consideration within an overall policy objective and it should be recognised that, for Climate Change to be addressed, actions that do not result in a direct financial benefit to building users must be considered.

Capital costs

The capital cost estimates are based on a 'central belt' price level. In other areas of Scotland prices may be different reflecting the availability and costs of materials

and labour. The following adjustments on the base (central belt) costs were considered reasonable to reflect the additional costs of working in more remote parts of the country.

- Central Belt (Glasgow, Edinburgh etc) – 100
- Borders / Dumfries and Galloway - 103
- Grampian (Aberdeen) - 103
- Highland - 110
- Orkney and Shetland - 125
- Western Isles – 130

5.4 New Domestic Buildings

National impact – annual capital cost.

Assessment is based upon an analysis of an extract of the Energy Performance Certificate (EPC) database for new domestic buildings. A total of just under 55,000 EPC records were included in the analysis and for derivation of the national build profile the most common sub-types were used as these allow sufficient determination of the impact of any changes to Building Standards. A projected build rate of 18,207 completed new dwellings per annum was projected based on seven sub-types.

In order to allow compilation of the national impact assessment, it has been necessary to extrapolate the data from this study to include dwelling types other than those used as baseline dwellings. It should also be noted that by its nature, the national impact assessment requires generalisations to be made, for example regarding dwelling sizes and configurations, and that there will inevitably be a margin of error with such an approach.

Table 2 - New domestic buildings – capital cost - national impact (single year build)

Emissions reduction	Annual cost – private sector	Annual cost – public sector	National annual cost – total
Option 1 - 32%	£ 52.3M	£ 30.8M	£ 83.1M
Option 2 - 57%	£ 88.0M	£ 51.7M	£ 139.7M

Notes: Assessment based upon projected build of 18,207 new homes per annum. Based on SG data, the public sector accounted for 37% of the total number of new dwellings completed in 2011-12. Whilst the proportion of each dwelling type constructed by the public and private sector differs slightly, this percentage is used above.

Table 3 - Illustration of additional capital cost for proposed levels of improvement - Percentage Uplift on 2015 Cost.

Dwelling Type	2015 Cost (Gas)	32% Gas	32% ASHP	57% Gas	57% ASHP
Detached house	£ 168,960	4%	3%	6%	5%
Semi-detached house	£ 97,106	4%	3%	7%	6%
Mid-terrace house	£ 88,662	4%	3%	7%	6%
Average flat	£ 84,114	3%	4%	5%	7%
Semi-detached house, ASHP	£ 95,938	N/A	4%	N/A	7%

This would indicate an average additional cost of approximately £4,560 per dwelling for Option 1 and £7,670 for Option 2. Assessment of national impact was carried out as part of the domestic research and the mitigation of these costs over the policy period of 10 years is discussed below.

National impact – total cost/benefit across policy period.

Based on the build/fuel mix, capital and lifetime costs, benefits and transition period applied, the national costs and benefits for Option 1 and Option 2 'with fossil fuel' (no fuel switching assumed) cases compared with continuation of the existing 2015 standards are shown in the Table below. The analysis is based on the HM Treasury Green Book standards and the accompanying supplementary guidance on the valuation of energy use. Relevant assumptions include:

- Energy savings are valued at the variable rate in accordance with the supplementary Green Book guidance. This is appropriate for social analysis and assumes that the retail energy savings enjoyed by the consumer occupying an energy efficient building does not fully reflect the social benefit.
- The appraisal time period for estimating the impact of the policy is 10 years with a consistent build rate and mix in each year equivalent to that forecast for 2021. We assume a 60 building life from the year of construction resulting in a total model period of 70 years.
- A discount rate of 3.5 per cent has been used for the first 30 years of building life and 3 per cent for subsequent years.
- Construction costs are in 2020 prices energy and carbon prices and costs are in 2019 prices all results are presented in line with a 2021 policy implementation year.

Table 4 - Summary (cost)/benefit assessment, including fuel and lifecycle costs – total over the appraisal period

New Dwellings (annual build)	**Option 1 - 29%**	**Option 2 - 54%**
Energy savings (£M)	417	483
Incremental costs (£M)	(609)	(1,171)
Total financial benefit/(cost) (£M)	**(192)**	**(688)**
Carbon savings - non-traded (£M)	153	346
Carbon savings - traded (£M)	36	31
Total carbon savings (£M)	189	377
Air quality savings (£M)	50	61
Net benefit/(cost) (£M)	**46**	**(250)**
Amount of gas saved (GWh)	9,647	24,122
Amount of electricity saved (GWh)	12,087	10,621
Amount of CO_2 saved - non-traded ($MtCO_{2e}$)	2	5
Amount of CO_2 saved - traded ($MtCO_{2e}$)	1	0
Cost effectiveness – non-traded (£/tCO_2)	50	125
Cost effectiveness – traded (£/tCO_2)	(19)	594

5.5 Non-domestic buildings

National impact - capital cost.

Assessment is based upon analysis of an extract of the Energy Performance Certificate (EPC) database for new non-domestic buildings. A total of 1,800 EPC records were included in the analysis and for derivation of the national build profile the most common sub-types were used as these allow sufficient determination of the impact of any changes to Building Standards.

Table 5 - New non-domestic buildings – capital cost - national impact (single year build)

Emissions reduction	**National annual cost – total**
Option 1 - 16%	£ 34.1M
Option 2 - 25%	£ 49.4M

Note: An estimated build rate of 672,100 m^2 per annum was projected based on 12 sub-types.

Table 6 - Illustration of additional capital cost for proposed levels of improvement - % Uplift on 2015 Cost.

Building Type	2015 Cost (£/m²)	Option 1 Gas + PV	Option 1 Heat Pump	Option 2 Gas + PV	Option 2 Heat Pump
Deep Office AC; Gas; AC	3,250	1%	2%	1%	2%
Deep Office AC; Elec; AC	3,266	N/A	N/A	1%	1%
Hospital; Gas; NV	4,185	1%	2%	2%	2%
Hotel; Gas; NV	2,603	2%	3%	3%	4%
Hotel; Gas; AC	2,789	1%	2%	2%	3%
Primary School; Biomass; NV	2,232	0%	1%	1%	2%
Primary School; Gas; MV	2,511	2%	3%	3%	4%
Primary School; Gas; NV	2,325	3%	4%	4%	5%
Retail; Gas; AC	3,500	2%	3%	2%	3%
Retail; Elec; AC	3,500	N/A	N/A	2%	2%
Shallow Office NV; Gas; NV	2,325	2%	3%	3%	4%
Warehouse Distribution; Gas; NV	1,579	4%	5%	5%	7%

Note: Information taken from non-domestic research (see links in item 5.3)

The cost associated with uplift in standards varies across modelled building types. This is noted as up to 5% for Option 1 and between 1% and 7% for Option 2. Assessment of national impact was carried out as part of the non-domestic research and the mitigation of these costs over the policy period of 10 years is discussed below.

National impact – total cost/benefit across policy period.

To assess the costs and benefits over the complete policy period, the total new build rate of 672,100 m² per annum was assumed. Based on the build/fuel mix, capital and lifetime costs, benefits and transition period applied, the national costs and benefits for Option 1 and Option 2 'with fossil fuel' cases (no fuel switching assumed) compared with continuation of the existing 2015 standards are shown in the Table below. The analysis is based on the HM Treasury Green Book standards and the accompanying supplementary guidance on the valuation of energy use. Relevant assumptions include:

- Energy savings are valued at the variable rate in accordance with the supplementary Green Book guidance. This is appropriate for social analysis and assumes that the retail energy savings enjoyed by the consumer occupying an energy efficient building does not fully reflect the social benefit.
- The appraisal time period for estimating the impact of the policy is 10 years with a consistent build rate and mix in each year equivalent to that forecast for

2021. We assume a 60 building life from the year of construction resulting in a total model period of 70 years.

- A discount rate of 3.5 per cent has been used for the first 30 years of building life and 3 per cent for subsequent years.
- Construction costs are in 2020 prices energy and carbon prices and costs are in 2019 prices all results are presented in line with a 2021 policy implementation year.

Table 7 - Summary (cost)/benefit assessment, including fuel and lifecycle costs – Percentage Improvement.

New Non-domestic buildings (2021-2031)	**Option 1 - 16%**	**Option 2 - 25%**
Energy savings (£M)	(366)	(497)
Incremental costs (£M)	245	264
Total financial benefit/(cost) (£M)	**(121)**	**(234)**
Carbon savings - non-traded (£M)	(4)	22
Carbon savings - traded (£M)	24	24
Total carbon savings (£M)	20	46
Air quality savings (£M)	78	80
Net benefit/(cost) (£M)	**(23)**	**(107)**
Amount of gas saved (GWh)	(467)	1,492
Amount of electricity saved (GWh)	6,684	6,746
Amount of CO_2 saved - non-traded ($MtCO_{2e}$)	0.0	0.4
Amount of CO_2 saved - traded ($MtCO_{2e}$)	0.4	0.4
Cost effectiveness – non-traded (£/tCO_2)	(335)	424
Cost effectiveness – traded (£/tCO_2)	129	356

5.6 Other proposed changes to standards

Detailed costings are made available above for the review of energy and emissions standard for new buildings. An interim assessment is being undertaken on the other elements of the review. This will be subject to further development, based upon consultation responses, in support of final recommendations to Ministers.

6.0 Scottish Firms Impact Test

The Scottish firms' impact test regards all firms with fewer than 50 full time employees as being small businesses. The majority of small firms have fewer than

10 employees and guidelines state that a concerted effort should be made to consult them over policy proposals.

As stated in item 3.3 above, consultation with business will take place during the public consultation period and will be presented within the final BRIA.

6.1 Competition Assessment

Having reviewed the four competition filter questions provided within the Office of Fair Trading document 'Completing competition assessments in Impact Assessments - Guidelines for Policy Makers', it is considered that proposals set out in this consultation will not result in a significant impact on competition within the market place.

In support of the above, it is noted that:

- The manner in which standards for new buildings are set allows flexibility in the solutions adopted which reduces the emphasis on performance of individual products or solutions;
- The level at which performance standards are set on an elemental basis in support of overall levels of performance is heavily influenced by the practicality of delivery;
- Improved standards are a recognised driver to product improvement and to innovation and as such, an element of challenge to all parties involved in delivering products and services is expected.

No significant areas where issues of competition, restriction or imbalance will arise have been identified. However, some concerns would benefit from commentary and further investigation prior to any decision on action following consultation. This includes the impact of standards on the technical capacity of less well-resourced organisations to deliver buildings and place construction products on the market. This will be investigated through direct discussion within the small firms impact test.

6.2 Test run of business forms

There are no new business forms proposed within any of the options identified.

7.0 Legal Aid Impact Test

Proposals within this consultation that would be the subject of regulation follow established process and premise. It is not anticipated that there will be any greater demands placed on the legal system by this proposal. Accordingly, it is not considered that there will be any effect on individuals' right of access to justice through availability of legal aid or on possible expenditure from the legal aid fund.

This will be reviewed further following consultation and this aspect of proposals will be verified in discussion with officials from the Scottish Government Access to Justice Team prior to production of a final impact assessment.

8.0 Enforcement, Sanctions and Monitoring

8.1 Background

The proposed changes within Options 2 and 3 will require amendment to published material forming the Building (Scotland) Regulations 2004 and the modification of the supporting guidance given within the Technical Handbooks (issued by the Building Standards Division of the Scottish Government) that support the Regulations. The Technical Handbooks list the mandatory functional standards set out under regulation 9 of the Regulations and give guidance on ways of complying with these mandatory functional standards.

All matters relating to enforcement, sanctions and monitoring will be carried out under the existing processes, which form the building standards system in Scotland, as set out under the Building (Scotland) Act 2003. Parties responsible for operation of this system are currently the 32 Scottish local authorities, appointed as verifiers under the Act, and the Building Standards Division, on behalf of Scottish Ministers.

8.2 Enforcement and sanctions

Work subject to the Building (Scotland) Regulations 2004 generally requires that a building warrant must be obtained before work commences and to have a completion certificate accepted once works are finished. Whether or not such work requires a building warrant is set out under Regulation 5 of the Regulations, the person responsible for the building or works, the 'relevant person' as defined in section 17 of the Building (Scotland) Act 2003, is required to ensure compliance with building regulations.

Where a building warrant is required, proposals are subject to the scrutiny of verifiers prior to approval of building warrant or acceptance of a Completion Certificate. Local authorities have enforcement powers under the Act to ensure compliance with approvals and the Regulations. Cases of non-compliance can be referred to the Procurator Fiscal and persons found guilty of offences in terms of the Act are liable on summary conviction to a fine not exceeding level 5 on the standard scale (currently £5,000).

8.3 Monitoring

The objective of this exercise is to determine whether proposed reductions in energy demand and greenhouse gas emissions in new buildings should be delivered through changes to building regulations. Building regulations are applied within a legislative framework summarised in item 7.1 above. In line with Scottish Government policy, any implemented changes which address this issue should be subject to review within a 10 year period. Any such review shall be accompanied by a further Impact Assessment.

9.0 Declaration and Publication

I have read the Business and Regulatory Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options. I am satisfied that business impact will be assessed with the support of businesses in Scotland.

Signed by the accountable Minister . . . . . .

Shona Robison, Cabinet Secretary for Social Justice, Housing and Local Government

Date:

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Annex B – Respondent Information Form

Scottish Building Regulations: Proposed Changes to Energy Standards, including ventilation, overheating and electric vehicle charging provision

Note: a Word version of this document, together with a full list of consultation questions is available to download on the consultation webpage.

Respondent Information Form

Please Note this form **must** be completed and returned with your response.

To find out how we handle your personal data, please see our privacy policy: https://www.gov.scot/privacy/

Are you responding as an individual or an organisation?

☐ Individual

☐ Organisation

Full name or organisation's name

Phone number

Address

Postcode

Email

If an Organisation, please select type:

Local Authority	☐	Commercial Organisation (other)	☐		
Professional Body	☐	Voluntary Organisation	☐		
Contractor/Developer	☐	Housing Provider / RSL	☐		
Designer/Consultant	☐	NDPB/Agency	☐		
Academic Body	☐	Advisory Body/Committee	☐		
Industry Association/Manufacturer	☐	Other	☐	Please specify here	

The Scottish Government would like your permission to publish your consultation response. Please indicate your publishing preference:

☐ Publish response with name

☐ Publish response only (without name)

☐ Do not publish response

Information for organisations:

The option 'Publish response only (without name)' is available for individual respondents only. If this option is selected, the organisation name will still be published.

If you choose the option 'Do not publish response', your organisation name may still be listed as having responded to the consultation in, for example, the analysis report.

We will share your response internally with other Scottish Government policy teams who may be addressing the issues you discuss. They may wish to contact you again in the future, but we require your permission to do so. Are you content for Scottish Government to contact you again in relation to this consultation exercise?

☐ Yes

☐ No

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Any enquiries regarding this publication should be sent to us at

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