Department of Finance
An Roinn Airgeadais
www.finance-ni.gov.uk

Review of energy efficiency requirements and related areas of Building Regulations

Discussion Document and Pre-consultation on next steps.

Revision A – published 11 October 2023.

(Amendments consist of minor typographical and formatting changes and removal of Question 4C.7)

Initial publication date: 26 July 2023

(closing date for receipt of responses is 15 November 2023 at 23:59)

Contents

Foreword

I am delighted to present this Discussion Document and Pre-consultation, that considers the way forward for energy efficiency and related aspects of the Building Regulations in the coming years.

The Executive's *Energy Strategy - Path to Net Zero Energy (December 2021)* and associated Action Plans included a commitment to an interim uplift through revised technical guidance, which took effect in June 2022. That strategy also seeks to ensure new buildings are designed and constructed to net zero ready standards from no later than 2026/27. This discussion document represents the next step in that journey and seeks information and evidence on a range of technical issues to help inform subsequent uplifts.

With high energy prices and mindful of our responsibility to reduce energy consumption and carbon emissions, your responses will be important in helping to inform the way forward.

The discussion document covers a range of building regulations technical areas which are mutually influential, including:

- Part F- Conservation of fuel and power
- Part K- Ventilation
- a new Part on mitigation of overheating in dwellings; and
- a new Part on potential electric vehicle infrastructure requirements (this is co-ordinated with DfI, which leads on transport and charging infrastructure policy).

I wish to thank all those involved in the preparation of this document, which has been developed in consultation with the Department's Building Regulations Advisory Committee (NIBRAC). I am particularly grateful to its specialist technical sub-committee, which brought together a range of experts in relevant areas, and for the supportive input from colleagues across other Departments with related responsibilities. I look forward to continuing this collaborative working as proposals develop further.

NEIL GIBSON

Permanent Secretary, Department of Finance

26 July 2023

Section 0: Information and how to respond

DISCUSSION PAPER PACKAGE – CONTENTS AND RESPONSE

0.1 This consultation has been issued by the Department of Finance, which has responsibility for maintaining the Building Regulations for Northern Ireland. This document, together with the other consultation documents, is available online at: https://www.finance-ni.gov.uk/consultations

0.2 The consultation documents are:

- Review of energy efficiency requirements and related areas of Building Regulations: Discussion Document and Pre-consultation on next steps
- Draft Equality Screening document
- Rural Needs Assessment

Responding to this discussion paper

0.3 We look forward to receiving your comments and views concerning any of the proposals contained in this discussion paper. We ask you to exercise care and refrain from the inclusion of any potentially defamatory material as it is our intention to publish responses on the Department's website. We will not publish the names or contact details of respondents, but will include the names of organisations responding.

0.4 We would encourage you to respond to the discussion paper using the online facility on the Citizen Space platform at https://consultations2.nidirect.gov.uk/dof/building-regulations-discussion-document-2023, where you can answer the questions and enter any supporting comments. It is not compulsory to answer all of the questions, so you can take part in the survey even if you do not have views on all of the issues.

0.5 If you respond to the discussion paper in another format, we encourage you to structure your answers according to the questions set out in this document in order for your views to be taken into account.

0.6 If you use the consultation hub - Citizen Space - to respond, you will receive a copy of your response via email. Otherwise, individual responses will not be acknowledged unless specifically requested.

0.7 Your opinions are valuable to us. Thank you for taking the time to read this document and respond.

0.8 If you require a hard copy of this document or have any other enquiries, please email your request to info.bru@finance-ni.gov.uk or you can write to us at:
Consultation Co-ordinator
Department of Finance
Building Standards Branch
6th Floor Goodwood House
44 - 58 May Street
Belfast
BT1 4NN

0.9 The Department will consider all the responses to this discussion paper received on or before the closing date, which is 15 November 2023 at 23:59.

Submissions made after this date cannot be considered.

Next steps in the consultation process

0.10 Where respondents have given permission for their response to be made public, and after we have checked that they do not contain personal information or product names, responses will be made available to the public at https://www.finance-ni.gov.uk/publications. We may also make responses to this consultation available to the Northern Ireland Assembly and for public inspection at the Building Standards Branch office.

0.11 Following the closing date, all responses will be analysed, and the Department will publish a summary of responses to the consultation.

0.12 All information will be handled in accordance with the General Data Protection Regulations.

Confidentiality and data management

0.13 If you ask for your response to be regarded as confidential and not to be published, you will be asked to explain to us why you regard the information you have provided to be confidential.

0.14 Information provided in response to this discussion paper, including personal data will be published or disclosed in accordance with the access

to information regimes (These are primarily the Freedom of Information Act 2000 (FOIA), the Data Protection Act 2018 (DPA), the UK General Data Protection Regulation, and the Environmental Information Regulations 2004. If we receive a request for disclosure of confidential information, we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances.

0.15 The Department of Finance will process your personal data in accordance with the law and in the majority of circumstances this will mean that your personal data will not be disclosed to third parties.

0.16 Are you satisfied that this consultation has followed the Consultation Principles? If not or you have any other observations about how we can improve the process please contact us at info.bru@finance-ni.gov.uk or write to the following address:

Building Standards Branch
Department of Finance
6th Floor Goodwood House
44-58 May Street
Belfast
BT1 4NN

Consultation period: 16 weeks

Territorial extent:

0.17 This call for evidence consultation applies solely to Northern Ireland.

Section 1: Introduction and General Information

Background

1.1 Some 15% of Northern Ireland's emissions stem from buildings, with 13% from our homes and residential buildings.[1] The vast majority of new buildings constructed in the coming years should still exist in 2050, alongside the many that have already been built, so today's regulatory requirements need to develop quickly for the net zero future demanded by our Climate Change legislation.

1.2 By improving energy efficiency and moving to cleaner heating in new buildings, we can help industry gear up to provide for 'net zero' technologies and ambitions throughout the stock.

1.3 Other interlinked regulatory issues such as ventilation, overheating and electric vehicle charging infrastructure also form part of this discussion document.

The Building Regulations

1.4 Our Building Regulations[2] set minimum performance requirements when building work is being carried out and when some specific material change of use cases occur. Other legislation and policies are used to incentivise, or require, retrofit of the existing stock, or to set additional requirements, but the Building Regulations set baseline construction standards for any work being done.

1.5 A provisional programme of uplifts to Part F (Conservation of fuel and power) of the Building Regulations was published by the Department for the Economy in the *Energy Strategy – The Path to Net Zero Energy (December 2021)*[3]. This set out a phased approach to uplifting the requirements of Part F and the more inter-related Parts, with a view to ensuring new buildings suitably contribute to the 'net zero' requirements for 2050 under Climate

[1] Figure 1.2, Reducing emissions in Northern Ireland, Committee for Climate Change February 2019 report Reducing emissions in Northern Ireland - Climate Change Committee (theccc.org.uk)

[2] In this document "Building Regulations" refers to The Building Regulations (Northern Ireland) Order 1979 (as amended) and The Building (Northern Ireland) Regulations 2012 (as amended), as supported by Technical Booklet and other relevant guidance.

[3] Northern Ireland Energy Strategy 'Path to Net Zero Energy' | Department for the Economy (economy-ni.gov.uk)

Change legislation[4]. The Building Regulations programme is led by the Department of Finance ('the Department') but impacts across other department's functions.

1.6 Phase 1 of the programme amended the technical guidance to Part F to provide an interim step to deliver a pragmatic uplift as quickly as possible. This was published in March 2022 and came into effect on 30 June 2022.

1.7 This Discussion Document is the second phase in the Department's programme for Part F and related aspects of the Building Regulations. Subsequent Phases are likely to require significant change from industry.

Purpose of this document

1.8 The intention of this document is to provide an early outline of potential proposals, to inform and explore the challenges, to consider any alternative approaches that other regions may provide and to encourage industry and enforcement to prepare for change. We are seeking evidence, data and views on a wide range of items at various levels of detail; many are detailed and specific, where the direction for next steps seems clear, others are more tentative, for the longer term or where the Department has limited scope or influence.

1.9 This consultation is aimed at industry, designers, energy assessors, trade bodies and accreditation schemes, developers, materials and product suppliers and district council enforcement. It is also open to input from other departments, agencies and public bodies, which interact in this area as well as interested members of the public. The document is technical in parts. It assumes that readers will be reasonably familiar with the current Building Regulations application processes, the technicalities of assessments and typical building outcomes.

1.10 The discussion refers to a range of other documents, cross-departmental programmes and positions in other jurisdictions. A glossary of acronyms is provided at Annex A.

[4] Climate Change Act (Northern Ireland) 2022 and Climate Change Act 2008 c.27 (as amended).

Future uplifts which will be informed by this exercise

1.11 Under Phase 3 the Department is aiming to introduce a step change in requirements by 2023/24, setting an expectation of much lower operational emissions and significantly improved energy performance of new buildings. New legislation and guidance will make use of the energy assessment methodology and software introduced in 2022 in England and other administrations. We are seeking evidence as to whether we should move as quickly as possible to implement uplifts largely in line with those recently put in place in England, or if we should take additional time to develop proposals so that our new build homes should be limited to low carbon heating solutions in Phase 3.

1.12 The proposals will also seek to uplift standards of work done to existing buildings, so that extensions are better aligned with new build practices and refurbishment work better supports the retrofit of existing building fabric and services.

1.13 The new requirements in other regions met outstanding technical obligations with the building regulations related aspects of the Energy Performance of Buildings (recast) Directive[5]. These include provision of a new primary energy target and, subject to policy lead from the Department for Infrastructure, provisions around electrical vehicle infrastructure points around buildings. Phase 3 will also consider Part K (Ventilation) of the regulations, as well as new measures to help prevent overheating in dwellings.

1.14 These Phase 3 proposals are discussed in some detail in the document, as a ‘pre-consultation’, in Sections 3 and 4. Further work, to provide an Impact Assessment and draft Technical Booklet guidance, will be needed to conclude the proposals and the Department will respond to evidence gathered from responses. It is intended that early signalling, now, will reduce lead-in times for subsequent steps and help industry preparation.

1.15 Phase 4 (2026/27) is expected to take England’s 2025 *Future Homes* and *Future Buildings* proposals into account, to ensure that all new construction has ultra-low emissions and is ‘net zero ready’ so that buildings will become net zero over time without further work to the building or its services. This is

[5] The Energy Performance of Buildings (recast) Directive 2010/31/EU as amended by Directive 2018/844/EU (EPBD)

expected to occur alongside an increasingly decarbonised and ‘smart’ electrical grid. Proposals coming forward in other regions, such as Scotland’s ban on direct emissions heating in new buildings and moves to bring forward a Scottish equivalent to Passive House standards, will also need to be considered. The EU’s Zero Emissions Building standard, proposed in an upcoming recast of the EPBD, may also be influential.

1.16 Scoping work on Phase 5 (2029) provides opportunity to consider some of the fundamental changes taking place, if not already addressed in Phase 4. It may consider new additional areas such as encouragement towards a circular economy approach as well as considering the impacts of some of the fundamental assumptions in the National Calculation Methodology assessment, among other issues.

Section 2: Background

Section 2A: Background- legislative considerations and policy contexts

Zero Carbon Commitments

2A.1 The Climate Change Act (Northern Ireland) 2022[6] was passed by the Assembly in March 2022 and received Royal assent on 6 June 2022. The Act provides for a local route map and carbon budgets to reduce emissions by 100% by 2050. It follows the *New Decade, New Approach* agreement[7] published in January 2020, which provided an agreed basis for the restoration of devolved government in Northern Ireland, with climate change being a strategic priority.

Cross-departmental programmes

2A.2 The Department of Agriculture, Environment and Rural Affairs (DAERA) is the lead department co-ordinating local action on climate change. DAERA is leading the cross-departmental *Green Growth* programme to set out how NI emissions will be reduced. It is scoping out the Carbon Budget and co-ordinating the *Climate Action Plan*, which will outline the actions planned to ensure conformity with the Climate Change Act 2022 obligations. It is also developing the 2nd Northern Ireland Climate Change Adaptation Programme, setting out its strategic direction and objectives and establishing a range of adaptation actions for the next five years[8].

2A.3 The Department for the Economy (DfE) is the lead department on energy policy matters. The Northern Ireland Executive's Energy Strategy –*The Path to Net Zero Energy* (December 2021) along with subsequent Action Plans aims to set ambitious targets and actions for a fair and just transition to a zero carbon society in alignment with the statutory obligations of the Climate Change Act (NI) 2022.

2A.4 As well as providing evidence on Building Regulations, this Discussion Document will help inform work streams under the Energy Strategy. Work

[6] Climate Change Act (Northern Ireland) 2022 (legislation.gov.uk)

[7] https://www.gov.uk/government/news/deal-to-see-restored-government-in-northern-ireland-tomorrow

[8] Environment Strategy for Northern Ireland, DAERA, 2019

is ongoing in a wide range of inter-related areas, including development of retrofit funding and delivery mechanisms, a smart systems and flexibility plan, one-stop shop advice and business energy efficiency support.

2A.5 The Department for Communities (DfC) has policy responsibility for housing and fuel poverty. As well as commencing work on a fuel poverty strategy, DfC is responsible for the provision of any Minimum Energy Efficiency (MEES) in the Private Rental Sector and Fitness Standards in the existing housing stock. DfC also has responsibility for design standards for new build social housing and works with the NI Housing Executive, in its Home Energy Conservation Authority role.

Minimum energy efficiency standards for existing buildings

Work on MEES for the Private Rental Sector is ongoing, following passage of the Private Tenancies Act (Northern Ireland) 2022. MEES are not provided for through Building Regulations, but other regions do make use of Energy Performance Certificates (EPCs) for these purposes. EPCs use the same software and methodologies under for energy and emissions assessments for Part F (Conservation of fuel and power) of the Building Regulations.

Building Regulations legislation

2A.6 The Department of Finance ('the Department') has policy and legislation responsibility for the Building Regulations, which set minimum standards when building work occurs.

Primary legislation

2A.7 The Building Regulations (Northern Ireland) Order 1979 (as amended)[9] ('the Order') is the primary legislation, which empowers the Department to make building regulations. This also provides for a number of procedures, such as appeals, and sets out requirements and limitations when making regulations or providing guidance.

[9] Building Regulations (Northern Ireland) Order 1979 (legislation.gov.uk)

Notes on the Order

Schedule 1 of the Order lists matters in regard to which Building Regulations may be made.

Article 3(2) notes that *"Building regulations may be expressed in terms of performance, types of materials, methods of construction, or of ensuring safety, or otherwise."* Hence, building regulations set fitness standards for work done rather than specifying the qualifications of those carrying out the work.

Article 5 of the Order requires that *"Requirements specified in any building regulations shall be such as in the opinion of the Department can reasonably be expected to be attained in buildings of the classes to which they relate".*

Articles 5 and 5A set out requirements for making guidance supporting the regulations.

Article 10 provides that District Councils have sole responsibility for the enforcement of the Building Regulations.

Secondary legislation

2A.8 The Building Regulations (Northern Ireland) 2012 (as amended)[10] sets out a range of further procedural requirements for building regulations applications and technical requirements for building work.

2A.9 Part A of the Building Regulations provides definitions and procedural requirements, with the remaining Parts setting requirements in technical areas. The technical requirements are largely 'functional' or descriptive, requiring 'reasonable' or 'adequate' provision on a particular aspect of construction. The Department's Technical Booklets provide guidance on what may be considered 'reasonable' or 'adequate' for common building situations (see Paragraph 2A.11).

2A.10 Our local Building Regulations are a devolved matter and, while there are some similarities, neither the Order nor the Regulations precisely replicate the powers, structure, wording or format of the legislation elsewhere.

[10] The Building Regulations (Northern Ireland) 2012 (legislation.gov.uk)

This Discussion Document is considering developments around energy efficiency aspects of the Building Regulations and related Parts, including standards for dwellings and other buildings, including where work is carried out to existing buildings:

- Part F (Conservation of fuel and power)
- Part K (Ventilation)
- Overheating (potentially a new part, or an additional aspect of Part F)
- Provision of Electric Vehicle charge-point infrastructure.
- Other issues, such as embodied carbon assessment of materials and energy assessment methodology issues such as energy storage, smart connections and impacts related to wider heat, green growth and energy strategy issues.

Technical Booklet guidance

2A.11 Technical Booklets[11] (TB) provide guidance for technical Parts of the Building Regulations to help industry and district council building control understand what is likely to be 'reasonable' or 'adequate' in common building circumstances. In effect, the Technical Booklets often provide a 'go-to' resource for industry, illustrating compliance for normal circumstances. The local TBs often seek technical parity of standards with England's equivalent 'Approved Document' (AD) guidance.

2A.12 The TBs are arranged in accordance with each technical Part. For example, Technical Booklet F1 (Conservation of fuel and power in dwellings) (TBF1) and Technical Booklet F2 (Conservation of fuel and power in buildings other than dwellings) (TBF2) provide the relevant TB guidance to Part F requirements.

2A.13 There is no requirement to follow the guidance in a TB, provided the regulatory requirement can be met by other means. However, the scope for alternative approaches can be relatively limited in the case of Part F, particularly in new buildings, as the use of the National Calculation Methodology (NCM) is explicitly required by the regulations.

2A.14 Text in many of the equivalent 'Approved Document' guidance booklets in England has been rationalised to clarify compliance with the regulatory requirements in light of Dame Judith Hackitt's review, *The Independent*

[11] Building Regulations Technical Booklets | Department of Finance (finance-ni.gov.uk)

Review of Building Regulations and Fire Safety.[12] This has tended to remove more general guidance commentary from the most recent editions.

The Energy Performance of Buildings Directive (EPBD)

2A.15 Prior to the UK's departure from the EU, the Department was responsible for local implementation of the principal requirements of the Energy Performance of Buildings Directive 2010/31/EU (EPBD)[13]. It was required to work with the UK government to ensure consistent application and interpretation[14].

2A.16 Minimum energy performance requirements of the EPBD apply when building work is carried out and are implemented via the Building Regulations. For example, the recent uplift to Part F technical guidance was, in part, to provide a more robust position around the Nearly Zero Energy Building (NZEB) requirements specified in Article 9 of the EPBD.

2A.17 The Energy Performance of Buildings (Certificates and Inspection) Regulations (NI) 2008[15] ('the EPB regulations') implements the EPBD requirements for energy performance certification and air conditioning inspections.

2A.18 Other aspects of the EPBD, such as Article 10 (financial incentives and market barriers), various reporting requirements and new potential fitness standards, required cross-departmental input and UK / Whitehall co-ordination, or place requirements on the EU Commission.

2A.19 In July 2018, Directive 2018/844/EU (EPBD 3) came into force, requiring a number of technical adjustments. Member States were required to transpose EPBD 3 requirements by 10 March 2020. The UK Government and Devolved Administrations did not meet the deadline and, although the UK subsequently exited the EU, the Department is expecting to transpose the EPBD 3 requirements, given this commitment. These new EPBD 3 technical requirements form a consideration for Phase 3, with most of the

[12] Independent Review of Building Regulations and Fire Safety: final report - GOV.UK (www.gov.uk)

[13] EUR-Lex - 32010L0031 - EN - EUR-Lex (europa.eu)

[14] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/316157/MoU_between_the_UK_and_the_Devolved_Administrations.pdf

[15] The Energy Performance of Buildings (Certificates and Inspections) Regulations (Northern Ireland) 2008 (legislation.gov.uk)

requirements now implemented in England through its uplift of June 2022 likely to be replicated here.

Building Regulations changes necessary for compliance with EPBD 3 include:

· Use of 'primary energy' as a metric for building regulations compliance assessments. This is included in the new NCM developments implemented alongside England's 2021/22 measures.

· Requirements for 'self-regulating devices' (e.g. thermostats) where heating systems are provided (including replacement installations)

· Provisions for electric vehicle charge-point infrastructure (subject to DfI consideration)

2A.20 The EU Commission published proposed further revisions to recast the EPBD in December 2021, which will not have to be implemented in the UK, given its exit from EU. These 'EPBD 4' proposals, nonetheless, provide context for further policy developments in Phase 4 or 5. These proposals are noted in Section 5 and Annex C of this document.

Northern Ireland Protocol

2A.21 Product standards are a reserved matter, subject to the Northern Ireland Protocol on the Withdrawal Agreement on the UK's exit from the EU.[16] DLUHC has published guidance on this, which notes "For as long as the Northern Ireland Protocol is in force, Northern Ireland will align with all relevant EU rules relating to the placing on the market of construction products." [17]

2A.22 The Protocol means products placed in the market here have to demonstrate compliance with the EU's requirements on product standards. Whilst UK standards may be assumed to be compliant with the Ecodesign Directive 2009/125/EC up to EU Exit day (31 Jan 2020), subsequent changes may lead to some divergence. The situation is currently undergoing extensive political debate, with the UK government developing legislation on this matter in light of the Windsor Framework Agreement.

2A.23 Ongoing alignment with the EPBD is not a specified requirement under the NI Protocol.

[16] New Protocol on Ireland/Northern Ireland and Political Declaration - GOV.UK (www.gov.uk)

[17] see https://www.gov.uk/guidance/construction-products-regulation-in-northern-ireland#history

Rural needs and grid reinforcement costs

2A.24 The Rural Needs Act (Northern Ireland) 2016[18], places a duty on Northern Ireland departments, district councils and the other public authorities to have due regard to rural (social and economic) needs when developing, adopting, implementing or revising policies.

2A.25 This is likely to be a significant policy consideration in off-gas grid areas, where reliance on oil heating or other fuels is more prevalent and where reinforcement of the electricity grid to provide for increased electrical loads can be more costly. Questions on issues with rural impacts, for example on fuel options for new dwellings, are asked in Section 3A and elsewhere throughout this document.

Electricity grid reinforcement and connections charges

2A.26 Additional capacity in the electricity grid is increasingly required alongside building work to support EV charging, electrical heating in buildings and to allow surplus renewable electricity generated on site to be exported to the grid. It can also be beneficial to further reinforce the grid, while doing this work, so that anticipated demands can be provided for at a lower overall cost without further subsequent disruption.

2A.27 Currently, the charging regime for this work expects developers to pay for a larger proportion of the reinforcement costs here than applies in other administrations, where more of the costs is socialised onto bill-payers. In some cases, particularly on small sites already at or near the limits of the current network capacity, the costs may be such that electricity led design proposals requiring a large amount of grid reinforcement work, bespoke system design or energy storage are uneconomic for the individual developer.

2A.28 NIE Networks has carried out a consultation on the changing expectations around loading and managing diversity demands for housing[19]. A review of the charging policy is also being undertaken by The Utility Regulator[20] and

[18] Background to the Rural Needs Act (NI) 2016 | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk)

[19] https://www.nienetworks.co.uk/design-demand-consultation

[20] Utility Regulator - Forward Work Programme 2023-2024 https://www.uregni.gov.uk/files/uregni/documents/2023-03/FWP%202023-24%20Final.pdf

will have to take into account how socialisation of grid reinforcement costs onto bill payers could risk increasing electricity unit costs relative to other fuels. The UK government has signalled an intent to reduce the price difference between electricity and other heating fuels. These issues sit outside the remit of Building Regulations.

Fuel poverty and cost vs carbon

2A.29 New build standards have already reduced energy demands and running costs to levels significantly lower than the average stock. This needs to remain a priority to help mitigate fuel poverty risks, even in new build homes, particularly at times of high energy prices and higher costs of living. Capital costs are also an issue in the provision of housing (particularly social housing) and for business investments.

2A.30 Issues with low carbon heating and potentially higher initial running costs are explored in Section 3A and Annex B, however it is worth emphasising that the heating costs of new homes will usually be lower than for existing homes, and that low carbon heating needs to be adopted at pace if climate change commitments are to be met. Beginning with easier installations in the new build sector should help low carbon retrofit in existing homes and may offer more resilient outcomes for all bill-payers over the longer term. However, current UK government projections[21] and assessment methodologies[22] still suggest higher initial and long term running costs than some conventional options.

2A.31 The Department for Communities has commenced work on a *Fuel Poverty Strategy* and will continue to collaborate across government on the fuel poverty impacts of new policies and regulations.

Coming into force periods.

2A.32 Updates to the Building Regulations are usually published with 6 months' notice prior to coming into operation to enable industry to prepare for the changes being introduced. Applications after the coming into operation date must meet the new uplifted standards but an application received prior to

[21] Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK (www.gov.uk)

[22] SAP 10.2 - 11-04-2023.pdf (bregroup.com)

the new uplift coming into operation can continue to completion under the previous regime. There have been concerns that a surge of plans applications made prior to the uplift means that buildings continue to be constructed to the older standard.

2A.33 Article 19 of the Order provides that where plans have been deposited with a district council and the works have not commenced within three years, the district council may issue a notice declaring the application to be of no effect. This normally means that if a valid plans application is deposited before an uplift comes into effect, the developer can build to the older standard, only if they commence construction within three years of the date of application.

2A.34 By contrast, England's latest uplift implemented relatively complex transitional provisions such that its new energy efficiency standards apply unless the work related to previous applications has commenced within one year of the new requirements coming into effect.

2A.35 In all cases (provided the works commenced within three years of the plans application and, in England, within one year of the uplift), the standards applicable at the date of the plan's application will continue to apply, irrespective of how long the construction process takes. This can mean that buildings completing on a particular date are often constructed to different standards, depending on how long the project has taken to complete.

2A.36 Our current Building Regulations already have measures in place under regulation 10, such that individual buildings containing one or more dwellings are each considered on their own merit as separate applications, regarding Article 19. This successfully addresses the most egregious cases of large site-wide housing applications, where the final dwellings are still being commenced under the provisions and standards of many years previous, as had been the practice in England. Regulation 10 appears to be working reasonably well in practice.

2A.37 It is not yet clear how the provisions in England would work out if applied here. For example, it is not clear if contravention notices for elements of the work which conformed to plans passed under the original application could be issued. The inter-dependence of the Parts is confused and threatened if only some Parts are subject to the new arrangements, as may be the case when the deadline is implemented through transitional provisions. The Department, therefore, believes that the best route to provide for any

similar arrangements here would be to consider shortening the time period under Article 19 of the Order.

2A.38 The Department therefore considers that this issue is best considered alongside future review of the Order.

2A.39 The three year provisions of Article 19 of the Order offer the opportunity for industry to skill up to meet the requirements for new standards while residual applications are built out. The phasing in period may justify taking more significant steps earlier in terms of energy efficiency expectations. We would be keen to receive any evidence or data to further inform if change to this position is appropriate.

Question 2A.1 **Do you agree that coming into force considerations would be best addressed through review of Article 19 of the Order, rather than by transitional provisions of any amendment to Part F?**

Question 2A.2 **Do the current arrangements here, with up to three year phasing in period, support an argument for a more ambitious uplift, as it provides scope for processes to be developed and training to take place?**

Question 2A.3 **What do you consider should be the maximum time permissible for previously approved applications to commence on site after the introduction of the new standards?**

Legislative refresh.

2A.40 The Department is mindful of the Hackitt report advice supporting rationalisation and simplification of Building Regulations. Conversely, a number of relatively recent Part F requirements have been implemented via prescriptive regulation in order to demonstrate fulsome transposition to the EU.

2A.41 While the additional EPBD 3 requirements will be implemented as a matter of technical policy, there should be some opportunity to rationalise the regulations themselves. The intention would be to ensure more straightforward approach rather than stepping away from the technical requirements currently in practice.

2A.42 Further liaison and legal advice would be required before detailed drafts revisions could be put to public consultation, but potential examples for consideration for reform might include—

- removal of regulation 43A "Consideration of high-efficiency alternative systems" requirements;
- remove NZEB requirements, as these would be subsumed into the normal new-build requirements under Phase 3, in any case;
- remove "Major Renovation" – unless specific or meaningfully different standards are to apply;
- rationalise exemptions from the energy efficiency requirements of the building regulations stemming from the EPBD (e.g. "places of worship" and "industrial sites") and assess historic buildings in line with other parts of the regulations[23];
- re-consider the use of terms like "National Calculation Methodology" in the regulations
- consider scope for district councils to relax regulation 40 (Target carbon dioxide emission rate) via amendment of regulation 17 (Exercise of power of dispensation or relaxation)
- consider retitling Part F with a view to conservation of energy and emissions reductions.
- consider if adoption of a definition of building (for Part F only) as *"a roofed construction having walls which uses energy to condition the indoor climate"*[24] would be helpful to ensure new-build standards are applied when a heated extension is being added to an unheated building.

Question 2A.4 Do you have a view on any specific regulations or definitions which would benefit from reform, with a view to simplifying or clarifying Part F regulations[25]? If so, please provide details.

[23] Ref Article 3A of the Building Regulations (Northern Ireland) Order 1979 (as amended)

[24] this would be in keeping with other administrations' definitions e.g. regulation 21(2) of England's Building regulations ref The Building Regulations 2010 (legislation.gov.uk).

[25] The Building Regulations (Northern Ireland) 2012 (legislation.gov.uk)

Section 2B: Background- (developments elsewhere)

Reliance on developments elsewhere

2B.1 Uplifts to local Building Regulations normally take place in light of revisions made in England and elsewhere. Whilst legislation may be different, the general policy direction and technical guidance, tends to be based upon a similar standard of technical performance with England in the first instance, although some local adjustments may be made.

2B.2 This approach has been a matter of long-standing convention across all technical Parts of the Building Regulations and follows the recommendations of the committee which first established the building regulations in NI (the McConnell report, 1970). This policy allows the Department to benefit from the policy development, research and implementation lessons elsewhere. The Department has no specific research budget to support independent developments.

A phased programme of steps

2B.3 The recent ‘Phase 1’ measures amending Technical Booklet F1 and F2 guidance from June 2022 have departed from the ‘follow England’ approach. In this particular instance, local, manual calculations and adjustments were applied as a one-off interim measure, while the Department reviews the proposals and measures implemented elsewhere. The Department considers that maintaining such an independent approach is unlikely to be efficient or feasible over the longer term and that, whilst challenging, the recent changes made in other regions now need to be brought forward here too.

2B.4 The current proposed 5-phase programme for future developments is based upon a return to the position of a presumption of a general re-alignment with England. Although some options explore adjustments or alternatives, such as an earlier move to low carbon heating, any alternative approaches, will take more time and come with higher delivery risks.

The 5 phase programme

Phase 1 provided an interim uplift from June 2022. This increased standards through higher targets and new minimum insulation values that should lead to improved building fabric and an increased use of on-site renewables. It was developed with a view to implementation as quickly as possible.

Phase 2 is a discussion document to inform longer term uplifts. This is seeking to gather evidence to identify and help remove constraints to higher standards in the long term.

Phase 3 is an uplift likely to be 2023/24 that would take into account uplifts which came into operation in other regions over 2022/23. These changes are likely to ensure buildings are at least future-proofed in relation to low-carbon heating. The uplift will make the highest carbon fuels, such as coal and oil, unviable for most new-build situations. It includes a review on some of the related parts, such as ventilation and overheating.

Phase 4 is an uplift in 2026/27 that would take into account the 'Future Homes and Future Buildings' standards and similar developments in other regions likely to be introduced in 2025. It is anticipated that these will explicitly support low-carbon heating solutions in new buildings.

Phase 5 is a further review in 2029/30. This will review the position and consider issues that have not been addressed in previous phases.

Following other regions

2B.5 The final position and out-workings of developments in England only become clear upon publication of their legislation, technical guidance and final impact assessments[26]. There are often valuable lessons learned during, or shortly after, implementation, particularly where other regions adjust the measures or take a different approach.

2B.6 The dates for NCM revisions and changes to England's building regulations (i.e. 2022 and then new *Future Homes* and *Future Building Standards* from 2025) therefore set the timeline for the Department to subsequently recalibrate the local position some 18-24 months later. The Department considers this to be the minimum time necessary to learn lessons, assess local implications and take the necessary legislative steps for implementation here.

[26] For example, England's 2012 proposals initially indicated an aggregate 20% emissions uplift would be applied to standards for new homes but was revised down to 6% at final stages. Similarly, proposals for "zero carbon homes" standards for new homes for 2016 were dropped in 2015.

Part F and the National Calculation Methodology (NCM)

2B.7 Reliance on developments in England is particularly embedded in regards to Part F. The Department relies on the provision of each new National Calculation Methodology (NCM) and its approval of associated software by the UK's Department of Levelling Up, Housing and Communities (DLUHC) and the Department for Energy Security and Net Zero (DESNZ)[27,.28] This extends to an inter-related network of support for delivery of EPCs

The National Calculation Methodology (NCM)

The UK NCM programme and the related policy supports are highly embedded into our local building regulations and EPC regime. For example ─

- local assessors are trained, accredited and overseen under provisions managed jointly with DLUHC;
- software is similarly first approved by DLUHC, before coming into operation here;
- the EPC regime data is held and managed by DLUHC on behalf of the Department;
- DLUHC manage and deliver the format and presentation of EPCs here to follow that of England and Wales;
- DESNZ and DLUHC manage the SAP and SBEM development programmes for domestic and non-domestic energy assessment methodologies and software.

The Department has no budget to manage these regimes independently and any local changes in the regime come with policy risks, particularly given the limited resource capacity and the need for ongoing, continuous oversight of any local variations.

2B.8 Each uplift to energy efficiency requirements of England's building regulations delivers updated NCM and software, which is then adopted locally for both Part F and Energy Performance Certificate (EPC) assessments. New editions of the NCM typically update cost and carbon intensity factors for fuels as well as amending assumptions or assessment methods to reflect an improved understanding of building physics arising from research. Management at the UK level has traditionally helped ensure a consistent approach to the EPBD by administrations.

[27]formally a part of the Department for Business, Energy and Industrial Strategy (BEIS)

[28] DLUHC leads on the SBEM and non-domestic NCM, whilst DESNZ leads on the development of SAP, which is the assessment tool for dwellings.

2B.9 The NCMs model ‘regulated’ energy uses for heating, cooling ventilation and lighting associated with the building. Other ‘unregulated’ energy uses, such as small power or industrial processes are outside the scope of the assessments.

The current NCM; Notional Buildings and Building Regulations

For building regulations purposes, the NCMs also include a Notional Building/Dwelling ‘recipe’ of assumptions around the type and efficiency of heating system, insulation values, airtightness etc. Designers are free to depart from this specification, but their design proposals must match the modelled Target carbon dioxide equivalent Emissions Rate (TER) performance that a Notional Building of the same size and shape would have obtained.

However, the NCMs used here, currently set the TER in such a way that the full impact of higher carbon fuels is not fully accounted for. Thus, a non-domestic Notional Building will presume the same fuel as proposed in the Actual Building, and the Notional Dwelling TER will be adjusted with ‘fuel factors’ to accommodate higher carbon fuels than the Notional Dwelling assumption, which presumed a mains gas boiler was used. It is proposed to remove these provisions as part of the Phase 3 proposals (see Section 3A and 4A) to more rigidly account for carbon performance.

2B.10 However, a number of significant changes within the new NCM (SAP 10 and SBEM v.6) and Notional Dwelling and non-domestic Notional Building specifications (which Actual Buildings have to match in performance terms) would have local implications, if replicated here. The removal of mitigations for higher carbon fuels is particularly significant, given our local dependence on oil and our more limited mains gas provision (see Sections 3A and 4A).

2B.11 There are significant differences between regimes here and in the Republic of Ireland, which maintains its own assessment regime and software with support from the Sustainable Energy Authority of Ireland (SEAI).

2B.12 While some impacts with respect to the forthcoming NCM are discussed as part of the Phase 3 pre-consultation proposals (Section 3A and 4A), we are also looking for local opinion and insight on longer-term issues, which might inform our limited input to DLUHC and DESNZ’s NCM programmes or lead to particular local metrics for building energy assessments here (see Section 6.). These changes and updates can also interact with EPCs.

EPC fitness review

The UK Department for Levelling Up, Housing and Communities (DLUHC) is carrying out an EPC fitness review which includes actions designed to deliver an EPC system that produces *accurate, reliable and trusted EPCs which engage consumer and support policies to drive action*.

The Department works closely and is reliant on DLUHC's systems around EPCs, so the lessons learned in this review are expected to apply equally here.

General note on comparison with standards in other regions.

2B.13 Caution is required when comparing current Part F energy or emissions performance standards to other regions' requirements, as variations in software, carbon and primary energy factors of fuels and multiple other methodological variations can be influential.

2B.14 The Department would be interested in any specific evidence or research directly comparing the compliant or 'Notional' buildings across administrations, ideally using an up to date and consistent methodology for comparative analysis purposes (e.g. SAP 10). Whilst we are continuing with some of our own modelling, it is thought that accreditation schemes, academics and assessors working on new-build proposals in different administrations may have routine access to this evidence, that could inform the future position here.

Question 2B.1 Have you modelling information directly comparing the compliant or 'notional' buildings across administrations, ideally using an up to date and consistent methodology for comparative analysis purposes (e.g. SAP 10)? If so, please provide a link or information on how to access this.

Key local characteristics

2B.15 Our building stock, energy system, industry and regulatory regimes are not the same as England's. Key considerations include─

a) EPC data suggests that some local new build dwellings are significantly larger, on average, than other regions. There is also a different new build mix with a greater percentage of detached houses than England, resulting in greater total energy consumption per dwelling and per occupant (see Section 6C).

b) The local gas network is much less extensive than in other regions, with high levels of reliance on oil for both existing (68%) and new (31%) dwellings. By contrast, the gas network provides for some 85% of dwellings in England.[29]

c) 64.8% of homes in NI have been built since 1965 whereas the UK average is 45.3%. Similarly, a much higher proportion of homes here had a higher standard of fabric insulation in 2016/2017, with 73% having an insulated cavity wall, compared with the UK average of 48%.[30]

d) Whilst our local electricity is produced using a high level of renewables, the lack of nuclear power and greater reliance on coal[31] here means that the carbon performance of the local grid is not equivalent to the GB grid. Caution therefore needs to be applied when carrying out modelling assessments using the UK National Calculation Methodologies (NCM) (see notes in Annex B).

e) The local electricity grid connection charging regime is not the same as other regions, where a greater degree of socialisation occurs. This currently means that reinforcement costs for upgrade to the supply at a particular site may fall to the individual developer to a greater extent than occurs elsewhere. In some cases, this can be costly. The regime is under review led by the Utility Regulator.

f) Construction costs and rates are typically considered to be slightly lower here than in GB and ROI, although materials may not necessarily be so discounted and have recently increased under abnormal inflationary pressures.

g) There is a greater preponderance of smaller developers and contracting firms compared to GB, where larger scale house builders tend to dominate the new-build housing markets.

h) There is competition for trades people, with many working in GB and Ireland, who may already be familiar with standards applicable there.

[29] The-Housing-Stock-of-the-United-Kingdom_Report_BRE-Trust.pdf (bregroup.com) and 'on construction' EPC data

[30] The-Housing-Stock-of-the-United-Kingdom_Report_BRE-Trust.pdf (bregroup.com)

[31] Coal fired generation at Kilroot is scheduled to end in September 2023 with conversion to gas turbines. see EirGrid_SONI_Ireland_Capacity_Outlook_2022-2031.pdf (eirgridgroup.com)

i) The extent of fuel poverty is generally considered to be higher here than in other regions, given higher rates of deprivation. Consumer Council reporting[32], estimates that 247,000 households in Northern Ireland are in fuel poverty. This represents a fuel poverty rate of 34% although comparison across administrations can be difficult, given the variations in how fuel poverty is defined in each administration.

j) Other regions' local planning conditions or programmes seeking a 'better than building regulations' approach, have often helped establish skills in advance of building regulations uplifts. It is possible that other areas are better prepared with the skills needed to deliver the changes as a result.

k) the building regulations application regime here flows entirely through the district councils' building control offices, whereas England operates private sector compliance routes with Approved Inspectors and, for more minor work, Competent Persons Schemes. Informal feedback would suggest that the local approach provides an approach to enforcement at less risk of conflicts of interests.

These issues should be borne in mind when considering subsequent sections.

Question 2B.2 Are there any additional local characteristics or issues around our local industry that the Department should be mindful of as we take forward proposals?

Developments elsewhere

2B.16 Annex C provides an overview list of recent and planned developments in other regions.

2B.17 Uplifts came into effect in England, Scotland and Wales over the course of June 2022-March 2023, all using the new NCM (SAP 10 and SBEM v6). The changes include measures on energy efficiency and carbon performance, ventilation, overheating and electric vehicle (EV) infrastructure. The Republic of Ireland instituted a major uplift with a view to NZEB requirements in 2019 and introduced EV requirements in 2021 in line with the EPBD requirements.

[32] Review Of Fuel Poverty Levels In Northern Ireland https://www.consumercouncil.org.uk/policy-research/publications/research-report-review-fuel-poverty-levels-northern-ireland

2B.18 Sections 3 (dwellings) and 4 (buildings other than dwellings) provide pre-consultation detail on issues involved in implementing a (Phase 3) Building Regulations uplift to take these developments in other regions into account. These include measures on ventilation, overheating and EV charge point infrastructure. An alternative heat-pump led approach to Notional Dwellings is outlined under an 'Option 2' approach (see Section 3A).

2B.19 While 'Phase 1' Part F amendments to TBF1 and TBF2 guidance uplifted local energy efficiency standards, the more recent measures in the other regions demonstrate the extent of ongoing reform. There are a number of far-reaching implications in following England's proposals for our own Phase 3 plans, and the intention in Sections 3 and 4 of this document is to inform and explore these challenges in detail, to outline the different developments in other regions and to encourage local industry to prepare.

2B.20 Other developments, likely to be influential, are outlined in Sections 5. These are also expected to apply in other regions after or alongside implementation of our Phase 3 and Phase 4 uplifts. They include─

- England's *Future Homes* and *Future Buildings* standards, due to apply there from some time in 2025;
- a proposed ban on Direct Emissions Heating in new buildings in Scotland from April 2024;
- a move to standards equivalent to Passive House standards in Scotland as part of its subsequent uplift in late 2024/25. This is likely to occur alongside NCM and other developments supporting England's Future Homes and Future Buildings workstreams;
- DESNZ scoping proposals[33] for new gas boiler standards sold in the UK to ensure they are hydrogen ready from 2026 and have a Minimum Energy Performance Standard (MEPS) of above 100%. The latter proposal would be achieved by hybrid heat pumps, incorporated within or alongside gas boiler appliances;
- new EU proposals for a recast EPBD expected in 2023, with application and transposition dates to be confirmed.

2B.21 Section 6 looks at other methodological questions, such as local factors not currently reflected in the NCM, and side issues, such as embodied carbon

[33] Improving boiler standards and efficiency - GOV.UK (www.gov.uk)

and sufficiency in space standards, that may need addressed in the longer term (Phase 5) or alongside the programme.

Question 2B.3 **Do you agree with the proposed timing of uplifts planned for 2023/24 (Phase 3) and 2026/27 (Phase 4), which are intended to follow developments in England by 18-24 months in each case?**

Section 3: Pre-consultation Phase 3 proposals for dwellings

Introduction- new build dwellings

3.1 The Climate Change Committee (CCC) is seeking new-build standards that require UK homes to be ultra-efficient, adapted to the changing climate and using low carbon heating from 2025 with the 'net zero emissions by 2050' target in mind[34]. Its advice report on Northern Ireland[35] outlines that *"All newly constructed homes should be zero-carbon as soon as practicable, with no requirement for later retrofit."* The Department recognises that the homes built and retrofitted in the coming years will still be in place in 2050 and accepts the need to improve new-build standards as quickly as practicable to support Climate Change targets.

3.2 Uplifts came into effect in England, Scotland and Wales over the course of June 2022-March 2023. The changes include measures on energy efficiency and carbon performance, ventilation, overheating and electric vehicle (EV) infrastructure. All use the new NCM (SAP 10, SBEM v6 and updated DSMs) for energy assessments. The Phase 3 proposals seek to implement an uplift implementing measures in line with these developments.

3.3 The Republic of Ireland instituted a major uplift with a view to NZEB requirements in 2019 and introduced EV requirements in 2021 in line with the EPBD requirements. While recent 'Phase 1' Part F amendments to TBF1 and TBF2 guidance uplifted local energy efficiency standards here, these and subsequent measures from the other regions demonstrate the extent of ongoing reform required in a number of areas.

3.4 There are a number of far reaching implications in following England's proposals for our own Phase 3 plans, and the intention in Sections 3 and 4 of this document is to—

- inform and explore these particular challenges;
- consider some of the different approaches in other regions;

[34] 2022 Progress Report to Parliament - Climate Change Committee (theccc.org.uk) Action for DLUHC

[35] Advice report: The path to a Net Zero Northern Ireland https://www.theccc.org.uk/publication/advice-report-the-path-to-a-net-zero-northern-ireland/

- gain evidence to inform decisions and mitigate risks;
- where possible, indicate the Department's current thinking and intended direction, subject to ongoing consultation and impact assessment work; and
- encourage local industry to prepare and upskill.

Low carbon heat - new build dwellings

Running costs of low carbon solutions

An initial appraisal of a semi-detached house has been provided in Annex B and shows how a heat pump may not reduce running costs to the same extent as solutions based on a conventional boiler and offset of emissions with photovoltaic arrays.

However, heat pumps or bio-fuels are the only solutions that, at present, reduce emissions to levels close to the expected 2050 levels demanded by the Climate Change Act. Further modelling of specific outcomes will be needed as part of future proposals, but this illustrates some off the challenges with low carbon heating led solutions.

3.5 England's 2021/22 measures were intended to go as far as possible while acknowledging that the transition to low carbon heat requires that the design, installation, and commissioning of technologies such as heat pumps needs further development in the UK. Their 2021/22 measures are intended to future proof buildings for low carbon heat and encourage, rather than requiring, low carbon heating as an integrated part of the new build at this stage.

3.6 Where low carbon heat is not provided, the measures introduced in England, Wales and Scotland all seek to ensure new homes match the carbon performance of a Notional Dwelling heated with a gas boiler with offsetting measures equivalent to a significant array of photovoltaic arrays, for example to over 40% of the roof.

3.7 In Section 3A an alternative 'Option 2' is also explored, looking at a heat pump led Notional Dwelling. This would be very challenging to deliver, given current Departmental resources, market conditions, assessment methodology constraints and associated risks.

3.8 Wider action on energy reform, such as smart systems flexibility, tariff and wholesale pricing reforms, may mean that buildings with low carbon heat come to provide more stable and cost-effective outcomes in the medium or longer term. However, the UK government's current NCM and its long term

cost projections, which the Department is obliged to use for impact assessments, continue to point to retail electricity vs gas price ratios that would not yet benefit heat pumps at current typical efficiencies.[36]

Statement from BEIS and The Prime Minister's Office 'British Energy Security Strategy.

The government is seeking to 'rebalance' the costs placed on energy bills away from electricity to incentivise electrification across the economy and accelerate a shift away from volatile global commodity markets over the decade. This will also ensure heat pumps no longer face the current market distortions and are comparatively cheap to run over time. We will publish our proposals on how to do so in due course, considering overall system impacts and limiting the impact on bills, particularly for low-income consumers.

Powering Up Britain- Energy Security Plan (March 2023)

We accept the Independent Review of Net Zero recommendation that Government should commit to outlining a clear approach to gas vs. electricity 'rebalancing' by the end of 2023/4 and should make significant progress affecting relative prices by the end of 2024. Rebalancing will generate the clear short-term price signal necessary to shift both households and businesses to lower-carbon, more energy efficient technologies like heat pumps. This is vital to meet Government's existing decarbonisation commitments, including our goal of 600,000 heat pumps installed per year by 2028.

Introduction- existing dwellings

3.9 Building Regulations do not require existing buildings to meet a fitness standard, unless building work is being carried out, or a change of use (to create a greater or lesser number of dwellings) occurs.

3.10 When carrying out work to existing buildings there is a balance to be struck between requiring additional measures to ensure the best holistic outcomes, and discouraging retrofit because the standards are too onerous. This informs the proposals around 'consequential improvement' and 'major renovations' where additional measures or a 'whole house' retrofit approach may not always be immediately feasible.

3.11 In broad terms, the Phase 3 uplift anticipates standards for new or replacement fabric elements and services to match new build standards

[36] BEIS *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*, Central case 2030 and 2040 cost estimates from data tables 4-8; Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK (www.gov.uk)

where possible. Renovation of existing elements is treated more flexibly, with a push towards more careful assessment of traditional construction. There is no requirement, at this stage, to prevent fossil fuel boiler replacements, or require low carbon heating when a replacement boiler is being installed. The CCC advice is that this should apply in off gas grid areas from 2030 and in gas-grid areas from 2033 (see Section 5).

Headline items

3.12 The relevant measures from England's 2022 uplifts include the following headline items for discussion in subsequent Sections -

Conservation of fuel and power (See Sections 3A and 3B)

- A new Notional Dwelling recipe with improved fabric measures and an expectation of 40% of a building's roof covered with photovoltaic arrays (unless heated by a low carbon source). England's consultation indicated that this would provide an improvement of some 30% in terms of modelled emissions over its previous standards for new dwellings from 2013, but this may not be applicable here, given the different build mix and carbon intensity of our local electricity grid (see Annex B).
- In addition to this, we are keen to assess the appetite for a move to an alternative 'Option 2' heat-pump led approach for Phase 3 (see Section 3A), noting this is a very likely outcome for Phase 4, in any case.
- Removal of all existing 'fuel factors' which currently ease emissions targets when higher carbon fuels are proposed. This will make use of conventional oil fuelled heating solutions very challenging in new dwellings and could lead to rural impact challenges.
- A new secondary metric of 'primary energy' to act in addition to the carbon performance requirement. This is important, particularly in the context of decarbonisation of the electricity grid.
- New fabric requirements with improved insulation and airtightness supported by a Fabric Energy Efficiency Standard (FEES) regulation to ensure that fabric energy efficiency standards cannot be unduly compromised by offsetting emissions or primary energy impacts with excessive on-site renewables.
- New heating installations are required to be designed to operate at lower flow temperatures to assist with later conversion to low carbon heating systems.

- Guidance on minimum standards for building services has been uplifted and brought within the Approved Document guidance, rather than being published as a secondary reference document.
- Various refinements of the SAP methodology, including a move to monthly, rather than annual, electrical grid factors (Ref: BEIS's SAP 2012 and 201637 and subsequent consultations).
- Provision of information, including geo-located and dated photographs to help quality assure evidence of on-construction details for as-built information.
- Legislative provisions so that new standards have to apply to all work that does not commence within a year of the introduction of the new requirements, even if the schemes had already obtained building regulations plans approval. (see paragraph 2A.31)
- Update of elemental standards for extensions and minimum services efficiencies for existing dwellings (see Section 3B).
- A greater emphasis on the differences in treating existing traditional moisture permeable construction and conventional construction, rather than limiting this solely to "protected" buildings.
- Proposed additional boiler controls, where a gas boiler is replaced (akin to England's 2018 'boiler plus' measures)
- Proposed new consequential improvements requiring some low cost interventions in existing dwelling where an extension is proposed. .
- Seeking of views on the benefit of measures to require additional work where a major renovation of a dwelling is proposed.

Ventilation (see Section 3C)

- Limitation on the use of natural ventilation to situations where an airtightness performance of $3m^3/(h.m^2)$@50Pa or more is achieved. Previous guidance suggesting a greater area of vents for more airtight constructions has been removed and the guidance on background ventilators is instead provided on the basis of rooms, rather than whole dwellings.
- Continuous mechanical extract ventilation is suggested where airtightness of less than $3m^3/(h.m^2)$@50Pa is achieved, or alternatively 'expert advice' may be sought.

[37] Public consultation on proposals to amend the Standard Assessment Procedure (SAP) 16 November 2016

- Removal of guidance on passive stack type solutions.
- Guidance on external pollution is brought into the main body of the document, instead of sitting in Appendix D of Approved Document F (Ventilation) (ADF).

Overheating (see Section 3D)

- This new Part of the building regulations (Part O) in England requires designers to carry out a 'simplified method' assessment of the extent of openings and glazing on the dwelling.
- Alternatively, or where the requirements of the simplified approach are not able to be met, dynamic thermal modelling of the dwelling should be carried out.
- Designers are obliged to demonstrate that all practicable passive measures have been used before adopting any mechanical cooling/air conditioning in dwellings.
- The assessments require further consideration of issues normally outside the scope of building regulations (e.g. security external noise and pollution) in assessing whether or not openings may function in practice. Openings guarded with grills, shutters or secure vents are a likely result in most cases.
- The proposals also consider if the overheating requirement should apply solely to the erection of a new building, or if they might be also applied to extensions and alterations.

Infrastructure for electric vehicle charge points (see Section 3E)

- This new Part (Part S in England) implements Article 8.2 and 8.5 of the EPBD (as amended by Directive 2018/844/EU) to require the provision of EV infrastructure ducting to parking spaces in and adjacent to new buildings and buildings undergoing major renovation work.
- It additionally implements government policy for England which seeks provision of an EV charge-point at all new dwellings where there is associated parking.
- The requirements to provide the charge point in England is subject to a cost cap of £3,600 for the average connection cost (i.e. the additional cost of the EV change-point would add to the electricity connection charge, excluding building work and the charge point itself). Infrastructure to facilitate future provision of a charge point is still required in the circumstance the cap applies.

Subsequent steps

3.13 Subsequent steps are discussed in Sections 5 and 6 of this document. England's 2021/22 measures were intended as a stepping-stone to the *Future Homes Standard* 2025, which will introduce a presumption of low carbon heating in new homes to achieve a 'net zero ready' standard. This would ensure that these buildings would operate with zero carbon emissions by no later than 2050 on the basis that their very low energy demand and ongoing decarbonisation of grid electricity and without additional building work.

3.14 Annex C provides an outline list of some of the inter-related proposals in other regions.

Question 0.1 **The Department's programme of proposals seeks to implement a 'Phase 3' uplift here in 2023 (likely now to be in 2024) to reflect the changes above. Do you agree that this is appropriate that this should cover the extent of issues above?**

Section 3A: Part F (Conservation of fuel and power) proposals for new dwellings, Phase 3

Proposed Notional Dwelling for 2023

3A.1 Regulation 40 (Target carbon-dioxide emission rate) of Part F requires new buildings to have a Dwelling Emissions Rate (DER) which is no more than a Target Emissions Rate (TER). The current technical booklet guidance to Part F additionally requires betterments of the TER in order to fulfil the requirements of Regulation 43B (Nearly zero-energy requirements for new buildings).

3A.2 The TER is based on the modelled emissions performance of a Notional Dwelling of the same size and shape as the actual dwelling, but constructed to a standard specification.

3A.3 The Phase 3 uplift will remove the current manual 'betterment' calculations brought in as an interim measure in 2022 and instead bring forward a new Notional Dwelling specification. While developers will retain a high degree of flexibility, the new Notional Dwelling will provide a more directly comparable specification which, if followed, will guarantee compliance. Two potential Options for the Notional Dwelling are outlined in this Section:

- Option 1- replication of England's Notional Dwelling specification[38] which is based on a mains gas boiler and photovoltaics
- Option 2- a heat-pump led Notional Dwelling specification, (without the PV array above).

A summary table of these proposed Notional Dwelling options is provided in Table 3A.1. Both Options adopt fabric and other expectations on services efficiencies from England's Approved Document. The Option 2 specification might also be adopted for some homes under Option 1 where a heat pump is proposed- for example, in areas without access to mains gas.

3A.4 There are significant differences between in the scale of emissions reduction and cost implications, with Option 2 likely to have lower emissions but higher operational costs and greater policy risks. Preliminary modelling outcomes for a semi-detached house are outlined in Annex B

[38] Ref Appendix R of SAP10 - Standard Assessment Procedure - BRE Group and summary Table 1.1 of ADL-Vol 1

and detailed consideration of the Options is provided throughout the rest of Section 3A. Capital cost impact assessments have not yet been carried out.

3A.5 Whichever option is adopted, it is proposed that the new Notional Dwelling should also provide outputs for some additional fabric energy efficiency and primary energy metrics alongside the TER/DER assessment. These are intended to prioritise energy (rather than carbon) assessment, as the electricity grid further decarbonises over the medium term.

Table 3A.1 Notional Dwelling Options 1 and 2

SPECIFICATION	EXAMPLE OF PART F 2022 COMPLIANT SPEC FOR TYPICAL 104m² SEMI-D HOUSE	PROPOSED PART F 2023/24 NOTIONAL DWELLING	
Area of Openings	Same as actual building up to 25% of floor area	Same as actual building up to 25% of floor area	
External Wall	0.22	0.18	
Party Wall	0	0	
Floor	0.15	0.13	
Roof	0.12	0.11	
Opaque Door	1.4	1	
Windows & Glazed Doors	1.4	1.2	
Thermal Mass	Medium	Medium	
Allowance for Thermal Bridging Y-value	0.06	0.05	
Ventilation	Natural with intermittent extract fans	Natural with intermittent extract fans	
Air Permeability	5.0m³/(h.m²) @ 50 Pa	5.0m³/(h.m²) @ 50 Pa	
Chimneys and open flues	None	None	
Main Heating Fuel	Mains Gas	**Option 1: (Mains Gas)**	**Option 2: (Heat Pump) (1)**
Heating System (2)	Boiler & radiators, water pump in heated space	Boiler & radiators, water pump in heated space. Design flow temp = 55°C	Air source heat pump Radiators, water pump in heated space. Design flow temp = 45°C
Boiler / Heat pump efficiency	Combination Boiler, SEDBUK (2009) 89.5%, room-sealed, fanned flue	Combination Boiler, SEDBUK (2009) 89.5%, room-sealed, fanned flue	Space heating efficiency(3)= 295% Water heating efficiency(3) = 195%
Heating System Controls	Time & temperature zone control, delayed stat start, weather compensation	Time & temperature zone control, TRV's, Boiler interlock, ErP Class V (4)	Weather compensation with time & temperature zone control and TRV's (4)
Hot Water System	Instant hot water, heated by combination boiler	Instant hot water, heated by combination boiler	Storage system with back up immersion heating
Hot Water Cylinder	N/A in this example	No	Yes
Waste water heat recovery	None	All showers connected to WWHR including showers over baths. Instantaneous WWHR with 36% recovery efficiency (at any flow rate) and utilisation of 0.98.	None
Water use limited to 125 litres per person per day	No	Yes	
Secondary Space Heating	N/A	N/A	
Lighting	100% Low Energy Light Fittings	Fixed lighting capacity (lm) = 185 x TFA Efficacy of all fixed lighting = 80 lm/W	
Electricity Tariff	Standard	Standard	
PV System	1.51 kWp	Option 1: kWp = 40% of roof plan area/6.5 (3.2kWp in case of 104m² 2 storey house)	None

Notes

(1) Appendix D Approved Document L1 2021 (subject to note 3
(2) Subject to policy on district heating systems (see paragraph 3A.92)
(3) These heating efficiencies are calculated in SAP 10, and are different from the COP. Appendix D Approved Document L1 2021 specifies an air source HP of 250% water heating efficiency and 250% space heating efficiency when measured in SAP. This has proven difficult to input in SAP modelling undertaken in Annex B. An alternative performance, close to the ADL1 specification, has been specified in lieu.
(4) programmer and room thermostat where dwelling single storey dwellings with living area greater than 70% of TFA

New Metrics – Summary

3A.6 The Department proposes that the metrics for new assessments after the next uplift to Part F should include;

a) Emissions; a TER/DER assessment, (without the need for the current manual alterations for NZEB assessments)

b) Primary Energy; a TPER/DPER assessment

c) Fabric Energy Efficiency (FEES) assessment

d) limiting U-values and airtightness standards; and

e) limiting services efficiencies

A level of performance will be required for each of these metrics.

3A.7 Alternative metrics on costs, energy use and a renewable energy ratio are used by other regions and are discussed later (see paragraphs 3A.28 – 3A.41) but are not proposed.

Proposed New Metric 1- Primary Energy

3A.8 The TER/DER emissions assessment is currently the principal metric for new-build building regulation assessments under Part F. However, this becomes less relevant as the electricity grid decarbonises and the carbon benefit of electrical savings or on-site generation from renewables consequently reduces. Ultimately, if all fuels used are zero-carbon, an emissions assessment would not be needed[39] England's latest measures therefore adopted a new additional metric of 'primary energy'.

[39] Scotland's ban on direct emissions heating (DEH) therefore removes the emissions assessment (see Section 5)

3A.9 The primary energy metric is intended to reflect the energy used to extract, refine, and transport the fuel as well as the energy within the fuel itself. Primary energy factors are provided in Table 12 of SAP 10 alongside the carbon and cost factor assumptions.

3A.10 The new Target Primary Energy Rate (TPER) is generated using the same Notional Dwelling used in the NCM SAP 10 software and following the same principles developed for the TER/DER assessments whereby the new Actual Dwelling's DPER must be no greater than the TPER. A new dwelling would have to be compliant with both emissions (TER) and primary energy (TPER) if the requirement is introduced.

3A.11 Assessment of both the primary energy and emissions performance has been a longstanding requirement under the Republic of Ireland's building regulations. It has also been adopted in Wales for non-domestic buildings as a requirement since 2014. It is part of the EU's methodology for assessments and the updated requirements of Annex 1 of EPBD 3 require that it is adopted.

3A.12 The Department therefore expects to adopt a primary energy assessment (kWh_{PE}/m^2) alongside the current emissions assessment. Given the efficiencies that heat pumps provide, the TPER, or any other energy assessment, could prove very onerous for other fuels under Option 2, although hybrid boiler/heat pump options may be viable with PV offset compensation for any higher carbon fuels used (See Table 3A.4). Biofuels may be particularly impacted by this, and we would be interested to understand how the uplifts in England and in Wales have impacted this sector (see paragraphs 3A.63 – 3A.69), particularly in areas without access to mains gas. Heat networks also require particular consideration (see paragraph 3A.92 – 3A.106)

Question 3A.1 Do you agree that a new primary energy metric and TPER targets should be introduced?

Proposed New Metric 2 - A Fabric Energy Efficiency Standard (FEES) and updated limiting values

3A.13 A 'fabric first' approach is often emphasised to reduce energy demands in new buildings over the coming decades and to counteract any undue reliance on-site renewables. All administrations implement limiting U-value

requirements, which set minimum insulating standards for new elements (walls, floors, roofs, windows and doors) in buildings.

3A.14 England's assessments also require that new dwellings attain a Fabric Energy Efficiency Standard (FEES) such that the fabric measures in the new dwelling achieve the same overall performance as that of the Notional Dwelling.

3A.15 This measure is intended to ensure that the total energy demand is sufficiently low, before any renewable generating technologies are provided. The lower energy demand helps ensure reasonable affordability when expensive fuels like low carbon electricity or biofuels, are proposed.

3A.16 The FEES includes a holistic assessment of

- insulation U-values
- thermal bridging psi- values; and
- airtightness.

As these elements are consistent across both Options 1 and 2, this metric should be viable under either scenario.

3A.17 Under the FEES assessment, improvements to any of these three aspects can offset reduced performance in another. In practice, it would seem likely that developers may have some opportunity to reduce insulation levels in dwellings by improving the thermal bridging assessment or the airtightness performance. However, this flexibility is restricted by separate limiting insulation requirements, which apply on the basis of the average elemental performances, and additional specific limiting airtightness standards.

3A.18 England has had a policy requiring FEES since April 2014[40]. Other nations instead rely on limiting air permeability and insulation values. The limiting U-values for building elements can be applied on an average element type basis (i.e. an average of all the walls of a building), or, in the case of the Republic of Ireland and Scotland, on an alternative whole building assessment. This also allows offsetting between element types (i.e. improvement in the roof insulation can offset a slightly worse value in walls).

[40] In previous measures (Part L 2014) FEES were set at 15% less than the relevant Notional Dwelling.

3A.19 The alternative (non-FEES) approach means that consideration of insulation levels is a discrete issue, irrespective of other measures such as airtightness and thermal bridging losses. The relative values for limiting U-values in each administration are provided in the Table 3A.2 below.

3A.20 Thermal bridging and airtightness are not assessed through the limiting U-value led approach, but they still do form a significant aspect of the TER emissions and TPER primary energy, or any other, overall modelling assessment.

3A.21 Our recent Phase 1 amendments implemented a limiting U-value assessment largely aligned to the current position in RoI. This allows an alternative whole dwelling assessment whereby limiting values in one element can be traded off if improvements are made elsewhere on the dwelling. A new FEES regulation and guidance would largely supersede this, as there is a substantial improvement in the fabric performance of the Notional Dwelling Specification from the current limiting U-values.

Table 3A.2 Proposed notional dwelling and limiting values for building fabric

ELEMENT TYPE	CURRENT ENGLAND PART L NOTIONAL & FEES VALUES (JUNE 2022) (PROPOSED FOR PART F 2023/24)	LIMITING VALUES ENGLAND PART L (JUNE 2022)	LIMITING VALUES SCOTLAND (DEC 2022)	LIMITING VALUES WALES PART L (NOV 2022)	LIMITING VALUES ROI PART L	LIMITING VALUES NI CURRENT AND POTENTIALLY RETAINED**(1)** FOR PART F 2023/24
Whole building vs elemental approach	Whole building	elemental	Elemental or whole building	elemental	Elemental or whole building	Elemental or whole building
External Wall	0.18	.026	0.17	0.18 (0.21 for flats)	0.18	0.18
Party Wall	0	0.2	0	0.2	0	0
Floor	0.13	0.18	0.15	0.15	0.18	0.18
Roof	0.11	0.16	0.12	0.13	0.16 (0.20 for flat roofs)	0.16
Opaque Door	1	1.6	1.4	1.4	1.4	1.4
Window & Glazed Doors	1.2	1.6	1.4	1.4	1.4	1.4
Air Permeability	5.0 @ 50Pa	8.0 @ 50Pa	n/a	8.0 @ 50Pa	n/a	10.0 @ 50Pa (6.0 @50Pa proposed)

(1) Subject to consultation and assessment with SAP software suppliers.

3A.22 It is likely that the new standards will be challenging for industry. For example, a conventional cavity wall of high-density masonry, with a 150mm

cavity fully filled with coated polystyrene bead is likely to achieve a U-value of 0.21-0.22 W/m^{2}K. This would be acceptable under the new limiting values in England but the FEES regulation may make it difficult to achieve in practice. It would currently be possible under a whole building U-value approach here and possibly in the Republic of Ireland if all other requirements are met. However, it would not be acceptable under limiting values of Wales. Alternatives to cavity wall construction such as internal and external insulation systems are likely to be increasingly required to upgrade many existing homes. Their introduction for new construction could help achieve economies of scale and skills for insulating older walls while achieving very low U-values in new construction.

3A.23 The Department is keen to support a fabric first approach with additional focus on thermal bridging and airtightness measures. There was very strong support for the retention and extension[41] of FEES when DLUHC consulted on the issue in England. The Department therefore expects to consult on the application of (full) FEES on the same basis as England.

3A.24 If FEES are applied, limiting fabric U-values are of limited concern as the FEES metric is more likely to determine typical outcomes in new builds. The Department would be interested in opinions as to whether the current limiting values here should be retained, in line with RoI, or if it would be acceptable and more straightforward to be consistent with England on this issue. Retention of limiting U-values in line with RoI could require negotiation with software suppliers, for potentially minimal benefit in practice, given the FEES requirement will predominate in practice.

3A.25 There might also be an option to specify even better U-values in the Notional Dwelling specification. Table 3A.3 shows the different fabric U-values applicable under Scotland's and Wales's Notional Dwellings for comparison alongside anticipated *Future Homes* values[42] alongside reference values from a range of exemplar dwellings which would pass current requirements in the Republic of Ireland[43].

[41] Previous FEES in England permitted a 15% relaxation from Notional Dwelling standards of the time, the 2021/22 uplift removed this and applied the updated Notional Dwelling fabric assessment fully.

[42] ref Option 1 of England Future Homes Consultation 2019

[43] ref Appendix E of Technical Guidance Document L – dwellings (2022)

3A.26 Some of these values are closer to the proposed 2025 Future Homes standards (see Section 5) but the variations between each administration need to be considered holistically and in the light of other limiting requirements, to fully appreciate whether these would actually be built, in practice. The proposed FEES (as adopted in England) requirement provides a very strong assurance that the overall fabric performance will have an overall performance in line with the Notional Dwelling fabric specification whereas there is significantly more flexibility to vary from the Notional Dwelling standards elsewhere.

3A.27 The Department's current programme would suggest these more advanced *Future Homes* fabric standards may become requirements here in 2026/27, but we are open to hear views or evidence on this. Our preliminary modelling suggests these combined higher fabric values might achieve as much as a 10% reduction in energy demand in semi-dwelling types, but is likely to be less in more compact forms such as flats and mid-terraces. The improved fabric measures to *Future Homes* standards would be likely to have very long payback periods, increasingly impacting potential overheating (see Section 3D) and ventilation considerations (see Section 3C).

Table 3A.3 Notional dwelling fabric values

ELEMENT TYPE	ENGLAND PART L NOTIONAL & FEES U-VALUES (JUNE 2022) (PROPOSED FOR PART F 2023/24)	NOTIONAL DWELLING U-VALUES WALES PART L (NOV 2022)	NOTIONAL DWELLING U-VALUES SCOTLAND (DEC 2022)	EXEMPLAR DWELLING U-VALUES (1)(2) ROI (DEC 2019)	INDICATIVE FUTURE HOMES U-VALUES (3) ENGLAND (2025)
External Wall	0.18	0.13 (0.18 for corridor walls)	0.15	0.13	0.15
Party Wall	0	0	0	0	0
Floor	0.13	0.11	0.12	0.14	0.11
Roof	0.11	0.11	0.09	0.11	0.11
Opaque Door	1	1	1.2	1.5	1
Window, roof windows & glazed doors	1.2	1.3	1.2	0.9	0.8
Air Permeability	5.0 @ 50Pa	5.0 @ 50Pa	5.0 @ 50Pa	3.0 @ 50Pa	5.0 @ 50Pa

(1) From exemplar compliant new dwelling specifications listed in Appendix E of RoI's Technical Guidance Document L for dwellings.

(2) Average, as-constructed, U-values of Walls: 0.17, Roof and Floor: 0.12 and Windows 1.17 were reported in 2021 for new homes to TGD L 2019 NZEB standard in Ireland[44]. These are very close to the proposed new Notional Dwelling values.

(3) Based on Option 1 fabric standards suggested in Future Homes consultation impact assessment.[45] An improved air tightness of <3.0m^3/m^2.h @50Pa is also anticipated.

Question 3A.2 **Are you content that a FEES metric and targets should be introduced in line with the assessment in England?**

Question 3A.3 **Could you provide a specification that house builders are actually adopting in practice in order to be compliant with England's current requirements? Please provide details and commentary or explanation.**

Question 3A.4 **Do you think the proposed Notional Dwelling fabric is suitable for Option 1 and Option 2's proposals?**

Question 3A.5 **Would you agree with replication of England's limiting U-values? We would be grateful for any evidence or reasoning if you think these should these remain in line with the Republic of Ireland or be otherwise different.**

[44] Passive House Plus magazine- edition 36 p16 "NZEB effect on new home specs emerges. Heat pumps dominate & mechanical ventilation grows but compliance risks emerge."

[45] The Future Homes Standard consultation impact assessment - GOV.UK (www.gov.uk)

Alternative Metric 3 – Cost (not proposed)

3A.28 Instead of FEES, Wales has introduced an energy efficiency cost metric along with its more onerous limiting U-values. The 'householder affordability' cost assessment means that a new dwelling must have a SAP rating of 81(B) or better. This was aimed at ensuring direct electric heating can only be installed where the overall energy requirement for the building is sufficiently low to limit high running costs. The alternative assessment, from England, is that FEES and building services efficiency requirements should deliver similar results.

3A.29 Fuel price volatility means that use of SAP energy efficiency ratings, based on cost, may not always be reliable in practice. A property rating may vary between various editions of SAP where a particular fuel cost fluctuates relative to others. While this can also happen with carbon metrics and primary energy, there is heightened focus where metrics report on running costs. By contrast Delivered Energy (as used in Scotland- see paragraph 3A.36 below) provides a more stable metric, but in measuring energy without discriminating by fuel, it does not assess relative merits or impacts of any particular fuel type or cost.

3A.30 The SAP 10.2 cost factors are already quite outdated, as they are based on cost predictions made prior to 2021 and the cost assessment for any particular building is based on a 'neutral' UK location meaning that the outputs will not be accurate or up to date. Therefore, the Department does not propose to add a cost-based metric at this stage. We expect that the Carbon, Primary Energy and FEES assessments, taken together, should provide a wide degree of protection to ensure energy use is low in new dwellings built to the new standards, particularly when compared to bills for the existing stock.

3A.31 However, the Department is open to considering this position as further evidence emerges, for example in considering alternative routes to compliance with Option 1, such as biofuels, direct electric heating or heat pumps, or if Option 2 proposals supporting low carbon heating are taken forward, it may be necessary to directly address higher potential running costs.

Question 3A.6 Do you agree that the Department should not introduce a cost (SAP rating) metric assessment?

Alternative Metric 4 – Energy Use Intensity (EUI) or delivered energy/m^2 (not proposed)

3A.32 There was a strong demand in responses to England's consultations for an energy use intensity (EUI) indicator, rather than the new primary energy metric. EUI is a record of the total energy requirements that the building has in kWh/m^2 before conversion factors, such as a carbon, cost or primary energy factor based on the fuels used, have been applied.

3A.33 EUI does not discriminate between fuels. Each kWh of fuel that is converted to heat (or cooling) is considered as one kWh. Under the current cost/primary energy or carbon assessment conversion factors in Table 12 of SAP adjust this to reflect the relative impacts and, in effect 'weight' each fuel differently.

3A.34 The Department is keen that EUI of each fuel is recorded more carefully in data records and we understand that this will be recorded in EPC data lodgements used for properties under SAP 10 and later SAP versions to better track improvements in the stock over time and assist in future re-assessment of buildings' performances.

3A.35 The Department notes that the EU Commission is proposing EUI metrics under proposed revisions to the EPBD (EPBD 4), however at this stage, we do not see the need or value of requiring it as a further performance metric in Building Regulations assessments, so long as this underlying measure is recorded in EPC data registers.

3A.36 Scotland has chosen a very similar format to EUI as a 'delivered energy target' under its proposals from December 2022. The Scottish assessment excludes any offset from exported energy from renewables, meaning those on-site renewables which are provided are only deemed to be of benefit in so far as the energy generated can be used by the building.

Question 3A.7 Do you agree that a delivered energy or energy use intensity metric is not needed as part of the Phase 3 uplift?

Alternative Metric 5 – Renewable energy ratio (not proposed)

3A.37 The Republic of Ireland sets a Renewable Energy Ratio (RER) requirement when new dwellings are constructed. The Republic's RER is the ratio of the primary energy provided from renewable energy technologies to total

primary energy as defined and calculated in DEAP (the Republic's software tool implementing its NCM in dwellings).

3A.38 The requirement responds directly to Article 13 of the Renewable Energy Directive 2009/28/EU (essentially retained in Article 15 of Directive 2018/2001/EU) which states that Member States shall, "*require the use of minimum* levels *of energy from renewable sources in new buildings and in existing buildings that are subject to major renovation."*

3A.39 The Republic's regulations and technical guidance requires a minimum RER of 0.2 to be achieved (i.e. 20% of the primary energy use of the building should be from renewable sources).

3A.40 Renewable technologies for the RER assessment include solar thermal systems, solar photovoltaic systems, biomass systems, systems using biofuels, heat pumps, aero generators and other small-scale renewable systems.

3A.41 Both Options for the proposed new Notional Dwelling set new targets (TER and TPER) based on an assumption of a high degree of on-site renewables input. The Department is minded that these, together with the increasing renewables on the mains grid more generally, should be sufficient, without a need for more explicit regulation to require an additional RER metric.

Question 3A.8 Do you agree that a renewable energy ratio assessment is not needed as part of the Phase 3 uplift?

Question 3A.9 Have you any comment to make on the metrics the Department is proposing to adopt for Phase 3?

Block averaging (no change proposed)

3A.42 At present a block averaging approach can be applied to buildings containing multiple dwellings. If the (floor area-weighted) mean average DER of the dwellings is compliant with the (floor area-weighted) average TER, then all the dwellings within the building can be classed as compliant with regulation 40 (Target carbon-dioxide emission rate). The same rules applies to the 'bettered' averages to demonstrate compliance with regulation 43B (Nearly zero-energy requirements for new buildings), and to TPER and FEEs calculations under England's ADL1 (2022) provisions. Similar provisions apply in the other administrations.

3A.43 This system applies to buildings containing multiple dwellings, i.e. it can apply to a terrace of houses or a block of flats. It means that developers can design buildings to use the same fabric and services solutions across the block.

3A.44 A potential downside of the system is that individual flats or dwellings could have a lower standard of performance, if balanced elsewhere in the block. In such a case, the improved dwelling would not necessarily help the bill-payer's costs in the sub-standard flat. The most obvious place where the poorer performance might occur could be in highly glazed flats, such as penthouse stories etc. These cases are likely to be reduced under any new overheating assessment which is likely to reduce the extent of over-glazing in such dwellings (see Section 3D).

3A.45 We would be keen for opinion and any evidence of poor performance in new construction, permitted through this route and whether the guidance should be amended to limit the extent of variance for any individual dwelling when reliant on a whole-block average performance to demonstrate compliance.

3A.46 At this stage the Department is minded to continue to permit average block assessments and to extend this principle to include any FEEs and TPER assessments.

Question 3A.10 Have you any opinion or evidence to support limiting the extent of variance for any individual dwelling when using a whole-block average performance to demonstrate compliance with TER, TPER or TFEE assessments?

Airtightness

3A.47 Airtightness testing of dwellings is now reasonably standard practice. The current regulations expect most new dwellings to be tested, although sample testing on multi-dwelling sites is still possible, albeit with a penalty of 2.0 $m^3/(h.m^2)$ @ 50 Pa applied to any untested dwellings which rely on a tests done to a similar dwelling.

3A.48 England's latest measures—

- require testing to all new dwellings;

- set a new maximum permissible air permeability level of 8.0 $m^3/(h.m^2)$ @ 50 Pa, which is a reduction from the previous value of 10 $m^3/(h.m^2)$ @ 50 Pa;
- adjust the assessment so that values are rounded to the nearest 0.5 $m^3/(h.m^2$to reflect uncertainties in the process; and
- cite CIBSE TM 23: 2000 which allows an alternative low pressure PULSE testing method;

3A.49 A new limit of 3.0 $m^3/(h.m^2)$ @ 50 Pa is applied in England to naturally ventilated buildings to discourage making naturally ventilated dwellings very airtight. This is due to concerns about the effectiveness of natural ventilation when there is no 'back-up' provided by air permeable gaps in the construction.

3A.50 Dwellings with full mechanical ventilation would continue to receive modelled energy savings from increased airtightness, even at air permeability levels at 3.0 $m^3/(h.m^2)$ @ 50 Pa, or less. This is because mechanically ventilated dwellings should have a designed solution which ensures sufficient continuous or controlled ventilation to prevent poor indoor air quality.

3A.51 The Department expects to accept these same changes, but would be keen to set a lower maximum permissible air permeability level than 8.0 $m^3/(h.m^2)$ @ 50 Pa. Analysis of EPC data from 2021 suggests that setting the requirement at 8.0 $m^3/(h.m^2)$ @ 50 Pa would impact fewer than 1% of new dwellings here, whereas setting the level at 6.0 $m^3/(h.m^2)$ @ 50 Pa or 5.0 $m^3/(h.m^2)$ @ 50 Pa would impact 3.2% and 9.5% respectively based on tested dwelling results up to 2020.

3A.52 The changes to England's guidance also emphasised the need to ensure air gaps at insulation junctions are eliminated.

Question 3A.11 Do you agree that the changes to the airtightness testing regime should include the measures introduced in England, but provide for a lower maximum permissible air permeability level than 8.0 $m^3/(h.m^2)$ @ 50 Pa? If so, what should the maximum permissible level be?

Removal of fuel factors.

3A.53 England's new guidance (Approved Document L1 2021) removes previous fuel factors, which raised the TER when fuels with a carbon factor higher than gas were used.

3A.54 Current fuel factors in Table 2.1 of TBF1 match England's previous provisions and a further local factor of 1.14 applies given the limited gas grid here. Taken together, these factors mean that a dwelling using oil heating can still be constructed here with only marginal improvements over one using gas, despite emitting some 38% more carbon than an equivalent gas fuelled dwelling.

3A.55 This disparity needs to be removed to encourage proper consideration of the carbon impacts and to address the commitment in the Energy Strategy to phase out fossil fuel heating oil.[46] EPC data suggests that some 30% or more of new dwellings here are still being constructed using home heating oil and the Department considers that the Phase 1 uplift of 2022 is unlikely to change this substantially, particularly given the recent high gas price relative to oil.

3A.56 The Department therefore intends to replicate the position in other administrations and remove current 'fuel factor' easements in the Phase 3 TER assessment.

3A.57 This will deliver a TER that reflects a carbon performance standard consistent with the UK's SAP carbon intensity fuel assumptions, irrespective of the fuel type used. It will mean that new dwellings would find it extremely challenging to use conventional oil heating or similarly high carbon fuels under either Option 1 or 2 Notional Dwelling specifications. This approach is in line with the uplifts implemented in other regions, however this would impact a much greater percentage of new build homes here.

[46] See page 44 Energy Strategy- Path to Net Zero

Note on Carbon intensity assumptions.

SAP 10 suggests UK electricity has an average annualised carbon intensity of 0.136 $kgCO_2e/kWh$ (taking account of monthly fluctuations, which are a further complicating factor). This is substantially lower than the values applied to gas 0.210 $kgCO_2e/kWh$ and oil 0.298 $kgCO_{2e}/kWh$ fuels.

In reality, different parts of the UK's electricity network can vary substantially from the SAP average value. The lack of nuclear generation and greater reliance on coal here, means that the local grid carbon intensity is substantially higher than the SAP average and is likely to have been in the region of 0.340 $kgCO_2e/kWh$ in recent years. This means that each unit of electricity consumed here still has a greater emissions impact than a unit of gas or oil. However, this position improves as the extent of the renewable supply to the grid increases, alongside reductions in coal/gas generation. It is planned that coal-fired electricity generation at Kilroot will cease on 30th September 2023.

Further analysis has been carried out by SEAI for the Republic of Ireland's similar DEAP assessment software, where a value of 0.244 $kgCO_2e/kWh$ has been adopted from January 2023. This value takes ongoing electricity grid decarbonisation until 2030 into account and is a substantial fall from a value of 0.409 $kgCO_2e/kWh$, applied in 2017.

Emissions benefits for each Option are dramatically impacted depending on which carbon intensity factor is presumed in the calculations. A lower intensity figure will support electrical heating such as heat pumps (i.e. Option 2 below), whereas a higher figure will support renewable technologies which generate electricity (i.e. Option 1's photovoltaics). See Annex B examples for further detail.

Section 6A considers if local carbon intensity factors should be used in NCM calculations, however this is unlikely to be a straightforward matter and the Department does not envisage local grid factors in a bespoke edition of SAP 10 for Phase 3.

Fuel viability

Table 3A.4 Outline viability of fuels for Options 1 and 2 based on SAP 10 Carbon intensity and Primary Energy factors)

VIABILITY OF FUEL SOLUTIONS (see note below)	OPTION 1	OPTION 2
Conventional mains gas	Yes – with PV or other on-site renewable generation to help offset emissions and primary energy performance*	Unlikely to be viable (due to emissions)
Conventional oil	Unlikely to be viable (due to emissions)	Unlikely to be viable (due to emissions)
Conventional LPG	Yes – with PV and further improvements (e.g. additional fabric measures) to help offset emissions performance	Unlikely to be viable (due to emissions)
Liquid bio-fuels (HVO/FAME/B30K etc)	Yes – with PV and further improvements to help offset emissions performance	Unlikely to be viable (due to the very low TPER delivered by the high co-efficient of performance from the ASHP)
Biomass (wood) and biogas (e.g. from anaerobic digestion)	Unlikely to be viable (due to primary energy metric and/or system efficiencies)	Unlikely to be viable (due to primary energy)
Direct electric resistance heating	Unlikely to be viable due to primary energy – possibly viable for occasional small rooms or in extremely low energy demand dwellings with on-site renewables and battery storage	Unlikely to be viable due to primary energy – possibly viable for small rooms in dwellings
Heat pump (electric)	Yes – without any PV	Yes – without any PV*
Hybrid heat pump (electric with fossil fuel)	Yes – potentially without any PV, if fossil fuel use is low	Yes – with efficiency measures, PV or other on-site renewable generation to help offset the emissions from limited fossil fuel use
Hybrid heat pump (electric with bio-fuel)	Yes – without any PV	Yes – with efficiency measures, PV or other on-site renewable generation to help offset primary energy performance of biofuels
Existing District Heat Network	Yes – a different Notional Dwelling applies in this case and uses the same carbon and PE factors as the actual district heating system	Uncertain - needs further consideration. Policy and software development
New District Heat Network system	Yes – if District Heating matches the performance of gas, then the same extent of PV as the Notional gas dwelling would be expected	Yes in principle - but needs further work – only the most efficient networks would be viable if the notional heat pump performance has to be matched (e.g. waste heat or heat pump led network)

This is an initial assessment only, on which we are seeking views. The assessment is based on some very preliminary modelling of a semi-detached house and inference of impacts to other fuels based on values on Table 12 of SAP 10.2. However, it may not always be possible to make sufficient compensatory improvements elsewhere in the building to account for a fuel with a worse primary energy or carbon emissions factor than the Notional Dwelling's fuel. For example, there may be less scope for fabric improvements or additional renewables in flats than houses.
This means that viability of particular fuels should not be presumed or inferred from this table to apply to all dwelling types or cases. Consultees are encouraged to undertake their own assessment modelling using England's SAP 10.2 software and alert the Department where there may be further issues.
* proposed Notional Dwelling

Rural impacts and heat pumps.

3A.58 A significant increase in the uptake of heat pumps is likely under both Options 1 and 2 in new homes off the gas grid, if oil heating is no longer viable. Under Option 1, heat pumps or alternative solutions (potentially biofuel) would be required in areas without access to mains gas. The Department has carried out some preliminary modelling based on a 104m^2

semi-detached house, in Annex B, showing potential increased running costs for heat pump and other potential solutions.

3A.59 Electricity grid reinforcement costs also tend to be higher in rural areas compared to more densely populated localities. Whilst impacts around this are likely irrespective of Building Regulations, given consumer demands for renewables and EV charging, the outcomes from the review on reinforcement charging seem likely to influence the pace at which electric led solutions for heating and powering buildings can be adopted.

3A.60 BEIS's consultation on *Phasing out the installation of fossil fuel heating in homes off the gas grid*[47] emphasises a "heat pump first" approach to new and replacement systems, in preference to other solutions, in areas off the gas grid. It highlights the need to ensure sufficient supply and wider sustainability impacts of alternative biofuels in coming to this conclusion. Heat networks would offer an alternative solution, which could be viable in urban areas or in clustered rural building developments.

3A.61 If impacts were considered to be disproportionate for rural situations, following a more complete Rural Needs Impact Assessment, then the potential options include—

- adapting Option 1 to retain emission fuel factors in some form (possibly in areas without access to the gas grid only); or
- adopt Option 2 to apply low carbon heating requirements and thus treat urban and rural areas equally (see paragraph 3A.106 onwards).

Both approaches would require detailed policy investigation and bespoke software adaptations which would need to consider primary energy impacts, as well as emission fuel factors

3A.62 Retaining fuel factors would reduce the level of carbon reductions achieved. The Department's strong preference is not to adjust the TER or TPER for off grid situations with revised local fuel factors.

Question 3A.12 Do you agree that all current fuel factors in TBF1 should be removed, so that targets (TER) are no longer relaxed where higher carbon fuels are used?

[47] Phasing out the installation of fossil fuel heating in homes off the gas grid - GOV.UK (www.gov.uk)

Biofuels

3A.63 It is possible that developers could look to biofuels, particularly where the technology is similar to the boiler installations they are accustomed to.

3A.64 Most biofuels have carbon factors ($kgCO_2/kWh$) much lower than mains gas, but most have Primary Energy factors (kWh_{PE}/kWh) higher than mains gas. This means that biofuels in a conventional heating system could fulfil carbon emissions performance requirements under Option 1 but would be challenged by the TPER. New buildings using these fuels would, therefore, need some additional measures to reduce the energy demand to allow them to match the TPER. Some biofuel solutions could be viable under Option 1 (provided sufficient compensatory measures, are installed), but the primary energy figure would certainly prove too large for conventional biofuels to be viable under Option 2. Hybrid heat pump/biofuel (and similar fossil fuel) solutions should still be viable in either scenario, but hybrids are less commercially available and are likely to be more expensive in capital cost terms.

3A.65 Under SAP 10.2's assumptions[48], liquid HVO and similar fuels have PE factors which are marginally worse than the gas used in the Notional Dwelling comparison under Option 1. With improved building fabric or other interventions, biofuels such as HVO may be viable for houses. Flats and mid terraces may find it more challenging, as opportunities for improved fabric and renewable generation would have less impact in reducing energy demands. Potential unapproved or illicit reversion to conventional home heating oil may also be a potential concern where liquid biofuels are initially installed (ref paragraph 3B.44).

3A.66 Biomass solutions such as wood pellets are particularly challenged given their primary energy factors (some 17% worse than gas). Poorer typical appliance efficiencies for other biomass logs or chips can also impact. As such, these fuels may no longer be viable as a conventional primary heating system for new builds, under either option. Biogas from anaerobic digestion may be similarly impacted by the PE metric. The Department would be keen for feedback on how these systems have coped with the recent changes in England to better understand outcomes in this area.

[48] See table 12 of SAP 10.2; the high PE factor for wood pellets is presumed to be due to the energy required for processing.

3A.67 Primary energy assessment checks for replacement boilers are considered at paragraph 3B.37 and the worked examples show potential outcomes in these replacement situations. Wood stoves or secondary room heaters should have a less significant primary energy impact, so should remain a viable feature in most new builds under Option 1, with modest compensatory efforts elsewhere.

3A.68 Most environmental policy groups argue that use of sustainable biofuels should be prioritised towards sectors where there are no other viable options (which is not the case for the majority of new builds) and that the Building Regulations should therefore not encourage the use of conventional biofuel solutions. The CCC supports this position, with some potential allowance for hybrid biofuel/heat pump solutions. The new Primary Energy metric would therefore go some way to support this.

In 2018 the Committee on Climate Change (CCC) recommended that

Whilst bioenergy does not have a significant long-term role in decarbonising heat in buildings, there is a case for some ongoing use of biomass within hybrid heat-pump systems in hard-to-decarbonise off gas-grid homes. There may also be a case for some small-scale biomass use in local CHP and district heat schemes.

BEIS should end support for biomass boilers for heat where there are other low-carbon options and target support at hybrid options rather than drop-in fuels (e.g. retaining an oil boiler but replacing oil with bio-LPG).

Biomass in a low-carbon economy - Climate Change Committee (theccc.org.uk)

3A.69 The Department will also consider the running cost implications of bio-fuel led solutions in Phase 3. If Option 1 is accepted, it may be that alternative metrics (such as delivered energy and/or cost) should be explored, if conventional (i.e. non-hybrid) biomass and biogas primary heating systems are to remain viable for new dwellings.

Question 3A.13 Are you content with the likely outcomes for biofuels under Option 1 and the proposed Primary Energy metric ? If not, how should the regime be less, or more, permissive towards biofuels?

Photovoltaic (PV) arrays and export / non-export connections.

3A.70 PV panels and other renewable generating technologies provide electricity for use in the building or for export to the grid. The new version of SAP

(SAP 10) now applies emissions and PE factors on a monthly basis to reflect the different seasonal contributions to grid electricity from renewables generation. It is not yet clear if future editions of SAP might consider if hourly or half-hourly profiles can be applied to consider diurnal variations. This would help manage day-to-day peak loads as well as the inter-seasonal benefits.

3A.71 Excess generation that cannot be stored or used directly in the building is normally exported, through an export capable connection, to the mains grid. The new SAP 10 methodology, provides an assessment of the 'in-use' β-factor for this assessment in dwellings.

Note on current assessment of export/non-export connections

Under the current Part F assessment, the nature of the connection from a PV array to the grid is not taken into account in the emissions assessment. The full potential generation from the PV array is attributed to the TER emissions performance, even if export is not viable in practice.

Under the new SAP 10 provisions, this will no longer be the case. An export capable connection (or on-site utilisation of energy generated) is presumed in the Notional Dwelling, TER and TPER targets.

Export can be an issue on some sites where the reinforcement of the grid, needed to support export, is expensive. Meeting the TER and TPER performance could be difficult if the export connection is not provided.

3A.72 Where export capable connections are not provided, significant additional compensatory measures will be required to offset for the loss of the carbon benefits that the export would have provided. These might include provision of battery storage or hot water diverter technology to improve the β-factor. Additional energy efficiency measures, such as improved airtightness or other measures may reduce emissions to some degree, but the overall standard could prove onerous to achieve when renewable generation is expected on new dwellings but an export connection is not viable. Risk on this issue may reduce under Option 2, as no PV is assumed in the Option 2 Notional Dwelling, whereas Option 1 anticipates a very large PV array over 40% of the roof area.

3A.73 If the Notional Dwelling specification is followed as per Option 1, PV arrays, would typically need to be of the following sizes;

- 190m^2 Detached House: 5.84kWp

- 104m^2 Semi or Terraced House: 3.2kWp

The formula dictating the amount of PV is dependent on the footprint area (including any unheated spaces), meaning that a house with a roof plan area of more than 59m^2 would be typically expected to have an array larger than 3.68kWp, assuming an export capable connection is provided. As things stand, such houses would not be able to avail of the more straightforward G98 application processes from NIE and provision of an export connection may be uncertain. The 3.68kWp limit may be less relevant if 3-phase connections were to be fitted as standard to new build houses, as proposed in NIE's recent Design Demand Consultation[49].

3A.74 Renewable generation technology is not included under Option 2's specification, although it may be a helpful additional factor in controlling running costs (see paragraph 3A.120 onwards and Annex B).

3A.75 Scotland has excluded the consideration of exported electricity from on-site renewables from the assessment considerations for its building regulations delivered energy assessments. The argument for this is that exported electricity is a matter for the grid and is not reflective of the building's performance, as such. At this stage, it is not clear how this will operate in practice. The position is complex and potential impacts to EPC assessments would also need to be considered. One consequence of excluding the carbon benefits of exported electricity would be that a net positive emissions building would never be possible under the assessment.

Question 3A.14 Have you any evidence or concern around the extent of renewable generating technology expected under either Option 1 or 2?

Question 3A.15 Have you any comment on the proposed revised treatment of non-export connections?

Low temperature heating systems

3A.76 The new measures from England and elsewhere require that new wet heating systems should be designed for a flow temperature of no greater than 55°C. This facilitates any future retrofit to low carbon heating, which operates more efficiently at the lower flow temperatures, and helps

[49] design-demand-consultation-jun22.aspx (nienetworks.co.uk)

condensing boilers operate more effectively. It would apply where a new system is installed, i.e. to both new-building and full replacement systems.

3A.77 Scotland's 2022 Domestic Building Services Compliance Guide 2022 sets a mean flow temperature requirement to 50°C with a ΔT of 10°C, which is a similar expectation.

3A.78 The Department expects to amend the TBF1 guidance to replicate these positions and require all new heating systems to be suitable for low temperature operation. Some stakeholders and respondents to consultations in other administrations, with a view to improving the efficiency of future heat pump installations, have suggested that the maximum flow temperature should be 45°C. However all three GB administrations have concluded on similar positions at 55°C, taking potential emitter (radiator) sizes in existing homes into account.

3A.79 The Department would encourage heating engineers and installers to take up training opportunities to help prepare for these changing design practices.

3A.80 The change would require larger bore pipework and larger emitters (radiators or under floor heating) than would otherwise be required for more conventional higher temperature systems. They do not necessarily require provision of hot water storage tanks as part of the work, if a combi-boiler is being installed. The Department would be open to views on this point, particularly in relation to new dwellings, given a perception of benefits from hot water storage in future proofing for low carbon heating. They also point to a need for behavioural changes in users who should no longer expect high temperature radiant heating in homes.

Question 3A.16 Do you agree that new heating systems should be designed and installed to operate with a maximum flow temperature of 55°C as per England's current guidance? If not please provide evidence to support a different maximum flow temperature, or position.

Minimum Efficiency of Services

3A.81 England's new Approved Document guidance now incorporates the minimum services efficiencies, rather than providing this as a separate second tier guidance document under the *Domestic Building Services*

Compliance Guide. Our guidance to date has always referred to the relevant *Building Services Compliance Guide* as published for England.

3A.82 The efficiencies of a range of items have been tightened, in part to improve alignment with 2018 Ecodesign standards. Changes include;

- for oil-fired boilers, to set the minimum seasonal efficiency at 91% ErP; For solid-fuel appliances, to remove guidance for appliances which are rarely installed, such as open fires and anthracite boilers;
- for heat pumps, to increase the minimum seasonal coefficient of performance (SCOP) of a heat pump installed in an existing dwelling to meet the minimum Ecodesign requirements for direct expansion units[50], and for all other systems a minimum SCOP of 3.0 for heating and 2.0 for domestic hot water;
- for cooling systems, to increase the seasonal energy efficiency ratio (SEER) to 4.0;
- for supply and extract ventilation systems, to have heat recovery at a minimum 73% efficiency, with packaged systems also being fitted with a summer bypass and variable speed controller; and
- for lighting efficacy of fixed lighting, to have a minimum of 75 lamp lumens per circuit-watt for both internal and external lighting.

Please refer to Sections 5 and 6 of Approved Document L1 2021 for further details.

Building Services and Ecodesign requirements

3A.83 Under the NI Protocol, ongoing dynamic alignment with EU Ecodesign requirements is necessary for relevant products placed on the local market. Ecodesign is therefore an issue related to the sale of systems, rather than their installation. Enforcement of the requirements is principally a matter for the UK's Office for Product Safety and Standards.

3A.84 The Department therefore expects to follow the guidance standards from England's Approved Document for Phase 3, and to cite the need for EU Ecodesign compliance where products are placed on the NI market. Such standards for installation should generally be as up to date, or better than, the Ecodesign requirements, based on England's current Approved Document. This issue may need to be revisited in Phase 4.

[50] Eco-design Commission Regulation No. 2016/2281

3A.85 An alternative approach would be for the Department to cite the EU Ecodesign standards and direct designers to meet these requirements, without specific citation to a particular requirement, as these may change over time.

3A.86 However, this would mean that;

- the software checks on services efficiency compliance used elsewhere may not be operable or reliable here;
- where the efficiencies in England's AD guidance are better than the EU's Ecodesign provisions, the higher standard would not be applicable to building regulations here; and
- there would be no 'fixed point' for building regulations compliance, as uplifts to Ecodesign could automatically apply for building regulations, making enforcement difficult.

Question 3A.17 Do you agree that replication of Sections 5 and 6 of England's Approved Document on building services and controls guidance into the next version of TBF1 would be appropriate for the Phase 3 proposals?

Question 3A.18 Do you have any comments or issues around how UK and EU Ecodesign requirements might interact with Part F guidance requirements at Phase 3 or over the longer term?

Water efficiency

3A.87 The primary legislation ('the Order') governing the Building Regulations does not provide powers to attend to water efficiency in the same way that England's Building Act does. Water efficiency policy and legislation in Northern Ireland is principally the responsibility of the Department for Infrastructure and is regulated for via The Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.

3A.88 However, the new version of SAP does include options to demonstrate reduced domestic hot water energy consumption, where a water consumption of no more than 125 litres/person/day is demonstrated. Guidance outlining how this can be demonstrated is provided in Section G2

of England's Approved Document G (Sanitation, hot water safety and water efficiency).[51]

3A.89 The English guidance offers both a straightforward fittings-based approach, which outlines maximum efficiencies for individual appliances, and an alternative water efficiency calculator approach (outlined in Appendix A of Approved Document G).

3A.90 The Department proposes to replicate these options as an appendix to the new TBF1 guidance so that the lower energy demand associated with improved water efficiency could be demonstrated and recognised here.

3A.91 The new Notional Dwelling assumption would be based on 125 litres/person/day. This would not be formally regulating to require water efficiency, but it would mean that energy savings would be able to be taken into account where the 125 litres/person/day or less has been demonstrated. Further details can be found in Appendix J calculations of the SAP 10.2 manual[52].

Question 3A.19 Do you agree that designers, should be able to demonstrate a water efficiency assessment as per Appendix A of England's Approved Document G?

[51] Sanitation, hot water safety and water efficiency: Approved Document G - GOV.UK (www.gov.uk)

[52] SAP10 - Standard Assessment Procedure | BRE Group

Heat Networks

Definitions from Approved Document L volume 1, Dwellings (ADL1))

Community heating system A system that supplies heat from a central source to more than one dwelling or premises within a single building.

District heat networks Supply heat from a central source to consumers, via a network of underground pipes carrying hot water. Heat networks can cover a large area or even an entire city, or can be relatively local, supplying a small cluster of buildings.

Existing district heat network A district heat network that is either in operation or is under construction on DD Month 202X [this will correspond to the relevant date of application of the uplift]. For these purposes, under construction means any of the following.

• The building to house the energy centre has been constructed.

• There is a heat offtake agreement signed between the heat network and a third party.

3A.92 District heat networks and community heating schemes are relatively limited locally. Assessing and dealing with them is not particularly straightforward and the Department is open to receive insight on implementation of recent uplifts in other regions to help inform its position.

3A.93 The CCC has suggested that heat networks should be developed to support 20% of the heating requirement for buildings in the UK[53] and SEAI's National Heat Study suggesting that networked heat energy could provide up to 50% of building heat demand in the Republic of Ireland[54]. Energy Strategy policy encourages new networks and support the expansion and ongoing decarbonisation of existing networks here also.

3A.94 New heat network solutions, such as ambient ground loop geothermal systems with heat pumps at each dwelling, or interface units to piped hot water systems, offer the prospect of good carbon performances. Combination with waste heat from industry or combined heat and power (CHP) generated heat can also be distributed in local networks typically considered more effective in dense developments. Heat networks using piped hot water may also provide a role in reducing peak electricity

[53] see page 115 The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf (theccc.org.uk

[54] https://www.seai.ie/publications/National-Heat-Study-Summary-Report.pdf

demands which may be increasingly significant alongside electrification of heat and transport.

3A.95 Older, mainly community heating, systems may use more conventional central boilers and plant to provide hot water to individual dwellings. Pipework heat losses and use of fossil fuels in such systems can result in a relatively poor emissions performance compared to the newer low carbon systems.

3A.96 However, the opportunity to replace the heat generator with lower carbon sources in poorer performing systems means that even in these cases, where a current network may not yet be low carbon, expansion of the network to new dwellings may be justified, provided reasonable performance is in prospect for the system. Such longer term decarbonisation of the sector is also to be encouraged under policy and legislation other than Building Regulations over time.

Heat Network assessment in a new dwelling

3A.97 The new guidance in England[55] sets out how heat networks are to be assessed and considered when connecting a new or an existing dwelling:

a) to an existing heat network; or

b) to a new heat network.

3A.98 Ideally, heat networks should be registered on the BRE's Product Characteristic Database (PCDB), which operates within SAP, so that the precise values and full benefits of the system are properly incorporated into the assessment. Alternatively, carbon and primary energy factors for district heating are provided in Table 12 of SAP 10[56] , if a system is not verified and incorporated onto the PCDB.

3A.99 **Where connection to an existing district heating is proposed,** England's guidance specifies that the TER and TPER[57] assessment can be based on the same carbon and primary energy factors used in the Actual Dwelling.

[55] Ref Approved Document L1 for further details.

[56] SAP10 - Standard Assessment Procedure - BRE Group

[57] Target Primary Energy Rate assessment- see paragraph 3A.8

3A.100 This means that, for the TER and TPER assessment, new dwellings should be able to connect to an existing district heat network provided that all other aspects of the standard Notional Dwelling (e.g. the fabric performance and any PV array) are provided and subject to a limitation noted below (see paragraph 3A.103).

3A.101 This approach is feasible under Option 1 as the network may not be too far from Option 1's notional gas boiler and a photovoltaic array over 40% of the roof would still be in-built to the specification. However, the poor performance of existing network in lieu of a Option 2's notional heat pump should not be simply accepted without mitigation such as a photovoltaic array over 40% of the roof. Significant further work on this would be needed to address this anomaly, if Option 2 was to be taken forward.

3A.102 Where the connection is to a particularly low carbon existing district heating network, comparison might be made to the 'standard' Notional Dwelling (i.e. gas & PV under Option1, or an air source heat pump under Option 2) instead of the pre-existing system's own carbon and primary energy factors . This would permit the house builder to benefit from the good carbon and primary energy performance of the network, to ease aspects of the specification elsewhere.

Heat Network limiting emissions performance standard

3A.103 Minimum services efficiency requirements always provide an overarching or 'backstop' control under Part F. Section 6 in England's ADL1 notes that "*an existing district heat network that is being connected to a new dwelling should not have a CO_2 emission factor for delivered heat to the dwelling which is greater than 0.350kgCO_2/kWh*." In practice, this limit means existing gas reliant networks are likely to be able to be extended to new dwellings, but heat networks reliant on a conventional oil or other higher carbon heat generators may not.

3A.104 **Where a new dwelling is connected to a new district heat network**, the Notional Dwelling used to calculate the TPER and TER should normally follow the standard specification shown in Table 3A.1 (excluding any WWHR assumptions).

- For Option 1, this would mean that the carbon and primary energy performance of the new heat network, should be no worse than a 89.5% efficient decentralised combi gas boiler, if compensatory improvements elsewhere (additional fabric or renewables measures beyond the standard approach) at the building are to be avoided.
- For Option 2, comparison with a heat pump would seem likely to rule out new district heating systems reliant on fossil fuels, unless the dwellings are fitted with very significant compensatory measures, such as additional PV arrays or improved fabric. The requirement would, essentially, support only the lowest emissions heat network options, such as those based on ambient or waste heat recovery based solutions, when a new network was proposed and even these may struggle given distribution and storage losses. Significant further research and policy development is likely to be needed to establish a functioning assessment to overcome this.

3A.105 The Department will continue to work closely with DfE to further assess the proposals and systems in place under England's uplift. In the meantime, we would be keen to obtain any further insight or evidence from stakeholders on where adjustments from England's position may be required here.

3A.106 In general terms however, the new Fabric Energy Efficiency Standard (FEES) assessment (see paragraph 3A.13) and the other features of the Notional Dwelling should ensure that the total energy requirements of the new dwelling are minimised in all cases.

Question 3A.20 Have you any suggestion or further insight on how heat networks should be assessed under the Phase 3 proposals? If so, please outline the issue and suggested handling in your response.

Option 2- Low carbon heating in the Notional Dwelling

3A.107 The Department wishes to consider whether the current phased programme should follow England's 2025 measures in 2026/27, or if it would be viable to move directly to a presumption of low carbon heating earlier, within the Phase 3 uplift.

3A.108 If viable, this 'Option 2' Notional Dwelling would be based on a heat pump, potentially using a specification slightly amended from ADL1 Appendix D specification. Appendix D of Approved Document L1 2021 suggests a

specification of 250% water heating efficiency and 250% space heating efficiency, as measured in SAP, should be achievable with an air source heat pump. This has proven difficult to input in SAP modelling undertaken to date (see Table 3A.1). An alternative performance of 295% for space heating and 195% for water heating is instead proposed, with the expectation that this would provide an overall performance close to the ADL1 specification.

3A.109 Fossil fuel led solutions would be unlikely to be able to meet the TER as the Option 2 Notional Dwelling would set a very low emissions requirement (see Table 3A.4)

3A.110 Option 2 has not included renewable generating photovoltaics to 40% of the roof area, as this was not in England's Appendix D specification and because both emissions and primary energy performance are substantially better under the Option 2 specification. While an additional PV array may improve cost outcomes over the course of the year, generation and peak demand are not normally considered to be particularly well matched.

Question 3A.21 Is the specification of the heat pump proposed for Option 2 appropriate? If not, how should it be amended?

3A.111 Costs may be assessed in further detail as part of Phase 3 work, but, assessments of similar options undertaken by the Scottish government in 2020/21 suggested that Option 1 (gas + PV) could provide a net benefit of £46M, but that heat pump options, presumed to be similar to Option 2, would be a net cost of £250M[58].

3A.112 Nonetheless the Scottish government has announced a new Buildings Heat Standard[59] which will ban direct emission heating in new buildings subject to a building warrant application from April 2024. The ban includes all fossil and biofuel combustion boilers and is discussed further in Section 5 of this document. Final details, including Scotland's technical guidance and impact assessments are yet to be published. With this and the CCC recommendations in mind, we are keen to gauge the appetite for both Options 1 and 2. Wales introduced similar requirements for its new-build

[58] Building regulations - new domestic buildings - modelling of proposed energy improvements: research report - gov.scot (www.gov.scot) Note- these assessments are coming from a different starting point if compared to our current compliant buildings.

[59] New build heat standard consultation: part II - Scottish Government - Citizen Space

social housing from October 2021, whilst also expecting an EPC 'A' rating.[60]

3A.113 'Pros' supporting a Notional Dwelling with a heat pump─

- Our region would be moving to a more explicit and fulsome expectation of low carbon heating for all new dwellings and thus meeting CCC recommendations more fully.
- The cost of renewable electricity generation and of power storage technologies has been falling and further innovation is likely.
- The new standards will require adoption of low temperature heating systems to future proof all new dwellings under both Options 1 and 2. Installing the heat pumps alongside the pipework and radiators in all new build dwellings may help ensure the quality of these systems when first installed and might more robustly support the move to low temperature heating from day one.
- The uptake of heat pumps is likely to increase under England's *Future Homes* standards for 2025, so the change to these systems for new dwellings is likely to be required in 2026/27 in any case.
- Introducing low carbon heating in the new build sector develops design, installation, and commissioning skills, helping to speed the decarbonisation of our existing housing stock (a much larger market).
- The UK government are promoting that boiler manufacturers make a rising percentage of heat pumps[61]. Governments elsewhere are pushing forward to renewables, and away from traditional fossil fuels, with heat pumps specifically identified as an important measure in this.
- Analysis of the new build housing stock has indicated that heat pumps are already being included as part of the installation in some 95% of new dwellings built to the Republic of Ireland's latest standards.[62]
- There would be no sense of discrimination between rural/off-gas grid and urban areas, where mains gas is likely to be accessible.

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[60] Welsh Government bans fossil fuel boilers in new social housing - Iabm (Iabmonline.co.uk)

[61] Market-based mechanism for low carbon heat - GOV.UK (www.gov.uk)

[62] Passive House Plus magazine- edition 36 p16 "NZEB effect on new home specs emerges. Heat pumps dominate & mechanical ventilation grows but compliance risks emerge."

Note- the fuel pricing issues in RoI are not the same as here.

- The building out of previous applications on site normally means the new requirements actually apply in a phased way over a number of years; this offers more time to skill up than the 'coming into operation' date might suggest (see paragraph 2A.32 onwards on commencement provisions).

3A.114 'Cons' mitigating against a low carbon heating approach to the Notional Dwelling─

- Option 2 would be a significant variation, acting ahead of England and Wales. It would require additional policy development work to assess outcomes and to deliver the necessary adjustments to the NCM and software. It could delay implementation of Phase 3 to late in 2024 or may even prompt further review in light of England's Future Homes proposals.
- It would be challenging to have skills in place at sufficient scale and capacity to provide for low temperature heating systems and low carbon heating solutions. England has held off on heat pump led requirements, given similar concerns there. However, the uptake of heat pumps in the Republic of Ireland, following introduction of their NZEB related uplift in 2019, has shown that the technology can be adopted at pace. A significant upskilling will be required to support low temperature heating systems and heat pumps in either case.
- Option 2 can be expected to have upfront higher capital costs and a longer payback period than Option 1.
- If heat pumps were applied to detached houses (as suggested in England's final stage Impact Assessment[63]) and off gas-grid areas, then heat pumps could be a likely solution perhaps as many as 50% of new homes under Option 1 in any case.
- The grid and electricity network capacity may be challenged under both scenarios, but the Option 1 specification provides more flexibility for particular sites where grid supply capacity may be an issue, as gas, LPG, biofuel and other solutions can still be deployed (although export from the PV array needed in these solutions could be an issue).

[63] The Future Homes Standard consultation impact assessment - GOV.UK (www.gov.uk)

- Continued expansion of the gas network would be impacted under Option 2 as new-build dwellings would only be able to connect if hybrid boiler/heat pump options were used alongside PV or other renewable generating technology to offset the limited fossil fuel emissions. There is some anecdotal feedback from England that even under Option 1, gas is not being installed in some sites, as the infrastructure would not be extended after the subsequent Future Homes / Phase 4 uplift in any case.
- In terms of 'back-up' alternatives to heat pumps; compliance with the new primary energy metric (TPER) would be challenging for most fuels under Option 2 if a heat pump is not used (see Table 3A.4).
- Consideration of heat networks would also be challenging (see paragraph 3A.91) and direct electric solutions would also be very difficult, even with super-insulated dwellings.
- Whilst the new building fabric measures and minimum requirements for services should help ensure that running costs are relatively affordable, low carbon heating risks higher running costs than Option 1's 'gas & PV' approach. This is because;

a) the gap between the relative prices of electricity and gas can be too wide to make heat pumps cost-effective (see example below), even when the efficiencies of the heat pump taken into account. although alternative tariffs or clever heat storage solutions may improve outcomes;

b) the gas notional dwelling benefits from electrical savings from the PV array; and

c) low carbon biofuels are more expensive than the fossil fuel alternatives.

- There are uncertainties around ensuring overall value for money under current impact assessment conventions when taking fuel price variations into account.
- Managing and accommodating such new technology can require behavioural change, such as learning to live with continuous mechanical ventilation and different controls and heating regimes. This will be a potential issue under both options, but risks increase under Option 2

- Acoustic risks from heat pumps have also been identified as a significant concern, and the risk on this increase if they are the default solution for the vast majority of cases.[64]
- It is not yet clear if homes where mechanical cooling is required could be accommodated successfully(see Section 3D), The additional cooling demand's emissions and primary energy impacts might exceed the total allowance of the Notional Dwelling- this risk increases substantially under Option 2, unless further assessment adjustment were developed.

Risks

3A.115 The Department is keen to receive opinion and evidence as to whether there would be sufficient skills and capacity in industry to support Option 2 over Option 1 and to ensure we understand potential risks.

3A.116 Some risks with Option 2, such as how to attend to connections to existing district or community heat networks, how to remediate or address higher capital and running costs and assessment of impacts on the biofuel sector etc are noted elsewhere. Other issues, such as quality control of ventilation systems or grid issues, may be exacerbated in some unforeseen way, if building to such challenging standards.

3A.117 The Department would be particularly concerned if some dwellings could not be constructed as a result of the new standard; for example, if pollution and overheating risks required mechanical cooling, but this was undeliverable under the onerous Option 2 targets.

3A.118 The specification should also ideally provide resilient routes to compliance with sufficient flexibility to enable compliance in less-than-ideal circumstances, for example in the face of a supply chain difficulties for any particular technology. There is a risk where only one solution (e.g., a heat pump) is viable in practice if there are skills shortages or grid capacity issues.

3A.119 There may also be risks with Option 1- for example with an increased reliance on biofuels, or grid connection issues, an over-reliance on PV offsetting or an undue continuance of fossil fuel led solutions.

[64] cieh.org/media/7538/heat-pumps-briefing-note-professional-advice-note.pdf

Question 3A.22 Do you have concerns or evidence on the viability and risks associated with either Option 1 or Option 2?

Question 3A.23 Should the Department implement Option 1 or Option 2 for the Phase 3 uplift?

Option 2- Potential improvements

Simplified example of running cost impacts; Heat pump vs Gas

SAP 10 estimates gas costs 3.64p/kWh, and electricity costs 16.5p/kWh. At 300% efficiency, heat from a heat pump would cost 5.5p/kWh of delivered heat. At a very low 80% efficiency, the heat from a gas boiler will still only cost 4.5p/kWh of delivered heat, meaning the heat pump has a worse SAP rating, with running costs increasing by as much as 20%.

By contrast, analysis based on recent local prices for domestic tariffs of 30p/kWh for electricity,10.5p/kWh for gas and 7.0p/kWh for oil could justify the heat pump compared to gas, but struggle with oil, even if we assume a poor boiler efficiency (although oil is unlikely to a viable choice for most new homes under the new assessment, in any case).

Savings from any PV array would be additional to this. This means Option 2 (heat pump), whilst offering a much lower emissions outcome, is significantly more expensive to operate than Option 1 (gas &PV) specification, unless it too is provided with additional photovoltaic array or is amended to provide further efficiencies elsewhere.

Fabric efficiencies minimise the heat requirement in all situations, so a heat pump option in new build dwellings ought to remain relatively affordable, compared to the average stock with poorer fabric.

Other policies or new electricity tariffs may impact this over time, as we move to low carbon heat and net zero emissions and as this feeds through to future editions of SAP. Nonetheless the price volatility and uncertainties continues to challenge the immediate case for heat pumps.

3A.120 Annex B shows preliminary modelling outcomes based on a 104m^2 semi-detached house, typically constructed here. The modelling shows that the heat pump led solution delivers excellent carbon reductions, but higher running costs. Reduced running costs could be delivered by[65]:

- using a more efficient heat pump than that assumed in the Notional Dwelling specification

[65] Assurance on relative fuel costs, such as guaranteed tariffs for heat pumps would be another intervention which could help, however this is beyond the remit of the building regulations.

- adding renewable generation technologies, like the PV in Option 1; or
- setting more onerous fabric performance requirements akin to Passive House or the Future Homes specifications.

3A.121 Each of the interventions above would likely increase capital costs for house builders and increase embodied carbon impacts where extra materials are used. Further work would be needed to assess the precise impacts, but the Department's preliminary modelling suggests that maximising fabric improvements might manage to reduce energy demands by around 10%. While this beds in efficiency for the longer term and may reduce heating capital costs, improving the fabric to standards akin to Passive House and Future Homes is likely to come with potential implications for ventilation and have a very long payback period.

3A.122 The addition of PV is likely to be the most cost effective measure which would yield an 'A' rating on the EPC running cost metric under Option 2, albeit that it comes with additional maintenance and replacement cycle impacts.

3A.123 The heat pump specified in Option 2 suggests that the heat pump should provide space and water heating efficiencies of 295% and 195% respectively, when assessed via SAP 10 (noting this is different to the co-efficiency of performance (COP)). We would be keen to receive evidence whether such efficiency rates would be appropriate under Option 2 (see Question Q3A.21).

3A.124 The Department would also be interested in appreciating whether there would be further synergies or benefits in homes with heat pumps, small PV arrays, and EV charging points that might limit grid impacts, storage implications and overall costs to mutual benefit of householders and industry.

3A.125 It is unlikely the Department would have capacity to implement such improvements beyond the Option 2 specification in time for the Phase 3 uplift, but this could be a possibility for Phase 4.

Question 3A.24 Have you any comment on how the Option 2 specification should be improved, for Phase 3 or Phase 4 or 5?

Notifications item 1 – as-built information and home user guide

3A.126 The emerging technologies and systems involved in new dwellings often require homeowners to operate the systems in a different way to conventional buildings. For example, improved air tightness may require additional consideration and maintenance of ventilation systems to ensure adequate indoor air quality. Poor appreciation of the construction and systems employed can be a factor in performance gaps between 'as-designed' and 'as-built' practice.

3A.127 Regulation 46 (Notice of emission rate) already provides for the supply of information used to demonstrate compliance in new-build SAP assessments to building control and others. Revisions has been developed for reporting this (a BREL (Building regulations England- Part L) for England[66] or BRWL assessment, (for Wales) to take account of the FEES and primary energy metrics, among other issues. The requirements have also been extended to include geo-located photography to help ensure good record keeping (see paragraphs 3A.130 below).

3A.128 Regulations 47 (Provision of information), of Part F, and 68 (Provision of information), of Part K (Ventilation), require provision of as-built operation and maintenance information for fixed building services and ventilation. Other regions have introduced a similar requirement to provide for on site renewables. In support of these requirements, England and Wales now additionally require a new Home User Guide.

3A.129 The Home User Guide should contain non-technical advice on how to operate and maintain the dwelling in a healthy and energy efficient manner. The guide should contain advice on—

a) ventilation.

b) heating and domestic hot water.

c) on-site electricity generation (if applicable).

d) staying cool in hot weather.

A template for a Home User Guide can be viewed at https://www.gov.uk/government/publications/home-user-guide-template.

[66] see Appendix B of Approved Document L1 (2021)

The Department anticipates that a similar approach should be implemented here.

Question 3A.25 **Do you agree that the Department should adopt the new BREL type format for notice of compliance with emissions, renewables and other requirements in keeping with England's provisions? See Appendix B of Approved Document L1 (2021) for further detail[67]**

Question 3A.26 **Do you agree that the Department's guidance should additionally require provision of a new non-technical Home User Guide in keeping with England's provisions? for further detail see https://www.gov.uk/government/publications/home-user-guide-template**

Notifications item 2 – geo-located photographs and evidence

3A.130 The new measures in the England require submission of additional evidence, including geo-located photographs to improve evidence of the as-built construction. This helps verify the construction and encourages compliance with design stage detailing to help limit changes which contribute to design vs as-built performance gaps.

3A.131 The onus is on the builder to ensure that all relevant junctions and constructions are properly documented and submitted to the assessor for Building Regulations and on-construction EPC assessments. It is not yet clear how assessors may warrant buildings where this evidence has not been recorded and it is possible that failure to provide the relevant photographs may lead to district council building control not issuing completion certification.

3A.132 The system in the Republic of Ireland already provides for more extensive lodgement of photographic evidence and certification sign off. Lodgement of the on-construction information, to an agreed schedule, would seem to be beneficial in supporting quality control and providing district councils with an additional enforcement resource.

[67] Conservation of fuel and power: Approved Document L - GOV.UK (www.gov.uk)

3A.133 The Department is clear that geo-located photography could be helpful to record keeping and quality control of building construction and reducing the gap between as-designed and as-built performances. The Department would be keen to be aware of any concerns, experience or suggestions around this from working in other jurisdictions to help assess whether the extra burden on industry and building control is proving worthwhile and effective in practice.

Question 3A.27 Do you agree that the Department should require geo-located photographs to be lodged to support evidence of the as-built construction?

Section 3B: Part F (Conservation of fuel and power) work to existing dwellings, Phase 3.

Introduction

3B.1 This section relates to standards for extensions, new and replacement elements and services, and renovation of existing elements. It will also apply where a greater or lesser number of dwellings is created by way of a change of use of an existing building under Regulation 8 (Application to a material change of use). The Building Regulations do not otherwise require existing houses to be brought up to a standard if work is not being carried out.

3B.2 At their most straightforward, requirements for work to existing buildings are set on the basis of individual elements and services efficiencies, as this may be the only work being done.

- This is referred to as “the Standards Based Approach”.

3B.3 In case of an extension or a material change of use, alternative, whole-extension or whole-building assessments can allow trade-off between thermal elements (walls, roofs, floors, etc.) with options to adjust one value, where the performance can be balanced elsewhere, providing a more flexible approach.

- A “Calculated Trade-off Approach” allows trade-off of the insulation performance between elements of an extension, if services efficiencies are in line with the Standards Based Approach.
- A more complex SAP assessment can be used to demonstrate an equivalent performance to a whole building as if the Standards Based Approach had been taken (a “Equivalent Target Approach”).[68]

3B.4 The alternative Calculated Trade-off and Equivalent Target approaches are less commonly used and not normally applied to general renovation work, particularly where only a limited intervention is taking place.

[68] These alternative approaches are not available with the Republic of Ireland’s Technical Guidance Documents, but are offered in the other regions

3B.5 Other regions[69] now require that an assessment of Primary Energy performance alongside the established Carbon emissions assessment when the Equivalent Target Approach is used. In England, equivalence with the FEES requirement is also applicable in these assessments. Phase 3 proposals are likely to replicate this approach here.

Question 3B.1 Do you support the addition of a Primary Energy and FEES metric assessment alongside the current Carbon emissions metric assessment when using the Equivalent Target Approach to demonstrate compliance in cases of dwelling extensions or material changes of use?

3B.6 Technical risks tend to be significantly greater in retrofit situations, given the nature of the existing building and because access to install components and control junction details may not always be possible without significant disturbance. Attending to other Parts of the Building Regulations may also be necessary, for example, where insulation and airtightness levels have been improved, additional ventilation is often needed to address indoor air quality or to reduce interstitial condensation risks. Proposals for revised guidance on ventilation when energy re-fit work is being carried out is included in Section 3C, but complexities like this highlight risks in setting very demanding retro-fit standards for some situations, such as internal wall insulation or work to traditional construction.

Types of interventions

3B.7 Most alterations to building fabric or internal elements will fit within the remit of regulation 7 (Application to structural alterations and extensions) to apply Part F. Work to services is applied through regulation 6 (Application to services and fittings).

3B.8 “Consequential improvements” require improvements to an existing building, or apply additional provisions, beyond the immediate work in hand. This is discussed in Section 3B.48, Consequential improvements currently apply to only to larger buildings, so impact only a very small number of interventions to existing dwellings.

[69] England, Wales and RoI apply this. Scotland requires a ‘delivered energy’ assessment.

3B.9 "Major renovations" are defined in regulation 38 (Application and interpretation) of Part F as "*renovation of a building where more than 25% of the surface area of the building envelope undergoes renovation"*. The Republic of Ireland has additional requirements and expectations of the whole building performance when a major renovation is carried out. This is discussed at paragraph 3B.56.

3B.10 The energy efficiency requirements of Part F do not apply to a dwelling if it is a protected building[70] and if compliance would unacceptably alter its character or appearance. Similar considerations are also applied in guidance where the building to which the work is to be carried out is not a protected building but has historic or architectural merit.

3B.11 The Department is interested in whether there should be greater differentiation between current conventional constructions and traditional moisture permeable constructions more generally, where there may be technical risks even if character and appearance is not necessarily the principal concern.

Minimum fabric standards in existing homes- elemental standards.

3B.12 In terms of elemental standards, the guidance across the regions provides for a variety of situations with terminology applicable for─

a) extensions and new elements

b) replacement elements

c) material change of use

d) change of energy status (e.g. introducing heating into a previously unheated space or a space previously exempt from energy efficiency requirements of the building regulations becomes subject to them[71]).

e) renovated elements

f) retained elements

3B.13 In most regions, the requirements tend to relate to this a) to f) hierarchy so that ─

[70] A protected building is defined in the Order as a listed building or a building situated within a conservation area with reference to The Planning (Northern Ireland) Act 2011.

[71] https://www.legislation.gov.uk/nisr/2012/192/regulation/38/made

- the more onerous 'new/replacement element' standards will always apply to any new and replacement elements (Situation A) in preference; before
- lesser 'renovated element' standards are applied to the renovated and retained elements (Situation B).

The regional values are listed in Tables 3B.1 (Situation A) and 3B.2 (Situation B), respectively.

Table 3B.1 Situation A: U-Values[72]

SITUATION A (NEW ELEMENTS)	NEW BUILD (comparison) ENGLAND NOTIONAL & FEES VALUES (JUNE 2022)	ENGLAND PART L (JUNE 2022)	SCOTLAND (DEC 2022) Also applies to conversions and renovations.	WALES PART L (NOV 2022)	ROI PART L	NI CURRENT FOR PART F
Whole building vs elemental approach	whole building	elemental	elemental	elemental	elemental or whole building	elemental
External Wall	0.18	0.18	0.17	0.18 (0.21 for flats)	0.18	0.28
Party Wall	0	n/a	0	0.2	0	0
Floor	0.13	0.18	0.15	0.15	0.18 (0.15 if underfloor heating)	0.22
Roof	0.11	0.15	0.12	0.13	0.16 (0.20 for flat roofs)	0.16 (0.18 for pitched insulation and flat roofs)
Door	1	1.4	1.4	1.4	1.4	1.8
Window	1.2	1.4	1.4	1.4	1.4	1.6
Rooflight		2.2 (horizontal plane)	2.1 (horizontal plane)	2.2 horizontal plane)	1.4 (vertical plane)	1.6 (vertical plane)

3B.14 Situation A standards tend to be the same or close to new build expectations. The Republic of Ireland, Scotland and Wales directly apply their limiting fabric standards for new build in these situations. England's position sits somewhere between their relatively relaxed limiting values and the FEES recipe, which applies to new builds in England (See paragraph 3A.13 and Table 3A.2) with the intention of reflecting a construction likely to align with U-values that might be adopted for new dwellings in practice.

[72] Alternative Window Energy Rating and Doors Energy Rating options are provided by way of reference to the Glass and Glazing Federation's *Manual Data Sheet 2.3, Guide to the Calculation of Energy Ratings for Windows, Roof Windows and Doors.*

3B.15 England's consultation[73] noted that its standards are intended to reflect the highest standard for each element which is still cost-effective using a simple measure of payback for investment over the life of the product or work. These standards are also technically achievable for the vast majority of work currently being done to existing dwellings and should not pose a significant increase in moisture risk, if appropriately considered.

3B.16 England and Wales delayed implementation of the provisions for timber window and door manufacturers to June and November 2023 to provide an additional year for re-tooling and product development for this sector. We would be interested to know if there would be any similar concerns here.

Table 3B.2 Situation B: U-values

SITUATION B (RENOVATIONS)	ENGLAND PART L (JUNE 2022)	SCOTLAND (DEC 2022)	WALES PART L (NOV 2022)	ROI PART L	NI CURRENT FOR PART F
Are threshold values sometimes applicable so that work is only required if the current U-values are higher than cited?	yes	no	yes	no	yes
Roof (threshold 0.35W/m^{2}K)	0.16	n/a	0.16	0.16 (0.25 for pitched insulation and flat roofs)	0.16 (0.18 for pitched insulation and flat roofs)
Wall cavity wall insulation (threshold 0.7W/m^{2}K)	0.55	n/a	0.55	0.55	0.55
Wall other (IWI/EWI threshold 0.7W/m^{2}K)	0.3	n/a	0.3	0.35	0.3
Floor (threshold 0.7W/m^{2}K)	0.25	n/a	0.25	0.45 (ground floor) 0.25 (exposed floor) 0.15 (underfloor heating)	0.25
Windows / doors etc (threshold 3.3W/m^{2}K)	1.4	n/a	1.4	1.4	1.6 (windows) 1.8 (doors)

Note on External Wall Insulation.

The Department has received mixed advice on the risks of External Wall Insulation (EWI), with some indicating a lower risk of cold zones or interstitial condensation could justify a U-value requirement of lower than 0.3W/m^{2}K. Others point to examples of poorly installed EWI, risks in pressing ahead of the other administrations, particularly with traditional buildings concerns. We would be interested any evidence on whether 0.3W/m^{2}K is considered appropriate here.

3B.17 Table 3B.2 shows less onerous 'Situation B' standards applicable to retained or renovated elements or where a material change of use or a change in energy status occurs.

[73]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1040925/Future_Buildings_Standard_response.pdf

3B.18 The guidance in all regions further expects that glazing in cases of a change of use and extensions should be limited to no more the 25% of the total floor area. The Equivalent Target Approach provides additional flexibility for situations where the scope for fabric improvements may be limited (such as in traditional buildings) or where services improvements may be more appropriate.

3B.19 Situation B interventions are normally predicated by trigger point standards whereby the improved U-value is only required if the pre-existing wall, roof, floor or window is above a threshold value (typically 0.35 W/m^{2}K for the roof, 0.7 W/m^{2}K for walls and floors and 3.3 W/m^{2}K for windows).

3B.20 England's consultation notes that "These standards are cost-effective and cover the most common upgrades to retained elements. Increasing standards in existing buildings could put homes at risk of condensation and fabric decay after some energy efficiency measures take place. Also, changes to threshold value would only capture a negligible amount of new work, and in the case of cavity wall could bring filled cavities into scope, and they therefore have not been changed."

3B.21 However, trigger point thresholds are not applied in Scotland or the Republic of Ireland, where the expectation is that the relevant standard ('A' in Scotland and 'B' in RoI) will apply in a change of use, change of energy status or for renovation work, irrespective of the elements' previous performance. This means Scotland is seeking standards, close to new-build expectations where a material change of use is occurring or an element is renovated.

3B.22 These expectations apply unless the building is of traditional construction. In such circumstances more bespoke or specialist advice is required, and specialist guidance is referred to, but the aim remains that the fabric should be improved so far as practicable.

3B.23 Scotland's Domestic Handbook includes the following definition: Traditional building means a building or part of a building of a type constructed before or around 1919:

a) using construction techniques that were commonly in use before 1919; and

b) with permeable components, in a way that promotes the dissipation of moisture from the building fabric.[74]

3B.24 Paragraphs 3.3-3.6 of the Department's current Technical Booklet F1 guidance already refer to the need for special consideration in cases of 'protected buildings' (Listed buildings and buildings in Conservation Areas) and 'buildings of historic or architectural merit'. There is an emphasis on the impact of the work in relation to the character and appearance of the buildings, with some emphasis on the need to consider the ability of constructions to 'breathe'. Within the particular section on renovation of thermal elements, paragraph 3.58 of TBF1 makes a further reference to "traditional buildings" with reference back to 3.3-3.6.

3B.25 The Department is minded that the risks to breathable traditional constructions require technical consideration, even where aesthetic value or historic merit may be limited and that the term "traditional building" may be helpful. The assessment of traditional construction and its ability to support renovation measures is a developing area where multiple inter-acting issues require a balancing of considerations in each individual case. The need for assessments of wind-driven rain and hygrothermal software simulations of upgrade proposals can be important, with our changing climate also impacting on risks. Ventilation must also be considered, to lower risks of condensation on wall surfaces or within construction layers (see paragraph 3C.32)

Minimum fabric standards in existing homes- proposed position.

3B.26 The Department intends to review the current Technical Booklet guidance, with a view to incorporating minimum fabric standards relevant to existing dwellings with the intention that–

a) new elements and replacement elements should be largely in line with expectations for new dwellings (see paragraph 3A.13 on FEES);

[74] Other administrations have similar references on traditional construction, but not a definition.

b) given the technical risks, a lesser performance, in line with the 'Situation B' table of values for England should apply where a building is subject to a material change of use, where a change of energy status occurs or where renovation work occurs, with additional considerations where it is a protected building or is of traditional construction;

c) guidance on installation of insulation will include an increased emphasis on sealing air gaps;

d) consideration of the extent of glazing, such that it should generally be expected to be no more than 25% of the floor area, should continue to form part of the assessment, including in a material change of use situation[75]; and

e) an increased emphasis on considerations and provisions for traditional construction should be made by reference to third party expertise (e.g. updated guidance from NIEA or DfC). Use and referral to expert or specialist assessment is also a likely course of direction in these cases.

Question 3B.2 **Do you have any particular concerns or insight on the U-values used in standards related to existing dwellings for any of the various situations in other administrations?**

Question 3B.3 **Do you agree that our U-value standards should be largely in line with the proposed standards for new building elements in cases of extensions and replacement elements?**

Question 3B.4 **Do you agree that our U-value standards should be largely in line with the values used in England, in cases of a material change of use of a building, for renovated elements and where a change of energy status occurs?**

Question 3B.5 **Are there any particular areas where alternative performance values for fabric elements (such as EWI) should be considered? If so please provide evidence and an indication of the value you consider appropriate.**

[75] in cases where glazing is >25% of floor area the extent of window could be reduced, or alternative compensatory measures adopted

Question 3B.6 **Do you agree that a maximum glazing area assessment should continue to form part of the requirements, where a material change of use to form a dwelling occurs?**

Question 3B.7 **Do you agree that traditional construction should be referenced out to third party guidance, with a greater scope for bespoke consideration in these situations?**

Minimum services standards in existing dwellings.

3B.27 Minimum standards for services are no longer provided in a separate *"Domestic Building Services Compliance Guide"* but have been incorporated into new sections in England's and Wales's Approved documents, e.g. England's ADL1. The Republic of Ireland similarly embeds services guidance within its Technical Guidance Documents, although with referral out to Ecodesign codes which can be periodically amended. This requires additional investigation by designers in many cases.

3B.28 In contrast, Scotland retained separate *Domestic/Non-domestic Building Services Compliance Guides.* Many of the features, policy developments and efficiency improvements from the changes in E&W are incorporated, however the separate document provides room for a more wide ranging and informative explanation of the context and rationale for the guide, which can be helpful.

3B.29 The new guidance documents in GB regions outline provisions for services in both new buildings and for replacement fittings and systems in existing buildings with standards updated to meet the Ecodesign 2018 standards.

Boiler Plus.

3B.30 In 2018, England introduced 'Boiler Plus' standards through amendments to their 2013 edition of the Domestic Building Services Compliance Guide. The standards apply whenever a boiler is installed in an existing dwelling either as a new installation or as a replacement of an existing boiler. There were no changes to standards for systems in new dwellings as a result of the measures.

3B.31 The amended guidance in 2018 explains that "When replacing a boiler, the boiler controls are considered to be a part of the boiler installation, and should therefore meet the standards set out in the relevant sections of this

document. For gas-fired combination boilers, certain energy efficiency measures are also considered to be part of the boiler installation..."

3B.32 The changes are principally focussed on the gas boiler sector, as the policy was developed with England's energy mix in mind. Provisions for oil boilers were less developed due, in part, to modulation control issues.

3B.33 For gas-fired boilers installed in existing dwellings, either as a new installation or as a replacement to an existing boiler, the following standards apply.

For all gas-fired boilers:

a) the ErP seasonal efficiency of the boiler should be a minimum of 92% and not significantly less than the efficiency of the appliance being replaced;

b) install a boiler interlock as defined for new systems; and

c) time and temperature control should be installed for the heating system.

Additionally, for gas-fired combination boilers:

d) at least one of the following energy efficiency measures should be installed. The measure(s) chosen should be appropriate to the system in which it is installed:

i. flue gas heat recovery – defined as a device which pre-heats the domestic hot water supply by recovering heat from the boiler's flue emissions;

ii. weather compensation – defined as a control function which maintains internal temperatures by varying the flow temperature from the heat generator relative to the measured outside air temperature;

iii. load compensation – defined as a control function which maintains internal temperatures by varying the flow temperature from the heat generator relative to the measured response of the heating system;

iv. smart thermostat with automation and optimisation – automation is a control function that automatically adjusts time and temperature settings, based on occupancy detection and/or stored data from user adjustments over time. Optimisation is a control function which starts the boiler operation at the optimum time to achieve the setpoint temperature at the start of the occupancy period.

3B.34 For oil fired boilers installed as a replacement of an existing boiler, time and temperature controls are applied as a new additional requirement.

3B.35 Boiler plus also moved to ErP classification of boilers, although the SAP SEDBUK assessment remains relevant to the Carbon and PE SAP assessments.

3B.36 In addition to this, new measures were introduced in 2022 in all the GB regions to require thermostatic controls when a heating appliance (a boiler, electric heating, or heat pump) is installed. This requirement applies to all rooms service by the appliance, subject to some concessions for adjoining rooms of a similar function (e.g. a kitchen and a utility room) and for small or open plan arrangements. The measures apply in both new and replacement installations and typically require both room thermostats and thermostatic radiator valve controls. These provisions implement aspects of Article 8(1) of the EPBD.

Question 3B.8 Do you agree that the Boiler Plus measures introduced in England in 2018 and thermostatic control measures introduced in 2022 should be replicated and included in revised guidance here?

Replacement heating- CO_2 and Primary Energy check

3B.37 Paragraph 3A.76-3A.80 outlined expectations that new heating systems in buildings should be designed to operate at maximum flow temperatures of 55°C. This would apply both in new dwellings and where a complete new or replacement heating system was to be installed in an existing building.

Question 3B.9 Do you agree that where a new or complete replacement heating system is being installed in an existing dwelling, it should be installed to operate with a maximum flow temperature of 55°C?

3B.38 Current guidance states that the efficiency of a replacement heating appliance should not be worse than two percentage points lower than that of the appliance being replaced. Additionally, where a change in fuel is proposed, a conversion with CO_2 emission factors is given to compare the efficiencies of appliances with different fuels.

3B.39 England's new guidance now requires that when a replacement service uses a different fuel, the new service should not emit more CO_2 emissions

and should not have higher primary energy demand than the service being replaced. The relevant Carbon and Primary Energy factors are as listed in Table 12 of SAP 10.

3B.40 The primary energy assessment would, for instance, mean that a gas-fired boiler should not generally be replaced with an electric flow boiler, even though it may be lower carbon. It could also mean that conversion from a fossil fuel to a biofuel boiler could be unacceptable under the assessment.

3B.41 However, England's guidance notes that where "a replacement fixed building service involves a fuel-switch in a home with very low heat loss a higher primary energy for the new heating appliance may be acceptable. For example replacing a gas boiler with direct electric heaters as part of a deep retrofit project, where the resulting heat loss of the dwelling is less than 25kWh/m^2 per year."[76]

3B.42 The Primary Energy metric is not used in Scotland. Instead, their guidance requires an assessment of the delivered energy per unit of energy consumed (i.e. the efficiency of the appliance) (see paragraph 3A.36). Under this assessment the gas-fired boiler **could** be replaced with an electric flow boiler as primary energy factors are not taken into consideration.

3B.43 The impact of the PE assessment should help prevent conversion to forms of electric or biofuel heating which are expensive to operate (albeit with the low carbon benefits). The Department is therefore minded to implement the measures in line with England's assessment.

[76] Box 99 of the SAP worksheet provides information on the dwelling's space heating demand.

Worked examples of fuel changes

Replacing an old oil-fired boiler with emissions of 0.298kgCO_2 /kWh and primary energy of 1.180 kWh$_{PE}$/kWh at 85% efficiency with ─

a) **an LPG boiler** with emissions of 0.241 kgCO_2 /kWh and primary energy of 1.141 kWhPE/kWh at 93% efficiency;

b) **a wood pellet boiler** with emissions of 0.053 kgCO_2 /kWh and primary energy of 1.325 kWhPE/kWh at 83% efficiency; or

c) **a direct electric boiler** with emissions of 0.136 kgCO_2 /kWh and primary energy of 1.501 kWhPE/kWh at 100% efficiency.

d) **a heat pump using electricity** of 0.136 kgCO_2 /kWh and primary energy of 1.501 kWhPE/kWh at 270% efficiency.

CO_2 emissions (England, Wales and Scotland)

Oil-fired boiler: 0.298/0.85 = 0.35 kgCO_2 /kWh
a) LPG boiler: 0.241/0.93 = 0.26 kgCO2 /kWh – acceptable
b) Wood Pellet boiler: 0.053/0.83 = 0.06 kgCO2 /kWh- acceptable
c) Electric boiler: 0.136/1 = 0.136 kgCO2 /kWh – acceptable
d) Electric heat pump: 0.136/2.7 = 0.05 kgCO2 /kWh – acceptable

Primary energy (England and Wales)

Oil-fired boiler: 1.180/0.85= 1.39 kWh$_{PE}$/kWh
a) LPG boiler: 1.141/0.93 = 1.23 kWhPE/kWh- acceptable
b) Wood Pellet boiler: 1.325/0.83 = 1.60 kWhPE/kWh- not acceptable
c) Electric boiler: 1.501/1 = 1.5 kWhPE/kWh- not acceptable
d) Electric heat pump: 1.501/2.7 = 0.56 kWhPE/kWh – acceptable

Delivered energy (Scotland)

Oil-fired boiler: 1.0/0.85= 1.176 kWh/kWh heat output
a) LPG boiler: 1.0/0.93 = 1.075 kWh/kWh heat output- acceptable
b) Wood Pellet boiler: 1.0/0.83 = 1.2 kWh/kWh heat output - not acceptable
c) Electric boiler: 1/1 = 1.0 kWh/kWh- acceptable
d) Electric heat pump: 1/2.7 = 0.37 kWh/kWh- acceptable

Question 3B.10 Do you agree that both an emissions and primary energy performance assessment should be applied to boiler replacements where a change of fuels is proposed?

Reversion from biofuels to conventional kerosene.

3B.44 On a more prosaic point, the Department is keen to better understand any technical restrictions in boilers that prevent reversion from liquid biofuels to conventional kerosene burners. This is not generally permitted under the current guidance in the *Domestic Building Services Compliance Guide*, as it would impair the emissions performance.

3B.45 As part of the Phase 3 changes, the Department will re-emphasise that work to boilers intended to provide for a fuel change requires a building regulations application, if necessary with an amendment to regulation 9(4)(e) (Giving of notice and deposit of plans). Any changes made will clarify that this includes changes from one type of liquid oil fuel to another.

Question 3B.11 Do you have information or evidence to help assure the Department that reversion from liquid biofuels to conventional home heating oil need not be a concern?

Services Efficiency Improvements.

3B.46 A range of additional services efficiency improvements have been developed in England's new guidance. These include

- for oil-fired boilers, to set the minimum seasonal efficiency at 91% ErP;
- for solid-fuel appliances, to remove guidance for appliances which are rarely installed, such as open fires and anthracite boilers[77]
- for heat pumps, to increase the minimum seasonal coefficient of performance (SCoP) of a heat pump installed in an existing dwelling to meet the minimum Ecodesign requirements for direct expansion units[78], and for all other systems a minimum SCoP of 3.0 for heating and 2.0 for domestic hot water;
- for cooling systems, to increase the seasonal energy efficiency ratio (SEER) to 4.0;
- for supply and extract ventilation systems, to have heat recovery at a minimum 73% efficiency, with packaged systems also being fitted with a summer bypass and variable speed controller; and

[77] The guidance on these systems remains with respect to England's Part J (Combustion appliances), which is similar to our Part J (Combustion appliances).

[78] Eco-design Commission Regulation No. 2016/2281

- for lighting efficacy of fixed lighting, to have a minimum of 75 lamp lumens per circuit-watt for both internal and external lighting.

Please refer to Sections 5 and 6 of Approved Document L1 2021 for further details.

3B.47 The Department is currently minded to move to adopt services related changes in line with England's Approved Document L1, subject to detailed considerations with NIBRAC and Phase 3 consultations.

Question 3B.12 Do you agree that Technical Booklet F1 should be amended to follow the minimum services provisions of Section 5 and 6 of England's Approved Document L1, subject to further NIBRAC and public consultations? Please include any 'lessons learned' from the roll-out of these provisions elsewhere which may merit consideration.

Consequential improvements.

3B.48 'Consequential improvements' apply additional improvements, beyond the scope of the intended work. The use of such provisions is limited as they require additional work to be done, with risks that this may be beyond the capacity or finances of the person carrying out the work.

3B.49 For example, in the event of a boiler failure and a distress purchase replacement, it would be unduly onerous to expect the homeowner to also replace all the pipework and radiators. However, some measures are considered reasonable; for example, the new replacement boiler needs to be of a reasonably efficient standard and, under the 'boiler plus' measures (see paragraph 3B.30), additional controls would need to be fitted.

3B.50 Both consequential improvements and major renovations (see paragraph 3B.9) can also be difficult to enforce where they rely on thresholds to trigger additional requirements. There are risks that such work may be parcelled into smaller projects rather than categorised under a single project application, in order to avoid having to carry out additional work the trigger point might have initiated. For example, if a 'major renovation' requires a replacement boiler, the work may be phased into separate applications so that windows are replaced and then a second application for walls to be insulated, such that the major renovation trigger point is not reached under

either intervention, even though it may have constituted a ‘major renovation’ if assessed holistically.

3B.51 Regulation 41 (Consequential improvements) currently requires that reasonable provisions are taken to ensure that the existing building complies with regulation 39 (Conservation measures) in large buildings with a total useful floor area of >1000m^2 and where the proposed work includes an extension or new or extended fixed building services. Although regulation 41 may occasionally apply to some blocks of flats, the working assumption is that regulation 41 rarely features when work to existing dwellings is proposed.

3B.52 The current local position on consequential improvements is essentially similar to England’s current position. Scotland has no such requirements in its domestic guidance. However, Wales has additional consequential improvement requirements which apply to dwellings where an existing dwelling is extended or part of the dwelling is converted, increasing the habitable volume.

3B.53 Where the increase in area is less than 10m^2, the Wales guidance suggests that any loft insulation in the existing dwelling should be increased to 250mm thickness.

3B.54 Where the increase in area is 10m^2 or more, the following energy efficiency improvements are included in Wales’s Approved Document L1:

a) if the dwelling has uninsulated or partially insulated cavity walls, fill with insulation where suitable (cavity wall insulation may not be suitable for sites exposed to driving rain);

b) if there is no loft insulation or it is less than 200 mm thick, provide 250 mm insulation or increase it to 250 mm; and

c) upgrade any hot water cylinder insulation as follows:

i) if the hot water cylinder is uninsulated, provide a 160 mm insulated jacket;

ii) if the hot water cylinder has insulated jacket less than 100 mm thick, add a further insulated jacket to achieve a total thickness of 160 mm; or

iii) if the hot water cylinder has factory-fitted solid foam insulation less than 25 mm thick, add an 80 mm insulated jacket.

3B.55 The measures in Wales appear to require pragmatic, low risk and proportionate measures which are likely to be in place in many dwellings already. The Department is keen to receive opinion on whether the consequential improvements provisions should be amended to largely replicate the position in Wales so far as extensions to dwellings are concerned.

Question 3B.13 Do you agree that the consequential improvements similar to those applicable to extensions to dwellings in Wales should apply here?

Major renovations.

3B.56 Major renovation" is defined in regulation 38 (Application and interpretation) as "renovation of a building where more than 25% of the surface area of the building envelope undergoes renovation". This definition stems from the Energy Performance of Buildings Directive and is replicated in England, Scotland, Wales and the Republic of Ireland.

3B.57 Under the UK's interpretation of the Directive, if individual elements are being renovated as part of a major renovation project, the whole of the element must be upgraded to the improved U-value outlined by guidance to regulation 43 (Renovation of thermal elements).

3B.58 The Republic of Ireland has an alternative interpretation with additional requirements and expectations when a major renovation is carried out, whereby consequential improvements are expected to bring the whole building performance up to a 'Cost Optimal' level.

3B.59 The Republic's guidance provides a table of measures[79], with options for either modelling to demonstrate that a whole building energy requirement of 125kWh/m^2/yr has been achieved, or provision of various specific measures (boiler and controls upgrade, loft and wall insulation) considered to be cost optimal when certain major renovation works take place.

3B.60 Significant exclusions apply to the RoI requirements. For example, only internal or external wall insulation treatments are considered in the assessment (i.e. adding a wet plaster layer or introducing cavity wall insulation to an existing wall are not part of the MR assessment). Similarly,

[79] See Table 7 of Technical Guidance Document L Conservation of fuel and energy for dwellings.

consequential measures are not required when the work is solely limited to window, roof or floor renovation or any combination thereof as it is not considered technically, functionally or economically feasible to bring the whole building to cost optimal level when replacing the surface area of these elements.

3B.61 The measures apply principally where internal or external wall insulation is applied and/or where an extension to the dwelling impacts 25% or more of the existing dwelling's envelope.

3B.62 The Department is open to receiving evidence on the success or otherwise of the major renovation measures in force in the Republic, but at this stage the complexity and the extent of exclusions, suggest it should not be a priority measure here. The Department is particularly alert to the unintended complexities that may emerge; for example, external wall insulation may be discouraged if this triggers the major renovation requirement whereby an old boiler also has to be replaced as part of the work.

Question 3B.14 Do you have any evidence or insight on the major renovation measures in place in the Republic of Ireland to suggest the Department should prioritise a similar approach here? If so, please include the evidence with your response.

Section 3C: Part K (Ventilation) dwellings- Phase 3

3C.1 This section considers amendments to Part K (Ventilation), to be undertaken as part of the Phase 3 proposals for dwellings to apply from 2023/24 and beyond. It is principally based on measures introduced via revisions to the Approved Document F guidance in England and in Wales, which came into operation in 2022. Some items, such as CO_2 monitoring, or other items not yet included in the updated England and Wales guidance, may be left for Phase 4.

Current concerns

3C.2 England's *Future Homes* consultation highlighted closed trickle vents, noisy fans and referenced research[80] pointing to poor indoor air quality in dwellings[81]. Recent changes to their technical guidance recognise concerns around poor quality installations and goes some way to address the use of natural ventilation in more air tight buildings and other issues.

3C.3 Gaps inherent in leakier, less air-tight constructions have provided uncontrolled background infiltration which does not occur in better sealed buildings. In more air tight dwellings, additional compensatory vents are provided with a factor of safety to account the for lower infiltration and variability of weather conditions. This tends to lead to unwanted drafts or the blocking or closure of vents, as occupants prioritise thermal comfort over indoor air quality.

3C.4 Reponses to these issues have tended to support moves to more controlled mechanical ventilation solutions, relying on low pressure fans extracting or supplying air to rooms. Additional energy is required to operate such systems continuously, so these systems benefit from reasonably air tight construction. In new build situations, or where airtightness is being rigorously addressed in a retrofit scenario, heat recovery can be combined with the continuous supply and extract systems to further improve energy performance.

3C.5 However, there are also concerns around poor quality mechanical installations. These include poor planning of ductwork routes, poor

[80] Section 4 of England's Future Homes consultation

[81] Investigation of Occupier Influence on indoor Air Quality in Dwellings (webarchive.org.uk)

installation practices and the failure to consider future cleaning and access arrangements. Behavioural and technical changes are also needed to ensure ventilation systems are not switched off by occupiers keen to reduce energy costs and that regular maintenance (such as filter changing) is carried out. Difficulties accessing ongoing product and maintenance support from manufacturers and installers has also been reported.

3C.6 The amendments made in other regions seek to balance these positions. Not all issues are fully addressed; for example considerations of in-situ noise testing of mechanical systems is proposed for a later review of acoustic requirements for dwellings, and it is recognised that ongoing review is likely to be necessary with further interventions over time.

Recent changes in England, Wales and Scotland

3C.7 England, Wales and Scotland all now publish separate domestic and non-domestic guidance documents. The Department is minded to follow this approach in any revisions, to facilitate ease of use and to assist in publication.

3C.8 In keeping with concerns on the need to simplify guidance and help make sure it is more easily understood, relevant aspects of the *Domestic Ventilation Compliance Guide* necessary for demonstrating compliance have been merged into Approved Document F Volume 1 guidance in both England and Wales. Supplementary supporting information was not included, in an effort to maintain a consistent approach with other ADs and maintain clarity on what is necessary to demonstrate compliance.

Question 3C.1 Do you agree that Technical Booklet K (TBK) should be split into two (similar to current Part F guidance) and that relevant guidance currently cited within the Ventilation Compliance Guides should be integrated within them?

3C.9 Guidance on passive stack ventilation solutions has been removed from the other nations' guidance as research[82] suggests these systems are used in less than 1% of installations.

3C.10 This removal simplifies the documents, to focus on 3 systems ─

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

- natural ventilation (for less airtight buildings);
- continuous mechanical ventilation; and
- continuous mechanical supply and extract ventilation (including mechanical ventilation and heat recovery (MVHR)).

3C.11 England's consultation noted that it is the government's view that *for scenarios outside the scope [of these systems], suitable expert advice should be sought in order to ensure new homes provide healthy indoor environments whilst delivering lower carbon emissions.*

3C.12 Dwellings are still expected to achieve suitable;

- extract ventilation (usually for removal of occasional high levels of moisture or cooking contaminants);
- whole dwelling ventilation (sometimes considered background ventilation, necessary to maintain general air quality); and
- purge ventilation.

Purge ventilation is used to remove high concentrations of pollutants and water vapour. Purge ventilation is used intermittently and required only for pollutants produced by occasional activities (e.g. fumes from painting). It can also be used to provide extract ventilation to sanitary accommodation.

3C.13 The guidance on natural ventilation in England and Wales has been revised to apply only to buildings designed to have an air-permeability of ≥5.0 $m^3/h.m^2$@ 50 Pa and where an as-built air-permeability test of ≥3.0$m^3/h.m^2$@ 50 Pa is achieved (less airtight dwellings). Where a better (lower) air tightness test result is achieved, continuous mechanical ventilation solutions are required, or 'expert advice' may be sought.

Some key definitions from Approved Document F1

Expert advice: Advice from a suitably qualified competent person. Examples from the ventilation industry of a person competent to give expert advice include a chartered or professional engineer, a building services specialist, a specialist ventilation manufacturer or members of professional trade bodies.

Highly airtight dwellings: Dwellings that achieve one of the following;

a. A design air permeability lower than $5m^3/(h \cdot m^2)$ at 50Pa.

b. An as-built air permeability lower than $3m^3/(h \cdot m^2)$ at 50Pa

Infiltration: The uncontrolled exchange of air between the inside and outside of a building, through gaps and cracks.

3C.14 England's guidance on background ventilators was revised to exclude the additional ventilation provisions currently required of more air-tight construction, as this is no longer applicable. Guidance was also changed so that it is provided on the basis of rooms, rather than whole dwellings, to ensure that each space is suitably provided for.

3C.15 The revised specific vent sizes required are noted in ADF1, but were re-calibrated from the original consultation proposals to facilitate current products and systems. The required vent sizes vary depending on the system adopted, for example Table 1.7 of ADF1 applies equivalent area sizes of 10,000mm^2, 8000mm^2 and 4000mm^2 for certain naturally vented rooms, while vents of 4000mm^2 are expected for all habitable rooms, if a continuous ventilation system is installed.

3C.16 Scotland has different (higher) rates for background provision for naturally vented rooms, with 10000mm^2 being the minimum requirement and 12000mm^2 required for each habitable room (an 'apartment' in Scotland's terminology). The Republic of Ireland has lower rates of 7000 mm to habitable rooms, and 3500 mm^2 to kitchens and bathrooms.

3C.17 All regions note that the natural ventilation provisions may not be appropriate for single aspect dwellings, where more specialist or expert advice is required. Scotland additionally notes that vent sizes should be doubled, where it is reliant on ductwork to account for flow resistance.

3C.18 The Department plans to review the minimum equivalent are for background ventilators in naturally ventilated buildings with NIBRAC and

others, but at this stage is minded to progress this aspect in line with England and Wales .

Question 3C.2 Do you agree that Technical Booklet K guidance should cite background ventilator sizes in line with England and Wales?

Compatibility of systems vs air tightness rates in Scotland and Republic of Ireland

3C.19 There is some variability in the application of the systems to air tightness in each region. The guidance on natural ventilation in England and Wales has been revised to apply only to buildings designed to have an air-permeability of ≥ 5.0 $m^3/h.m^2$@ 50 Pa and where an as-built air-permeability test of ≥ 3.0$m^3/h.m^2$@ 50 Pa is achieved (less airtight dwellings).

3C.20 Scotland limits applications of systems, for both designed and as-built levels, as per Table 3C.1 below.

Table 3C.1 Ventilation strategies for new dwellings in Scotland

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

3C.21 Technical Guidance Document F in the Republic of Ireland anticipates an air tightness of no greater than 5.0 $m^3/h.m^2$@ 50 Pa, with natural ventilation (with intermittent extract) guidance predicated on a test result of ≥ 3.0$m^3/h.m^2$@ 50 Pa being achieved. Where the test result is less than 3.0, additional, but unspecified, 'appropriate additional measures' are required.

3C.22 The approach adopted could be significant where unanticipated or improved air tightness performance test results required a redesign to an alternative system. Scotland's definitive thresholds at both 5.0$m^3/h.m^2$ @ 50Pa and 3.0$m^3/h.m^2$ @ 50Pa seem more likely to lead to this issue on site.

3C.23 The Department is minded to replicate the guidance along the lines of England and Welsh ADs on this issue; i.e.─

- restricting natural ventilation to buildings designed to have an air-permeability of ≥ 5.0m^3/h.m^2@50 and where an as-built air-permeability test of ≥ 3.0m^3/h.m^2@50 Pa is achieved; and
- allowing continuous mechanical systems to apply to buildings of any air permeability performance,

albeit with an expectation that the general performance will be no greater than 5.0 m^3/h.m^2 @ 50Pa in new construction.

3C.24 This may interact with the air tightness limitations for new build dwellings. In other regions this was reduced from 10.0 to 8.0 m^3/h.m^2 @ 50Pa, but the Department is questioning if an improvement on this should be required here (see question 3A.11).

Question 3C.3 Do you agree that revised TBK guidance should align the three principal systems (natural, continuous mechanical extract and continuous supply and extract/MVHR) in keeping with air-permeability thresholds England and Wales?

Noise

3C.25 Considerations of external noise are normally addressed at planning stages with input from Environmental Health. Acoustic baffles and vents are encouraged where necessary to reduce external noise infiltration while still ensuring adequate indoor air quality.

3C.26 In keeping with the current principles in TBK, the guidance in all regions does not explicitly require in-situ acoustic testing of mechanical ventilation systems, where noise can also be a problem. However, guidance does set out acoustic performance standards that should be achieved and could be a useful reference if there are concerns in practice.

3C.27 The updated ADF1 guidance revises these slightly, setting a higher 45dB L_{AeqT} requirement for intermittent extract operation (but not for boosted purge ventilation) in less sensitive spaces, rather than the previous 35dB L_{AeqT} for continuous operation in such spaces.

3C.28 In-situ noise testing is not required in any administration, however England is reviewing the provisions of its Part E (Resistance to the passage of sound).

Question 3C.4 **Do you have any evidence or guidance that should prompt the Department to develop an independent approach to noise of mechanical ventilation systems in dwellings?**

Performance based routes to compliance

3C.29 Appendix B of the revised ADF1 in England and in Wales is similar to Appendix A (Performance based ventilation) in TBK. It sets out an alternative performance specification which can be used to assess alternative routes to compliance. This includes indicative limits to moisture levels, indoor air pollutants, and bio-effluents.

3C.30 Minor changes in the new ADF1 include;

- addition of maximum formaldehyde concentration levels.
- alteration to permit an alternative assessment based on concentrations of individual compounds using *Public Health England's Indoor Air Quality Guidelines for Selected Volatile Organic Compounds (VOCs) in the UK*, rather than total volatile organic compound (VOC) levels.
- a change from 3.5 to 4 air changes per hour to attend to control of bio-effluents (body odours).
- simplification of assumptions on infiltration to 0.15 air changes per hour for less airtight buildings.

3C.31 This performance specification is rarely used in practice, but does provide an important datum of expectations where alternative designs are proposed. The Department is minded to replicate these amendments to align with the updated provisions in England.

Question 3C.5 **Do you agree that the updated performance based specification in England's ADF1 (Ventilation – dwellings) should be replicated in equivalent guidance here?**

Ventilation where work is occurring on existing dwellings

3C.32 Current TBK guidance on ventilation to existing buildings provides particular guidance on;

- addition of a habitable room
- addition of a wet room
- addition of a conservatory

- refurbishing a kitchen or bathroom

3C.33 The new guidance in England and Wales expands on this to address the issue of ventilation when installing common energy efficiency improvement measures which are likely to have varying effects on reducing ventilation infiltration levels. The general principle of the requirements is that newly created spaces should be provided for, in a similar way to new-build dwellings, while work done to existing buildings should not reduce the previous ventilation performance, taking into account any infiltration reductions[83] . Some minor alterations on the existing guidance is made to support this in the four cases above.

3C.34 The uplifted Approved Document guidance offers two routes to demonstrating compliance when energy efficiency retrofit work is being carried out to an existing dwelling─

1. Method one categorises different energy efficiency measures as having a major or minor effect on a building's ventilation levels. Depending on how many major or minor measures are installed, a flow diagram and checklist aids the user in determining a way in which the Building Regulations requirements may be met.
2. Method two suggests seeking expert advice, which may include carrying out an air permeability test or complying with a referenced industry standard (PAS 2035: Retrofitting Dwellings for improved energy efficiency).

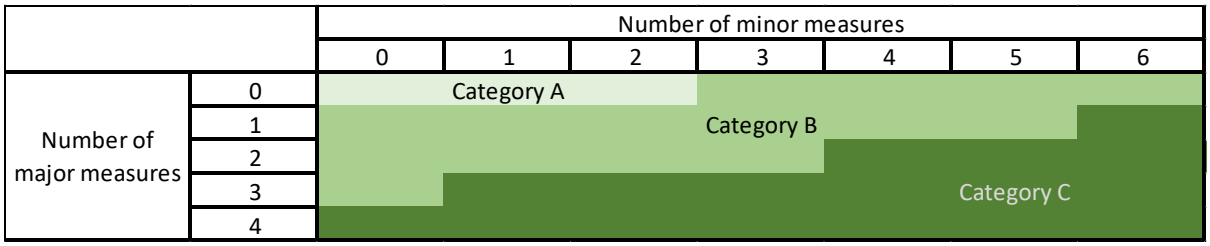
3C.35 Method one lists typical interventions as major or minor. For example

- replacement of >30% of the windows or doors is 'major'
- renewing loft insulation is 'minor';
- chimney sealing is 'major'.

For further details see ADF (Ventilation) Vol 1 (2021)

3C.36 A chart is used to assess all interventions applied since the dwelling's original construction to assign a category to the work (See Diagram below).

[83] This principle is governed by Regulation 7 (Application to structural alterations).



3C.37 Category A assumes infiltration has not been impacted sufficiently to require additional ventilation measures for the building, although some may be required locally, for example, if the window being replaced had trickle vents, an equivalent replacement vent would be expected.

3C.38 Category B measures direct users to the guidance on the three 'systems', with the presumption than natural ventilation may be able to be used, provided it is brought up to new-build standards.

3C.39 Category C measures, presume that infiltration has been improved to a level where use of natural ventilation would require expert advice. Solutions conforming to the standard guidance on continuous mechanical extract or supply and extract could be installed otherwise.

Question 3C.6 Do you support amendment of the Technical Booklet K guidance in line with the developments in England and Wales, to address ventilation alongside fabric retrofit work?

Validation of performance

3C.40 Paragraph 2 of regulation 65 (Means of ventilation) already requires testing and commissioning of fixed mechanical ventilation. Regulation 67 (Notification of testing and commissioning) requires notification of air flow testing of installations in new dwellings and that testing and commissioning certification is passed to the district council. Regulation 68 (Provision of information) requires provision of operation and maintenance information to the building owner and notification of that this has been done to the district council.

3C.41 Information for energy performance validation and a new Home User Guide has been outlined in paragraphs 3A.125. The new guide is intended to provide non-technical advice on how to operate and maintain the dwelling in a healthy and energy efficient manner. A template for a Home User

Guide can be viewed at https://www.gov.uk/government/publications/home-user-guide-template.

3C.42 The Department is alert to supporting appropriate oversight of ventilation design and commissioning. Appendix C of the updated ADF1 in England and Wales now notes that commissioning documents should be signed by a person who is both competent to install the system and responsible for installing and commissioning the system.

3C.43 The Republic of Ireland requires that "systems should be installed, balanced and commissioned by competent installers e.g. Quality and Qualifications Ireland accredited or Education Training Board or equivalent." It has established a requirement for an additional layer oversight via "independent third party validation checks by an independent competent person e.g. NSAI certified or equivalent."

Question 3C.7 **Have you any comment or insight on how the Department or others should support skills or cite competence standards for the design, testing and commissioning of ventilation systems in dwellings? Please include relevant details in your response.**

Question 3C.8 **Have you any other evidence on issues or suggestions on ventilation standards in dwellings, which the Department should consider as part of the review of Park K (Ventilation)?**

Potential Additional items for new dwellings

3C.44 The following issues are cited with a view to assessing the appetite for inclusion in Phase 3 or Phase 4 proposals. However, any additional provisions beyond a straightforward replication of measures in England are likely to require additional consideration and may require legislation to institute the additional requirement.

CO_2 monitoring

3C.45 Research carried out recently for the Scotland's Building Standards Division[84] indicated that over 90% of occupiers believe the indoor air quality

[84] Investigation of Occupier Influence on indoor Air Quality in Dwellings (webarchive.org.uk)

within their main bedrooms is very good or fairly good. However, onsite monitoring of carbon dioxide (CO_2) levels found that 83% of properties tested had time weighted concentrations greater than 1,000 parts per million (ppm) within the main bedrooms.

3C.46 Although in terms of health and safety, exposure to CO_2 levels of up to 5,000 ppm over an 8 hour period is generally not considered a risk, levels of over 1,000 ppm can be taken as an indicator of poor indoor air quality and ventilation. High levels of CO_2 will, therefore, be associated with the presence of higher levels of other contaminants, such as volatile organic compounds, formaldehyde, particulates, bacteria, etc. The levels of these other contaminants are less easy to identify accurately without very sensitive testing equipment.

3C.47 In response, Scotland introduced a requirement for CO_2 monitoring in the principal bedroom in new dwellings, in 2015. The monitoring is intended to act as proxy for indoor air quality in the dwelling. The system is not an alarm, but provides dwelling occupiers with an output result which, together with as-built guidance on appropriate levels of intervention (e.g. ‘make sure background ventilators in the room are open’, or ‘monitor daily’), should allow occupants to respond appropriately to the reading. The intention would be that any action should be replicated in other rooms.

3C.48 At this stage we are unsure how valuable or successful implementation of CO_2 monitoring has proven to be in practice, but we would be keen to gather evidence. We will review any findings or insights emerging from further research or follow-up assessments in Scotland or elsewhere. We anticipate further consideration will be given to CO_2 indoor air quality monitoring, potentially as part of Phase 4 provisions, in order not to unduly delay progress.

3C.49 Note: CO_2 monitoring is proposed under Phase 3 for certain occupiable rooms in buildings other than dwellings- (see Section 4C).

Question 3C.9 Do you agree that CO_2 monitoring in dwellings should be a consideration for Phase 4?

Clothes drying facilities

3C.50 Drying washing indoors can produce large amounts of water vapour and is frequently cited as a factor in addressing condensation, damp and mould in

existing dwellings. The tendency to build 'tighter' buildings could increase these risks by trapping the moisture within the building.

3C.51 Scotland's building standards requires a dedicated indoors clothes drying space and an outdoor drying space, where it is reasonably practicable. Under its guidance, the internal space needs to be at least $1m^3$ with no dimension less than 700mm and both internal and external spaces should be provided with 1.7m of hanging line for each 'apartment' or habitable room. The outside space should be part of the dwelling's ownership (i.e. communal drying areas are not encouraged).

3C.52 The internal space can be provided at high level in a bathroom using a pully system, if the ceiling is sufficiently tall, but it should not inhibit access to other facilities. The space needs to be provided with ventilation at a rate of 15 l/s connected through a humidistat set to activate when the relative humidity is above a set value of between 50% and 65%. In many cases this will utilise the existing extract system in the bathroom or utility space.

3C.53 The Department is minded to recognise that drying washing indoors is a likely outcome in most homes and that the ventilation guidance should specifically recognise this risk with an expectation of humidity controlled extract ventilation in indoor areas where clothes drying is likely to occur. Repercussions will need further investigation to assess if this will be completed under Phase 3 or Phase 4 work streams, but we would welcome any evidence or insight you may have.

Question 3C.10 Do you support inclusion of ventilation guidance to more specifically consider clothes drying, in line with current provisions in Scotland ?

Question 3C.11 Do you have any evidence or insight on other aspects of ventilation for dwellings which the Department should take into account?

Section 3D: Mitigating overheating risks in dwellings – Phase 3

Introduction

3D.1 This section considers the introduction of overheating mitigation standards to the building regulations and associated Technical Booklet guidance as part of the proposed Phase 3 uplift.

3D.2 In 2018 the Environmental Audit Committee (EAC) held an inquiry into heatwaves and their impact on the UK. Within the final report[85] the EAC recommended that the government should create a new regulation to stop buildings being built, which are prone to overheating.

3D.3 In response to this recommendation and after conducting modelling research that indicated significant overheating risks in new dwellings in England, DLUHC introduced a new Part O (Overheating) to their building regulations and published associated technical guidance in Approved Document O (Overheating). Part O came into effect on 15 June 2022.

3D.4 Similarly, the Welsh government consulted on and published new Part O standards which took effect there on 23 November 2022. Scotland also introduced a new standard and provided supporting guidance on overheating, coming into effect on 1st December 2022.

3D.5 In England and Wales, the new requirements apply solely to the erection of a new dwelling or similar residential building. They do not apply where work is carried out to existing buildings, or cases of a material change of use. In Scotland the new requirements apply to the erection of a new dwelling or similar residential building and also to conversions.

3D.6 The new regulation O1, in England is typical of the requirements in all regions, and requires the following—

[85] Parliament UK, 2018. Heatwaves: adapting to climate change. Available online: https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/826/826.pdf

O1 Overheating mitigation

(1) Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel ("residences") to—

a) limit unwanted solar gains in summer;

b) provide an adequate means to remove heat from the indoor environment.

(2) In meeting the obligations in paragraph (1)—

a) account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence; and

c) mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it.[86]

3D.7 Previously, overheating solar gains were assessed under the SAP assessment under criteria outlined in an Appendix P, for dwellings and under non-domestic modelling assessments for other building cooling loads. However, Appendix P has been omitted from the new SAP 10 in light of the new overheating requirements introduced in the GB regions.

Definition of overheating

3D.8 Overheating occurs when the local indoor thermal environment presents conditions in excess of those acceptable for human thermal comfort or those that may adversely affect human health.

3D.9 The Chartered Institution of Building Services Engineers (CIBSE) TM59 sets out two compliance criteria which both need to be met to prevent overheating in naturally ventilated homes.

- Criterion A applies to living rooms, kitchens and bedrooms. It requires that the internal temperature does not exceed a defined comfort temperature[87] by 1 °C or more for more than 3% of occupied hours over the summer period (1 May to 30 September).

[86] https://www.legislation.gov.uk/uksi/2021/1391/regulation/11

[87] Comfort temperature is something of a moving target, although it's usually in the range of 20-25°C, and is impact by the external temperature, levels of ventilation, etc.

- 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.

3D.10 The dwelling is deemed acceptable if both criteria are met. If one or both of the criteria are not met, the implication is that mitigation measures are necessary to reduce the risk of overheating.

3D.11 Homes only need to overheat for part of the time for these criteria to not be met; to exceed Criterion B, a bedroom would typically only need to exceed 26°C overnight for 33 hours per year which could occur during a week-long heat wave. The extent of any mitigation measures depends on how much the criteria have been exceeded, taking into account the scale of the elevated temperatures, the duration and time-of-day that they occur.

3D.12 For predominately mechanically ventilated situations (e.g. homes with restricted window openings) the CIBSE fixed temperature test must be followed. This requires that all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of occupied hours.[88]

3D.13 TM59 can also be used to assess care homes and accommodation for vulnerable occupants. In this scenario, naturally ventilated homes assume Type 1[89] occupancy and consequently must meet more stringent Criterion A standards. In mechanically ventilated situations the requirement remains as per paragraph 3D.12 above.

Weather Data

3D.14 The TM59 standard requires the simulation to use the DSY1 2020s high emissions scenario, 50th percentile weather data published by CIBSE. CIBSE has published DSY1 weather data for 14 UK locations, including Belfast. DSY1 (Design Summer Year 1) is intended to represent a moderately warm summer. The 2020s weather data is intended to represent 2011 to 2040. CIBSE recommend that overheating assessment should be undertaken with assumed thermal comfort based on TM52 Category 2 by default (i.e. normal expectation for new buildings).

[88] CIBSE Guide A (2015a)

[89] See CIBSE TM52 (2013) for description.

3D.15 The weather file data used appears to be highly influential on outcomes. SEAI carried out research for the Irish Government using the Belfast locational data in 2019, which suggests low risks of overheating here[90]. Risks increase where the dwelling cannot provide good cross ventilation, where the openings are restricted (this could be an issue of noise or pollution, as well as a physical restrictor) or where a large area of glazing on south or west facades. South west facing, highly glazed rooms to single aspect flats with restricted openings would therefore seem to be the most problematic situation.

Standards in England

3D.16 The new overheating guidance in England applies to new residential buildings only; this includes dwellings and other types of residential accommodation such as care homes and student accommodation.

3D.17 Compliance with the new regulation "O1 Overheating mitigation" can be demonstrated by using either a simplified method for limiting solar gains and removing excess heat or by using the dynamic thermal modelling method.

Simplified Method

3D.18 When using the simplified method, two overheating risk categories have been identified by location;

'Moderate risk' location – England, excluding high risk parts of London. 'High risk' location – urban and some suburban parts of London (Note; the Department does not consider this category relevant given our local climatic conditions).

3D.19 For the purposes of the simplified method, it is necessary to identify whether cross ventilation is possible. In additional to this, the location (high

[90] Pratima Washan Report Overheating risk in new dwellings 2019-05-14 (seai.ie)

vs moderate risk) is then used to select relevant guidance for the purposes of

i. limiting unwanted solar gains in summer; and
ii. providing appropriate means of removing excess heat from the indoor environment.

3D.20 Limiting solar gains is achieved by limiting the extent of glazing in the most glazed room and across the building as a whole. The permitted extent of glazing varies depending on orientation and availability of cross ventilation.

3D.21 Removing excess heat is achieved by providing adequate ventilation openings which depend on location and availability of cross ventilation provided by the building's layout. Cross ventilation requires openable areas on opposite orientations of the building; corner flats, for example, would not fulfil this requirement.

3D.22 Applying the simplified method will usually result in free areas that exceed the free areas in England's Approved Document F (Ventilation), Volume 1: Dwellings.

3D.23 The 'simplified' method requires a considerable range of quite complex assessments including—

- assessment of glazed areas at the residential unit level relative to floor area and "*determined using the orientation of the façade that has the largest area of glazing*".
- assessment of glazed areas in the most glazed room "*determined using the orientation of the façade that has the largest area of glazing*" relative to room's floor area. This may not be the actual floor area in some deeper plan rooms with more than one use (e.g. an open plan kitchen/living space);
- calculation of free areas with consideration of the window/opening type, opening dimensions hinge position and any degree of restrictor/restriction necessary to calculate the equivalent free area for each opening (in most cases, this would be necessary for the rapid ventilation assessment for indoor air quality in any case)
- total minimum free areas in the residential unit compared to total floor area

- total minimum free areas in the residential unit compared to glazing area
- minimum free area in each bedroom compared to floor area of the room

Further detail can be reviewed via–

- Tables 1.1 and 1.2 from England's Approved Document O, which provide information on glazing limits.
- Tables 1.3 and 1.4 provide information on assessing the minimum free areas for heat purge ventilation from rooms and buildings.

Alternative Method (Dynamic Thermal Modelling)

3D.24 Alternatively, designers may demonstrate compliance by the dynamic thermal modelling method. This is a standardised approach to predicting overheating risk for residential buildings and, whilst it requires more detailed modelling, it can consider a wider range of circumstances and offers more design flexibility.

3D.25 CIBSE's TM59 methodology should be used for any such modelling and a report must be provided to building control showing that the proposal passes the assessment. Certain limits apply to when using this methodology.

3D.26 Under the TM59 assessment, acceptable strategies for limiting solar gains in summer include the use of fixed shading devices, glazing design and building design. Shading provided by adjacent permanent buildings, structures or landscaping can also be included in the assessment, and dynamic modelling may be included where this is proposed.

Removing heat when using the dynamic thermal modelling method

3D.27 Removing excess heat can be achieved through the use of opening windows and/or ventilation louvres in external walls. However, contributions from mechanical ventilation or mechanical cooling can only be considered under the DSM modelling approach. Passive means must be used as far as reasonably practical before adopting mechanical cooling.

3D.28 The TM59 methodology applies in all the regions where overheating mitigation measures have been introduced. In effect, it can be the only realistic option to demonstrate compliance where conflicting issues require

mechanical interventions (e.g. where noise, pollution or security issues prevent the use of openings for purge cooling). Many designers already use DSM software, particularly in the modelling of non-domestic buildings. The Department would encourage industry to obtain further training and use of the DSM tools for application in this area.

3D.29 Many of the DSM software packages have modules or aspects which are approved for the purposes of conservation of fuel and power requirements under the administrations' building regulations. However, at this stage, there is no formal approval or accreditation by government of the DSMs' TM59 assessment although the programmes used are already relied upon by design consultants.

Other considerations

3D.30 Overheating mitigation strategies must also take account of occupant safety and their reasonable enjoyment of the residence. Designers must consider noise at night, pollution, security, protection from falls and protection from entrapment. These usability issues are expanded upon later in this Section. Consideration of adequate daylighting is already covered in Part F technical guidance, but there is no strict requirement to ensure this is achieved.

Standards in Wales

3D.31 The new overheating standard and guidance in Wales applies to new residential buildings only; this includes dwellings and other types of residential accommodation such as care homes and student accommodation.

3D.32 Modelling undertaken by Wales found that cross ventilated houses there were not prone to overheating provided they met ventilation requirements set by Part F (Ventilation) of their regulations.[91] Consequently, Part O requirements in Wales do not require cross ventilated houses to follow the simplified or modelled approach, provided they meet the normal ventilation requirements and do not have usability concerns (noise, pollution, security, safety). If usability issues are present the house must follow either the

[91] This is in line with TM59 which suggests *"Individual houses and developments with a low risk of overheating may not require the use of dynamic thermal modelling".*

simplified or modelled approach to mitigate any overheating. In practice it is likely that dynamic thermal modelling would be needed where usability issues arise.

3D.33 Wales have also introduced a simplified method and dynamic thermal modelling method, however their simplified assessment is different to and simpler than England's. The more straightforward approach in Wales sets different glazing limits and ignores orientation. It also considers extent of glazing only at an overall dwelling level and largely irrespective of orientation

3D.34 Furthermore, Wales, unlike England, do not set minimum requirements for purge ventilation of bedrooms for the removal of heat. Again, the approach in Wales is to consider purge ventilation for cooling at a whole dwelling level only.[92]

3D.35 The alternative Dynamic Thermal Modelling method for Wales again uses the CIBSE TM59 Design methodology for assessment of overheating risk in homes (2017).

3D.36 Wales's guidance requires that any dynamic modelling should be carried out by a competent person, this is a person appropriately trained in thermal comfort modelling (for example, a Low Carbon Energy Assessor (LCEA) Level 5 who has experience in thermal comfort modelling in buildings).

3D.37 Wales have not highlighted any areas of 'high risk'; the same standard applies to residential buildings throughout the region.

Standards in Scotland

3D.38 Scotland's new requirements apply to residential units and shared multi-occupancy residential buildings. In the case of conversions, the building as converted should meet the requirements of the standard in so far as is reasonably practicable and in no case be worse than before the conversion.

3D.39 Again two options can be used; a simplified method or dynamic thermal analysis modelling.

[92] See Table 1.2 of Approved Document O, for Wales https://www.gov.wales/building-regulations-guidance-part-o-overheating

3D.40 Scotland's simplified method requires assessment of rooms on building elevations exposed to the sun path (i.e. through east-south-west) in order to limit solar gain through glazing. If the area of glazing is greater than 20% of the floor area of the room, it is necessary to provide shading devices or to revise the glazing g-value to reduce solar gain in proportion to the increase in glazing area above 20%.

3D.41 The simplified method also requires adequate ventilation to assist in cooling. Under Scotland's simplified method, where a building is arranged such that it can provide suitable cross-ventilation or where it is a single aspect north facing arrangement then the normal purge ventilation for rooms, provided to meet indoor air quality requirements, is considered sufficient and no further action is required to provide for ventilation to assist in cooling.

3D.42 In all other cases the minimum area of ventilation openings should be increased by 50%; for example from 5% (1/20th of the floor area of the room, as set out in clause 3.14.3 of Scotland's Technical Handbook for Domestic Buildings) to 7.5% of the floor area of the room, where windows open beyond 30 degrees.

3D.43 There is a requirement to distribute ventilation openings in cross ventilated dwellings with no less than 1/3rd of the ventilation openings provided per opposite elevation, where the simplified method is used.

3D.44 Scotland also require increased ventilation in conservatories (Standard 3.14.9), with ventilator or ventilators with an opening area of at least 1/5th of the floor area it serves.

3D.45 Where either mitigation of heat gain or provision of passive ventilation to assist in cooling is not considered practicable, Dynamic Thermal analysis should be undertaken. This, again, uses the CIBSE TM59 Design methodology for assessment of overheating risk in homes (2017).

3D.46 Scotland, similar to England and Wales, seek to ensure usability of mitigation measures and by considering the following; noise at night, pollution, security, protection from falling and protection from entrapment.

Standards in Republic of Ireland

3D.47 Overheating guidance is included in their Part L (Conservation of fuel and power) Technical Guidance Document. Similar to the current position in NI, DEAP software will flag up dwellings that present an overheating risk. There have been no announcements indicating that RoI intends to introduce stand-alone overheating guidance outside DEAP.

Usability of mitigation measures

3D.48 The regions in Britain that have implemented overheating mitigation measures all require mitigation strategies to take account of all the following factors;

- Noise at night
- Pollution
- Security
- Protection from falling
- Protection from entrapment

3D.49 Noise at night can present a problem if overheating strategies rely on the opening of bedroom windows during sleeping hours (23:00 – 07:00).

- In England, where external noise may be an issue (e.g. where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours. England indicate specific noise levels in their guidance of when this is likely to occur and suggest testing on site. Evidence supporting the chosen overheating mitigation strategy can be provided to indicate these levels are not exceeded.
- Wales, through their guidance, state that building control bodies may accept that noise is not a concern if evidence is provided to demonstrate that it was not considered an issue at planning stage. If noise was considered an issue at planning, it is necessary to show that proposals for heat removal during sleeping hours can be accommodated. Additionally, Wales require designers to consider the noise generated by mechanical ventilation measures, if applicable.

- Scotland also require that noise issues are considered, with such matters usually being a material consideration at planning stage. Again, the proposed overheating mitigation strategy Pollution is another usability concern.

3D.50 Pollution is another usability concern.

- England's Part O refers to their Part F (Ventilation) guidance in order to minimise the intake of external air pollutants. Designers should already be familiar with Part F requirements and Part O does not add any improved requirements beyond this.
- Wales, similarly refer to the applicable section of their Part F (Ventilation) guidance.
- Scotland treats potential pollution concerns in the same way as noise in that if it is highlighted at planning stage as a material consideration any proposed overheating mitigation measures should also be cognisant of the problem.

3D.51 Security is another concern as a consequence of the likelihood that openings will be larger and open for longer as part of for purged ventilation measures in naturally ventilation dwellings.

- England require that the free opening area available for ventilation during sleeping hours should be only the amount that can be securely provided and they highlight ground floor and easily accessible bedrooms as being particularly vulnerable to intrusion by burglars. England's guidance notes that openings can be made secure by using fixed/lockable louvered shutters or fixed/lockable grills or railings. "Easily accessible" is also a defined term.
- Wales's Part O guidance replicates the position in England, with some additional emphasis that any security measures should not obstruct the means of escape strategy for fire.
- In Scotland, 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.

Easily accessible is defined as any of the following.

· A window or doorway, any part of which is within 2m vertically of an accessible level surface, such as the ground or basement level, or an access boundary.

· A window within 2m vertically of a flat or sloping roof (with a pitch of less than 30 degrees) that is within 3.5m of ground level.

3D.52 Protection from falling is another usability criteria. The expectation is that purge ventilation requirements may result in most glazing provision being openable, sometimes for long periods and that this might increase the risk of falls from height.

- England require consideration of window handle reach distances and guarding additional to the normal/previous requirements which permitted guarding at windows to be provided at 800mm at windows[93].
- Wales again replicate the approach in England but also add that if exceeding the minimum guarding height this should not impact the means of escape in the event of fire.
- Scotland simply state that 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 of dwelling security. Unlike England and Wales, no specific or additional requirements for guarding are explicitly specified for windows used for purge ventilation to meet cooling requirements. Minimum sill height permitted in Scotland without a protective barrier appears to have remained at 800mm.

3D.53 Protection from entrapment is the final usability concern raised by England and Wales.

- England's guidance requires that louvered shutters, railings and grilles should not allow body parts to become trapped with more detailed requirements provided.
- Wales replicate this position.
- Scotland's previous position outlined above around delivering a safe environment would presumably extend to protection from entrapment.

[93] See diagram 3.1 Approved Document K

Proposed overheating mitigation standard

3D.54 Given the removal of Appendix P from SAP 10 and the EAC report, the Department is minded to introduce a new regulation on overheating, supported by Technical Booklet guidance.

3D.55 The Department expects to work on the basis that only a low to moderate risk of overheating assumption would be applicable across the region, given the evidence from the Irish Government's research.

3D.56 The Department currently considers that Scotland's approach is the most practicable and that a similar approach, would be proportionate given presumed similarities in climate data.

3D.57 The simplified approach would require an assessment of each room facing west, south or east such that:

i. glazing is limited to 20% of the total floor area of the room (or an equivalent reduction supported by shading or an lower g-value for the glass); and

ii. in dwellings or relevant residential spaces where cross ventilation is not possible or where the rooms are not facing north, openings for purge ventilation are increased by 50% beyond that which would be required for rapid ventilation for Part K (Ventilation)

3D.58 Where this was not possible, or the designer choose to pursue a more in-depth assessment, the TM59 modelled approach could be used to demonstrate compliance.

3D.59 The principal benefits of following an approach closely aligned to Scotland is that it provides the assurance that all habitable rooms orientated towards the suns path will be individually assessed. Additionally, linking heat removal requirements to current purge ventilation standards helps reduce the compliance burden on designers. Assessment on a habitable room basis should also enable the requirement checks to apply to extensions and alterations. The Department is also minded that it should apply to

change of use applications related to dwellings or relevant residential buildings.[94]

3D.60 The current Part K (Ventilation) guidance already requires a minimum of 4 air changes per hour of rapid (purge) ventilation to habitable rooms in dwellings and is equivalent to England, Wales and Scotland.

3D.61 The Department expects that all reasonably practicable passive measures should be required to be used before including any active measures to mitigate overheating.

3D.62 Compliance with the new regulations would be demonstrated by following technical guidance either in a new Technical Booklet O (Prevention of overheating), or within TBF1 or TBK1. Final regulations and more developed guidance would be subject to further policy development, including public consultation.

Question 3D.1 **Do you agree that local regulation and guidance will be needed to mitigate overheating in new dwellings and residential buildings?**

Question 3D.2 **Do you agree with the proposed course of action whereby DSM modelling to TM59 requirements would be used in more complex situations but a simplified approach, largely following Scotland's proposals, could be applied in more straightforward situations?**

Question 3D.3 **Should the new requirements only apply to new-build situations (i.e. to the erection of a building) or should it also apply to material change of use situations and/or extensions and structural alterations?**

Typical issues/outcomes to consider

3D.63 The Future Homes Hub provides additional technical guidance[95] for England's Part O standard that includes a detailed overview and case studies that demonstrate the challenges of the new standard in England and its impact on building design. Fewer challenges and impacts, are likely

[94] Case 1, Case ii, Case IX, Case X, Case XI and Case XII of Regulation 8 (application to material change of use)

[95] 2441_Part O Overheating Technical Guide.pdf (cdn-website.com)

here if the proposed guidance above is implemented given the simpler route is much more straightforward and because the Belfast weather file, used for the TM59 modelling approach, are likely to be less onerous.

3D.64 The new requirements are likely to reduce the extent of glazing in some buildings. This, and/or provision of shading, may impact planning permissions, so early appraisal and consideration of these issues needs to be emphasised. In some circumstances, where mechanical cooling is proposed and passive shading measures have not been deployed, it may be necessary to obtain a statement or somehow show that shading devices were not acceptable or where discouraged for planning reasons.

3D.65 The new measures would place greater consideration on the quality of glass (the g-value in particular) and/or the need for shading devices. Conservatories and other highly glazed spaces such as sun rooms could be difficult to incorporate into new build dwelling designs, although many conservatories would remain exempt[96] (there is no proposal to amend the current position on this exemption).

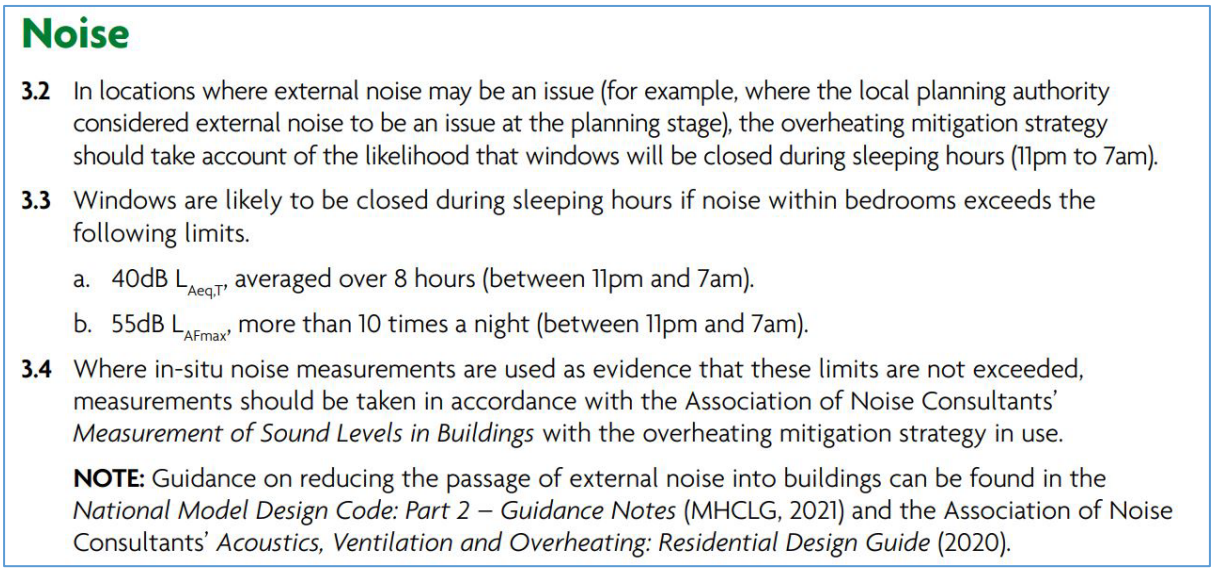
3D.66 Mechanical cooling may be required in some circumstances, if passive measures are inadequate to purge heat. The proposed guidance would seek to minimise this, requiring that all reasonably practicable passive measures have been employed to reduce cooling needs.

3D.67 The uplifted Part F (Conservation of fuel and power) requirements would also require offsetting measures, in terms of carbon and primary energy impacts, to account for any additional cooling loads when assessed in SAP. This means that buildings in polluted or noisy areas may be more difficult or expensive to build. This could be a viability issue if Part F was to specify a very low energy demand Notional Dwelling specification, as proposed under Option 2 of Section 3A, and the additional cooling demand was unable to be compensated for elsewhere in the specification.

3D.68 Openable areas to remove heat present particular challenges in determining when noise, pollution, security and safety issues should prevent standard openable windows or purge ventilating solutions from being used.

[96] ref Class 8 of Schedule 2 (Classes of exempted buildings) to regulation 4 (exemptions) and the definition of “Conservatory” in regulation 2 (definitions) of the Building Regulations (Northern Ireland) 2012 (as amended)

3D.69 For example, England's ADO notes that where noise has been identified as an issue at planning stage, windows may not be left open at night such that purge cooling and the simplified approach may not be viable. It sets levels where on-site testing is used to justify an approach.



Noise

3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).

b. 55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am).

3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' *Measurement of Sound Levels in Buildings* with the overheating mitigation strategy in use.

NOTE: Guidance on reducing the passage of external noise into buildings can be found in the *National Model Design Code: Part 2 – Guidance Notes* (MHCLG, 2021) and the Association of Noise Consultants' *Acoustics, Ventilation and Overheating: Residential Design Guide* (2020).

Figure 3D.1 Extract from Approved Document (Overheating)

3D.70 Appendix D of Technical Booklet K (Ventilation) already provides for consideration of ventilation issues where external air may carry additional pollution risks. The intention would be to refer to this, in a similar way to the other regions.

3D.71 The new guidance will need to provide for security to ground floor and easily accessible bedroom windows, which may be vulnerable to opportunistic burglary. It will also provide guidance on ensuring windows that open wide do not unduly increase risks of falls from heights or entrapment. The principal intention is to highlight where security grills may be appropriate.

3D.72 Any new requirement for additional guarding at 1100mm to windows provided for purge cooling will need consideration on potential conflicts on with provisions under part E (Fire safety), Part H (Stairs, ramps, guarding and protection from impact) and Part R (Access to and use of buildings).

3D.73 More detailed consideration of these usability issues will be required in further policy development stages. The following questions are intended to help gather evidence to support this work.

Question 3D.4 **Should the noise assessment levels be based on planning issues, or should bespoke noise assessment and testing be expected where openings are proposed for purge cooling of rooms in dwellings or similar buildings?**

Question 3D.5 **Are you content that the guidance in Appendix D of the current Technical Booklet K provides sufficient clarity on pollution assessment where natural purge ventilation for cooling is proposed?**

Question 3D.6 **Do you agree that guidance should be revised to support a 1.1m high guarding at openings for purge cooling or should the current 800mm height for guarding at windows remain?**

Question 3D.7 **Are there any other issues which should be taken into consideration in terms of the usability of openings for purge cooling?**

Question 3D.8 **Have you any evidence or modelling to indicate if a requirement for cooling could result in new Carbon emissions or Primary Energy targets proposed in Section 3A (see Table 3A.1) being difficult, or impossible, to deliver in practice in some circumstances e.g. single aspect flats next to noisy/polluted roads? If so, please provide details and outputs.**

Question 3D.9 **Can you evidence any 'lessons learned' from roll out of the overheating mitigation policies elsewhere that we should consider?**

Section 3E: Electric Vehicle infrastructure- background and Phase 3 proposals for dwellings

Background

3E.1 The Northern Ireland Executive's Green Growth Strategy sets out its long-term vision for tackling the climate crisis and this is supported by its Energy Strategy – The Path to Net Zero Energy. Transport is responsible for 33% of greenhouse gas emission in Northern Ireland and, with the UK Government banning the sale of new fully petrol and diesel cars from 2030 and hybrids from 2035, decarbonisation of transport is a crucial part of achieving government targets for lowering carbon emissions. With a greater demand for Electric Vehicles (EVs) projected over the next few years, ready access to convenient and reliable EV charging infrastructure shall be required.

3E.2 Although policy relating to electric vehicles and transport in Northern Ireland rests with the Department for Infrastructure (DfI), the intention is to introduce these EPBD requirements using legislative provisions through amendments to the Building Regulations, which will require the provision of either charging points (CPs) or ducting infrastructure in all new dwellings, or buildings undergoing major renovation.

3E.3 We are seeking comments on DfI's preferred policy options relating to the installation of EV charge points and associated infrastructure (i.e. trunking, conduits, and/or cable trays for electricity cabling). These policies will facilitate the installation of EV charge points and associated infrastructure at residential dwellings and non-residential buildings in the coming years.

3E.4 Article 8 of the Energy Performance of Buildings Directive (EPBD)[97] deals with technical building systems, electromobility in and around buildings, and smart readiness indicators. Article 8 sets out the minimum requirements for the UK to adopt in complying with the EPBD. The minimum requirement includes the provision of ducting for electric vehicles and in some non-residential cases, a charge point, as listed in Table 1 – EPBD Requirements, below.

[97] 2010/31/EU as amended by 2018/844/EU

3E.5 For the purposes of section 3E and 4D of this consultation document, 'residential' is used interchangeably to mean 'dwellings', and 'non-residential' to mean 'non-domestic' or 'buildings other than dwellings'.

Table 3E.1 EPBD Requirements

	CATEGORIES OF BUILDINGS	EPBD REQUIREMENTS
1	New, non-residential buildings with more than 10 parking spaces* * parking spaces within or physically adjacent to the building	Art 8.2 – Installation of At least one charging point (CP); and Ducting infrastructure for at least one in every five parking spaces
2	New residential buildings with more than 10 parking spaces	Art 8.5 – Installation of ducting infrastructure for every parking space
3	New domestic dwellings with a parking space located within the dwelling curtilage	None
4	Existing non-domestic buildings undergoing major renovation with more than 10 parking spaces.	Art 8.2 – installation of At least one CP; and ducting infrastructure for at least one in every five parking spaces.
5	Existing non-domestic buildings with more than 20 parking spaces.	Art 8.3 – require installation of a minimum number of CP points by 01 January 2025.
6	Existing domestic dwellings undergoing major renovation, with more than 10 parking spaces	Art 8.5 – installation of ducting infrastructure for every parking space.
7	Existing buildings undergoing material change of use to create a new dwelling	N/A, however if there are more than 10 spaces and these situations include a 'major renovation', it would bring Article 8.5 into play.
8	Removal of regulatory barriers	Art 8.7 – Requires the government to simplify the introduction of recharging points.

Please note that proposals go further than these minimum requirements.

3E.6 The UK government has announced plans to end the sale of new petrol and diesel cars and vans from 2030 onwards. All vehicles will be required to have a significant zero emissions capability (e.g. plug-in and full hybrids) from 2030 and be 100% zero emissions from 2035. As a result of this, there will be a transformational change in the composition of vehicles on our roads and the charging infrastructure for electric vehicles needs to be improved to facilitate this.

3E.7 In the years up to 2035, when sales of new hybrid cars will cease, we expect to see shifts in the technology around battery efficiency and range as well as corresponding reductions in battery costs, which will increase the ownership of EVs. The automotive industry is expected to bring a large range of EVs to the public market. In March 2023, there were 1.25 million registered vehicles in NI, of which around 12,890 were Ultra-Low Emission Vehicles (ULEVs), i.e., 1.1%. A research project commissioned by DfI to assess the development of EVs in NI, produced by Steer, forecasts that

there could be between 60,000 and 125,000 EVs in NI by 2025[98]. Therefore, such a significant increase in the number of EVs running on our roads necessitates a greater availability of CPs to conveniently recharge them.

3E.8 Charging electric vehicles at home is cheaper, offers added convenience for consumers and makes it possible for electric vehicles to play a major part in the overall energy and transportation systems. Therefore, the expectation is that the majority of electric car charging is likely to take place at home and home charging will be a central component of the future charging ecosystem.

3E.9 Although at-home/building EV charging will increase a building's electricity use, it may also bring benefits to some aspects of the overall building performance. For example, the β-factor (the percentage of electricity generated by on-site renewables able to be used at the building) would improve, but the assumptions on time of day charging use, interconnection with other on-site electricity storage and any bi-directional smart provision complicate any standardised assessment. These challenges will need to be assessed and addressed under the UK government's NCM programmes associated with later Phases. Management of issues where CPs are not integrated with a specific dwelling meter, via a landlord operated CP, for example, is also challenging.

ZEV mandate

3E.10 The UK Government has committed to introducing a zero-emission vehicle (ZEV) mandate from 1 January 2024. The regulation will set targets, requiring an increasing percentage of manufacturer's new car or van sales be zero emission each year. The aim of the ZEV mandate is to encourage the sale of increasing numbers of zero-emission vehicles and this projected increase forms the targets set for our transport sector within the Climate Action Plan.

3E.11 Ministerial agreement means the proposed zero emission vehicle (ZEV) mandate regulation is extended to Northern Ireland. Sales of ZEVs currently make up circa 7% of total new cars registered in Northern Ireland and the introduction of the ZEV mandate has the potential to accelerate the

[98] Development of Electric Vehicles in Northern Ireland (infrastructure-ni.gov.uk)

update of ZEVs by setting quotas for manufacturers that will be achieved through sales by car dealerships.

3E.12 The final consultation (2 out of 3 have been completed), on the zero-emission vehicle (ZEV) mandate and CO_2 emissions regulation for new cars and vans in the UK, carried out jointly alongside the UK government and the other devolved administrations, was published on Friday, 31 March and closed on Wed, 24 May.

3E.13 Following completion of the final consultation it is likely that legislation will have to be introduced to support the regulation on the ZEV mandate.

EV charging

3E.14 Convenience and availability of charging infrastructure are often seen as limiting factors that negatively impact an individual's decision to purchase an EV. It is therefore important that the scale of charging infrastructure installation matches that of EV uptake. Given, that in the region of 80% of properties in Northern Ireland have access to a driveway, charging an EV at home overnight will continue to provide the most convenient and cost-effective opportunity for most households. It is therefore likely that the bulk of charging in the future will be done at home. However, for those without access to a driveway, other options, such as workplace, leisure locations, communal charging hubs, and the local council provided On Street Residential Charge-point Scheme[99], will be key to enable EV owners to charge their vehicles.

3E.15 Measures in other administrations laid out below go beyond the minimum requirements of the EPBD. The requirement to implement the EPBD into law gives us an opportunity to make sure EV provision is a part of new or renovated buildings and the previous Minister of Infrastructure, John O'Dowd, decided the best way to ensure this was to go above the minimum requirements, in line with counterparts in other administrations.

[99] https://www.infrastructure-ni.gov.uk/news/funding-boost-electric-vehicle-charge-points-residential-areas-welcomed

Table 3E.2 England and ROI policy measures

	CATEGORIES OF BUILDINGS	EPBD REQUIREMENTS	RoI MEASURES	UKG MEASURES for ENGLAND
1	New, non-residential buildings with more than 10 parking spaces	Art 8.2 – Installation of At least one CP; and Ducting infrastructure for at least one in every five parking spaces	Installation of: At least one CP; and Ducting infrastructure for at least one in every five parking spaces.	Installation of: One CP; and Ducting infrastructure for one in 5 parking spaces.
2	New residential buildings with more than 10 parking spaces	Art 8.5 – Installation of ducting infrastructure for every parking space	For all new multi-unit buildings (irrespective of the number of parking spaces), ducting infrastructure should be provided for every parking space.	A CP at each space up to one CP per dwelling; Infrastructure to every other space
3	New residential buildings with one or more parking spaces located within the building's curtilage.	N/A	EV recharging infrastructure should be provided for the future installation of an EV CP.	A CP at each space up to one CP per dwelling
4	Existing non-residential buildings undergoing major renovation with more than 10 parking spaces.	Art 8.2 – installation of At least one CP; and Ducting infrastructure for at least one in every five parking spaces.	Installation of At least one CP (accessible); and Ducting infrastructure for at least one in every 5 parking spaces.	Installation of One CP; and Ducting infrastructure for one in 5 parking spaces.
5	Existing non-residential buildings with more than 20 parking spaces.	Art 8.3 – require installation of a minimum number of recharging points by 01 January 2025.	*N/A* *This will be transposed under the RoI European Communities Act 1972. It is not yet clear what form this legislation will take.*	N/A *It is not open to apply this requirement through Building Regulations, as it applies to existing building parking spaces retrospectively. Article 8.3 is therefore outside the scope of this consultation.*
6	Existing residential buildings undergoing major renovation with more than 10 parking spaces.	Art 8.5 – installation of ducting infrastructure for every parking space.	For a multi-unit building (irrespective of the number of spaces) ducting infrastructure should be provided for every parking space.	Installation of A CP at each space up to one CP per dwelling; and Ducting infrastructure for each parking space.
7	Existing buildings undergoing material change of use to create one or more new dwellings.	N/A, however if there are more than 10 spaces and these situations include a 'major renovation', it would bring Art 8.5 into play	TBC – existing route to application by way of 'change of use' likely to apply.	At least one EV charging point per newly created dwelling with an associated parking space.

3E.16 Installation of EV charge points and the infrastructure for future installations, will support the shift to EVs over the next 10-15 years. The cost of retrofitting a building with charge points and infrastructure is significantly more expensive than installing these during the initial construction phase. Therefore, requiring the installation of charge points and ducting infrastructure in car parks for residential buildings during construction, or when major renovations are taking place, should significantly lower any associated costs. NIE Networks recently launched its RP7 business case[100] and proposes to reform expected capacities for

[100] https://www.nienetworks.co.uk/rp7-business-plan

developments, for example increasing the grid supply to a new single dwelling development from 12kW to 18kW, in part to facilitate EV charging.

Proposed route to implementation

3E.17 In keeping with the other administrations, it is proposed to use Building Regulations to legislate for the new EV infrastructure requirements here.

3E.18 England's legislation takes a highly prescriptive approach, with regulations citing a number of detailed conditions. To remain in keeping with the current format of our own regulations, we anticipate taking a functional approach (e.g. requiring 'adequate' or 'reasonable' provision for EV charging; see paragraph 2A.9), subject to legal advice. This should allow issues, such as any proposed cost cap or similar limitations, to be clarified through Technical Booklet guidance, so far as possible and in the normal manner. We note that Ireland and Scotland have legislated in this way[101], but we expect to learn lessons from all administrations.

3E.19 The Department for Infrastructure will be creating a technical guidance document to work alongside these Building Regulations with relation to the EPBD requirements. The Technical Guidance will point to the Department for Infrastructure's *Parking Standards* Guidance[102,] as adherence to *Parking Standards* is expected to continue to be a requirement for planning applications.

Question 3E.1 Do you agree with the proposed approach to use Building Regulations to legislate for EV infrastructure requirements?

Proposed EV infrastructure requirements

3E.20 The Department of Infrastructure's current expectation is to seek outcomes that provide technical equivalence to the standards introduced in England under Part S (Infrastructure for charging electric vehicles) of its building regulations, as outlined below and in Section 4D (for non-domestic buildings).

[101] See Standard 7.2 in Building standards technical handbook June 2023: domestic - gov.scot (www.gov.scot)

[102] Parking Standards | Department for Infrastructure (infrastructure-ni.gov.uk)

3E.21 Further details can be found in England's Approved Document S (ADS) together with associated FAQs[103]. You are encouraged to consider these documents and provide comment. The Department's understanding of what the proposals might entail is outlined below and in Section 4D, for non-domestic building situations.

Question 3E.2 Do you agree with the proposed approach to follow the technical provisions in England? The Department would be grateful for any comment on the guidance or out-workings there or in other regions.

Proposed EV infrastructure requirements in dwellings

Charge points

3E.22 Charge points should be smart capable and have a minimum of 7kW rating at supply voltage of 230V AC.

3E.23 Additional requirements, such as being of a minimum of a Mode 3 specialised system for electric vehicle charging running from a dedicated circuit, or equivalent, as defined in BS EN IEC 61851-1 and having a lit visual display are noted in Section 6 of ADS[104].

Requirements for new dwellings and dwellings undergoing a major renovation.

3E.24 **Requirement 1:** Parking spaces associated with new buildings containing one or more dwellings should be provided with whichever is the lesser of:

- one CP per dwelling, or
- one for each associated parking space provided within the site boundary.

Note- this requirement is beyond the requirements of the EPBD and is not applied in the Republic of Ireland.

[103] Infrastructure for charging electric vehicles: Approved Document S - GOV.UK (www.gov.uk)

[104] See para 6.2 of Infrastructure for charging electric vehicles: Approved Document S - GOV.UK (www.gov.uk)

Key terms from England's Approved Document S

Associated parking space Any parking space that is available within the site boundary of the building, for the use by the occupant of, or a visitor to, a dwelling in the building, including any parking space which is for the use of any occupant of, or any visitor to, any dwelling in a building containing more than one dwelling.

Boundary The boundary of the land and/or buildings belonging to and under the control of the building owner.

Connection cost The cost of upgrades needed to the electricity system in order to accommodate a charge point, excluding the cost of any building work or the cost of the charge point itself.

Site boundary The boundary of the land in relation to a building, in respect of which building work is being carried out, means the boundary of the land, upon which that building is situated, that is controlled or owned by the same person who owns:
· that building, or
· in the case of the erection of a new building, the land upon which building work is being carried out.

3E.25 **Requirement 2**: In addition, for those residential buildings with 11 or more parking spaces, cable routes to all additional associated parking spaces should also be provided. (i.e. ductwork to all spaces not provided with a CP).

Note- this requirement is applied in the Republic of Ireland to all parking spaces at new buildings containing one or more dwellings, irrespective of the number of spaces involved. [105]

Outcomes on typical sites

3E.26 We are using the term "associated parking spaces", rather than limiting references strictly to spaces "in or physically adjacent to the building" as specified in the directive. Communal parking provision associated with a group of buildings or houses is "associated with the building" and within the "site boundary", even if it is not necessarily within the plot of a specific building.

3E.27 We expect that on-street parking at public roads would not be "associated with the building" for the purposes of the requirements. This is an important

[105] See Technical Guidance Document L- 2022 (Conservation of fuel and energy)

distinction from the position in England, which we would expect to clarify further in any subsequent consultation.

Defining the site boundary

"The site boundary will be determined at the point of depositing a full plans application/building notice or submitting an initial notice. The parking space will be within the site boundary if, at this point in time, it is located on land that is owned or controlled by the same party that owns or controls the land on which the building is being built.

For example, if a single house is being built on a standalone plot then the site boundary is likely to be the boundary of the plot on which the house is located.

If a development of 10 houses is being built, then the site boundary for each of the houses is likely to be the boundary of the whole development."

from FAQs to England's Approved Document S

3E.28 Flats are normally treated as a single building. If there are more than 10 parking spaces associated with the block of flats, then ductwork would have to be provided to any spaces not provided with a CP.

3E.29 However, each house can be treated as a building in its own right (even if attached to another house or building) for the purposes of the assessment for requirement 2 (ductwork). In addition to any in-curtilage spaces, communal spaces are allocated, on a pro-rata basis, to assess how many spaces are "associated" with each house. In almost all cases, it is unlikely that any individual house would have more than 10 spaces, with the result that additional ductwork should not be required on most housing led schemes.

3E.30 For example ─

- in a development of 20 houses, where each house has one in-curtilage space, and 10 shared communal spaces are arranged around the site in off-street parking bays under the management of the development's maintenance company; the 20 houses would necessitate provision of 20 CPs. In determining the numbers of associated parking spaces at any one building, the 10 communal spaces are allocated pro-rata to the 20 houses, (10 / 20=0.5 to each house). 0.5 communal + 1 in-curtilage space = 1.5 parking spaces per house. Since no one house has more than 10 spaces, further ductwork for future CPs is not required;

- in an equivalent development, where only 12 of the 20 houses had one in-curtilage space each and 18 communal spaces were shared; again 20 spaces (one per house) would still need to be provided with a CP because all 30 spaces are deemed to be within the site boundary. Whether spaces are within the individual dwelling plots is not relevant, although it would clearly be preferable for as many of the required CPs as possible to be connected to a house's electricity supply (this would provide a much cheaper running cost). As only 12 houses have in-curtilage parking, independent CP service provision to communal spaces would be needed to at least 8 of the communal spaces[106]. Again, no ductwork would be required to the remaining spaces, as no one house is considered to have 11 or more spaces on completion of the work;
- a new apartment block with five flats and 12 communal parking spaces within the building's site boundary would require five CPs and ducting for the other seven spaces;
- three new separate apartment blocks of 3 flats each, built as a single development and sharing 15 spaces within the development's site boundary, would require 9 CPs (for the 9 flats), but ductwork would not be required to the 6 additional spaces as none of the individual buildings is deemed to be associated with 11 or more spaces. However, if the 9 flats were constructed as a single block and shared 15 spaces, ductwork would be required to the 6 parking spaces not provided with CPs, as all 15 spaces are associated with the building;
- if there are 25 dwellings, but only 17 parking spaces on a site, then a CP would be required to each of the 17 spaces.

3E.31 These examples illustrate how associating spaces with buildings can be quite a complex issue, which can get more complex if there are dwellings and buildings of different types in the development with different shared parking arrangements. In these circumstances allocation of the spaces to each particular building is expected and further guidance may be required (see England's FAQs to ADS for further examples).

3E.32 Where CPs are provided to communal parking there may also be issues around oversight of the CP service, as communal systems charge for their

[106] a community micro-grid arrangement might be another potential option, but this is not a normal arrangement and would require bespoke consideration.

services. Oversight arrangements and regulation of CP service providers is not a matter for Building Regulations.

3E.33 The following situations are worth considering—

a) **CPs serving communal private parking within a building;** limitations apply to covered parking, for requirement 1 (provision of CPs) (see paragraph 3E.35), however future CP provision is intended within these spaces.

b) surface (non-covered) private parking serving a building or group of houses (including off-street car parking on a private road); again, these are normally operated by building service management companies and oversight of any CP service would fall under their remit.

In these both cases, it seems unlikely that the benefits and interactions will impact individual dwellings' energy performance and they are unlikely to be connected to a resident's meter.

Question 3E.3 **Do you agree that for new dwellings with associated parking spaces; one CP per dwelling or one per associated parking space (which ever is the lesser) should be required and that, in addition, for those buildings with more than ten associated parking spaces, ducting to the rest of the residential parking spaces to facilitate future installations, should also be required?**

Exemptions for requirements for new dwellings (also applicable to major renovations)

3E.34 **Limitation 1**- As noted above, requirement 2 (provision of ductwork to every associated parking space) is limited to situations where the building would have (or, in the case of parking shared with another building, could be deemed to have) more than 10 associated parking spaces after the completion of the work.

3E.35 **Limitation 2**- The UK is currently researching fire safety for enclosed car parking. Until this research has been conducted and a way forward decided, the charge point requirements (requirement 1) do not apply to spaces in enclosed 'covered' car parks (e.g. basements, spaces below buildings, and multi-stories). Ducting requirements (requirement 2) should still be met. Where there are both covered and non-covered car parking

spaces within a site, the non-covered car parking spaces shall be provided with a CP to meet the minimum provision requirements set out earlier, so far as possible. Single dwelling garages and carports appear to be excluded from England's definition of covered car park[107], although DfI is of the opinion that CPs should not be installed in enclosed spaces.

3E.36 This dis-application of requirement to provide the CP in covered car parks applies to all building situations (new build, major renovations and material change of use) and all building types (residential, non-residential and mixed use).

Question 3E.4 Do you agree with the proposed limitations 1 and 2 (as outlined in paragraph 3E.34 and 3E.35) restricting the application of the requirements for EV infrastructure at parking spaces associated with new dwellings?

Additional grid connection cost cap (for new dwellings only)

3E.37 **Limitation 3**– In England, a limitation dis-applies the requirement where the installation of a CP would increase the grid connection costs by more than £3,600 per CP. The Department for Infrastructure is commencing work to assess what precisely would be included in any equivalent cost assessment here, taking local factors into account. (For example, grid reinforcement costs to developers' connection costs are applied differently here to GB). However, we are keen to gauge what additional connection cost (excluding the supply and fit cost of the CP itself), if any, would be an appropriate limit to apply. We note that Scotland's guidance sets the cap at £2000 per CP connection[108].

3E.38 The assessment should be purely related to additional network operator (NIE Networks) connection charges applicable solely for the EV CPs. We are aware this could be difficult to establish, depending on other aspects of the scheme concurrently impacting grid connection costs (e.g. the various on-site renewable generating technologies or heat pump based solutions that may be being explored by developers in consultation with NIEN). We would be keen to receive evidence on how successfully this is being

[107] Appendix A Key Terms of ADS defines a "Covered car park" as *Any car park which is enclosed by a roof, except garages or carports that are intended to be used solely by the occupant of, or a visitor to, a dwelling or carports that cover otherwise open parking spaces.*

[108] See section 7.2.1. of Scotland's Technical Handbook - Domestic (www.gov.scot).

assessed elsewhere, where evidence from the DNO is usually provided to support such exemptions. We are also aware of ongoing reviews and we expect to take account of any developments in future consultations.

3E.39 In cases where the cost exemption applied, the developer would still be expected to install as many CPs as possible up to the cost cap limit, and to provide the ductwork infrastructure for future installations to meet the normal requirements.

3E.40 England's regulations appear to apply the cost cap solely to new residential buildings, (defined in ADS as those containing solely dwellings). This could mean the cost cap may not be applicable to mixed use or other buildings or where a change of use or major renovation occurs, even if a new electrical connection is being provided. We will consider if extending any cost cap to these situations may be appropriate.

Question 3E.5 **Do you think there should be a limitation to the application of the requirements, on the grounds of additional grid connection costs that may accrue to developers as a result of the provision of CPs?**

Question 3E.6 **If the answer to Q 3E.5 is yes, do you think the amount of £3600 (which is currently under review) is appropriate and do you have any comment on how it should be assessed?**

Limitations for buildings containing one or more dwellings undergoing major renovation

3E.41 **Limitation 1**- 'Major renovation' under the EPBD and Building Regulations means the renovation of a building where more than 25 % of the surface of the building envelope undergoes renovation.

3E.42 **Limitation 2-** the major renovation must result in a building with more than 10 car parking spaces associated with it, for the requirements to apply. Unlike new builds, where this limitation applies solely to requirement 2, for major renovations it applies to both requirements. In effect this means that major renovation of an individual house is unlikely to ever invoke the EV infrastructure requirements under the proposed Building Regulations.

In RoI this limit is not applied; instead, ductwork has to be provided to all in-curtilage parking spaces, irrespective of the extent of the parking at the building. There is no requirement to provide an actual CP in RoI.

3E.43 **Limitation 3**- EV infrastructure requirements would only apply where the major renovation is accompanied by the renovation of the car park, its electrical infrastructure (if car park is within the site boundary of the building) or the building's electrical infrastructure (if the carpark is within the building)[109].

3E.44 **Limitation 4**-- The requirement for CPs only applies so far as the capacity of the existing electricity supply can provide for them, without upgrading the supply to the building. This is a consistent approach across GB, as retrofitting is considered cost prohibitive, thus we are reticent to make costs more onerous. We would be interested in how this is being assessed elsewhere, given that electrification of heat or other interventions, such as provision of cooling, may also call upon the existing connection's supply capacity when major renovation works are under way.

3E.45 **Limitation 5**- The requirement is not applied where the cost of installation for EV charge points and ducting infrastructure exceeds 7% of the total cost of the major renovation. Ducting and CPs would still have to be installed in line with the normal requirements up to the point they can be accommodated within the overall 7% threshold.

3E.46 **Limitation 6**- where the major renovation is being carried out on residential properties with historical fire safety deficiencies (i.e. cladding remediation), the requirements need not be applied

3E.47 Major renovation work may be accompanied by a new electrical supply serving the building. We are interested on views as to whether "the capacity of the existing electricity supply" assessment should still be applied in this circumstance, or whether the cost cap should be applicable instead. It would not be the intention to require a new supply.

Question 3E.7 **Do you agree that where a major renovation results in a residential building being associated with more than 10 parking spaces, then CPs should be provided at a rate of one per dwelling[110], or one per associated parking space (whichever is the lesser) and that that ducting should be**

[109] Note- it is proposed not to apply these requirements to car parks within buildings- ref paragraph 3E.35

[110] this would apply to the existing dwellings- newly created dwellings would be addressed through the other routes ("new dwellings" or "a newly created dwelling by way of a material change of use").

installed in each associated car parking space, to support the future installation of an EV CP?

Question 3E.8 **Do you agree with the proposed limitations to requirements in the case of major renovations, as outlined in paragraph 3E.41-3E.47?**

Requirements where a material change of use which creates a new dwelling

3E.48 Parking associated with dwellings newly created by way of a material change of use would require the following─

3E.49 **Requirement:** a CP for every newly created dwelling or one for every parking space (whichever is the lesser) associated with the newly created dwellings.

3E.50 There is no explicit requirement in England's ADS guidance for additional spaces to be fitted with cable routes for further future provision of CPs, although this could be triggered if a major renovation accompanied the work.

Limitations applicable to a material change of use which creates a dwelling

3E.51 **Limitation 1**- The requirement to provide CPs would only apply to the newly created dwellings. There is no requirement to provide CPs for pre-existing dwellings in the building, unless the major renovation criteria apply.

3E.52 **Limitation 2-** The requirement would only apply where the change of use is accompanied by the renovation of the car park, its electrical infrastructure (if car park is within the site boundary of the building) or the building's electrical infrastructure (if the carpark is within the building).

3E.53 Given this limitation means that extensive work will be underway in the car park, we would be interested in views as to whether there should be an additional requirement for cable routes to any additional spaces associated with the newly created dwellings, if the building has more than 10 spaces after the material change of use. This would keep the proposal in line with the new-build assessment. It would not require EV provision for the pre-existing building (unless it was undergoing a major renovation).

3E.54 **Limitation 3** The provision of CPs would be limited by the capacity of the existing electricity supply. We would be interested in how this is being assessed elsewhere, given that electrification of heat or other interventions, such as provision of cooling, may also call upon the existing connection capacity.

3E.55 **Limitation 4**- As with all situations, the requirement to provide CPs would exclude covered parking spaces. (see paragraph 3E.35). Where there are covered spaces such that the CPs cannot be provided, ductwork provision for future installation of CPs would apply, in lieu.

3E.56 Building work carried out alongside a material change of use is normally assessed in parallel with the change of use requirements, with priority given to the requirements associated with the building work[111]. In some cases the work may be accompanied by a new electrical supply servicing the newly created dwellings. We are interested on views as to whether "the capacity of the existing electricity supply" assessment should still be applied in this circumstance, or whether the cost cap should be applicable instead. It would not be the intention to ever require a new supply; the issue is solely where a new supply is being provided by the developer.

Question 3E.9 **Do you agree that where a dwelling is created through a material change of use, a CP should be required at any parking space associated with the new dwelling?**

Question 3E.10 **Do you agree with the proposed limitations to the application of the requirement, where a newly created dwelling is established under a material change of use, as outlined in paragraph 3E.51-3E.55?**

Question 3E.11 **Should a cost cap apply, instead of limiting the number of CPs on the basis of the existing supply, where a new electrical supply connection to the building occurs alongside a major renovation, or a material change of use that creates a new dwelling?**

Question 3E.12 **Should there be a requirement for cable routes to all spaces associated with dwellings newly created by way of**

[111] See regulation 8(4)(b) of the Building Regulations (Northern Ireland) 2012 (as amended).

a material change of use, in circumstances where a building has more than 10 parking spaces?

Note on historic buildings

3E.57 'Protected buildings' (listed buildings and buildings in conservation areas) are already subject to special consideration under the provisions of Article 3A of the Building Regulations Order. The EPBD provides additional explicit exemptions where the work would unacceptably alter the character and appearance of such buildings. This is in keeping with the similar exemptions already in place under Part F and it is proposed that application to any EV infrastructure provisions should be in line with developments on Part F (see paragraph 2A.42).

Other issues

3E.58 Other issues, such as spatial requirements, accessible parking bay layouts, routing for cabling, EV CP standards (including future bi-directional charging), building energy performance assessments and related issues, will require further assessment over time, either under Building Regulations' consultation or other DfI policy interventions. Many of these, such as bi-directional charging capability, will interact with energy and electricity policy in other areas (e.g. tariffs and smart meters). We would be keen to receive any evidence or comments you may have, particularly if supported with evidence following implementation or policy elsewhere.

Question 3E.13 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 and accessibility within the built environment)?

Section 4: Pre-consultation Phase 3 proposals for buildings other than dwellings

Introduction

4.1 As outlined in Section 2B, current new build standards here are less onerous than those in England, where an important uplift came into effect on 15 June 2022 and applied changes to a number of Parts of their Building Regulations. These measures, alongside the revised National Calculation Methodology (NCM)112 and England's Approved Document113 guidance, normally provide the basis for policy developments here. Similar measures are being implemented in Wales (from 29th March 2023) and Scotland (1st February 2023), albeit with some variations (see Annex D).

4.2 The range and complexities of non-domestic buildings means that, at this stage, the Department is minded to implement the non-domestic measures applied in England directly, and to focus any bespoke proposals on dwelling standards. The Department is open to receiving evidence on where there would be value in considering or adopting measures from other regions, but notes that this could delay adoption of uplift more generally.

Headline items

4.3 The relevant measures from England's 2022 uplifts include the following headline items, some of which are explained and explored further in subsequent Sections

Conservation of fuel and power

4.4 Wide ranging legislative and guidance changes were made with updates to the NCM. Overall changes included ─

- A new Notional Building recipe with improved fabric measures and an expectation of 20%-40% of a building's roof covered with photovoltaic arrays, subject to easement where heat pumps provide space heating.

[112] https://www.uk-ncm.org.uk/filelibrary/NCM_Modelling_Guide_2021_Edition_England_15July2022.pdf

[113] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1099628/ADL2.pdf

- A new secondary metric of 'primary energy' has been set to act in addition to the carbon performance requirement. As with the proposals for dwellings, this is important in the context of decarbonisation of the electricity grid.
- Where a building is fuelled with gas, LPG, fuel oil, smokeless fuel, or solid mineral fuels the new Notional Building is assumed to operate with a gas boiler. This is a fundamental change from the previous position, where both Actual and Notional buildings were assumed to use the same fuel in most cases[114]. As with the changes to standards for new dwellings, this makes use of conventional oil fuelled heating solutions very challenging. Guidance on installation of oil and LPG boilers in new buildings is, therefore, much reduced or removed.
- The Notional Building hot water demands assume provision by point of use electric heating for low hot water demands (less than 200l/m^2/y) but gas fuelled hot water storage is specified for higher demands where the heating system is fuelled with gas, oil or coal.
- Various amendments were made to the Activity Database, which provides the assumptions (occupancy, heating set points, hot water demands etc) for the activity zones modelled in SBEM. One example, is a reduction in the expected hot water demand for schools.[115]
- The treatment of heat networks is revised so that new buildings can connect to an existing network in lieu of the assumption of a gas boiler. New, more rigorous, carbon factors are provided for any new network provided alongside a new building.
- Improved limiting U-value standards for new walls, roofs, floors, windows and doors. These standards also apply where an extension or a replacement element is provided.
- New assumptions on the extent and 'g-value' of glazing in the Notional Building to help limit solar gains and cooling loads.

[114] Exceptions being direct electric heating and fuels with an emissions factor greater than 0.319 kgCO2e/kWh (typical of fuel oil), where the 0.319 kgCO2e/kWh cap would apply- see Table 7 of https://www.uk-ncm.org.uk/filelibrary/NCM_Modelling_Guide_2013_Edition_20November2017.pdf

[115] Ref Question 19 and 3.6.6 in https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956037/Future_Buildings_Standard_consultation_document.pdf

- Revised assessment for roof windows U-value adjustments to reflect the inclined plane, with roof lights always assessed on the horizontal plane.
- Amendments to the guidance requirements for air handling and distribution systems, including fitting of heat recovery on all air distribution systems, where technically feasible, and lowering of specific fan power limits.
- Amendment of guidance to support provision of thermostatic room controls[116] whenever a new heating system is installed whether in a new or in an existing building.
- Amendment of guidance on lighting to require improved efficiencies, with alternative routes to compliance using Lighting Energy Numerical Indicator (LENI) methodologies, adjustments for display and specialist lighting and clarifications that stage lighting etc sits outside the provisions.
- Amendment to cooling Seasonal Energy Efficiency Ratio (SEER) requirements to align with, or go beyond[117], the Ecodesign 2018 requirements.
- Heating installations are required to be designed without oversizing and wet heating systems are required to operate at a maximum flow temperature of 55°C to improve efficiencies and assist with future potential conversion to low carbon heating.
- Removal of 'heating efficiency credits'[118], which, in existing buildings, allowed relaxation of boiler and appliance efficiency standards where installations provided additional controls or other compensatory measures.
- A new requirement has been introduced to provide Building Automation Control Systems (BACS) where a heating or cooling system of >180kW is installed.

[116] in part to reflect Article 8.1 of EU Directive 2010/31/EU as amended by 2018/844/EU

[117] • split and multi-split air conditioners (of any capacity/size); and

• variable refrigerant flow systems.

[118] measures are listed in Table 8 of the Non-domestic building services compliance guide 2013

- Amendments on commissioning, (including a regulatory amendment, to require commissioning of BACS and any on-site electricity generating technologies) and provision of energy forecasts for each fuel use for new buildings greater than 1000m^2 floor area.
- Incorporation of guidance on building services, which would previously have sat within the *Non-domestic building services compliance guide,* into the main guidance Approved Document L2 (equivalent to our own Technical Booklet F2).
- Uplift to the guidance on requirements for modular buildings with recalibrated relaxations for these buildings to encourage improvement.
- A new method has been set, similar to that used for dwellings, to ensure that any boiler fuel changes do not result in a poorer performance under either a Carbon or Primary Energy assessment.
- Legislative provisions so that new Part L standards have to apply to all work that does not commence within a year of the introduction of the new requirements, even if the schemes had already obtained building regulations plans approval (see paragraph 2A.31).

4.5 England's consultation indicated that these changes would, together, provide an improvement of some 27% in terms of modelled emissions over its previous standard from 2013, given its building mix.

Note- Scotland's plans to ban direct emissions heating will change the position there from April 2024, but this is discussed in Section 5, alongside options for phase 4.

Ventilation

4.6 Amendments to England's Part K (Ventilation) were to guidance only- i.e. no regulatory changes were made. The changes included the following provisions for reducing the risk of transmission of infection via aerosols in non-domestic buildings─

- Provisions for CO_2 monitoring (as a proxy for indoor air quality) in offices and specific higher risk 'occupiable rooms' where members of the public may gather or where cold temperatures and low humidity are envisaged.
- A new 'Appendix C' supports CO_2 monitoring as a proxy for indoor air quality and outlines relevant considerations.

- Recommendation that mechanically ventilated common spaces in offices should be provided with 0.5 l/s.m^2 of air.
- Changes to guidance on recirculating systems, to require a design which is capable of including a HEPA filter, or includes a UVC air cleaning system, unless the system is capable of operating on an 'outdoor air only mode'.

4.7 In terms of other aspects, the following changes are noted ─

- Guidance on intake ventilation and consideration of external sources of pollution is now within the principal document, rather than Appendix D.
- Requirements to assist in consideration of noise from mechanical systems, including correct duct sizing and jointing, resilient mountings and fan sizing.
- Requirements on ducting, including a requirement that flexible ductwork should meet the standards of BSRIA's BG 43/2013.
- Minor updates and simplification of the alternative performance criteria limiting acceptable level of pollutants under Appendix A of the technical guidance.
- A revised table pointing to appropriately updated specialist guidance to design and install adequate ventilation in a range of building types.
- Reference standards updated throughout the technical guidance.
- Simplification and rationalisation of the document including removal of guidance on a number indirectly related areas[119]
- Support for trickle vents or other ventilation improvements where windows are being replaced.
- Updated and revised guidance on commissioning requirements.

Infrastructure for electric vehicle charge points

4.8 The new Part S in England[120] largely reflect the requirements of Article 8.2 and 8.5 of the EPBD (as amended by Directive 2018/844/EU) to require─

[119] See para 4.3.7 and Q68 of the Future Buildings Consultation for list of areas removed.

[120] https://www.gov.uk/government/consultations/electric-vehicle-chargepoints-in-residential-and-non-residential-buildings

- New non-residential buildings with more than 10 parking spaces within the site boundary of the building to have a minimum of one charge point and in addition, cable routes for electric vehicle charge points in one in five of the total number of spaces.
- Every non-residential building undergoing a major renovation, with more than 10 parking spaces within the site boundary of the building after the renovation is complete, to have a minimum of one charge point and in addition, cable routes for electric vehicle charge points in one in five of the total number of spaces.
- There are complex limitations (including non-application to covered car parks) and considerations around the association of parking spaces to each building use.

Overheating

4.9 Contrary to the proposals for dwellings, there is no new regime for the assessment or mitigation of overheating in non-domestic buildings, other than certain residential buildings, such as care homes and student accommodation where the proposals for dwellings would also apply. This is discussed in Section 3D. For most non-domestic situations the longstanding checks under the non-domestic energy modelling assessments are expected to continue to apply under Phase 3 proposals., albeit with updated test case assumptions (see paragraph D.10 in Annex D).

Section 4A: Part F (Conservation of fuel and power) proposals for new buildings other than dwellings Phase 3

Background

4A.1 Non-domestic standards attend to a wide variety of building types, usage patterns, forms and energy benchmarks for the relevant activity. This makes independent policy development a higher risk challenge and promotes greater reliance on UK led programmes such as the National Calculation Methodology (NCM) for energy assessment of non-domestic buildings. The variabilities in the non-domestic sector mean it is appropriate for some requirements, such as limiting fabric standards, to be less rigid than in domestic situations. For example, cooling loads can be more demanding than heating in some situations.

4A.2 Despite these complexities, non-domestic Part F assessments follow the same principal steps applicable to domestic assessments i.e.

- Modelling of emissions against a Notional Building of the same size and shape as the proposed Actual Building;
- Minimum limiting standards for building fabric elements (U-values), and building air-permeability;
- Minimum services efficiencies for each individual fixed building service; and
- Limiting unwanted solar gains[121]

4A.3 The following sections outline the changes implemented in England and other administrations in 2022/23, with a view to developing similar measures here in 2023/24 under the Phase 3 workstream.

4A.4 Subsequent considerations, including further steps to support low carbon heating, for Phase 4, are discussed in Section 5.

Proposed Phase 3 Notional Building

4A.5 The format of current TER emissions assessments requires that the proposed building (‘the Actual Building’) matches or betters the emissions

[121] this is now dealt with in a separate ‘Overheating’ section so far as dwellings are concerned- see Section 3D

performance of a Notional Building, of the same size and shape, conforming to a Notional Building specification. Constructing a building precisely in line with that nation's Notional Building specification will guarantee conformity with the emissions target[122]. Developers are free to vary this specification, within limiting backstops, provided the emissions and primary energy targets are achieved or bettered.

4A.6 The latest requirements in England and Wales apply target primary energy assessments alongside the emissions assessment. Scotland has introduced an alternative 'delivered energy' assessment metric. This is discussed more fully in Section 3A (see paragraph 3A.8 and 3A.36). In each case, the Notional Building specification provides the basis of the assessment for all metrics and therefore provides a helpful basis for comparison (see Annex D and the relevant NCM Manual[123]).

4A.7 The Notional Building approach also means that targets ('X'kgCO_2/m^2/yr or 'Y'kWhPE/m^2/yr) change in accordance with the size, shape, zoning arrangement, orientation and fuel choice of the Actual Building.

Types of Notional Building

· Emissions and newly introduced primary energy performance expectations for each use are set through a generic "Notional Building", with specifications informed by the Activity Class based on the use of building (or each zone within the building).

Two particular Notional Building types are applied─

· side-lit (applied to the majority of more conventional cases, such as schools, offices etc); and

· top-lit type constructions (usually metal clad industrial building and warehouse situations).

It is not clear if additional Notional Building types might be applied in future to ensure a more 'type specific' specifications for each activity class (for example for school, hotel, hospital etc building types).

4A.8 In common with dwellings, the Department is proposing to introduce a new, additional target metric of primary energy. The Actual Building would have to match the primary energy performance of the Notional Building in

[122] The 2022 guidance to Part F introduced an additional 15% betterment factor which applies here also- ref TBF2

[123] NCM (uk-ncm.org.uk)

addition to the current emissions based assessment. The rationale for this has been outlined in Section 3.A (see paragraph 3A.8) which deals with proposed metrics.

Question 4A.1 Do you agree that the Department should adopt the same Primary energy metric for new non-domestic building assessments, as proposed for domestic buildings?

4A.9 The Department is proposing to adopt the non-domestic Notional Building specification in line with England's current 2021 NCM modelling guide[124] for the Phase 3 uplift. A further consultation on any Phase 3 proposals with more developed details and impacts would be necessary before any such measures could be implemented. At this stage the Department is keen to gather evidence on likely impacts.

4A.10 For their 2023 uplifts, Scotland and Wales each developed independent Notional Building specifications, enabling some comparison between the GB administrations (see Annex D). By contrast, the current local system and the methodology in the Republic of Ireland both apply 'betterment' factors to a historic Notional Building specification, making any such direct comparison difficult.

4A.11 A summary of the principal differences in the GB nations' Notional Building specifications is provided in Annex D and provides further insight on the level of performance new buildings would be expected to achieve. We would encourage industry to assess their current projects under the current software in use in England to advise us on the impacts this may demonstrate.

4A.12 Advantages of replicating measures in line with England include:

- high levels of industry familiarity and training on the standards
- England's fabric U-values and other standards appear to provide a sensible basis for progressive steps
- software can be more easily provided, requiring fewer validation checks
- swifter implementation
- lower implementation risks

[124] Microsoft Word - NCM_Modelling_Guide_2021_Edition_England_26Sep2022.docx (uk-ncm.org.uk)

- maintenance of parity in the systems helps local industry access England's market (the largest in the islands)
- assists with implementing subsequent steps and developments, which are likely to be led principally by DLUHC
- efficiency in terms of policy development resources, allowing focus on domestic developments, where impacts and benefits of a local focus may be more appropriate

4A.13 Adopting England's Notional Building, rather than a bespoke specification, might miss opportunities for recalibration to suit local circumstances; for example, slightly different fabric U-values or limiting g-values in glazing might be argued to be appropriate here, with different climate characteristics, such as lower levels of direct sunlight, or yield a better total emissions benefit given a particular local non-domestic build mix.

4A.14 However, we believe that any such benefits would delay implementation and are likely to be only marginal and temporary, given further uplifts are to follow from 2025 onwards. At this stage, we are more concerned to be alert to any individual 'show-stopper' issues, where the impact would perhaps prevent construction projects progressing in a way which would not have been relevant to England or other nations.

4A.15 Two particular aspects of the new Notional Building specification that may merit consideration are;

- Gas, LPG and oil fuelled buildings would be expected to match, or better, the emissions performance of a gas fuelled scenario. This is particularly likely to impact new-build situations where oil or similar higher carbon fuels might currently be used and where mains gas may not be available; and
- increased reliance on renewables provision to help offset emissions. Photovoltaic (PV) arrays are specified at 20-40% of the roof under England's Notional Building specification. However, this proportion reduces in proportion to the extent to which where a heat pump is used as the sole heating source. Thus if 50% of the space heating is provided with heat pumps, the renewables provision is reduced by 50% (i.e. from 20% to 10% of the roof PV for a side lit building type). Further details can are provided in Annex D, paragraph D.20 and we would be particularly interested in feedback on this, given the different levels of PV specified in Scotland and Wales, and taking into account our own local electricity network.

Complexity in non-domestic buildings; regulated and unregulated electrical requirements

The interaction between the regulated energy (heating, cooling, ventilation and lighting) and other unregulated energy uses can have significant impacts.

For example, a high percentage of an office or industrial building's electrical needs may be due to unregulated energy demands for processes happening in the building. However these may apply only during parts of the day with perhaps very low electrical demands in the building at weekends.

Such variabilities mean it can be difficult to accurately assess the interaction and benefits of on-site renewables and any energy storage that may be provided.

Present building regulations assessments award the full benefits of on-site renewable generation on the assumption that all the power generated will be used within the building, or exported to the grid and that this of equal value in both emissions and primary energy terms. This is applied even if the building has a zero-export connection. This position has continued under other regions' recent uplifts of non-domestic standards albeit with some limits applied based on the anticipated total monthly electrical or primary energy demand.

This is not the case in the latest uplifts to dwellings where β-factor (a calculated assessment of the degree of self-use of the on-site generation) and export connection assessments have been built into the updated SAP 10 methodology.

The Department expects that this will be considered further under the forthcoming Future Buildings review and SBEM v7 development for 2025 uplifts in England and that a better assessment of the self-use and exported energy may emerge.

4A.16 On balance, the Department is of the view that oil heating in new buildings should no longer be the norm, and that the risks in adopting England's Notional Building (as opposed to a bespoke Notional Building) are likely to be no higher than other options, which would equally need to challenge heating from higher carbon fuels. The specification may actually incentivise a move to heat pumps, particularly in areas without access to mains gas, in line with the longer-term objectives towards low carbon heat.

4A.17 However, we would be interested to receive any modelling work or other evidence if greater consideration of any particular aspect of the specification needs to be reviewed locally. Annex D offers detail on the variations in the Notional Building specification between England, Scotland and Wales, for additional insight, if required

Question 4A.2 **Do you agree that the Department should develop proposals to adopt the Notional Building specification in line with England's Part L 2022 specification and requirements? If not, please provide evidence of why and how the specification should be altered.**

Limiting fabric standards

4A.18 Limiting fabric and services standards are applied in all regions to ensure that excessive offset from on-site renewables cannot permit undue relaxation of efficiency measures.

4A.19 There is no overall FEES output in the non-domestic software, so U-values and air permeability performance are each assessed separately in non-domestic assessments, as per Table 4A.1 below.

Table 4A.1 Limiting non-domestic fabric standards

LIMITING U-VALUES & AIR PERMEABILITY FOR NEW NON-DOMESTIC BUILDINGS	ENGLAND (JUNE 2022)	WALES (MAR 2023)	SCOTLAND (FEB 2023)	NI (JUNE 2022) and ROI (2017)
External wall	0.26	0.26	0.21	0.21
Floor	0.18	0.22	0.18	0.21
Roof flat / pitched	0.18 / 0.16	.2	0.16	0.2 / 0.16
Windows, roof windows & glazed doors (curtain wall)	1.6	1.6	1.4	1.6 (1.8)
Pedestrian Doors	1.6	1.8	1.4	1.6
Air Permeability	8.0 @ 50Pa	8.0 @ 50 Pa	7.0 @ 50Pa (recommended only)	10.0 @ 50Pa / (5.0 @50Pa ROI)

4A.20 U-values are assessed at an average elemental value in the GB regions. For example, this means the average U-value of the exposed or ground floors must be no greater than 0.18W/m^{2}K in England, with no option to trade this off by improving U-values of other elements elsewhere in the building.

4A.21 By contrast, an area weighted whole-building approach is permitted as an alternative under the current NI and ROI approach. This allows greater trade-off between elements provided the whole building average U-value is the same as would have been achieved if each element had met the limiting U-value criteria.

4A.22 The current limiting U-values under TBF2 (2022) are currently assessed using manual calculation checks provided by the applicant. This includes options to provide a manual whole building trade off calculation. In all other

regions, however the U-value checks are checked within the SBEM/DSM software.

4A.23 Adopting England's standards on this would reduce the current flexibility offered by the whole building assessment approach, but it would ensure that no one fabric element can be of particularly poor performance. It also minimises software alterations needed.

Question 4A.3 Do you agree that the Department should develop proposals to adopt the limiting fabric U-values in line with England's Part L 2022 requirements?
If not, please provide evidence of how the specification is impractical here and what alternative standard should be required.

Air permeability requirements

4A.24 Other administrations have all further restricted maximum permissible air-permeability values for non-domestic new builds to 8.0 $m^3/(h.m^2)$ @50Pa in England and in Wales, and with a 'recommendation' of 7.0 $m^3/(h.m^2)$ @50Pa in Scotland.

4A.25 The Department is keen to explore setting a more onerous maximum permissible air permeability rate of possibly 5.0 $m^3/(h.m^2)$ @50Pa. This would bring our air permeability requirements into line with RoI and generally uplift our minimum fabric standards above the current RoI limits (although Ireland's TPER, TER and their Renewable Energy Ratio requirements are normally the much more significant factor). The guidance in England and RoI does not highlight the same risks or limits to using natural ventilation in air-tight construction as is proposed within dwellings, but we are open to further advice on this.

4A.26 In proposing this, the Department is mindful that most new non-domestic buildings have specialist M&E input, which ought to help ensure appropriate ventilation. The Department will further review EPC outputs to assess the levels achieved in practice currently, but we would be interested to receive any evidence of concerns at or support for this proposal.

4A.27 If lower permissible air-tightness levels are supported and seen to be worthwhile, further discussion with software suppliers will also be required.

A bespoke alteration for the local NCM could be required, but we anticipate that this ought to be a straightforward adjustment to make.

Question 4A.4 **Do you agree that the Department should develop proposals to adopt maximum permissible air-permeability values for new builds of 5.0 $m^3/(h.m^2)$ @50Pa, or should it maintain consistency with England's approach?**

Limiting services standards

4A.28 Limiting services standards provide minimum or 'back-stop' performance requirements. The guidance also tends to be presented alongside the minimum efficiency standards for services being installed in existing buildings, which normally align, or are close to, the back-stop limits for new-builds.

4A.29 Currently, this guidance is provided in the Non-Domestic Building Services Compliance Guide (NDBSCG) (the 2012 edition applies locally)[125].

4A.30 Conforming to the limiting values for services will not be sufficient in new build situations to achieve the TER and TPER. This normally requires combinations of ─

- additional on-site generation, in line with or better than the Notional Building specification; and/or
- other compensatory measures, such as fabric, thermal bridging or air-permeability improvements.

4A.31 The new guidance on limiting services standards has been brought within the Approved Document L2 guidance in England and in Wales. Scotland, in contrast, has continued to maintain separate building services compliance guides[126] which provide slightly more explanatory text in presentation. This can help illustrate the principles as well as the outcomes that need to be achieved.

4A.32 The new (2022/23) limiting standards are equivalent, or very similar, across the administrations and are summarised in Annex E. This also outlines the

[125] Conservation of fuel and power: Approved Document L - GOV.UK (nationalarchives.gov.uk)

[126] see Section 6 of Key supporting technical guidance - Building Standards: list of guidance - gov.scot (www.gov.scot)

minimum service efficiency requirements where services are installed in existing buildings.

4A.33 The new guidance includes

- the expectation that new (and replacement) heating systems should be designed to operate with a maximum flow temperature of 55°C (similar to proposals for dwellings see paragraph 3A.74)
- lighting efficiencies of 95 lumens/ luminaire circuit W or use of alternative LENI assessment
- changes removing heating efficiency credits and instead a built in assumption of heat recovery on certain installations

Further details of the particular services efficiencies and a comparison with existing requirements is provided in Annex E.

Question 4A.5 **Do you agree that the Department should develop proposals to adopt the limiting services standards in line with the requirements in England, Wales and Scotland? If not, please provide evidence of how the specification is impractical here and what alternative standard should be required.**

Question 4A.6 **Do you agree that the Department should develop proposals to include the limiting services standards within the Technical Booklet guidance documents, or is a more explanatory, separate Non-domestic Building Services Compliance Guide preferable? Please provide reasoning in your response.**

Building Automation and Control Systems (BACS)

4A.34 England, Scotland, Wales and the Republic of Ireland have all introduced requirements for BACS in new buildings with higher total energy demands for heating, cooling or ventilation (or certain combinations thereof). This measure, in part fulfils requirements of Articles 14 and 15 of the EPBD[127]. The new BACS requirements apply separately from the emissions and energy targets applied through the Notional Building assessment.

[127] as amended by Directive 2018/844/EU

4A.35 In England, if a new building has a space heating or air-conditioning system with an effective rated output greater than 180kW, a building automation and control system should be installed. This 'gold plates' the EPBD requirement in applying the requirement at a lower threshold than the 290kW trigger point specified in the EPBD. A BS EN 15232 Class A rated type system is normally expected. The same measures apply at a threshold of 290kW for the other regions.

Question 4A.7 Do you agree that the Department should develop proposals to require BACS in new buildings? If so, should the threshold be at 290kW or 180kW? Please provide evidence or reasoning for your view.

Commissioning and reporting requirements

4A.36 Commissioning is currently required to ensure systems are tuned to optimise performance. The current requirements here appear to be broadly in line with the new guidance elsewhere and the Department is not planning to amend them as part of the Phase 3 uplift. Proposals on commissioning of ventilation systems are contained in Section 4C.

4A.37 The current TBF2 guidance to regulations 46 (Notice of emission rate) and 47(Provision of information) requires a Building Log Book to be provided in accordance with CIBSE TM31 templates. This provides the essential information and principles to help operate the building in a way which maximises energy efficiency. The TER/BER and any future TPER/BPER are also recorded in the log.

4A.38 This requirement is in keeping with the other regions (although the requirement in RoI does not specify TM31) and continues to apply under the all the recent uplifts in England, Wales and Scotland. However, additional reporting requirements (outlined below) have been introduced in England (a forecast of energy use) and Scotland (an explanation of conversion to zero direct emissions heating), which the Department is likely to consider alongside future uplifts.

4A.39 Where a new building has a total useful floor area of more than 1000m^2 England's ADL2 guidance has added a new requirement to forecast the actual energy use of the building in kWh/year, broken down by fuel type. This should include allowances for unregulated energy uses and the details recorded in the log book.

4A.40 ADL2[128] suggests the following methods can be used for the as-built forecast assessment

a) design calculations

b) energy benchmarks

c) an energy forecasting methodology such as CIBSE's TM54[129]

d) other building modelling or spreadsheet tools

e) any combination of (a) to (d).

4A.41 ADL2 notes that compliance outputs of SBEM or other Building Regulations compliance tools are not suitable for direct use as energy forecasting estimates for any size of building. The intention of the new measure is to encourage additional, more accurate modelling to aid performance expectations and future monitoring of these larger buildings.

4A.42 Additional modelling to TM54 is a significant additional task for designers to complete at the as-built stage of the works. It places further onus on the designer to re-model the designs using different software, not necessarily approved by government.

4A.43 The Department is interested to understand how effective this is proving in practice; whether Building Control Bodies or other accreditation groups verify documents submitted, or whether they are solely overseeing that an assessment has been completed.

4A.44 Scotland's guidance requires that the occupier shall be provided with information that sets out the process and work involved to deliver the future installation of a non-direct emissions heat source, simply and without disruption beyond the immediate vicinity of the current heat source. The intention is to ensure that when a boiler is used, designers plan to minimise disruption for the building's future conversion to low carbon /non-direct emissions heating.

Question 4A.8 What is your view on the value of requiring either TM54 modelling of actual energy use in buildings >1000m2 (as

[128] See Paragraph 9.4 of ADL2

[129] CIBSE TM 54; Evaluating operational energy use at the design stage (2022).

applicable in England) or Scotland's conversion to Zero Direct Emissions Heating reports?

Section 4B: Part F (Conservation of fuel and power) proposals for work to existing buildings other than dwellings Phase 3

Introduction

4B.1 This section relates to standards for extensions, new and replacement elements and services, and when existing elements are renovated. It will also apply where a new building is created by way of a change of use of an existing building under Regulation 8 (Application to a material change of use). They do not require existing houses to be brought up to a standard if work is not being carried out as this is not within the remit of the Building Regulations.

4B.2 At their most straightforward, the requirements are set on the basis of individual elements and services efficiencies, as this may be the only work being done. This is referred to as "the Standards Based Approach".

4B.3 In case of an extension or a material change of use, alternative, whole-extension or whole-building assessments can allow trade-off between thermal elements (walls, roofs, floors, etc.) with options to adjust one value, where the performance can be balanced by another, providing a more flexible approach.

- A "Calculated Trade-off Approach" allows trade-off of the insulation performance between elements of an extension, provided services efficiencies are in line with the Standards Based Approach.

- A more complex SBEM or DSM assessment can be used to demonstrate an equivalent performance to a whole building where the elemental and services efficiencies approach had been taken (a "Equivalent Carbon Target Approach").[130] This approach is offered for extensions, material changes of use and where an change in energy status occurs (e.g. where a previously exempt part of the dwelling, such as a thermally isolated conservatory, is no longer exempt and therefore is considered a part of the building).

4B.4 Other regions now require that an assessment of Primary Energy performance alongside the established Carbon assessment where the Equivalent Target Approach is used.

Question 4B.1 Do you support the addition of a Primary Energy metric assessment alongside the current Carbon emissions metric assessment when using the Equivalent Target Approach to demonstrate compliance in cases of work to existing buildings?

4B.5 The risk of unintended consequences can be significantly greater in retrofit situations, given the nature of the existing building and as access to install components and control junction details may not always be possible without significant disturbance. Attending to other Parts of the Building Regulations may also be necessary, for example, where insulation and airtightness levels have been improved, additional ventilation is normally needed to address indoor air quality or to reduce interstitial condensation risks. Such complexities and risks can make it difficult to set very demanding retro-fit standards for some situations, such as internal wall insulation.

4B.6 The alternative Calculated Trade-off and Equivalent Target approaches are not normally applicable to general renovation work, particularly where only a limited intervention is taking place. For example, if an individual wall is to be renovated with a new layer of render, the expectation is that the Standards Based Approach should apply to it, provided it is technically and economically feasible, without the ability to compensate elsewhere.

[130] These alternative approaches are not available with the Republic of Ireland's Technical Guidance Documents, but are offered in the other regions

4B.7 The additional flexibility in these alternative 'offset' approaches are not applied to cases of renovation of individual elements as this would risk allowing sub-standard renovations to multiple aspects of the dwelling on the pretence that only a small renovation had been proposed. This would lead to a lost opportunity to install cost-effective upgrade measures.

4B.8 "Consequential improvements" require improvements to an existing building, or apply additional provisions, beyond the immediate work in hand. This is discussed in paragraph 4B.37 onwards, Consequential improvements currently apply to only to larger buildings, so impact only a very small number of existing dwellings.

4B.9 "Major renovations "are defined in regulation 38 (Application and interpretation) as "renovation of a building where more than 25% of the surface area of the building envelope undergoes renovation". The Republic of Ireland has additional requirements and expectations of the whole building performance when a major renovation is carried out. This is discussed at paragraph 4B.45.

4B.10 In keeping with the proposals for dwellings, the Department is interested in whether there should be greater differentiation between current conventional constructions and traditional 'breathable/ moisture permeable' constructions, where there may be technical risks, even if character and appearance is not necessarily the principal concern.

Minimum fabric standards related to existing buildings- elemental standards.

4B.11 In terms of elemental standards, the guidance across the regions provides for a variety of situations with terminology applicable for─

a) Extensions and new elements

b) Replacement elements

c) Material change of use

d) Change of energy status (e.g. introducing heating into a previously unheated space or a space previously exempt from energy efficiency requirements of the building regulations becomes subject to them[131]).

[131] https://www.legislation.gov.uk/nisr/2012/192/regulation/38/made

e) Renovated elements

f) Retained elements

4B.12 These requirements generally relate to the a) to f) hierarchy so that ─

- the more onerous 'new/replacement element' standards will always apply to any new and replacement elements (Situation A) in preference; before
- lesser 'renovated element' standards are applied to the renovated and retained elements (Situation B).

The regional values are listed in tables 4B.1 (Situation A) and 4B.2 (Situation B), respectively.

Table 4B.1 Situation A, U-Values

SITUATION A (NEW ELEMENTS) Applies to extensions and replacement elements	**NEW BUILD (comparison) SIDE / TOP-LIT ENGLAND NOTIONAL BUILDING (JUNE 2022)**	**ENGLAND PART L (JUNE 2022)**	**SCOTLAND (DEC 2022) Also applies to conversions and renovations (unless traditional buildings)**	**WALES PART L (NOV 2022) [*buildings essentially domestic in character]***	**ROI PART L**	**NI CURRENT PART F**
Whole building v elemental approach	Whole building	Elemental	Elemental	Elemental	Whole building or elemental	Elemental
External wall	0.18 / 0.26	0.26	0.21	0.26 *[0.21]*	0.21	0.28
Floor	0.15 / 0.22	0.18	0.18	0.22 *[0.18]*	0.21 (0.15 if underfloor heating)	0.22
Roof (pitched)	0.15 / 0.18	0.18 (0.16)	0.16	0.18 (0.15) *[0.15]*	0.2 (0.16)	0.18 (0.16)
Door (vehicle door)	1.9 (1.3) / 1.9 (1.3)	1.6 (1.3)	1.4	1.8 *[1.5]*	1.6 (1.5)	1.8 (1.5)
Windows	1.4 / n-a	1.6	1.4	1.8 *[1.4]*	1.6 (1.8 for curtain walling)	1.6
Rooflights	n-a / 2.1 (horizontal plane)	2.2 (horizontal plane)	2.2 (horizontal plane)	2.2 (horizontal plane)	1.6 (vertical plane)	1.8 (vertical plane)

Table 4B.2 Situation B, U-Values

SITUATION B (RETAINED ELEMENTS) Applies in a material change of use or where an element is being renovated	**ENGLAND PART L (JUNE 2022)**	**SCOTLAND (DEC 2022)**	**WALES PART L (NOV 2022)**	**ROI PART L [note different ROI thresholds]**	**NI CURRENT PART F**
Are threshold values sometimes applicable so that work is only required if the current U-values are higher than cited?	yes	no	yes	yes	yes
Roof (threshold 0.35W/m^{2}K)	0.16 (0.18 for flat roof or if insulation is at rafter level)	n/a	0.16 (0.18 for flat roof or if insulation is at rafter level)	0.16 (0.25 for pitched insulation and flat roofs) *[0.25]*	0.16 (0.18 for pitched insulation and flat roofs)
Wall cavity wall insulation (threshold 0.7W/m^{2}K)	0.55	n/a	0.55	0.55 *[0.55]*	0.55
Wall other (IWI/EWI threshold 0.7W/m^{2}K)	0.3	n/a	0.3	0.35 *[0.55]*	0.3
Floor (threshold 0.7W/m^{2}K)	0.25	n/a	0.25	0.45 (ground floor) *[0.45]* 0.25 (exposed floor) *[0.6]* 0.15 (underfloor heating)	0.25
Windows / doors etc (threshold 3.3W/m^{2}K)	1.6	n/a	1.8	1.6 *[3.6]*	1.6 (windows) 1.8 (doors)

4B.13 Situation A standards are intended to be close to new build expectations. England, Scotland and the Republic of Ireland, directly apply their limiting fabric standards for new build situations (see paragraph 4A.18). Wales has applied variations from this, with some easements for windows and vehicle doors but also with some tightening of expectations for other building elements, particularly where they apply to domestic/residential type accommodation (student accommodation, care homes etc).

4B.14 In England, Wales and Northern Ireland, limits to the extent of openings are applied to extensions in in accordance with Table 4B.3 below. This applies only where the elemental standards based approach is used; the calculated trade-off and emissions assessment approaches offer additional flexibility for increased opening areas, where necessary.

Table 4B.3 [132] Maximum extent of openings in an extension, if using the elemental assessment method

BUILDING TYPE MAX % OF OPENINGS	Windows and personnel doors as % of exposed wall *[Scotland variation]*	Rooflights as % of area of roof
Residential buildings where people temporarily or permanently reside	30 [40]	20
Places of assembly, offices and shops	40	20
Industrial and storage buildings	15	20
Vehicle access doors, display windows and smoke vents can be added to the above, as required		

4B.15 In Scotland a 40% maximum percentage of exposed wall allowance for openings applies to residential buildings as well as other building types (i.e. there is a more generous glazing allowance for residential situations), while in the Republic of Ireland the emphasis is on ensuring sufficient glazing for daylighting purposes, with no maximum restriction apparent in current guidance.

4B.16 Table 3B.2 shows how less onerous 'Situation B' standards apply to retained or renovated elements or where a material change of use or a change in energy status occurs.

4B.17 The current guidance here and in England and Wales, further expects that glazing in cases of a change of use should be limited to no more the 25% of the total floor area[133.] The Calculated Trade Off and Equivalent Target Approaches provide flexibility for situations where the scope for fabric improvements may be limited (such as in traditional buildings).

4B.18 No such limits are applied in Scotland or the Republic of Ireland (this is unlike their position on material change of use cases that create dwellings). However Scotland's guidance does still require consideration where an alteration takes place that increases the area of display window openings[134]

[132] see Table 3.1 of TBF2 2022 (NI), Table 10.1 England's ADL2 2021, Table 10.1 of Wales's ASL2 2022, Table 6.4 of Scotland's Non-domestic Technical Handbook, and paragraph 2.1.2.3 of the Republic of Ireland's Technical Guidance Document L, Buildings other than dwellings.

[133] see para 3.36TBF2 2022 (NI), para 11.7.c of England's ADL2 (2021), para 11.7.c of Wales's ADL2 (2022)

[134] see para 6.2.11 of Scotland's Non-domestic Technical Handbook

4B.19 Situation B interventions are normally predicated by trigger point standards whereby the improved U-value is only required if the wall, roof, floor or window is above a threshold value (typically 0.35 W/m^{2}K for the roof, 0.7 W/m^{2}K for walls and floors and 3.3 W/m^{2}K for windows). The trigger points are lower in the Republic of Ireland's guidance.

4B.20 Trigger point thresholds are not applied in Scotland, where the expectation is that the relevant standard ('A' in Scotland) will apply in a change of use, change of energy status or for renovation work, irrespective of the elements' previous performance. This means Scotland is applying standards, close to new-build expectations where a material change of use is occurring or an element is renovated.

4B.21 These expectations apply unless the building is of traditional construction. In such circumstances more bespoke or specialist advice is required, and specialist guidance is referred to, but the aim remains that the fabric should be improved so far as practicable.

4B.22 Paragraphs 3.6-3.9 of the Department's current Technical Booklet F2 guidance already refer to the need for special consideration in cases of 'protected buildings' (Listed buildings and buildings in Conservation Areas) and 'buildings of historic or architectural merit'. There is an emphasis on the impact of the work in relation to the character and appearance of the buildings, with some emphasis on the need to consider the moisture permeability of constructions and allowing them to 'breathe'.

4B.23 The Department is minded that the risks to moisture permeable traditional constructions require technical consideration even where aesthetic value or historic merit may be limited and that the term "traditional building" may be helpful. The intention in any revisions to the Technical Booklet guidance would be to give greater prominence and flexibility for such construction by more explicit reference to "traditional buildings" and citation of other guidance. The flexibility should be available where renovation is to elements of a traditional construction and not solely where work is occurring on historic or protected buildings.

4B.24 The assessment of traditional construction and its ability to support renovation measures is a developing area where multiple inter-acting issues require a balancing of considerations in each individual case. The intention would be that the 'Standard B' performances should provide a commonly attainable default standard for most situations, whilst the

extended emphasis on consideration of traditional construction should promote a thoughtful approach, encouraging expert judgement where necessary.

Minimum fabric standards related to existing buildings- proposed position.

4B.25 The Department intends to review the current Technical Booklet guidance, with a view to incorporating minimum fabric standards relevant to existing buildings with the intention that–

a) new elements and replacement elements should be largely in line with the updated expectations for new buildings;

b) given the technical risks, expectations of a lesser performance, in line with the 'Situation B' table of values for England should apply where a building is subject to a material change of use, where a change of energy status occurs or where renovation work occurs, with additional considerations where it is a protected building or is of traditional construction.

c) consideration of the extent of glazing, such that it should generally expect be no more than 25% of the floor area, should continue as part of the assessment in a material change of use situation; and

d) an increased emphasis on considerations and provisions for traditional construction should be made with reference to updated third party expertise (e.g. updated guidance from NIEA or DfC). This will clarify that there is significant scope for the applicant and building control to assess and adjudicate what 'reasonable provision' means in each particular case of traditional construction.

Question 4B.2 **Do you have any particular comment, concern or insight on the U-values used for standards related to existing buildings in any of the various situations in other administrations?**

Question 4B.3 **Do you agree that our U-value standards should be largely in line with limiting standards for new buildings in cases of extensions and replacement elements on buildings other than dwellings?**

Question 4B.4 **Do you agree that our U-value standards should be largely in line with the values used in England, in cases of a**

material change of use of a building, for renovated elements and where a change of energy status occurs involving buildings other than dwellings?

Question 4B.5 **Are there any particular areas where alternative performance values for renovated elements or services should be considered for buildings other than dwellings? If so please provide evidence and an indication of the value you consider appropriate.**

Question 4B.6 **Do you agree that a maximum glazing area assessment should continue to form part of the requirements for extensions and be included where a material change of use occurs to buildings other than dwellings?**

Question 4B.7 **Do you agree that traditional construction should be referenced out to third party guidance, with a greater scope for bespoke consideration in situations applicable to traditionally constructed buildings other than dwellings?**

Minimum services standards related to existing buildings other than dwellings.

4B.26 Minimum standards for services are no longer provided in a separate *"Non Domestic Building Services Compliance Guide*" and are instead now incorporated into new sections in England's and Wales's Approved documents, e.g. England's ADL1. The Republic of Ireland similarly embeds services guidance within its Technical Guidance Documents, although with referral out to Ecodesign codes which can be periodically amended. This requires additional investigation by designers or purchasers of the equipment in many cases.

4B.27 In contrast, Scotland retained separate *Non Domestic/Non-domestic Building Services Compliance Guides* although many of the features, policy developments and efficiency improvements from the changes in E&W are incorporated.

4B.28 The new guidance documents in GB regions outline provisions for services in both new buildings and for replacement fittings and systems in existing buildings with standards updated to meet the Ecodesign 2018 standards.

Replacement heating- CO_2 and Primary Energy check

4B.29 Paragraph 3A.76-3A.80 outlined expectations that new heating systems in dwellings should be designed to operate at maximum flow temperatures of 55°C. This would also apply both in new buildings and where a complete new or replacement heating system was to be installed in an existing building.

Question 4B.8 Do you agree that where a new or complete replacement heating system is being installed in an existing building, it should be installed to operate with a maximum flow temperature of 55°C?

4B.30 Current guidance states that the efficiency of a replacement heating appliance should not be worse than the appliance being replaced. Additionally, where a change in fuel is proposed, a conversion with CO_2 emission factors is given to compare the efficiencies of appliances with different fuels.

4B.31 England's new guidance now requires that when a replacement service uses a different fuel, the new service should not emit more CO_2 emissions and should not have higher primary energy demand than the service being replaced. The relevant Carbon and Primary Energy factors are as listed in Table 12 of SAP 10.

4B.32 The primary energy assessment aspect is a new requirement and would, for instance, mean that a gas-fired boiler should not generally be replaced with an electric flow boiler, even though it may provide a lower carbon outcome. Unlike the guidance for dwellings in England and Wales, there is no special provision for buildings with a very low heat loss (see paragraph 3B.41).

4B.33 The Primary Energy metric is not used in Scotland. Instead their requirement requires the CO_2 assessment and an assessment of the delivered energy per unit of energy consumed (i.e. the efficiency of the appliance) (see paragraph 3A.36, 3B.37 and worked examples). In this assessment the gas-fired boiler could be replaced with an electric flow boiler, as primary energy is not taken into consideration.

4B.34 The impact of the PE assessment should help prevent conversion to forms of electric heating which are expensive to operate (albeit with the low carbon benefits that come with a move to electricity).

Services Efficiency Improvements.

4B.35 A range of additional services efficiency improvements have been developed in England's new guidance. These are outlined in Annex E. There is minimal, if any, difference in the new standards when comparing provisions in England, Scotland and Wales.
Please refer to Sections 5 and 6 of Approved Document L2 2021 for further details.

4B.36 The Department is currently minded to move to adopt services changes in line with England's Approved Document L2, subject to further detailed considerations with NIBRAC and consultations.

Question 4B.9 Do you agree that Technical Booklet F2 should be amended to follow the minimum services provisions of Section 5 and 6 of England's Approved Document L2, subject to further NIBRAC and public consultations? The Department would be grateful to understand any 'lessons learned' from the roll-out of these provisions elsewhere.

Consequential improvements.

4B.37 'Consequential improvements' apply additional provisions, beyond the scope of the intended work, to require additional improvements to the existing building. The use of such provisions is limited as they require additional work to be done, with risks that this may be beyond the capacity or finances of those carrying out the work.

Background to regulation 41 (Consequential improvements) and regulation 43 (Renovation of thermal elements)

Current consequential improvement and major renovation requirements stem from Article 6 of the original EPBD from 2002 (Directive 2002/91/EC), which applied a 1000m^2 threshold in its requirement for cost–optimal improvements of existing buildings where a major renovation was taking place. This was revoked under the recast directive 2010/31/EU.

The Department is keen to consider options and to simplify the requirements and guidance relating to regulations 41 and 43, if possible.

4B.38 Regulation 41 (Consequential improvements) currently requires that reasonable provisions are taken to ensure that the existing building complies with regulation 39 (Conservation measures) in large buildings with

a total useful floor area of >1000m^2 and where the proposed work includes an extension or new or extended fixed building services. The expectation, outlined in section 3 of TBF2 is that some 10% of the cost of the extension or extended fixed building services works ('the principal works') should additionally be spent on cost-effective improvements to the existing building.

4B.39 Both consequential improvements and major renovations (see paragraph 4B.45) can be difficult to enforce where they rely on thresholds to trigger additional requirements. There are risks that such work may be parcelled up into smaller projects rather than categorised under a single project application in order to avoid having to carry out additional work the trigger point might initiate. For example, a detached new building may be constructed with a separate project to 'link' the buildings later so that only this 'link' would trigger 'consequential improvement' requirements.

4B.40 The current position is similar to England's, where the related guidance was updated in 2021 with only a very minor upgrade that lighting circuits with an efficiency of less than 60 lumens per circuit-watt should be upgraded, rather than the previous thresholds at 40 and 45 lumens per circuit watt.[135]

4B.41 Scotland's equivalent requirements apply to extensions to non-domestic buildings, where the value of the work is £50,000 or more and involves the extension of the existing building services. Their upgrades are based on building services improvements only and do not require or take the fabric improvement into account. Instead they require 5% of the cost of the principal works to be spent on appropriate services measures for the existing building.[136]

4B.42 Wales applies consequential improvement requirements to extensions, irrespective of any thresholds, thus 10% of the costs of the extension are expected to be applied to improve the existing building, irrespective of the size of the existing building or the cost of the extension. A 1000m^2 threshold does still apply however, where the principal work is not an extension, but the provision of a fixed building service for the first time, or increases the installed capacity of a fixed building service per unit area.

[135] Ref Annex D of England's Approved Document L2 2021

[136] Ref Annex 6C of Scotland's Non-Domestic Technical Handbook 2022

The suggested measures that should be applied are the same as those applicable in England.[137]

4B.43 The Department is keen to receive evidence on the success or otherwise of consequential improvements and to consider if the requirements should be─

- retained (i.e. maintained in keeping with England),
- amended (for example to apply where the principal works are of a particular value, rather than being based on the total floor area of the existing building),
- extended to apply to all extensions, irrespective of existing building sizes, (as Wales); or
- revoked.

4B.44 Revocation would not, on the face of it, encourage holistic retrofit, but if the costs involved are discouraging building owners from carrying out projects or encouraging them to adopt new-build solutions instead, or if the intended level of interventions is routinely circumvented, then removing this requirement might be justifiable. It would also help significantly simplify the current system and guidance.

Question 4B.10 **Do you have any evidence on the success or otherwise of consequential improvements? If so, please include this with your response.**

Question 4B.11 **Do you think consequential improvement requirements should be─**
a. retained (i.e. maintained in keeping with England),
b. amended (for example to apply where the principal works are of a particular value, rather than being based on the total floor area of the existing building),
c. extended to apply to all extensions, or otherwise extended; or
d. revoked?
Please provide a reasoning for your response and evidence that supports any changes you would propose.

[137] Ref Annex D of Wales's Approved Document L2 2022

Major renovations.

4B.45 "Major renovation" is defined in regulation 38 (Application and interpretation) as *"renovation of a building where more than 25% of the surface area of the building envelope undergoes renovation".* This definition stems from the EPBD and is replicated in England, Scotland, Wales and the Republic of Ireland.

4B.46 Under the UK's interpretation of the EPBD, if individual elements are being renovated as part of a major renovation project, the whole of the element must be upgraded to the improved U-value outlined by guidance to regulation 43 (Renovation of thermal elements).

4B.47 The Republic of Ireland has an alternative interpretation with additional requirements and expectations when a major renovation is carried out, whereby consequential improvements are expected to bring the whole building performance up to a 'cost optimal' level.

4B.48 The Republic's guidance provides a list of measures based on replacement of building services that are more than 15 years old, to be carried out when a major renovation is taking place.[138] Alternatively, compliance can be demonstrated if a certain building primary energy performance can be shown. The required performance levels vary by building type, from 338kWh/m^2/yr for air conditioned buildings to 60 kWh/m^2/yr for schools, and the assessment has to be carried out with the same software that would apply to new-build assessments (NEAP).

4B.49 The measures apply principally where internal or external wall insulation is applied and/or where an extension impacts 25% or more of the existing envelope.

4B.50 The Department is open to receiving evidence on the success or otherwise of the major renovation measures in force in the Republic of Ireland, The Department is particularly alert to the unintended complexities that may emerge; for example, external wall insulation may be discouraged if this triggers a major renovation requirement for substantial additional services work.

[138] See paragraph 2.3.4 of Technical Guidance Document L Conservation of fuel and energy for buildings other than dwellings (2022).

Question 4B.12 **Do you have any evidence or insight on the major renovations measures in place in the Republic of Ireland to suggest the Department should prioritise a similar approach here for buildings other than dwellings? If so please include the evidence with your response.**

Section 4C: Part K (Ventilation) buildings other than dwellings Phase

4C.1 Section 4C relates to Phase 3 proposals for ventilation standards applicable to new and existing non-domestic buildings. It follows a similar approach to Section 3C (for ventilation in dwellings) in many aspects. The proposals largely reflect changes implemented in England and Wales under their 2021/2022 uplifts.

4C.2 Part K (Ventilation) of the Building Regulations sets functional requirements for “adequate ventilation” for people and car parking spaces, requires commissioning of mechanical systems, notification of that commissioning to the district council and provision of information to the building owner.

4C.3 Technical guidance on these legislative requirements, including what constitutes “adequate ventilation” and “sufficient information” for normal building circumstances, is provided in Technical Booklet K (TBK). In England this is provided in a similar document ‘Approved Document F Vol 2; Ventilation for building other than dwellings’ (ADF2).

Current concerns

4C.4 In general terms, installations in non-domestic buildings are likely to incorporate a higher level of specialist M&E input with workplace health and safety considerations and maintenance, in mind. Moisture risks typically tend to be lower in most non-domestic environments and provision of specialist equipment is commonplace in circumstances where high levels of moisture are likely; for example, in commercial kitchens or swimming pools.

4C.5 Ventilation systems need to be carefully designed to ensure adequate indoor air quality. Greater consideration of infection risks has been highlighted in light of the Covid pandemic.

Technical Guidance format

4C.6 Section 3C included a proposal to split the current TBK into two documents─

- TBK1 Ventilation in dwellings; and
- TBK2 Ventilation in buildings other than dwellings.

These would reflect the split in England's Approved Document F with ADF Volume 1, for dwellings, and ADF Volume 2, for buildings other than dwellings. Industry feedback on these documents would be helpful for informing next steps here. We have asked for your opinion on the proposal to create separate guidance for dwellings and non-dwellings (see Q3C.1).

4C.7 The text in the new ADKs has been rationalised to provide a more concise explanation to clarify compliance requirements. The intention is in line with efforts to simplify other building regulations compliance documents in light of Dame Judith Hackitt's review, *The Independent Review of Building Regulations and Fire Safety.*

Ventilation strategy

4C.8 In keeping with dwellings, non-domestic buildings are still expected to achieve suitable;

- extract ventilation (usually for removal of occasional high levels of moisture or odours in particular spaces like kitchens, sanitary accommodation and wet rooms);
- background ventilation (necessary to maintain general air quality); and
- purge ventilation (for very occasional purging of the air, for example after a room has been painted).

4C.9 Provisions are largely considered in terms of the general building class, so specialist situations, such as particular manufacturing processes, could require additional provisions outside the normal guidance requirements.

Noise and installation of systems

4C.10 England's updated guidance was revised to provide a clearer emphasis that mechanical ventilation should be designed and installed to minimise noise[139]. It sets some generic advice around selecting appropriate equipment, resilient mounting and duct sizing, but it has not yet set specific numerical acoustic level requirements.

4C.11 Further acoustic consideration would be a complicated area to explore, influenced by adjacent outdoor background noise and other considerations.

[139] See para 1.5-1.6 of ADK; Vol 2

England has instead suggested that this should be considered under reviews of the resistance to the passage of sound (Part G here). The Department is minded to follow a similar approach, responding in due course to the outcome of developments elsewhere.

4C.12 The revisions in England and Wales included measures to assimilate some second tier guidance from the current Domestic Ventilation Compliance Guide, which may be equally applicable in some non-domestic buildings of a domestic nature. This guidance includes provisions around the quality of installation including minimising lengths of flexible ducts and sizing, ensuring joints are adequately sealed and terminal points have sufficient free area.[140]

Question 4C.1 Do you agree that Technical Booklet K should take a similar approach to noise and installation of ventilation systems, as England and Wales?

Performance based standard

4C.13 Section 3C (see paragraphs 3C.29-3C.31) outlined provisions around the alternative performance based standards, based on permissible pollutant level, rather than ventilation rates. The proposed amendment includes revisions to the assessment of volatile organic compounds and the new ADF guidance amends some of the associated calculations in the Appendices.

Question 4C.2 Do you agree that Technical Booklet K should replicate the proposed performance based guidance outlined for dwellings?

4C.14 The guidance in England has also been amended so that the previous guidance on pollution is embedded into the core of the document, rather than as an Appendix (see Appendix D in TBK[141]). The Department would propose to replicate this approach in new TBK2 guidance.

[140] See paragraphs 1.16-1.20 of ADK; Vol 2

[141] Building Regulations Technical Booklets | Department of Finance (finance-ni.gov.uk) (TBK)

Question 4C.3 **Do you agree that Technical Booklet K (TBK) should bring the Appendix D guidance on polluted external air into the main body text of TBK?**

Ventilation in buildings other than offices or car parks.

4C.15 TBK provides guidance on ventilation to generic office spaces and car parking. In the case of other buildings, reference is made to specialist guidance to demonstrate compliance.

4C.16 The current guidance[142] on buildings other than car parks and offices, lists the relevant specialist guides. The equivalent guidance in England and Wales[143] has been updated to refer to the latest relevant sources for these particular situations. References are replicated in Annex F of this consultation, for ease of reference. In some residential building cases, such as rooms in care homes, the proposed mitigation of overheating requirements would require additional openings to the standards in the documents cited.

4C.17 It is proposed to replicate the Annex F table into the updated guidance as part of the Phase 3 update, with a caveat note on overheating requirements. The Department would be keen to appreciate if there are any concerns or issues that should prevent this. It is likely that the various updates will have improved our current standards for equipment and testing in many non-domestic situations. Designers or persons with specialist expertise or specific concerns are asked to highlight where potential impacts should be taken into account or if any local alternatives would be more appropriate.

Question 4C.4 **Do you agree that the list of sources for design guidance provided in Annex F should be replicated in the new TBK, for application to specialist building types?**

Question 4C.5 **Are there any specific concerns or issues with the updated references proposed in the Table in Annex F, that the Department should consider? If so, please provide details.**

[142] See paragraphs 3.30-3.58 of Technical Booklet K (Ventilation) 2012

[143] See Table 1.1 of England's Approved Document F, Volume 2

Additional measures related to infection risks

4C.18 New measures have been introduced in England and Wales in response to the need to disperse airborne contaminants, for example infectious agents being transmitted as aerosols, in non-domestic buildings. These include;

- air quality monitoring in certain spaces
- increased ventilation rates in certain spaces
- particular measures in offices

Air quality monitoring

4C.19 England's new guidance introduced a requirement for CO_2 monitoring in certain rooms likely to be occupied by larger numbers of people. The intention is to use CO_2 as a proxy indicator of indoor air quality. Checking levels of CO_2 using a monitor can help to identify areas that are poorly ventilated. Guidance on their use is based on the Scientific Advisory Group for Emergencies (SAGE) *EMG/SPI-B advisory group paper Application of CO_2 monitoring as an approach to managing ventilation to mitigate SARS-CoV-2 transmission.*

4C.20 The requirement is for mains powered non-dispersive infrared (NDIR) type CO_2 monitors and applies to the following occupiable rooms, between 50m^2 and 320m^2 floor area─

- occupiable rooms in offices.
- occupiable rooms where singing, loud speech or aerobic exercise or other aerosol generating activities are likely to take place or where public are likely to meet, for example gyms, nightclubs, sport venues etc.
- occupiable rooms which are maintained at both low temperatures and low levels of humidity. These may include rooms used for chilled food processing and occupied cold stores.

Question 4C.6 Do you agree that requirements for air quality monitoring, similar to those introduced in England and Wales, should be included in the Phase 3 uplift package to Part K (Ventilation)?

4C.21 England's consultation similarly considered introducing a requirement that ventilation systems, including natural ventilation, should be designed to

provide a minimum of 15 litres per second per person of outdoor air in the following types of occupiable rooms—

a) rooms where singing, loud speech or aerobic exercise or other aerosol generating activities are likely to take place.

b) rooms where members of the public are likely to gather in large numbers.

c) rooms which are maintained at both low temperatures and low levels of humidity.

However this was not taken forward.

4C.22 Situation 'a' or 'b' above may include rooms, for example, in public buildings, hotels, shopping malls, gymnasiums, indoor sports venues, dance studios, theatres, concert halls, public houses, nightclubs or assembly halls as well as in other types of building.

4C.23 Situation 'c' may include rooms used for chilled food processing and occupied cold stores.

Question 4C.7 Question omitted following correction issued October '23.

Ventilation in offices

4C.24 England's guidance on ventilation in offices includes new measures to reduce the risk of air-borne infection. In offices, these include—

- ventilation requirements extended to include common areas, such as corridors at a rate of 0.5 l/s per m^2 or openings of $1/50^{th}$ of the floor area;
- requirements for outdoor air supply to office spaces amended to 1 l/s/m^2 of floor area or 10l/s per person, whichever is the higher— (the 1 l/s/m^2 of floor area is a new additional check); and
- mechanical ventilation systems to be designed with a capability to filter, disinfect or avoid re-circulation of air (i.e. operate in an 'outdoor air only' mode).

Question 4C.8 Do you agree that additional requirements for ventilation in offices, similar to those introduced in England and Wales, should be included in the Phase 3?

Other measures

4C.25 Other measures considered under England's Future Buildings consultation, such as—

- the ability to continuously operate extract fans at intermittent operation rates in sanitary accommodation,
- purge ventilation capacity of 4 air changes per hour to office spaces and
- provision of a minimum of 15 litres per second per person of outdoor air to certain places (such as hotels, gyms, pubs and dance studios)

were not taken forward, as the scientific evidence supporting action in this area is still emerging.

Commissioning

4C.26 The Department is not aware of any particular changes in the commissioning requirements for non-domestic ventilation installations under the uplifts in other regions. Current arrangements, in line with CIBSE Commissioning Codes as outlined in TBK and ductwork testing should generally be expected to continue to apply.

4C.27 It is expected that there will be further developments, reviewing non-domestic ventilation standards further, in Phases 4 and 5, dependent on outcomes in other regions.

Section 4D: Electric vehicle infrastructure- Phase 3 proposals for buildings other than dwellings

4D.1 This section should be read in conjunction with Section 3E, which outlines the background, expected application and limitation of EV infrastructure requirements for dwellings and more generally.

4D.2 In terms of buildings other than dwellings, Article 8.2 of the EPBD requires the provision of

a) a minimum of one EV charging point (CP); and

b) ducting infrastructure for at least one in every five parking spaces to enable the installation of a CP at a later stage; in

all new non-residential buildings and non-residential buildings undergoing major renovation with more than 10 parking spaces.

4D.3 Article 8.3 of the EPBD does not fall to the remit of Building Regulations. If necessary, it will be implemented separately by DfI.

4D.4 For the purposes of section 3E and 4D of this consultation document, 'residential'[144] is used interchangeably to mean 'dwellings', and 'non-residential' to mean 'non-domestic' or 'buildings other than dwellings'.

Implementation

4D.5 As with the proposals for dwellings (ref section 3E), the Department of Infrastructure's preferred option is to legislate using Building Regulations with new technical guidance to introduce measures similar to those recently introduced in England (see 3E.17 for additional background).

4D.6 Further application and technical detail can be found in England's Approved Document S (ADS) together with associated FAQs[145]. You are encouraged to consider these documents and provide comment. The Department's understanding of what the proposals might entail is outlined below.

4D.7 The EPBD offers an exemption from the requirements for small/medium enterprise (SME) business premises. This has been adopted by the

[144] "residential" can imply different meanings under the Building Regulations, for example "a room for residential purposes" can include a room in a care home, rather than a dwelling.

[145] Infrastructure for charging electric vehicles: Approved Document S - GOV.UK (www.gov.uk)

Republic of Ireland, but has not been included in the implementation in other administrations. Tenancy and ownership status are not grounds for consideration under the Building Regulations. In keeping with England and other GB administrations we anticipate that the new requirements should, therefore, apply to all businesses, including small/medium enterprises (SMEs).

Question 4D.1 **Do you agree with the proposed use of Building Regulations to implement Article 8.2 for the provision of EV charging point infrastructure at buildings other than dwellings?**

Charge points

4D.8 Charge points should be smart capable and all to be a minimum of 7kW rating at supply voltage of 230V AC.

4D.9 Additional requirements, such as being of a minimum of a Mode 3 specialised system for electric vehicle charging running from a dedicated circuit, or equivalent, as defined in BS EN IEC 61851-1 and having a lit visual display are noted in Section 6 of ADS[146].

Proposed requirements for new non-residential buildings with more than ten parking spaces and for major renovations of such residential buildings.

4D.10 For new non-residential buildings with more than 10 associated parking spaces (or for major renovation of such buildings):

Requirement 1: a minimum of one CP would need to be installed; and

Requirement 2: ducting infrastructure for at least one in every five parking spaces should be provided.

4D.11 A minimum of one in every five means that, for example, if there are 27 parking spaces, five parking spaces must have access to cable routes in addition to the one parking space with an electric vehicle charge point.

[146] See para 6.2 of Infrastructure for charging electric vehicles: Approved Document S - GOV.UK (www.gov.uk)

4D.12 England's provision do not highlight any route to application by way of a material change of use, unless a new dwelling is created (see 3E.48). We therefore have no proposals at this stage to bring forward requirements where other changes of use occur.

Limitations to requirements for new non-residential buildings and for major renovations of non-residential buildings.

4D.13 **Limitation 1**- the non-residential building would need to have more than ten associated parking spaces (i.e. 11 or more associated parking spaces) on completion.

4D.14 **Limitation 2**- requirement 1 (to provide a CP), would not apply to spaces in enclosed, roofed or open-sided car parks (e.g. basements, those below buildings, and multi-stories), but would apply where a non-covered space is provided. Ducting requirements should still be met even in covered car parking, as laid out above.

Additional exemptions to major renovations of non-residential buildings.

4D.15 **Limitation 3-** EV infrastructure requirements would only apply where the major renovation is accompanied by the renovation of the car park, its electrical infrastructure (if car park is within the site boundary of the building) or the buildings electrical infrastructure (if the carpark is within the building).

4D.16 **Limitation 4-** an exemption is proposed where the cost of installation for EV charge points and ducting infrastructure exceeds 7% of the total cost of the major renovation. Ducting and CPs would still have to be installed in line with the normal requirements up to the point they can be accommodated within the overall 7% threshold.

4D.17 **Limitation 5-** where the major renovation is being carried out on properties with historical fire safety deficiencies (i.e. cladding remediation), it should be exempt from the requirements.

4D.18 For residential buildings, the requirement for CPs only applies so far as the capacity of the existing electricity supply is sufficient to provide for them. This is not considered necessary for major renovation of non-residential buildings, as only one CP is required.

Question 4D.2 **Do you agree that ducting infrastructure for one in five parking spaces and one CP, should be installed when a non-residential buildings with more than 10 non-residential car parking spaces is being erected or is undergoing a major renovation?**

Question 4D.3 **Do you agree with the proposed limitations (outlined in para 4D.13- 4D.18) to the application of EV charging requirements for new non-residential buildings and for major renovations of such buildings? If not, please comment on how should they should be changed.**

Application to mixed use buildings.

4D.19 England's AD outlines how the requirements should apply in mixed use situations, such that the more onerous residential requirements should apply in preference to the non-residential aspects.

Question 4D.4 **Do you agree that more onerous residential requirements should apply in mixed-use building situations and shared parking arrangements?**

4D.20 Note - Question Q3E.11 offers opportunity to provide any further views on any aspects of the EV infrastructure proposals or related issues.

Section 5: Considerations for Phase 4 uplifts

5.1 Annex C provides a timeline overview of some of the proposed developments in other regions, for building regulations and related policies over the next few years. These measures are likely to inform developments here and, their scale, pace and detail is likely to act as a spur to action here also.

Future Building Regulations proposals for England.

5.2 England's 2021/22 measures were intended to go as far as possible while acknowledging that the transition to low carbon heat requires market technologies, such as heat pumps, and skills to be significantly developed.

5.3 The measures in England were seen as a step change towards a further uplift introducing a *Future Homes* and *Future Buildings Standard* by 2025. The expectation is that these future standards will require a highly insulated building fabric and low carbon heating. New buildings would be 'net zero ready', i.e. able operate with very low and then zero carbon emissions as the electricity supply decarbonises further. These developments provide a base case of expectations, which has informed the Department's proposals.

5.4 DLUHC is planning to consult on these measures in Summer 2023. The details and implementation of proposals should become clear by 2025, after which further consideration and preparation time will be needed for implementation here. The Department's 'Phase 3' proposals are intended to ensure improvements here are progressed as far as possible in the interim, while Phase 4 will adopt or learn from England's *Future Homes* and *Future Buildings* measures.

5.5 Some details have already been outlined in England's Future Homes consultation from 2019 and are noted in Section 3A. This includes anticipated U-values of 0.15 W/m^{2}K for walls, 0.11 W/m^{2}K for roofs and floors and 0.8 W/m^{2}K for windows. Details on air-tightness are less clear, but will almost certainly be 3.0 m^3/h.m^2 @50 Pa or less. Services packages on proposed heating, any proposed renewable generating technology, MVHR and other measures are also awaited.

5.6 Consultations on SAP 11 and SBEM v7 (the domestic and non-domestic NCMs) are anticipated as part of these developments, and issues on assessment assumptions and metrics are likely to be considered within

these UK government led developments. We would be keen to encourage local responses directly to the SAP and SBEM consultations to ensure local issues are considered. We are also keen to gather local views and touch on some of the potential issues on this more generally in Section 6A.

5.7 In terms of non-domestic buildings, a review of SBEM is underway with significant stakeholder engagement on interfaces and Activity Class types and characteristics. It is likely that more detailed and updated data will apply and more Activity Classes may be added to try to ensure a more accurate benchmarking of buildings types.

5.8 Further measures on validation of as-built performance could also come through in these packages, as operational performance evaluation was a theme in some of the responses to DLUHC's recent consultations. However, how this can be assessed and implemented when a clearly delineated pass/fail assessment it needed to enable completion prior to occupation is not clear. The Department would be open to receiving evidence on further as-built testing or recording procedures, such as thermographic assessment, that industry feel would be appropriate.

Developments on boiler policy.

5.9 The CCC Advice report: The path to a Net Zero Northern Ireland advises that By 2030 for homes off-gas grid and 2033 for homes on-gas grid, all new heating appliance installations should be zero-carbon. This has implications for supporting infrastructure, including the necessary strengthening of electricity networks. Fully zero-carbon solutions would be particularly challenging to install in existing buildings, in that they tend to work best with low-temperature heating and alongside improved fabric efficiency measures. Similar measures are suggested for other regions, but there is no clear provisions yet established from other regions on how this might be achieved.

5.10 The UK Government (DESNZ) has consulted on new requirements for any boilers sold on the GB market[147], with the suggestion that, from 2028, they should be—

[147] Improving boiler standards and efficiency - GOV.UK (www.gov.uk)

- super-efficient (i.e. have efficiencies of >100% through incorporation of heat pumps); and/or
- hydrogen ready

5.11 This timescale sits a little way behind the Future Homes and Future Buildings steps and seems likely to have a greater impact on retrofit boiler replacements, rather than new-build requirements.

5.12 This development would be highly influential for Building Regulations standards for replacement boilers. It is also possible that *Future Homes* and *Future* Buildings standards measures will include action on replacement installation efficiency and emissions performance and/or further consequential improvement requirements to help ensure low carbon heating is installed.

5.13 Any proposals to require hydrogen ready or hybrid heat pump boilers in GB could be subject to NI protocol outcomes. It may be that EU standards would have to apply to products sold here, but building regulations could set higher efficiency standards for what is able to be **installed**. This would, additionally, be subject to EU technical notification procedures.

Developments in Scotland.

5.14 The Scottish Government has consulted on a New Build Heat Standard (NBHS), with the intention of banning all direct emissions heating (DEH), including bio-fuelled heating, in new builds and conversions subject to a building warrant application from April 2024.

5.15 This is subsequent to the building regulations uplift it introduced in February 2023 and forms an additional step prior to a further building regulations amendments in 2025 which will adopt changes to the NCM in light of the *Future Homes* and *Future Buildings* work.

5.16 The measure is supported by the pre-planned adoption of their direct emissions metric into building energy assessments and the requirement to outline a plan for conversion to a non-direct emissions heat source, if DEH is installed in new builds prior to the April 2024 thresholds.

Direct Emissions Heating-definition

A 'direct emission heating system', in relation to a building, means a system (other than a heat network) by which the building is heated or is cooled, or by which hot water is made available in the building, which uses thermal energy produced by a source of production that:

is located within the building, or the curtilage of the building, and

during normal operation produces greenhouse gas emissions at the point of production of that thermal energy.

The Building (Scotland) Amendment Regulations 2022

5.17 New builds subject to the ban will effectively be restricted to electric or district heating, with electric heat pumps likely dominant, given the limited extent of district heating. Biofuels are included in the ban as these have direct emissions at the building's location. As things stand, the measures would also apply to hybrid boiler/heat pump solutions in new builds, as these still have some direct emissions.

5.18 Scotland's Minister has further committed to develop 2024/25 proposals with a view to implementing standards equivalent to Passive House standards[148][149]. This is expected to develop concurrently with England's *Future Homes* and *Future Buildings* proposals.

5.19 *Passive House* is a voluntary certification scheme and standard which is owned and defined by a private sector body, the Passive House Institute. Full certification expects the use of designers, products, software and installers with PHI accreditation, to ensure performance and build quality. It is therefore anticipated that Scotland will apply a Scottish equivalent level of performance achieved under Passive House, rather than requiring PHI certification. The reforms are expected to consider both performance metrics and verification measures.

5.20 The performance metric reforms may require NCM reforms. For example, Passive House targets are expressed as absolute, numeric performance measures (e.g. a space heating requirement of 15kWh/m^2/yr) rather than being relative to a Notional Building specification. This way of working means there is no set recipe that developers can follow to ensure

[148] Meeting of the Parliament: 10/01/2023 | Scottish Parliament Website

[149] International Passive House Association | Criteria (passivehouse-international.org)

compliance under the PH methodology, as each building will be impacted by its particular form and the location's weather file. NCM and performance metric reforms are further discussed in Section 6.

The Passive House standard is a widely recognise voluntary standard which sets a range of technical criteria intended to ensure high efficiency new build standards including—

- Space heating requirement no greater than 15kWh/m2/yr or 10W peak demand;
- Primary Energy demand no greater than 120kWh/m2/yr;
- Internal Temperature not to exceed 25C for more than 10% of the year; and
- Air tightness to be no greater than 0.6 air changes per hour @50 Pa.

5.21 Verification, commissioning and on-site testing are also strongly enforced under PHI certified assessments, supported by a system of accredited builders, designers, testers and manufacturers. This helps reduce performance gaps between as-designed and as-built performance.

5.22 Any replication of equivalent measures on Direct Emissions or Passive House equivalence will tend further towards electrification of heat and would need to take account of deliverability, given grid impacts. The Department will therefore monitor the outcome of Scotland's proposed DEH ban alongside the review of connection charging and grid reinforcement review work being led by the Utility Regulator.

5.23 Future decisions around verification may also have to take the powers under building regulations are made into consideration. Current primary legislation does not empower the Department to strictly limit an aspect of building work to licenced or accredited designers, installers or testing commissioners, in the way that the Passive House system promotes, although guidance for common situations often points to this as a reasonable expectation for common situations.

Recast of the EPBD (EPBD 4)

5.24 The EU Commission published proposals to recast the EPBD in December 2021[150], which have recently been amended by the EU parliament[151]. The proposals are still to be finalised through the EU legislative processes and negotiations, with an implementation anticipated by mid/late 2023. While there will be no requirement to adopt the EPBD 4 measures here, the proposals provide some context of the actions elsewhere and may influence developments in coming years.

5.25 Aspects of the draft EPBD 4 which might be applied through, or impact, Member States' building regulations include—

- a new *'zero-emissions building'* standard to be applied to new buildings occupied, operated or owned by public authorities from 1st Jan 2026 and all new buildings from 1 Jan 2028 (note the Commission had proposed 2027 and 2030 for these respective dates);
- setting limit values for whole-life global warming potential for new buildings by to apply from 2030 (see Section 6B on embodied carbon);
- a ban on the use of heating systems using exclusively fossil fuels (hybrid and renewable systems would be outside this scope) in new builds and in deep or major renovations from the date the Directive comes into force;
- new buildings are to be designed to optimise their solar energy generation potential, enabling the subsequent installation of solar technologies with deployment of that solar generation required on new public and non-residential buildings within 2 years of the Directive coming into force;
- indoor environmental quality measurements to be taken in new buildings and buildings which have undergone major renovation to at least include

  a) the level of carbon dioxide;

  b) the temperature and thermal comfort;

  c) the relative humidity;

[150] EUR-Lex - 52021PC0802 - EN - EUR-Lex (europa.eu) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0802&qid=1641802763889

[151] TA (europa.eu) https://www.europarl.europa.eu/doceo/document/TA-9-2023-0068_EN.pdf

d) the level of daylight illumination or adequate daylight levels;

e) the ventilation rate in air changes per hour;

f) acoustic indoor comfort, such as the control of the reverberation time, background noise level and speech intelligibility;

- a greater emphasis on holistic assessment of structure, air quality, fire and seismic and climate change adaption risks concurrent with any work being done;
- whole life cycle global warming potential (GWP) assessments for new buildings from 2030;
- continuous energy monitoring to be provided in new buildings and buildings subject to a major renovation, where technically and economically feasible, from 2025;
- increased provisions for EV charge-point infrastructure, including charging for E-bikes and similar, taking efficiency of load management and grid into consideration with pre-cabling;
- charge-points to support bi-directional charging/export.

Proposed definitions of new building standards from draft EPBD 4 (following review by the EU Parliament).

'**zero-emission building'** means a building with a very high energy performance, as determined in accordance with Annexes I and III, which contributes to the optimisation of the energy system through demand-side flexibility, where any very low residual amount of energy still required is fully covered by energy from:

(a) renewable sources generated or stored on-site;

(b) renewable sources generated nearby off-site and delivered through the grid in accordance with Directive (EU) 2018/2001 [amended RED];

(c) a renewable energy community within the meaning of Directive (EU) 2018/2001[amended RED]; or

(d) renewable energy and waste heat from an efficient district heating and cooling system within the meaning of Directive (EU) .../.... [recast EED], in accordance with the requirements set out in Annex III;

'**nearly zero-energy building'** means a building with a very high energy performance, as determined in accordance with Annex I, which cannot be lower than the 2023 cost-optimal level reported by Member States in accordance with Article 6(2) and where the nearly zero or very low amount of energy required is covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby;

5.26 Other measures in the proposals are beyond the scope of building regulations, with a focus of a promotion of retrofit, including new energy performance requirements to EPC bands E by Jan 2027 and band D by Jan 2030 for existing non-residential buildings, and 2030/33 for existing residential buildings[152]. They also include numerous detailed requirements around national renovation plans, EPC data, EV and cycle provisions, ending of grants for fossil fuel boilers, one stop shop provisions, and more wide ranging safety checks and assessments.

Some further details and timelines are noted in Annex C.

Local proposals for Phase 4.

5.27 The Department expects to maintain a watching brief on the above developments across the administrations to help inform Phase 4. Given the local reliance on the NCM programmes and building regulations policy

[152] The Commission's proposals where for bands F and E to apply to these respective dates.

historically, any proposals are likely to be significantly influenced by developments in England's *Future Homes* and *Future Buildings* programme in the first instance.

5.28 In any case, very high fabric performance and low carbon heating such as heat pumps or heat networks, should be standard expectations for new builds by no later than 2026/27. Aspects of this many be included earlier, in standards for new dwellings, particularly if the Option 2 Notional Dwelling proposal was to be implemented at Phase 3 (See Section 3A).

5.29 Replication of Scotland's DEH ban, comes with significant risks, as it rules out biofuels and we expect it would rule out hybrid heat pump systems in new buildings also. Given a very limited roll-out of heat networks to date, it would seem likely to place significant demands on the current electrical infrastructure to support heat pump roll-out. We are concerned that there could be instances where this may not be viable, even if very robust fabric or additional on-site renewables measures limited the total energy demand of a new building.

5.30 Option 2 in Section 3A proposes a heat-pump led approach to the Notional Dwelling. This prevents the use of conventional fossil fuel installations, but might allow hybrid boiler systems to operate, if emissions from their very limited fossil fuel use was offset with PV or other renewable generating technologies on site. Ensuring this limited fossil fuel use relies on good controls and consumer engagement and further policy development for assurance on this may be required. Nonetheless, at present, the Department views the limited potential flexibility hybrids might offer as preferable to any outright ban on all DEH solutions, however we are open to receiving evidence on this. A DEH ban could theoretically be implemented following Option 1 or Option 2, as it further reduces the use of fossil fuel solutions under either scenario. It is difficult to see how hybrids could be compatible with Phase 4 net zero ready aspirations for new-builds, unless they are also hydrogen ready or limited to biofuel use.

5.31 The Department will review Scotland's Impact Assessments on the policy banning DEH, where available. We will monitor the policy delivery in Scotland and any market or interrelated policy developments in considering any potential introduction of similar measures here.

5.32 The Department recognises that adjustment of the NCM towards Passive House principles, with accommodation of new fixed metrics or other

changes, may well be worthwhile, albeit that it would no longer provide a ‘sure fire’ Notional specification that guarantees compliance. Officials will try to monitor developments in Scotland around this, with a view to consideration where appropriate, but we note a risk that a dwelling with a poor form factor (typically a small, less compact detached dwelling), might not be able to pass the building regulation assessment if absolute targets are applied at an onerous level. This may have planning implications, particularly in rural situations were detached dwellings with poorer form factors may be more prevalent.

5.33 As with Phase 3 proposals, these developments will require inter-related and ongoing cross-departmental policy development around—

- grid connections and reinforcement;
- relative fuel prices to support heat pump outcomes;
- smart systems and flexibility;
- assessment and management of peak loads;
- consideration of biofuel suitability for heat in local buildings;
- decarbonisation of heat networks;
- support schemes for retrofit, energy efficiency, storage and low carbon technologies in buildings;
- software assessment tools and NCM developments;
- EPC fitness;
- management of any divergence in product standards between EU and GB markets;
- consideration on risks around technical notification of measures to the EU (which will not apply in England, Wales or Scotland);
- consideration on re-use of existing buildings and implications for traditional construction in particular; and
- ongoing green skills development.

5.34 In most respects, it is likely that local plans will be more quickly implemented where they replicate measures in England as closely as possible.

5.35 The Department is also interested to hear about other relevant aspects of building regulations which may need consideration, particularly in relation to new non-domestic building standards. For example, the assessment of

export/non-export ratios from on site renewable generating technologies is one issue in non-domestic building assessments where the Department would like to see improvements, if possible.

Question 0.1 **Do you agree that, for Phase 4, the Department should expect to replicate measures introduced in England's Future Homes and Future Buildings (2025) in the first instance, or is there a particular administration that we should seek to align with for Phase 4? If possible, please provide supporting evidence for your preference?**

Question 5.2 **Would you support a ban on direct emissions heat generators or combustion appliances, similar to Scotland's measures banning such appliances? (Please take into account your answer to Question 3A.23 on which Option you have supported.)**

Question 5.3 **Do you support efforts to more closely align the NCM and targets towards passive house standards, where possible?**

Question 5.4 **Have you any advice or evidence as to how further verification measures might help ensure the standard is delivered in practice (please provide details)?**

Question 5.5 **Are there any other particular or detailed issues that the Department should be considering for new build Part F requirements for non-domestic buildings as part of Phase 4 developments?**

Phase 5 proposals.

5.36 Phase 5 proposals are speculative at this stage and are somewhat dependent on the outcomes of Phase 4 and wider Energy Strategy developments. These might potentially include:

- further measures to work alongside UK government expectations that replacement heat generators in existing buildings should be more than 100% efficient (i.e. hybrid heat pumps), or otherwise low carbon.
- measures to address and assist with electrical storage and peak capacities limits
- more refined smart systems performance/indicators

- operational performance targets or post occupation feedback on outcomes
- further steps to improve verification and on-site assessment of construction
- further measures to improve assurance on construction. for example testing and validation assurance of as-built performance
- other related measures such as improved embodied carbon or whole life performance, design for dismantling or other circular economy provisions (see Section 6)

Question 5.6 **Are there any other issues which the Department should be considering for Phase 5? Please note that some further/concurrent issues are discussed in Section 6 which may influence input on this.**

Section 6: Concurrent issues - headline summary

6.1 The Department's immediate focus is on delivering the uplifts outlined in Section 3 and 4 of this document to take into account the recent developments in other regions. However, we are aware that there are additional issues, which may help inform future development, working co-operatively with other administrations.

National Calculation Methodology (NCM) issues

6.2 The NCM and modelling assumptions are undergoing strategic review as part of the EPC fitness and building regulations workstreams. Use of Notional Dwelling comparison, rather than fixed, absolute metrics is one issue characterised in the differences between current assessments vs Passive house or similar methodologies (see paragraph 5.18). The current Notional approach accepts the form of the building, without penalty, whereas form factor and location impact outcomes in absolute terms.

6.3 Energy assessment outcomes at present are based on a set of assumptions, which also tend to reflect current UK averages rather than local conditions, or conditions likely to arise over the future life of the building. This can tend to provide a false picture of outcomes either in specific buildings and cases, or more generally, for example where conditions locally are markedly different to the UK average. For example, Annex B and Section 3A outline the consequences of using current local carbon intensity factors for electricity, rather than UK averages.

6.4 There is an increased focus attending to peak vs base load situations and how to better integrate and reflect EV charging, heat pumps and energy storage solutions which help balance demands. The EU has developed a voluntary Smart Readiness Indicator assessment tool which starts to address how building assessments might consider some of these issues alongside the conventional EPC outputs.

6.5 These issues are discussed further in Section 6A.

Embodied Carbon

6.6 Calls for action on Embodied Carbon assessment are increasing and the Department recognises that this is an increasingly significant issue, as operational emissions reduce. At present the Department has no resource

to develop an independent approach or act alone on this, but is open to following developments from the other administrations. This is discussed further in Section 6B

Over-sized new homes

6.7 The Department's EPC data indicates that a high number of new build homes here are significantly larger than the average in other regions, particularly in relation to detached houses. There is minimal benefit in improving the emissions and energy performance per m^2 if, at the same time, we are creating buildings that are significantly larger than necessary.

6.8 We would be keen to examine if this is a fair reflection of the position and to consider if anything could/should be done through the Building Regulations to discourage over-sized dwellings. This is discussed in further detail in Section 6C.

Performance gap

6.9 There continues to be concern at the difference in EPC / Building Regulations' assessments compared with post occupancy metered energy performances in practice. Improvements require widespread industry cultural reform, but we would be interested in any local feedback in this area. This is outlined further in Section 6D.

Section 6A: National Calculation Methodology issues

6A.2 Given the proposed pace of delivery of its programme, the Department anticipates that delivery of the each Part F uplift should adopt the latest NCM produced by England (i.e. SAP 10 and SBEM v6 for Phase 3, SAP 11 and SBEM v7 for Phase 4). This should normally occur with only minimal adaptations. However, if Option 2 in Section 3A is deemed feasible, a low carbon Notional Dwelling would need to be commissioned from software suppliers or a more rapid 'jump' straight to SAP 11 and SBEM v7 may be preferred.

6A.3 This section is not considering the Notional Building targets where, at least theoretically, a local specification could be set. Rather it is about the methodology itself; what assumptions are made and how the calculations are developed. The Department's strong preference is to seek to influence the NCM programme to ensure the local position is properly considered

within its overall remit, rather than introduce an independent methodology. We are seeking local stakeholder views on some of these core issues, albeit that UK government consultations lead on these processes.

Notable changes under SAP 10 and SBEM v6 (proposed for Phase 3)

6A.4 As well as providing a new Notional Dwelling/ Building, new editions of the NCM methodologies reflect an improved understanding of building physics. Changes from the versions currently used for Part F (SAP 2009 and SBEM v4) include—

- emissions impacts of methane and nitrous oxides within the Carbon Dioxide factors for fuels
- Measures to better reflect improved performance of high heat retention storage heaters
- Revised methodologies around photovoltaics, including a new β-factor assessment in SAP to help assess the extent of any exported electricity from on site renewable generation
- Revised assessment of electricity to reflect monthly variations in carbon and primary energy performance of electricity. It is not yet clear if SAP 11 and SBEM v7 programmes may consider if this should be extended to hourly or even half-hourly datasets to reflect diurnal demands.
- Revised notional dwellings and buildings for building regulations assessments
- Updated thermal bridging assumptions
- Improved assessments of lighting and ventilation

Further details can be found at the relevant SAP/NCM consultations and Main Changes page of NCM Manuals[153]

6A.5 Many of these changes will be reflected in both the Notional Building and Actual Building assumptions, so have relatively limited impact. Others will

[153] https://www.gov.uk/government/consultations/public-consultation-on-proposals-to-amend-the-standard-assessment-procedure-sap

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/253350/sap_2012_summary_consultation_responses_decisions_publication.pdf

https://www.uk-ncm.org.uk/filelibrary/NCM_Modelling_Guide_2021_Edition_England_15July2022.pdf

https://www.uk-ncm.org.uk/filelibrary/NCM_Modelling_Guide_2013_Edition_20November2017.pdf

be more relevant, particularly where designers are proposing solutions that vary from the Notional Dwelling specification (e.g. where photovoltaics cannot export to the grid- see paragraph 3A.70 and 4A.15).

Longer term issues

6A.6 We wish to gather evidence as to whether there is significant need for a more localised data input or considerations in the NCM over the medium term, to help co-ordinate with England's *Future Homes* and *Future Buildings* proposals, and our subsequent Phase 4 work.

6A.7 Scoping work, industry engagement and development work has commenced in relation to a proposed SAP 11, with potential for quite deep and widespread reform of the methodology for dwelling assessments[154] and similar work has commenced on the non-domestic NCM[155].

6A.8 A preliminary study by Etude set out a series of challenges and recommendations for the future of SAP, which the NCM programme will consider at UK level. The work on the non-domestic NCM methodology may also be influenced by these developments.

6A.9 The Etude report set out 25 recommendations and the Department is open to receiving any evidence that would support any particular direction of travel here. Etude's recommendations largely seek improved modelling accuracy of the absolute outputs at a building level similar to Passive House principles, whereas the current regime has been developed with an emphasis on relative outcomes by comparison to a standardised Notional or Reference specification applied equally across all locations.

[154] See https://www.etude.co.uk/news/the-future-of-sap-calculations/

[155] Cite the recent consultations underway on SBEM

25 Key recommendations for SAP/RdSAP 11 from Etude Report Making SAP and RdSAP 11 fit for Net Zero for BEIS

Alignment between SAP/RdSAP and its strategic objectives

1. SAP can and must become a tool for Net Zero Carbon ready new buildings.
2. SAP/RdSAP can and must become a better tool for whole house retrofit
3. SAP/RdSAP can and must become better at evaluating energy use.
4. Homes need to become smart ready and SAP/RdSAP needs to help with this.
5. SAP can and must play a bigger role in reducing the performance gap.

Improvements to the methodology

6. Carbon factors: replace the short term with long term factors (e.g. 25-year average).
7. SAP should remain a steady-state monthly tool, but with a new module for flexibility.
8. SAP should 'tell the truth' and enable bespoke non-regulatory uses.
9. A significant improvement of Appendix Q and the PCDB process is required.
10. Overheating: towards a simplified 'flagging system'?
11. SAP/RdSAP outputs need to be compatible with disclosure and data analysis goals.

Improvements to SAP/RdSAP and its ecosystem for Net Zero

12. No more notional building: the introduction of absolute energy use targets
13. New metrics for Net Zero Carbon (and not primary energy).
14. Better governance: a modular architecture and an evidence-based culture
15. New EPC ratings from SAP/RdSAP to support Net Zero and fuel poverty objectives.
16. SAP should be fully integrated in the digital age.

A better evaluation of energy use

17. Location should be taken into account and not normalised as it is now.
18. Domestic hot water should be modelled more accurately.
19. SAP/RdSAP should better model the energy performance of ventilation systems.
20. Thermal bridges: good practice should be rewarded (and bad practice penalised).
21. SAP needs to better reflect all energy uses, including cooking and white goods.
22. Occupancy: the standardised assumptions should be re-validated.

Support to decarbonisation of heat and electricity

23. SAP/RdSAP needs to model all heat pump systems accurately to reward efficiency.
24. Heat networks: SAP/RdSAP should evaluate distribution losses more accurately.
25. Solar Photovoltaics require better modelling and a prominent SAP/RdSAP output.

Some of the more significant issues around the NCM include the following recommendations:—

6A.10 **Use forward looking fuel cost, carbon and primary energy factors in the assumptions for fuels**, so that longer term future positions are

assumed in the EPC and building regulations assessments. This would mean the EPC and building regulations assessment would be looking at perhaps the average position over the next 10-25 years (taking decarbonisation of fuels, such as gas and electricity into account), and based less on current costs and carbon factors.

6A.11 **Provide fixed numeric value outcomes/m^2, rather than performances relative to a Notional Building**. Numeric, absolute performance targets, similar to the fixed numeric targets under the Passive House (see paragraph 5.18), arguably set a more rigorous approach for individual buildings. These criteria better reward more compact buildings with a good form factor, as the shape of the building would strongly influence the performance. Less compact, small standalone buildings or buildings with a lot of exposed surfaces would be penalised by a fixed numeric performance requirement as they would require higher fabric standards than forms with lower surface area/floor space ratio. This could be applied to discourage less efficient building types with a poor form factor, such as detached houses or, at an extreme, to make them unviable.

6A.12 Such buildings are already more expensive/m^2 floor area to construct, so there are already strong incentives for developers towards more efficient and compact forms. Conversely, developers and designers would have less certainty of compliance as there would be no guaranteed ‘notional building’ solution to compare to if fixed numeric outcomes were used. This impact increases if local weather data is used.

6A.13 **Use local weather data, rather than UK average assumptions**. Taken with absolute targets (see above) this would mean buildings in colder parts of the UK would have to be built to significantly better standards than those in warmer locations. Weather data is currently used slightly differently in the domestic and non-domestic NCMs (see insert).

Local climate data use in NCMs

SAP, the domestic NCM, assumes that both Notional and Actual Dwellings are constructed in a UK average (East Pennines) location. This applies when calculating the SAP rating on EPCs as well as for building regulations calculations. However other EPC outputs, such as recommendation savings etc, are calculated on the basis of the nearest local weather file at postcode level and use updated (albeit UK average) cost information.

The non-domestic NCM operates slightly differently but has generally similar impacts. It adopts a Belfast weather file for all outputs (Notional and Actual Building), although this can be overridden, where an alternative weather file would be more appropriate (e.g. files for a more northerly or exposed location in Britain may be appropriated in similarly exposed sites). The adopted weather file applies equally to the Actual and Notional buildings (applicable to building regulations) and the Reference building (used for EPC assessment), thereby standardising the assessments.

Because the TER is based on a Notional Building, using the local weather file does not fundamentally impact on the standard of construction needed to pass the building regulations. However the higher TER for the colder locations can mean that, where a non-domestic building deviates from the Notional Building specification, the extent of compensatory measures could be impacted by the building's location.

The Department currently considers the typical climate here is sufficiently close to the UK averages to continue without extending the use of the local climate data, however we are open to taking further evidence on this issue.

6A.14 The Department currently considers that the single weather file for NI, as used in non-domestic modelling, provides sufficient balance between performance and accuracy, but remains open to considering any wider NCM developments and practice around this, or other issues.

6A.15 **Use local carbon, cost and primary energy factors.** Our local grid is likely to remain at some variance from the values used in Table 12 of SAP 10 and SBEM v6 /DSM for non-domestic buildings. SAP 10 applies a carbon intensity factor of 0.136 $kgCO_2/kWh$ for electricity, whereas the local intensity of recent years is estimated at around 0.340 $kgCO_2/kWh$. The impact of this, along with an assessment with Ireland's DEAP assumption of 0.244 $kgCO^2/kWh$, is outlined in Annex B.

6A.16 This particular issue is largely due to the lack of nuclear and greater reliance on coal in the local grid, meaning each unit of our electricity has a greater emissions impact than the UK average, despite having a high renewables contribution. This means EPC and building regulations

assessments are fundamentally inaccurate in terms of the absolute outputs related to current carbon emissions from electricity. This is arguably less significant in a relativist assessment exercises (such as currently applies under the Building Regulations), as the Notional, Reference and Actual buildings all apply the same assumptions on this issue. However it is fundamental to how much benefit is assumed to be provided by each technology; low carbon intensity factors will support the use of electricity, higher factors will support offsetting with additional on-site renewable generation, such as PVs.

6A.17 SAP costs also operate on the basis of UK averages, rather than reflecting local prices. Any move to local costs or carbon factors would require reassessment of the fundamental operations around EPCs, SAP ratings, emissions ratings and banding assessments, which would require significant resources and comes with oversight risks. Any move to local costs in the NCM is also a complicating factor if a running cost performance metric was to be included in building regulations assessments (see 'Alternative Metric 3' paragraph 3A.28).

6A.18 In the longer term, as the electricity grid decarbonises further[156], the carbon metric will decrease in significance for building regulations compliance. More localised individual building assessments may be welcome, but the efforts to maintain them, would be a significant and ongoing task, with consideration needed on pre-existing EPC assessments also needed. The Department would be keen to gain insight on sources of accurate forward looking projections for local cost, carbon and primary energy factors for fuels, and for electricity in particular. However, the task of independently developing and maintaining local monthly carbon and primary energy intensity factors for different types of electricity (e.g. PV export to grid, off peak use etc), in parallel with SAP 10's monthly UK average tables[157], would be a significant undertaking.

6A.19 **Better consideration and inclusion of unregulated energy demands.** The SAP assessment is based EPBD protocols which require assessment of heating, cooling, ventilation and lighting energy uses only. Other small

[156] Section 15 of the Climate Change Act (Northern Ireland) 2022 requires that *The Department for the Economy must ensure that at least 80% of electricity consumption is from renewable sources by 2030.*

[157] See table 12d and 12e in the SAP 10.2 Manual.

power (largely electrical) uses are not included in the assessment[158] and are considered 'unregulated' demands outside scope. This means assessments do not portray the overall picture of energy requirements and bills, contributing to perceptions of a performance gap. As regulated energy use decreases, these unregulated uses become increasingly relevant.

Examples of potential outcomes

6A.20 If we adopt a more local carbon factor to reflect the higher carbon intensity of our local electricity, and the Notional Dwelling specification assumes a gas boiler (see Option 1 specification as per Table 3A.1, Section 3A), then alternative solutions, such as an electrically operated heat pump led solution, would not demonstrate the same emissions benefit here as they would in other administrations. A PV panel would have a greater impact, as each kWh of electricity it generated would be saving more carbon. This is demonstrated in Annex B outcomes.

6A.21 By contrast, if the Notional Dwelling assumes a heat pump (as per Option 2 in Section 3A) then a gas or LPG boiler led solution would be penalised less heavily than it would be in GB, and may even be viable, if a very much higher local carbon factor for electricity were used here.

6A.22 If we include estimated unregulated electrical uses in the assessment, then the total emissions figure increases and electricity considerations are potentially given greater weight. It would be important that any such development should keep careful record of the unregulated use demands, in order to help maintain comparison with previous records.

6A.23 If local weather data were used in domestic assessments in the same way as the non-domestic NCM, then the EPC and building regulations assessments would provide a more accurate estimate of emissions. However, there would be very limited building regulations impact as any marginally colder or wetter days here would apply equally to both Notional (TER) and Actual (DER) building models. Nor would the EPC ratings be impacted, since both Notional and Reference buildings would use the same dataset (as occurs under the non-domestic NCM). However, this would require quite fundamental changes to the core SAP calculation and

[158] although assumptions around heat gains from such appliances are included in the incidental heat gain assessment

software, for potentially only minor improvement in the accuracy of local numeric outputs, but with limited or no practical benefits in practice as regards the Part F assessment.

6A.24 If we assume we have a wetter and colder climate here than the UK average, and use this local climate in the emissions assessment for building regulations, then the actual TER and DER emissions will both be higher. This could, again, mean that where designs vary from the Notional Building 'recipe', compensatory measures will be marginally more demanding to achieve here than under the 'UK average' regime.

6A.25 If we move away from a Notional Building approach to absolute numeric metrics of 'X' kWh/m^2, 'Y' $kgCO_2e/m^2$ or 'Z' £/m^2 (where X, Y or Z are fixed numerical values applicable to all dwellings or other buildings), then using localised climate data would mean that buildings in colder locations would need to be constructed to significantly better standards than those in warmer locations in order to meet the energy, emissions or any cost per m^2 requirements. This would be a significant change in practice, particularly as it would mean that the Notional Building recipe may not always guarantee compliance. This would, however, align with the principles of other assessment criteria, such as Passive House.

Smart Readiness

6A.26 EPBD 3 offers voluntary provisions to adopt a Smart Readiness Indicator (SRI) for buildings[159] which might sit alongside EPC and building regulation assessments. The SRI has been developed at EU level and is intended to be used to measure the capacity of buildings to use information and communication technologies and electronic systems to better suit the needs of the occupants and the grid, and improve energy efficiency and overall performance of the buildings.

6A.27 The methodology for the SRI described in the EPBD is expected to take into account features such as smart metres, building automation and control systems, self-regulating devices for the regulation of indoor air temperature, built-in home appliances, recharging points for electric vehicles, energy storage and detailed functionalities and the interoperability

[159] See Article 8(10) and 8(11) of Directive 2018/844/EU https://ec.europa.eu/info/news/commission-launches-consultation-establishment-smart-readiness-indicator-buildings-2019-aug-16_en

of those features, as well as benefits for the indoor climate condition, energy efficiency, performance levels and enabled flexibility[160].

6A.28 The UK Government is may consider the SRI provisions alongside the EPC fitness review and SAP 11 programmes. Assurance of appropriate smart metering or controls could be required. In Northern Ireland, DfE is responsible for the smart electricity policy[161]. The Department is therefore not proposing to adopt any SRI provisions in Phase 3, but will try to input to UK NCM developments to ensure any local smart metering policy here is suitably accommodated.

Current thinking in the Department

6A.29 We are open to receiving input, but some issues, such as forward-looking, carbon intensity factors and potential smart readiness indicator measures, are likely to apply equally in all regions and to have a greater bearing on EPC and building regulations assessments than most local discrepancies, such as local weather files. Local electricity grid carbon intensity figures are the exception to this, but similar issues persist in GB regions also.[162]

6A.30 Generally speaking, more accurate local factors (carbon, cost, primary energy) or weather files would better reflect the likely performance of individual building assessments here, and promote accuracy. However the workload and risk in maintaining this challenges Departmental resources and may not provide value for money. Bringing any of these issues into the assessment risks a reduced pace of policy development. It could place additional demands on software suppliers (who may prioritise other larger markets) and policy development teams working on energy issues across local Departments.

6A.31 In terms of building regulations, the proposed new metrics, (e.g. primary energy and FEES assessments) are likely to be less affected by local discrepancies. This may mean there is little practical benefit in immediately seeking more accurate local data for building regulations compliance at

[160] Energy Performance of Buildings Directive (EPBD) 2018/844/EU

[161] https://www.economy-ni.gov.uk/energy-strategy-call-for-evidence

[162] https://scottishbusinessnews.net/huge-regional-variations-in-carbon-intensity-of-great-britains-power-new-analysis/

Phase 3, as, in practice, these other metrics may outweigh local discrepancies in running costs or carbon performance over time.

6A.32 It is nonetheless important that policy makers and people relying on EPCs understand that the local position is not necessarily accurately reflected in our EPC or building regulations assessment outputs.

6A.33 The Department, with DfE, will maintain a watching brief on any DESNZ and/or DLUHC development work on metrics and any smart readiness indicator reforms.

Question 6A.1 Do you agree that the local NCM should be consistent with England? If not, please provide any particular thoughts on how it should be varied, for example with the use of a local NI weather file, or with local cost or carbon intensity factors, rather than UK averages, in building regulation assessments.

Section 6B: Embodied Carbon

Introduction

6B.1 The UK Green Building Council (UKGBC) defines net zero carbon over the whole life of a building as being "when the amount of carbon emissions associated with a building's embodied and operational impacts over the life of the building, including its disposal, are zero or negative."[163]

6B.2 While operational carbon deals with emissions from the building's use, embodied carbon assessment measures emissions involved in the materials' production, delivery, installation and normally also considers what happens at the end of the building's life. As operational emissions reduce, with improved construction and services standards and as the grid decarbonises, the relative significance of the embodied carbon locked into the building's construction increases. Whole life assessment looks at the wider picture, combining embodied and operational carbon impacts.

6B.3 This can be illustrated in practical terms. For example, one type of insulation might help a building use slightly less energy over its lifetime than another insulation material. However, if the embodied carbon of the first material is significantly higher than that of the second, then the additional saving in the building's operational emissions could be inconsequential.

6B.4 Similarly, a material generally considered sustainable but that has been transported around the world could have more embodied carbon than a material perceived as being less sustainable, but which does not have to be transported as far.

6B.5 To date, building regulations have been focused on reducing operational performance for certain regulated uses (heating, cooling, ventilation and lighting), but some countries have introduced, or are considering the introduction of, reporting or targets for embodied carbon with a view to whole life carbon assessments. Similar action is also being called for with a proposed Part Z campaign targeted principally at England's building regulations[164] and in a range of other voluntary approaches such as the

[163] UK Green Building Council (2019), Net Zero Carbon Buildings: A Framework Definition. Available from: https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition/

[164] Part Z (part-z.uk)

RIBA Climate Challenge and London Energy Transformation Initiative (LETI) campaigns.

6B.6 As product suppliers engage with the issue, it becomes easier to make better specification choices that target meaningful reductions in embodied carbon, alongside net zero operational carbon.

Part Z

A speculative draft proposal for an 'Approved Document Z' seeking requirements around embodied carbon emissions via a new Part Z to England's Building Regulations has been produced by Industry analysts. This proposes, in the first instance, that emissions on schemes greater than 1,000m^2 or 10 dwellings, should be reported by designers when a new building is being constructed. It is proposed that the data submitted should help inform subsequent embodied carbon performance requirements for new buildings.

Calculating Embodied Carbon

6B.7 BS EN 15978 Sustainability of construction works — Assessment of environmental performance of buildings— Calculation method outlines the stages of assessment under a lifecycle approach and describes A-D modules.

- Stage A relates to the product manufacture stages, from A1 (raw material extraction) to A3 (fabrication) to A4 (transportation to site) and A5 Construction installation process).
- Stage B related to the carbon in use, maintenance, repair, replacement and refurbishment (B1-B5), with B6 related to operational energy and B7 operational water carbon impacts.
- Stage C relates to dismantling or demolition of the building and potentially returning the state for re-development

6B.8 A further stage D, called *"benefits and loads beyond the system boundary"* deals with the potential for reuse, recovery or recycling of the product, as well as considering energy exported beyond the building system boundary during the building's life. Where a product can be reused, recovered, or recycled, it reduces the total amount of carbon calculated for the product across the rest of its lifecycle.

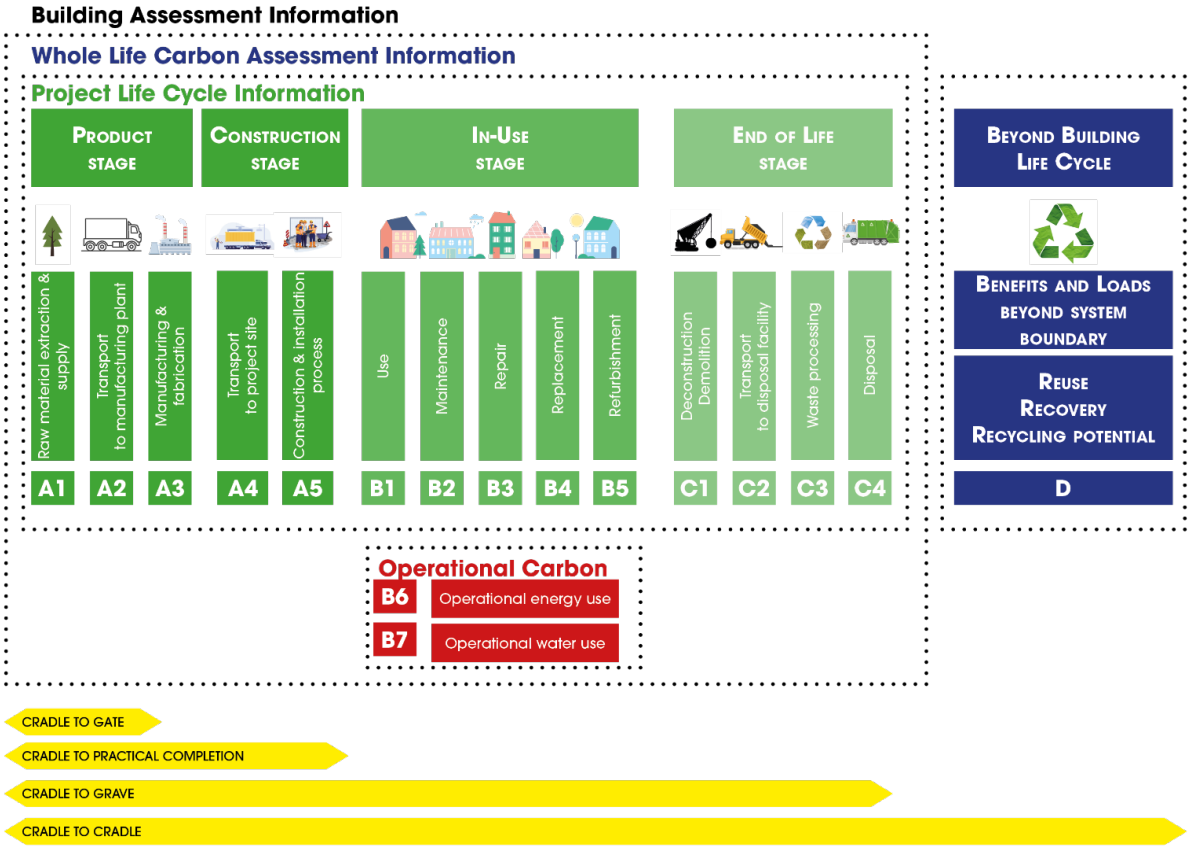


Figure 6B.1: System boundary diagram based on LETI Embodied Carbon Primer[165] and BSI Standards Limited (BSI) to accord with EN 15978:2011.[166].

6B.9 The RICS Professional Statement: *Whole Life Carbon assessment for the built environment*[167] has been developed with the intention of supporting consistent application of BS EN 15978 in the UK.

[165] Embodied Carbon Primer | LETI

[166] EN 15978:2011, Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method (Permission to reproduce extracts from British Standards is granted by BSI Standards Limited (BSI). No other use of this material is permitted.)

[167] Whole Life Carbon Assessment for the Built Environment (rics.org)

Scope of assessments- Lifetime.

- 'Cradle to gate' embodied carbon assessment covers only modules A1 to A3 (the product stage) and is typically reported on product suppliers' environmental performance declarations (EPDs).
- 'Cradle to grave' assessments span from module A1 (Raw material extraction) through to module C4 (Disposal) and may or may not include the B6/B7 operational energy assessments. Stage D benefits (for example from the potential re-use of product after the building has been dismantled) may not be fully included.
- The RIBA Climate Challenge criteria for embodied carbon assessment includes modules A1-A5, B1-B5 and C1-C4 (including sequestered carbon)
- RICS Professional Statement: *Whole Life Carbon assessment for the built environment* provides a template which offers a range of reporting options, including a suggested minimal assessment to include super structure and external sub-structures only, over stages A1-A5, with the addition of a stage B4 applicable to external walls and elements only.
- The Part Z proposals seek recording of an entire Whole Life Cycle assessment (all stages, including stage D values and sequestered carbon) before setting mandatory targets for an embodied carbon maximums based on stages A1-A5 only ('Cradle to practical completion').
- The Lord Mayor of London's London Plan Guidance requires a Whole Life Cycle Assessment to cover the entirety of modules A, B, C and D, rather than just the minimum requirements identified in the RICS PS.
- LETI targets are also set with respect to 'upfront' embodied carbon targets based on stages A1-A5, whilst campaigning for consideration of the full life-cycle impacts together with reuse of products towards circular economy principles.

6B.10 The RICS Professional Statement also sets out assumptions, technical details, metrics and calculation requirements. It provides some default carbon values assumptions for some situations/stages (e.g. mileage impact assumptions for local, national, European, and globally manufactured materials) as well as setting out a hierarchy for sources of carbon data with respect to materials and products. The standard is currently being updated to improve its clarity and enlarge its scope to cover infrastructure assets.[168]

[168] Decarbonising UK real estate report

RICS Hierarchy of sources for carbon data

- Type III environmental declarations (EPDs and equivalent) and datasets in accordance with EN 15804
- Type III environmental declarations (EPDs and equivalent) and datasets in accordance with ISO 21930
- Type III environmental declarations (EPDs and equivalent) and datasets in accordance with ISO 14067
- EPDs and datasets in accordance with ISO 14025, ISO 14040 and 14044
- Type III environmental declarations (EPDs and equivalent) and datasets in accordance with PAS 2050.

6B.11 BS EN 15804 standard defines the product category rules to develop Environmental Product Declarations (EPD) of construction products. EPDs provide a source of environmental data for a life cycle analysis of a manufacturer's specific product. They typically specify declarations across some, or all, of the four different stages of construction that the standard identifies for the purposes of lifecycle analysis.

6B.12 Differences between the methodologies adopted can have a significant impact on the outcome of the assessment. For example, the RICS guidance sets out a 60-year lifespan, while the EU Level(s) framework[169] sets the design life at 50 years. With some individual components having a presumed lifespan of 25 years, this will mean the inclusion of fewer replacements of such components are required over the projected life of the building. RIBA and LETI use the RICS 60-year figure, while the RIAI generally use the EU 50-year figure, in Ireland. It has also been suggested that changes could be made in future to adjust the anticipated lifespan based on particular building types.

Question 6B.1 Do you have any comments on EPDs that you would like to bring to the attention of the Department at this stage?

Question 6B.2 Have you any insight or evidence on the likely professional costs incurred in carrying out a whole lifecycle assessment of carbon in a project? For example, is it likely to be comparable to the cost of a traditional Bill of Quantities? If

[169] Level(s) is an assessment and reporting framework that provides a common language for sustainability performance of buildings.

so, what phases of the lifecycle assessment and data were included?

Challenges

6B.13 Advocates for action on embodied carbon suggest that initial reporting on emissions would be a helpful step to progress developments and to inform future targets / requirements. The Department recognises the support from industry and is sympathetic to the aspirations for greater consideration of embodied carbon. However, agreement on the scope of the assessment and values applied is not straightforward and the associated bureaucracy significant.

6B.14 Any practical delivery requires significant consideration and agreement (often on a pan-administration basis) on a range of areas including─

- clarity on the scope of the assessment (e.g. extent of the building and inclusion/exclusion of landscaping works, building type and product lifetime cycles, replacement cycles, maintenance carbon impacts, end of life assumptions, treatment of stage D allowances and sequestration);
- the default carbon values and assumptions applied to materials and products where an EPD is not available, including attending to discrepancies between RICS vs EU approved or other sources;
- addressing and facing down challenges from sectors which may disagree with any assumptions in the assessment method, (noting trading arrangements here require NI to notify the EU on changes to technical standards, which opens additional issues of potential challenge which may not be relevant to other administrations);
- agreement as to how default values or assumptions may be reviewed over time as embodied carbon lowers alongside decarbonisation of energy supplies or as research evidence re-evaluates carbon impacts. For example- in whole life cycle assessments, operational emissions savings may need to be calculated differently to the current Part F modelling assumptions, in order to reflect the likely decarbonisation of fuels over the lifetime assessment period;
- the admissibility and management of EPDs and acceptance of their oversight regimes, particularly if they have different assumptions;
- potential national/international trade implications in adopting any particular assumptions or assessment methodology;

- accreditation or authorisation of assessment tools;
- the oversight, training and accreditation standards for those carrying out the assessment;
- the extent, legal vires or value of issuing contravention notices, particularly if as the as-built embodied carbon performance is unlikely to be able to be subsequently rectified to meet a target;
- consideration of application to extensions and alterations and/or how to manage alteration work after initial completion that may result in a poorer embodied carbon performance;
- the collation and management of data submitted (e.g. conventions for categorisation of building types to establish targets) and provisions for a register;
- the value of local data, relative to the dataset that a larger administration, such as England, would provide, (e.g. a wider range of building types would be lodged and available in England); and
- the capacity of district council building control to oversee and manage enforcement of any new requirements.

6B.15 Current resourcing, the local policy remit of adopting policy developments in light of developments in other administrations and the need for a consistent approach, means that the Department expects to co-operate with the other administrations on these issues in its future developments rather than develop a local independent approach.

Question 6B.3 **Have you any opinion or insight on how to address any of the challenges listed? For example, a view on the extent and scope of assessments.**

Question 6B.4 **Do you agree that the intricacies and implications of embodied carbon mean that it is best considered at a UK wide level and that the Department should concentrate efforts on attending to the current gap in standards compared to other regions, in the first instance?**

Developments in other administrations

6B.16 The UK government response to its consultation in 2021 on proposed changes to the Building Regulations for England indicated that DLUHC and BEIS are developing a Statement of Intent that will consider what more

needs to be done by government and industry to deliver net zero buildings by 2050.

6B.17 The Future Homes Hub, set up as part of the Future Homes Task Force, has carried out work to develop an industry-led proposal for reducing embodied and whole-life carbon in new homes. The UK government is noted to be considering regulation in the area, with a consultation due to be published in 2023[170].

6B.18 BEIS and the Infrastructure and Projects Authority (IPA) are "working to develop a common set of metrics to better understand construction performance across government and support organisations in improving delivery performance." [171] This involves the application of UK standards BS EN 15978:2011, BS EN 15804:2012+A2:2019, the RICS Professional Statement: 'Whole Life Carbon Assessment for the Built Environment' and PAS 2080[172] and this will be the subject of the cross Government working group on Government Construction Metrics run by the IPA.

6B.19 The Irish Green Building Council (IGBC) has recently launched a roadmap to decarbonise Ireland's construction and built environment sector[173]. Among its recommendations is a requirement to introduce mandatory Whole Life Carbon measurements for buildings over 2,000m² from 2024 and for all new buildings and large renovations from 2026.

6B.20 The EU Commission's proposals for EPBD 4 , as amended by the EU parliament outlines a mission for national targets and whole life-cycle emissions for different building typologies to be set.

6B.21 Their measures include provisions for the whole life-cycle Global Warming Potential (GWP) emissions to be included on EPCs. At this stage, these measures are initial propositions only and are subject to ongoing development through EU legislative processes. Other aspects of EPBD 4 are outlined in Section 5 and Annex C.

[170] Current Future Homes Hub Project - Embodied and whole-life carbon

[171] Written submission to the Westminster Environmental Audit Committee's report on "Building to net zero: costing carbon in construction",

[172] PAS 2080- Carbon Management in Infrastructure Verification.

[173] https://www.igbc.ie/wp-content/uploads/2022/10/Building-Zero-Carbon-Ireland.pdf

Proposals

6B.22 The Department is supportive of the principle of embodied carbon assessment and wishes to encourage industry upskilling in this area. As an initial step, the Department is open to considering an advisory Information Note or Appendix to Technical Booklets on Part F, with a view to encouraging, but not requiring, embodied carbon assessment. Delivery on this would be dependent on resource and feedback upon this consultation. However due to the scale, complexity and the need for consistency across administrations, we are unlikely to lead independent proposals to regulate embodied carbon at this stage.

Question 6B.5 Would you support the development of an advisory Information Note or Appendix to Technical Booklets on Part F to support embodied carbon assessment?

6B.23 It is expected that the works referenced above being undertaken elsewhere will lead to a clearer level of understanding and wider agreement on the exact nature of the intricacies of calculating carbon emissions and developing an agreed standard approach in this area in due course.

6B.24 The Department will continue to seek to engage in the developments with the other administrations.

Circular Economy

6B.25 LETI and some other campaigns have allied embodied carbon assessment with circular economy principles, suggesting that the move to zero carbon embodied carbon could/should support improved design for dismantling and reuse of components.

6B.26 This approach points to the long-term limits of carbon as the principal metric in whole life assessments, i.e. as production and supply chains increasingly decarbonise the carbon metric becomes less viable. At the extreme, a new product, made solely with renewable energy, would be as equally, or more, worthy than a recycled product or a re-used one initially created using fossil fuels.

6B.27 The recent and ongoing decarbonisation of the electricity grid is one example of how the carbon impacts and considerations can change over time. As the grid itself decarbonises the offset value from photovoltaic panels, for example, is likely to be of less carbon benefit. The same may

apply to decarbonised, recycled or re-used materials if the carbon metric provides the sole criteria for assessment in the longer term.

6B.28 The Department also notes the calls for design for longer lifetimes. The RSUA Climate Action Paper 2023 calls for a 100 year 'built to last' standards for public sector buildings. We would be interested to understand how this, or any other lifetime might be assessed in practice and if/how the longer lifetime might be accepted under RICS embodied carbon assessment methodology.

6B.29 Alternative or additional criteria may be needed to ensure prioritisation of long life cycles as the wider economy decarbonises. This points to requirements for a 'design for dismantling' requirement and percentages of recycled or re-used products within construction works. However, this is also a challenging prospect to regulate for, with many of the issues, such as metrics (e.g. a % value by mass, cost or volume), assessment criteria and supply capacities etc all to be resolved.

6B.30 Finally, the limits of devolved responsibility and capacity set constraints. For example, the Department does not have powers to amend taxation on VAT or otherwise to support re-use of existing buildings over new-build construction. Such interventions may offer more effective solutions.

Question 6B.6 Have you any practical suggestions for how circular economy principles may be best encouraged in construction or, if necessary, regulated for in the future?

Section 6C: Over-sized new homes

6C.1 Build mix and dwelling sizes are principally determined by market drivers, with planning policy being the method by which the development of land and buildings is planned for, managed and controlled.

6C.2 There is clear evidence of a different build mix, (with more houses and fewer flats), and outline evidence of larger new-build dwelling sizes here, compared to other regions of the UK.

6C.3 At present the methodology used for building regulations compliance purposes evaluates performance on a "per m²" basis rather than total consumption or consumption per (likely) occupant. The outcome of this is that there is no penalty for building larger homes with a higher total energy consumption.

6C.4 In practice, there is limited benefit in improving the emissions and energy performance per m^2 if, at the same time, we are creating buildings that are significantly larger than might be necessary.

6C.5 Additionally, it is becoming increasingly important to consider the energy performance of new homes at the earliest design stage as this will allow designers to make informed decisions that will help ensure compliance with building regulations and reduce operational costs for homeowners.

6C.6 Build mix and dwelling sizes and form are principally determined via planning permission stages early in the development process, but energy implications are normally addressed at Building Regulations application stage. At present the metrics used are all related to "per m^2" rather than to total consumption or consumption per (likely) occupant. Building regulations assessments are also compared to a Notional Building emissions rates rather than via absolute metrics ('X' $kgCO_2/m^2$ or 'Y' kWh/m^2) which would be influenced by the 'form factor'[174] of the building (see paragraph 6A.10).

[174] 'Form factor' is the ratio of total envelope area to floor area; a lower form factor implies a more efficient form with lower space heating losses/m^2 floor space. Flats with their relatively limited envelope will tend to have a very low form factor, where as a small standalone house will have a very high form factor.

Current new-build dwelling sizes

6C.7 Belfast's new Local Development Plan (LDP) seeks compliance with the Department for Communities' (DfC) Housing Association Guide (HAG), Design Standards.[175] Comparison with EPC data suggests most new dwellings are reasonably close to the HAG standards, but new detached dwellings tend to be particularly large (see Table 6C.1).

Table 6C.1 Comparison of EPC data with HAG design guide

DWELLING TYPE (examples only, see HAG design guide for further details)	DfC HAG design guide sizes NI (m^2)	Mean average size NI (m^2)
Detached (5 person, 3 bed – 7 person 4 bed)	90-120	188
Semi-detached / end terrace (4 person, 3 bed – 6 person 4 bed)	80-105	103
Mid-terrace (4-5 person 3 bed)	80-95	98
Flat (2 person 1 bed – 4 or 5 person 3 bed)	50-80	70

6C.8 The EPC data would tend to suggest many detached new builds might be significantly larger than reasonable. We are not yet clear if this is a fair reflection of the position but we are keen to receive any evidence to help inform this further.

Question 6C.1 Have you any evidence on new-build dwelling sizes that should be taken into account in future policy making on larger dwellings?

Highlighting energy impacts from larger or less efficient dwelling layouts.

6C.9 We are open to considering how best to highlight the total energy consumption impact of potentially over-sized dwellings. EPCs already provide an assessment of total running costs for heating, hot water, lighting

[175] https://www.belfastcity.gov.uk/getmedia/bba4bd89-157d-4209-8d5e-8a6eb58dd760/PS001-Plan-Strategy-Final-Web-May2023.pdf

https://www.communities-ni.gov.uk/publications/hag-development-guide-design-standards-tables

An alternative standard may be England's Nationally Described Space Standard. https://www.gov.uk/government/publications/technical-housing-standards-nationally-described-space-standard

and ventilation, but this can present as a low figure to consumers, as it currently excludes other unregulated energy uses which also impact bills.

6C.10 One option might be to require developers to notify building owners if a dwelling is larger than the HAG Design Standards by a particular amount (for example 25%). The notification might need to highlight that *the dwelling is significantly larger than might be expected for a typical new-build house with equivalent bed spaces and that it is therefore likely to need more energy than a more spatially efficient solution*. This could be reflected in the EPC assessment outputs and/or at Building Regulations plans assessment stage

6C.11 Another option might be to apply absolute metrics or a form factor assessment to new dwellings. This would encourage more efficient forms, such as flats and terraced homes which could potentially even prevent poorer form factors, such as less compact detached bungalows.

Question 6C.2 Do you believe that action should be taken to better highlight the higher total energy demand for large, less spatially efficient dwellings? If so, how should this be best achieved?

Section 6D: Performance gap

6D.1 There continues to be concern at the differences in Building Regulation and EPC assessments compared with post occupancy performance. In part, this can be due to limitations inherent in the NCM outlined in Section 6A, but design and on-site construction discrepancies are normally major factors also.

6D.2 We would be interested in any local evidence as to how the extent of this issue here compares to other administrations.

6D.3 Improved as-built performance is likely to be desirable and we would be interested in any local evidence of support for actions that may help address perceived performance gaps. Examples of possible further action might include—

- further limitations in the technical guidance to promote oversight by accredited providers (e.g. ductwork or ventilation commissioning and test services, renewables installations, heat balancing etc.);
- additional in-situ testing or verification of performance (e.g. a limited adoption of whole building co-heating testing or thermographic assessments);
- more formalised and 'signed-off' inspections by applicants, energy assessors attesting or third party accreditation on details employed and products used on site;
- oversight of standardised construction details and assurances of as-built details matching designed details assessed at plans application stage (especially thermal bridging);
- additional building control involvement or inspections;
- additional focus or enforcement on specific areas (e.g. thermal bypass through gaps in insulation, or pipework insulation etc)
- greater consideration of local conditions in standardised product testing (e.g. standardised U-value or services performance assessments may not fully recognise the impact of our damper weather).
- application of 'factors of safety' measures or penalties, based on research evidence of performance of similar constructions or systems and how they perform or degrade over time (this would be likely to be an NCM issue).

- amendments to the NCM, such as increased thermal comfort taking where fabric efficiencies are improved.
- measures to accommodate on-site performance measurements to re-assess or challenge the designed or as-built assumptions, for example work with the UK government's SMETERs[176] programme.

Question 6D.1 **Do you have any particularly local evidence on design vs as-built performance gaps?**

Question 6D.2 **Do you have any evidence or insight supporting specific actions to address specific performance gaps in Parts F or K of the Building Regulations?**

[176] Smart Meter Enabled Thermal Efficiency Ratings (SMETER) Innovation Programme - GOV.UK (www.gov.uk)

Annex A Glossary of terms

Airtightness/ Pressure Test	An on-site measurement on completion of construction to measure the airtightness/permeability of the building fabric
ADL1	Approved Document L1- Conservation of fuel and power, volume 1, for dwellings. This is England's technical guidance to Part L and the energy efficiency aspects of it Building Regulations and is of a similar standing to Technical Booklet F1 (Conservation of fuel and power) for dwellings, which applies here. Wales also uses the 'Approved Document' nomenclature for its guidance.
ADL2	Approved Document L1- Conservation of fuel and power, volume 2, for buildings other than dwellings
ADF1 / ADF2	Approved Document F ventilation; volume 1, for dwellings / volume 2, for buildings other than dwellings.
ADS	Approved Document S Infrastructure for the charging of electric vehicles.
BACS	Building Automation Control System
B30K	A fuel blend of 70% kerosene and 30% recycled cooking oil
BER	The Building carbon dioxide Emissions Rate measured in $kgCO_2/m^2/yr$
BRE	Building Research Establishment
CCC	The Climate Change Committee
CIBSE	Chartered Institution of Building Services Engineers
COP	Co-efficient of Performance
CP	Electric Vehicle Charging Point
BPER	The Building Primary Energy Rate measured in $kWh/m^2/yr$
DAERA	NI Department for Agriculture, Environment and Rural Affairs
The Department	NI Department of Finance
DEH	Direct emissions heating (heating where a combustion appliance is used on-site)
DER	The Dwelling carbon dioxide Emissions Rate measured in $kgCO_2/m^2/yr$
DESNZ	UK Department of Energy Security and Net Zero
DfC	NI Department for Communities
DfE	NI Department for the Economy
DLUHC	UK Department of Levelling Up, Housing and Communities
DPER	The Dwelling primary Energy Rate measured in $kWh/m^2/yr$

DSM	Dynamic Simulation Modelling; used for calculating energy ratings in complex buildings other than dwellings currently approved for use in Northern Ireland
EPC	Energy Performance Certificate
EPD	Environmental Product Declaration
EPBD	Energy Performance of Buildings Directive
EUI	Energy Use Intensity
EV	Electric Vehicle
EWI	External Wall Insulation
FAME	Fatty Acid Methyl Ester (biodiesel)
FEES	Fabric Energy Efficiency Standards
G98 / G99	NIE Networks application processes for new grid connections (G98 applies 16amp limits to the export capacity of any renewables fitted and provides a more straightforward assessment)
GWP	Global Warming Potential (usually measured in $kgCO_2/m^2/yr$).
HEPA	High Efficiency Particulate Absorbing filter
HVO	Hydrotreated Vegetable Oil
kWh	Kilo Watt Hour (a unit of energy)
kWp	Kilo Watt Peak (these units communicate the generating capacity from a renewable generating technology if operating at 100% efficacy)
LENI	Lighting Energy Numerical Indicator- a
LPG	Liquefied Petroleum Gas
MEES	Minimum Energy Efficiency Standards
MHCLG	Ministry of Housing, Communities and Local Government
MVHR	Mechanical Ventilation with Heat Recovery
NBHS	New build heat standard (applicable in Scotland), banning DEH
NCM	National Calculation Methodology; the calculation methodology used to assess the energy performance of buildings and implemented using approved editions of relevant software (SAP and SBEM/DSMs)
NIBRAC	Northern Ireland Building Regulations Advisory Committee
NIE Networks	Northern Ireland Electricity Networks
NZEB	Nearly zero-energy buildings
PHI	Passive House Institute
PV	Photovoltaic solar panels
RIA	Regulatory Impact Assessment
RIBA	Royal Institute of British Architects

RICS	Royal institution of Chartered Surveyors
RSUA	Royal Society of Ulster Architects
SAP	The Government's Standard Assessment Procedure for calculating energy ratings in dwellings, currently approved for use in Northern Ireland. The SAP programme is managed by the UK government (BEIS) which consults on the changes made within each new edition. Details of the various SAP editions and methodological changes can be found on the BRE's website at SAP - Standard Assessment Procedure - BRE Group
SAP 2009	Version of SAP currently used for Part F building regulations assessments. Carbon factors in SAP 2009 are outdated and do not reflect recent and ongoing decarbonisation of the electricity grid or other developments.
SAP 2012	Version of SAP used in GB regions for building regulations assessments prior to 2022/23. A reduced version RdSAP2012 is used to produce EPCs for existing dwellings.
SAP 10	Version of SAP used in GB regions for building regulations and on-construction EPC assessments subsequent to building regulations uplifts applicable from 2022. A reduced version 'RdSAP 10' is currently under development.
SAP 11	A new version of SAP. SAP 11 will support England's Future Homes developments, due to be implemented from 2025. As well as then being adopted by other devolved administrations, it may also support the EPC fitness review and other programmes.
SBEM	The Simplified Building Energy Model, used for calculating energy ratings in non-complex buildings other than dwellings currently approved for use in Northern Ireland. SBEM v4 applies in NI, whilst other regions have recently adopted v6.
SMETERs	Smart Meter Enabled Thermal Efficiency Ratings innovation programme under development by DESNZ and BEIS.
SRI	Smart Readiness Indicator
TER	Target carbon dioxide Emission Rate measured in kgCO2/m2/yr
TFA	Total Floor Area- note is limited to the floor areas within the heated (or 'conditioned') and insulated envelope of the building; for example, unheated garages would not be included.
TPER	Target Primary Energy Rate measured in kWh/ m^2/yr
U-value	Measure of heat loss through a construction element, expressed in W/m^2K (the lower the U-value the lower the rate of heat loss)
UVC	Ultraviolet C; a sub-type of ultraviolet light with wavelengths between

	200 – 280 nm
ZEB	Zero Emissions Building

Annex B Preliminary modelling outcomes for a new build house

Scenarios modelled.

B.1 The following Tables B1-B2 below illustrate potential running costs and emissions performance for a typical 104m^2 new-build semi-detached dwelling, for a number of scenarios under current conditions (fuel cost, carbon and primary energy factors).

B.2 Assumptions are inherent in all modelling and figures should be treated as preliminary only (this is particularly the case for Scenario 8). Heat networks have not been modelled as these are given particular consideration elsewhere (see paragraph 3A.89). Further assessment of other dwelling types and on capital cost impacts will be needed in coming phases.

B.3 The scenarios include ─

Scenario 1. An existing 'average' gas-fuelled dwelling, assumed to have a SAP rating of 60D[177].

Scenario 2. A 'gas + 1.5 kWp PV' specification, compliant with the current Part F new-build standards.

Scenario 3. An 'oil + 1.9kWp PV' specification, compliant with the current Part F new-build standards.

B.4 None of the above scenarios would be acceptable under Phase 3 proposals for new-builds.

Scenario 4. A specification based on gas boiler and a PV array to 40% of the roof in line with England's current standards – This provides an 'Option 1' Notional Dwelling specification for Phase 3.

B.5 Conventional heating with boilers using fuels with very high carbon intensities (such as oil) or primary energy intensities (such as wood pellets) were found to be no longer be viable under Option 1, even when additional renewables and ultra efficient fabric standards were used.

B.6 Running costs for gas dwellings were reduced by approximately 30% (based on April 2023 cost assumptions), but there was little or no running

[177] In reality, the average SAP rating of housing would be likely to improve slightly from the current average of 60D under the SAP 10.2 assessment assumptions, but a rating of 60D was maintained.

cost reduction in moving from oil to gas (although there may be some capital and space saving in not requiring a hot water cylinder and oil storage tank).

B.7 Option 1 leads to emissions reductions of some 27% from the current Part F gas complaint specification and 37% from the current Part F oil compliant specification if relatively high carbon fuels are retained (gas or LPG). Additional emissions reductions are possible where the lowest carbon heating solutions, such as a heat pumps or biofuels, are adopted.

Scenario 5. A heat pump led 'Option 2' specification based on England's 'Appendix D', albeit with amended heat pump efficiencies.

B.8 Scenario 5 could be relevant─

a) as a potential 'Option 2' Notional Dwelling specification (noting this would be very challenging to deliver- see paragraph 3A.107); or

b) where a heat pump led solution is adopted under Option 1.

B.9 Scenario 5 would be viable (in terms of emissions and primary energy performance) for most dwelling types and situations under both option 1 and 2, but comes with initial running costs of some £600/y more than scenario 4 and £200-£600 more than the current Part F standard gas or oil solutions. These could be reduced by adding PV panels (saving some £600/yr) and/or additional fabric improvements, similar to the Future Homes fabric noted in Table 3A.3, saving £50-80/year- (see scenario 8).

B.10 Scenario 5 could be deemed to be net-zero ready, as the low emissions it provides will reduce alongside future decarbonisation of the electricity grid. However, it is not yet as 'low-carbon' as might be presumed under SAP assessment, as the local electricity grid is not yet as low carbon as the UK average.

B.11 Whilst capital cost impacts have yet to be assessed, England's Final stage Impact assessment suggested that heat pumps may be a preferred lower capital cost solution for developers than scenario 4, as it avoided mains gas infrastructure supply costs. As such, England anticipated this as the preferred solution to all new-build detached houses.

Scenario 6. An LPG led scenario is modelled as an alternative route to compliance under Option 1, and would be likely to be most used in areas without access to mains gas. This solution would not be viable if Option 2 applied a heat pump led Notional Dwelling due to poorer emissions and primary energy performance.

B.12 This scenario requires additional fabric improvements (similar to the Future Homes fabric alluded to in Table 3A.3) to reduce the amount of LPG consumed, along with PV to 40% of the roof area, in order to pass the emissions requirements under Option 1.

B.13 It is not yet clear if similar solutions would be viable for flats or houses with an efficient form factor, as fabric improvements would have less impact in such dwellings.

B.14 Running costs were in keeping with those of mains gas (scenario 4) helping to address Rural Needs Act concerns.

B.15 Emissions were also similar to scenario 4 (which sets the TER), with any minor differences when adjusted for local characteristics due to the slightly higher proportion of electricity use and monthly impacts.

Scenario 7. A liquid biofuel (e.g. HVO) led option is modelled as an alternative route to compliance under Option 1, and would be likely to be most used in areas without access to mains gas. This solution would not be viable if Option 2 applied a heat pump led Notional Dwelling, due to the primary energy performance.

B.16 This required additional fabric improvements (similar to the Future Homes fabric suggestions in Table 3A.3) along with PV to 40% of the roof area, in order to address their higher primary energy factors in the biofuels.

B.17 Again, it is not yet clear that similar solutions could be adopted to sufficiently reduce the fuel demand in flats or dwellings with a very low form factor.

B.18 Running costs would be close to scenario 5 outcomes (the Option 2 heat pump scenarios), creating a strong incentive for illicit reversion back to home heating oil.

B.19 The large PV array and the very low emissions applied to biofuels would mean these solutions could be viewed as carbon positive (at least as far as the emissions associated with the ‘regulated’ heating, cooling, ventilation, and lighting energy requirements of the building).

Scenario 8. A ‘near zero’ scenario of very high fabric standards, a PV array to 40% of the roof area and a heat pump. This would comply with both Option 1’s and Option 2’s Notional Dwelling performances and is one possible scenario, which might meet net-zero ambitions for 2026/27.

B.20 Outcomes under this scenario come with much greater uncertainties than other scenarios, as the interactions between the PV generation and energy use is critical. **Further, more specialised modelling work would be needed to verify outcomes.**

B.21 Running costs are much lower than current Part F compliant solutions under standard SAP assumptions, but are still close to the current Part F running costs for an oil dwelling when local costs were applied.

B.22 The initial SAP modelling suggests very low (although not carbon positive) emissions outcomes.

B.23 Capital costs and grid connection impacts would need much greater consideration before this would could be embedded as a Notional Dwelling standard that had to be achieved.

General findings

B.24 The tables below illustrate the potential opportunity for significant emissions savings from heat pump led solutions, particularly as the grid decarbonises, but, if solely reliant on the heat pump without PV or further fabric uplifts, this comes with significantly increased running costs and lower SAP ratings than Option 1, given current fuel pricing.

B.25 The abandonment of home heating oil is challenging, as oil is particularly competitively priced currently relative to other options.

Variability in cost and emissions assumptions.

B.26 Discussions in section 3A assume that SAP 10.2 Table 12 cost, carbon and primary energy intensity factors (based on UK average) would apply to all calculations for building regulations compliance and, where applicable, for EPC assessments. Clearly this is not accurate for local purposes, as;

a) local and UK costs are now significantly different from SAP 10.2 Table 12 assumptions, and

b) the local carbon intensity factor for electricity is significantly higher than the SAP 10.2 Table 12 UK average values and could have different monthly profiles, given the different mix in electricity generation here.

B.27 The tables below attempt to offer an overview of the likely outcomes in practice taking our local characteristics into account. They also highlight the deficiencies in adopting an assessment based on UK averages (See Section 6A).

Table B.1- Running costs

B.28 Modelling was carried out using SAP10.2 software, which provides the SAP rating and band for each dwelling using cost data inputs from SAP10.2 Manual, Table 12. These numerical SAP cost calculation, rating scores and A-G bands on Table B1 have not been adjusted[178].

B.29 We have also re-calibrated annual running costs to take account of recent local fuel prices (p/kWh). Electricity was taken to be 30p/kWh standard tariff, gas to be 10.35p/kWh from Consumer Council comparison data from 1st April 2023[179] and exported electricity priced on the current Power NI Export Tariff of 17.66p/kWh.[180] [181] Gas standing charges (applied in SAP 10's normal assumptions) were also dis-applied as they are not as relevant in the NI market.

B.30 LPG prices of 10p/kWh and £60/year standing charge were included in Scenario 6, and HVO price of 18.25p/kWh in Scenario 7 were based on local price quotes.

B.31 An additional 2400 kWh of electricity has been added as an indicative contribution for unregulated energy use.

B.32 The variance highlights the relatively high costs involved in moving to lower carbon heat. It also highlights the difficulty in assessing or relying on

[178] SAP applies different incidental heat gain assumptions for costs and emissions calculations; these have been maintained in the assessment tables.

[179] https://www.consumercouncil.org.uk/policy-research/publications/electricity_price_comparison_table_note- this includes certain Energy Price Guarantee allowances from the UK government, which are unlikely to continue.

[180] this applies to electricity generated on site but exported to the grid. Self-consumed electricity generation is valued at the full 30p/kWh.

[181] SAP ratings are calculated using a gas standing charge of £92/annum and 3.64p/kWh, electricity standard tariff 16.49p/kWh and electricity export 5.59p/kWh electricity standing charges are not included as an electricity connection is not considered optional for new dwellings. Modelled running costs and potential savings costs, printed as a '£/annum' figure on EPCs, use an alternative 'PCDB cost' updated periodically. However, this is also aligned to UK average fuel costs, rather than local costs, and at time of development was complicated by Energy Price Guarantee and other issues.

running costs for longer term policy decision making. The Department will seek to use updated SAP 10 Table 12 costs, if available in future SAP 10 editions; however this is normally a UK-wide policy matter.

black= not viable under Options 1 or Option 2 (provided for comparison)

light green= viable under Option 1 only

darker green= viable under Option 1 and Option 2

Table B.1 modelled annual running costs (£/yr)[(1)], 104m² semi-detached house

RUNNING COSTS (£/yr)	Scenario 1 Typical Existing Build (SAP 60D)- gas boiler	Scenario 2 Current Part F (Gas boiler & 1.51kWp PV System)	Scenario 3 Current Part F (Oil boiler & 1.95 kWp PV System)	Scenario 4 **Option 1 Notional Dwelling** Gas boiler, improved fabric & PV to 40% roof	Scenario 5 **Option 2 Notional Dwelling** ASHP & improved fabric	Scenario 6 LPG boiler, very high fabric & PV to 40% roof	Scenario 7 HVO boiler, very high fabric & PV to 40% roof	Scenario 8 ASHP, very high fabric & PV to 40% roof **[Potential future Notional Dwelling for Phase 4/5?]**
SAP10.2 RATING	**60D**	**90B**	**91B**	**95A**	**84B**	**91B**	**93A**	**96A**
SAP 10.2 regulated running cost used to calculate rating	£1,074	£254	£235	£116	£420	£222	£182	£98
LOCAL RUNNING COST regulated uses only	£2,726	£503	£158	£153	£765	£176	£536	£71
LOCAL RUNNING COST (inc 2400 kWh for 'unregulated' uses)	**£3,446**	**£1,223**	**£878**	**£873**	**£1,485**	**£896**	**£1,256**	**£791**

Notes

(1) Running costs are based on local fuel pricing (see above), however SAP ratings will be based on fixed cost assumptions from Table 12 of the SAP 10.2 methodology. The relative differences between SAP and local assumptions (particularly the much better return for electricity exported to the grid), accounts for the discrepancies between fuel costs and ratings.

(2) Regulated uses include energy associated with heating, cooling, ventilation, and lighting, and include the full benefits of on-site renewable generation. This applies whether the generation is contributing to reductions in the regulated uses, unregulated uses or exporting to the grid. Other energy uses, such as white goods, consumer goods, energy used outside the building (e.g. external lighting), are not included in the SAP rating assessment.[182]

[182] although some assumptions on this are made for incidental heat gains from such uses.

B.33 Option 1 shows an improved running cost performance for gas based new homes (£350 saving under local costs) and no worsening of running costs for oil homes, if they have access to gas and use this fuel instead.

B.34 Option 2's figures show that homes reliant on a heat pump will have significant additional running costs than current Part F solutions, unless the dwelling is fitted with additional measures (see below). Alternative low carbon fuels, such as liquid biofuels might be a possibility under Option 1 for off-gas grid situations, but these also have running cost implications.

Table B.2– Emissions

B.35 Annual emissions ($kgCO_2e/yr$) were calculated using SAP 10.2. This suggests a UK average electricity grid performance of 0.136 $kgCO_2e/kWh$, but also applies adjusted carbon intensity figures to reflect monthly impacts (e.g. a unit of electricity in the winter will typically have a higher carbon impact than during the summer).

B.36 SAP's 0.136 $kgCO_2e/kWh$ average figure is much lower than local performance in recent years which was closer to 0.340 $kgCO_2e/kWh$[183]. Despite a higher renewable contribution than GB, our local electricity is not yet of the low carbon intensity that SAP 10 might imply, due to our local lack of nuclear provision, higher reliance on coal[184] and smaller system.

B.37 Alternative carbon intensity factors, based on recent performance of the NI grid or on RoI's DEAP electricity grid carbon intensity factor,[185] show more realistic, local short-term emissions performance in Table B2. The DEAP assessment of 0.244 kgCO2e/kWh includes forward looking allowances reflecting the anticipated carbon intensity reductions in Ireland's grid out to 2030 and may offer a sensible, if approximate, 'middle ground' for considering medium term emissions outcomes and longer term trajectories[186].

[183] Northern Ireland greenhouse gas inventory 1990 – 2020 statistical bulletin | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk)

[184] noting conversion of Kilroot power station to gas in 2023 should impact this.

[185] DEAP Software & Methodology | Support for BER Assessors | SEAI

[186] GHG emissions per unit of electricity generated reduced 45% from 2004-2020 (631gCO2 / kWh to 347g) in NI

black= not viable under Options 1 or Option 2 (provided for comparison)

light green= viable under Option 1 only

darker green= viable under Option 1 and Option 2

Table B.2 Modelled operational emissions (kg/y); 104m² semi-detached house

EMISSIONS ($kgCO_2e/yr$)	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6		Scenario 7		Scenario 8	
	Typical Existing Build (SAP 60D)- gas boiler		Current Part F (Gas boiler & 1.51kWp PV System)		Current Part F (Oil boiler & 1.95 kWp PV System)		**Option 1 Notional Dwelling** Gas boiler, improved fabric & PV to 40% roof		**Option 2 Notional Dwelling** ASHP & Improved fabric		LPG boiler, very high fabric & PV to 40% roof		HVO boiler. very high fabric & PV to 40% roof		ASHP very high fabric & PV to 40% roof	
	regulated (1)	total (2)	regulated (1)	total (2)	regulated (1)	total (2)	regulated (1)	total (2)	regulated (1)	total (2)	regulated (1)	total (2)	regulated (1)	total (2)	regulated (1)	total (2)
SAP 10 (0.136)	5069	5395	1360	1686	1992	2318	1052	1378	388	714	1052	1378	-88	238	5	331
DEAP (0.244)	5105	5642	1287	1824	1894	2432	823	1361	639	1177	866	1403	-278	260	8	546
NI Estimate (0.340)	5152	5968	1190	2006	1765	2581	521	1337	970	1786	620	1436	-528	288	13	829

(1) Regulated uses include energy associated with, heating, cooling, ventilation, and lighting only. Other energy uses are not included in the SAP assessment.[187]

(2) Total figures allow an estimated 2400kWh for unregulated uses. It is assumed unregulated loads apply equally throughout the year- i.e. no adjustment for monthly variation in use or for carbon intensity fluctuations have been applied to unregulated emissions contributions within the 'total' figure.

[187] although some assumptions on this are made for incidental heat gains from such uses.

B.38 High carbon intensity estimates induce a greater benefit for a PV array, crediting 'offset' production from the PV at the higher value. Even a small PV array's generation surpasses the electrical demand for regulated energy use (heating, cooling, ventilation, and lighting), so the total emissions are seen to be reducing as the carbon factor increases.

B.39 By contrast, using electricity for heat production (such as a heat pump) leads to increasing emissions as the carbon factor is increased. Heat pumps are, therefore, better supported under lower carbon intensity grid scenarios.

B.40 A carbon intensity figure of 0.340 $kgCO_2e/kWh$ (our estimate of the recent performance of the current local grid), shows that Option 2 would have less than half the Year 1 emissions benefits that Option 1 with its photovoltaics, would have. However, Option 2 offers the prospect of ongoing decarbonisation alongside the decarbonisation of the electricity supply over the medium to longer term. Option 2 is therefore more akin to a "zero-carbon ready" specification.

B.41 The difference in emissions performance between Options 1 and 2 reduces under the DEAP assessment, but shows an additional emissions benefit under Option 2's heat pump scenario compared to Option 1.

Monthly impacts

B.42 The more granular monthly assessment, introduced as part of the SAP 10 upgrade, has been applied to the regulated uses only in these comparisons. The general assumption is made that small power will be a largely unaffected by seasonal use[188].

B.43 In terms of regulated uses, we estimate that the monthly assessment under SAP reduces benefits of summer PV generation by roughly 20 kg or so per year and increases the emissions from use of heat pumps (mainly in the winter) by approximately 40 kg/yr. These impacts vary in each circumstance and increase pro-rata with increases in the assumed DEAP and NI carbon intensity factors.

[188] The Department acknowledges this may be incorrect of some aspects, such as tumble drier uses

B.44 This becomes increasingly significant as more technology is adopted and the total regulated emissions reduce. The low emission outcomes in the scenario 8 therefore have a wider sensitivity range and should be treated with caution.

B.45 Smart management and storage could impact this further, particularly if half-hourly impacts were to be considered. There is significantly less certainty and on all figures where both low carbon heating and PV arrays are applied in consequence of this.

Option 2 and potential future improvements.

B.46 The Option 2 specification is largely based on Appendix D of Approved Document L Volume 1. It has no PV array, but specifies a heat pump with space heating and water heating efficiencies of 295% and 195% efficiency when modelled in SAP.[189] Alternative solutions might help address high running costs and improve emissions performance, but will likely increase capital costs. We would be interested in evidence on the appropriate specification for heat pumps, which have been modelled and costed in accordance with the proposed new fabric standards (see question Q3A.21).

B.47 Solely increasing fabric standards to those anticipated for England's Future Homes standards (see Table 3A.2) led to a £50 reduction in Option 2 running costs and brought the SAP rating up to 86B, from the 84B outcome cited in Table B.1.

B.48 Adding a PV system (3.2kWp) over 40% of the roof, in line with Option 1 specification, saved approximately £600 in running costs (using current local pricing). This was the only improvement which brought the heat pump dwelling up to a SAP 'A' band and brings the new home very close to a zero carbon performance standard.

B.49 Capital cost and grid impacts (alongside EV charging) could be significant from these measures, especially if considered alongside EV charging. Scenario 8 is therefore more likely to be a basis for consideration for Part F only in 2026/27 (Phase 4). However, we would be interested in evidence as to whether other incentives such as low carbon mortgages, might stimulate

[189] This is different to Co-efficiency of Performance (CoP) or SCoP.

provision of these extra measures as an extra measure if Option 2 were adopted.

B.50 Further assessment of load management to maximise benefits from potential off-peak tariffs with thermal or electrical storage, has not been considered and would require more expert assessment.

Similarly, grid impacts and outcomes where electrification of heat was not straightforward would need in-depth assessment under any adoption of Option 2.

Annex C: Developments in other regions

C.1 Table C.1 represents a sample of recent and forthcoming policy developments here and in other regions. It is intended to illustrate something of the extent and detail of proposals from other regions, potentially influencing future phased uplifts to the Building Regulations, or building energy performance policy, here.

C.2 Table C.2 outlines the proposed recast of the Energy Performance of Buildings Directive (EPBD 4). It includes both the EU Commission's proposed text from December 2021, and the EU Parliament's subsequent amendments in March 2023. Final measures are still to be agreed under ongoing 'trilogue' engagement. Both the Commission and Parliament proposals are noted, with the intention of highlighting the range of potential outcomes.

C.3 There is no direct UK or local obligation to implement the EPBD 4, but standards adopted through it, may influence developments generally.

C.4 The tables represent the Department's current summary understanding of positions, but come with the caveat that interpretation of texts, particularly legal texts, such as EPBD, require careful consideration in each case. Details on interpretation, including potential exemptions or alternative options for compliance, have not been cited in all cases. Where a precise measure seems particularly relevant, further research to confirm such details or interpretation is advised.

Table C.1 Recent and forthcoming measures in local administrations

DATE	REGION	GREEN = IMPLEMENTED MEASURE BLUE= PROPOSED MEASURE	DISCUSSION DOCUMENT REFERENCE
Apr 2018	England	Boiler Plus Standards take effect. Part L (Conservation of fuel and power) changes to efficiency and controls requirements for boilers in new and existing buildings.	Section 3B
De 2018	GB	Ofgem: Access and Forward-Looking Charges Significant Code Review- launched	
Jan 2019	Ireland	Revised Technical Guidance Document L (Conservation of fuel and energy)- Buildings other than dwellings 2017 takes effect	
Jul 2019	England	Consultation: EV charging infrastructure in residential and non residential buildings- New Part S	Section 3E & 4D
Oct 2019	Ireland	Revised Technical Guidance Document L-dwellings takes effect	
Oct 2019	England	Future Homes and interim steps Consultation Interim Parts F (Ventilation) and L (Conservation of fuel and power) uplifts for dwellings.	Section 3A
Feb 2020	UK	Consultation on ending the sale of new petrol, diesel and hybrid cars and vans- published	
Dec 2020	Scotland	New Build Heat Standard - scoping consultation proposed ban on direct emissions heating from 2024	Section 5
Jan 2021	England	Future Buildings and Interim Steps Consultation Parts F & L, for non-domestic buildings, Part O (Overheating) and second stage of Part L for new dwellings Parts F & L for existing dwellings	Section 4A, 3B, 3C, 3D
Mar 2021	Scotland	Heat Networks (Scotland) Act 2021 includes targets of 3% of 2021 heat demand to be supplied by heat networks by 2027 and 8% by 2030	Section 3A and 4A
Jul 2021	Ireland	Revised Technical Guidance Documents on Part L implements EPBD requirements for EV charging	Section 4D
Jul 2021	UK	Consultation on ending the sale of new petrol, diesel and hybrid cars and vans- Response published with ban on conventional fossil fuelled cars and vans from 2030 and then hybrids from 2035	
Jul 2021	Scotland	Consultation on uplifts building regulations ref energy, ventilation, overheating and EV charging standards	Sections 3 & 4
Oct 2021	N Ireland	Phase 1 Building Regulations- Part F (Conservation of fuel and power) Consultation	Section 2
Oct 2021	England (some UK aspects)	Heat in Building Strategy published	
Oct 2021	Scotland	Heat in Buildings Strategy achieving net zero emissions in Scotland's buildings published	

DATE	REGION	GREEN = IMPLEMENTED MEASURE BLUE= PROPOSED MEASURE	DISCUSSION DOCUMENT REFERENCE
Oct 2021	England	Consultation- Phasing out the installation of fossil fuel heating in homes off the gas gridan end to new fossil fuel heating installations in homes off the gas grid from 2026a 'heat pump first' approach to replacement heating systems in homes off the gas grid from 2026requiring high performing replacement heating systems where heat pumps cannot reasonably practicably be installed	Section 5
Nov 2021	Ireland	Expert Group on Future Skills Needs publication of Skills for Zero Carbon report	
Dec 2021	N Ireland	Northern Ireland Energy Strategy - the Path to Net Zero Energy; published	Section 2A
Dec 2021	EU	Commission publishes proposals for a recast of EPBD (EPBD 4) See Table C.2 for details	Section 5
Feb 2022	Ireland	SEAI publishes National Heat Study with reports which include a call to prioritise low carbon heat roll out over a fabric first ideology; strong support for district heating and electrification of heat.	Section 3A, 3B, 4A, 4B, 5
Mar 2022	Ireland	SOLAS launch- Green Skills for Further Education and Training 2021-30	
May 2022	GB	Ofgem Announces changes to grid charging a greater degree of cost socialisation for grid reinforcement	Section 2A
Jun 2022	N Ireland	Phase 1- Part F uplift to Technical Guidance takes effect	
Jun 2022	England	Interim uplift ref Parts F, L, O & S; takes effect for dwellings and buildings other than dwellings	
Jun 2022	N Ireland	NIE Design Demand Consultation	
Jul 2022	Ireland	Government publishes OPW report phasing out of fossil-fuel heating from public buildings. Recommends that Public sector should not install heating systems in new buildings that use fossil fuels and to restrict leasing of buildings with fossil fuel based heating systems, subject to specified exceptions.	
Oct 2022	Scotland	New Build Heat Standard - consultation part II proposed ban on direct emissions heating from 2024	
Oct 2022	N Ireland	Consultation on changes to planning permitted development rights to protect the environment and help address climate change	Section 3A
Nov 2022	Wales	Uplift to Parts F, L, O & S- takes effect for dwellings	
Dec 2022	GB/UK	Consultation- Improving boiler standard and efficiency proposals to be implemented through GB's Ecodesign regulations new efficiency, controls, and efficiency standards from 2025 hydrogen ready boilers from 2026 explores role of hybrid boilers from 2028	
Feb 2023	Scotland	Building Regulations Section 6 (Energy)- amendments take effect with new Notional dwellings and buildings Section 3 (environment)- new ventilation and overheating requirements	Sections 3&4

DATE	REGION	GREEN = IMPLEMENTED MEASURE BLUE= PROPOSED MEASURE	DISCUSSION DOCUMENT REFERENCE
Mar 2023	EU	EU Parliament amends EU Commission proposals for a recast of EPBD (EPBD 4) See Table C.2 for details	Section 5
Mar 2023	Wales	Parts F, L & S take effect for buildings other than dwellings	Section 4
Apr 2023	GB	Ofgem changes to grid charging take effect	
Apr 2023	Ireland	Met Eireann publish climate maps and weather files for use in building design to enhance resilience in support of climate change adaptation	Section 3D. 5, 6
Jul 2023	N Ireland	Phase 2- Discussion Document publication	
Jun 2023	England	Future Homes & Future Buildings consultations- due for publication	
late 2023?	EU	Recast Energy Performance of Buildings Directive (EPBD 4)- anticipated publication	
Jun 2023	Scotland	Electric vehicle charging- new standard 7.2 requirements to come into operation	
Nov 2023	Wales	Publication of consultation in line with or beyond England's Future Homes & Future Buildings	
Dec 2023	Ireland	Heat and Built Environment Delivery Taskforce to publish a detailed roadmap for electrification of heat with heat pumps as the main heating system in new dwellings	
2023	Scotland	New EPC Format proposals anticipated, with reviewed metrics Running cost rating Environmental Impact (CO2) rating; and Delivered energy rating (kWh/m2)	
2023	Scotland	Publication of Bioenergy Action Plan	
2023	UK	Consultation on embodied carbon in materials	Section 6B
2023	Ireland	Department of Enterprise Trade and Employment to Government publish a report on actions to decrease embodied carbon in the whole life-cycle of construction materials	Section 6B
Late 2023 / Early 2024	N Ireland	Consultation on Phase 3 uplift to Building Regulations	
Apr 2024	Scotland	Ban on direct emissions heating in new buildings takes effect	
Q3 2024	England	Government Response to Future Homes/Future Buildings Consultation very high fabric standards and an anticipated end of fossil fuel boilers in new buildings in England	
Q3/4 2024	N Ireland	Phase 3 uplift to Building Regulations to take effect	
2025	England	Future Homes & Future Buildings Standards- takes effect subsequent uplifts are likely in Wales 6-9 months later	
2025	Scotland	Uplift to building regulations and equivalence to Passive House standard- to take effect	
Q1 2025	Ireland	Building Regulations update taking count of 2023 Cost-Optimal analysis- to take effect	
2025	N Ireland	Phase 4 uplift to Building Regulations- Consultation (timing dependent on publication of Gov response to Future Homes/Buildings Consultation)	
2025	GB/UK	Ecodesign regulations uplifting boiler standards to take effect	

DATE	REGION	GREEN = IMPLEMENTED MEASURE BLUE= PROPOSED MEASURE	DISCUSSION DOCUMENT REFERENCE
2026	GB/UK	Ecodesign regulations Gas boilers to be 'hydrogen ready'	
2026	England	Phasing out of fossil fuel heating in homes off the gas grid measures to take effect to implement a heat pump led approach to boiler/heating replacements in off-gas grid areas.	
2028	GB/UK	Ecodesign regulations a hybrid heat pump approach considered for new boiler standards	
2030	N Ireland	CCC recommendation that new heating appliances should be zero carbon for areas off the gas grid	
2030	EU Commission	All new buildings to be zero-emission buildings (EU parliament wishes to bring this date forward to 2028)	
2030	UK	Proposed ban on the sale of new fully petrol and diesel cars and vans	
2035	UK	Ban on new hybrid cars- UK Government proposal for all new cars and vans to be fully zero emission at the tailpipe	
2035	EU	Ban on petrol/diesel/hybrid cars- All new cars that come on the market cannot emit any CO2	
2035	UK	End the sale of new and replacement natural gas only boilers	

Table C.2 Outline summary of EPBD 4 proposals (not applicable to UK)

PROPOSED DATE OF APPLICATION (EU COMMISSION / *EU PARLIAMENT)*	EU COMMISSION PROPOSALS (DEC 2021) FOR RECAST OF EPBD (EPBD 4)- COM(2021) 802 & *EU PARLIAMENT (EUP) AMENDMENTS (MAR 2023)- P9_TA(2023)0068 - (IN ITALICS)* BLUE= Building Regulations (had UK remained in the EU) GREEN=EPB Regulations or other legislation (had UK remained in the EU)	ARTICLE REFERENCE	DISCUSSION DOCUMENT REFERENCE
	a new zero-emissions building (ZEB) standard is defined as a building with a very high energy performance... where the very low amount of energy still required is fully covered by energy from renewable sources generated on-site, from a renewable energy community ...or from a district heating and cooling system...	Art 2	Section 3A. 4A, 5, 6A
Jun 2024	submit draft national renovation plans to ensure building stock is decarbonised to ZEB standard by 2050, with interim 2030 and 2040 targets — *EUP amendments provide greater consideration on historic construction, vulnerable households, skills action plan, whole life cycle assessment ,materials availability and sufficiency assessment, with involvement of local authorities and integrated district approaches in national building renovation plans*	Art 3	
	changes to energy assessment methodology	Art 4	Section 3A. 4A, 5, 6A
	changes to cost-optimal methodology used to verify building regulations requirements cost-optimal assessment *to take life cycle GWP into account*	Art 6	Section 3A. 4A, 6B
	EUP provide a greater emphasis on demand response, energy storage and demand management in all of the above		Section 3A, 4A, 5
Jan 2027 *(2026)*	all new public authority buildings to be ZEBs	Art 7	
Jan 2030 *(2028)*	all new buildings to be ZEBs	Art 7	Section 3A. 4A, 5, 6A
Jan 2027	life-cycle Global Warming Potential (GWP) recorded and displayed on EPCs for new buildings >2000m^2	Art 7	Section 6B
Jan 2030 *(2027)*	life-cycle GWP recorded and displayed on EPCs for all new buildings	Art 7	Section 6B
Jan 2030	*life-cycle GWP targets required for all new buildings*	Art 7	Section 6B
	ban on conventional (i.e. non-hybrid) fossil fuel installations in new builds, deep renovations, major renovations and renewal of a heating system from the entry into force of the directive	*Art 7/8*	Section 3A, 3B, 4A, 4B, 5, 6
	requirement to consider wider risks are extended to include adaptation to climate change and accessibility where carrying out work to existing buildings	Art 8	Section 3D
Jan 2027	all existing non-residential buildings to achieve minimum EPC rating of F *(E under EUP amendment)*	Art 9	

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Jan 2030	all existing non-residential buildings to achieve minimum EPC rating of E *(D under EUP amendment)* and residential buildings a rating of F *(E under EUP amendment)*	Art 9	
Jan 2030	all existing residential buildings to achieve minimum EPC rating of E *(D under EUP amendment)*	Art 9	
	note- these are backstop provisions in addition to national renovation plan measures for 2030 and 2040 targets		
	ensure deployment of solar energy installations on all new non-residential buildings from coming into operation of directive	*Art 9a*	Section 3A, 4A, 5
Dec 2026	*ensure deployment of solar energy installations on all existing non-residential buildings*	*Art 9a*	
Dec 2028	*ensure deployment of solar energy installations on all new residential buildings and roofed car parks*	*Art 9a*	Section 3A, 4A, 5
Dec 2032	*ensure deployment of solar energy installations on all major renovations*	*Art 9a*	Section 3B, 4B, 5
	a simple notification procedure to be sufficient for solar installations of <50kWp	*Art 9a*	
Dec 2023	Commission to establish a framework for building renovation passports *to include information on GWP, circularity, bill of materials, wider health and comfort benefits and improved adaptive capacity of the building to climate change for renovation measures*	Art 10	Section 3D, 5 and 6
Dec 2024	introduce a building renovation passport regime in line with Commission framework	Art 10	
	devices for indoor air quality monitoring and regulation to be installed in ZEBs and buildings undergoing major renovation *EUP adds emphasis on hydronic balancing and extend the requirements to existing public buildings and all new buildings*	Art 11	Section 3B, 3C, 4B, 4C
	EUP requires environmental quality assessment to include CO_2, humidity, temperature, ventilation rates, and acoustic performances	*Art 11a*	
	EV charging provisions applied to non-residential building car parks with more than 5 (rather than 10) spaces in new builds and major renovations *EUP changes provision from "at least one charge-point" to at least one for every five parking spaces and provides scope for local authority re-assessment taking local conditions into account.*	Art 12	Section 3E, 4D
	a cycle parking space to be provided for every parking space in new builds and major renovations *EUP changes this to provide for an assumption of 15% of building user. Cycle parking to take non-standard cycles into account.*	Art 12	Section 3E, 4D

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Jan 2025	Commission to publish guidelines specifying the standards and protocol to be recommended to national and local public authorities for fire safety in roofed car parks.	Art 12	Section 3E, 4D
Jan 2027	existing parking with >20 spaces (or 10, if technically feasible) at all non-residential buildings to install a charge point for every 10 parking spaces and cycle parking for every space	Art 12	
Jan 2033	existing parking at public authority buildings to be fitted with pre-cabling to half of all spaces	Art 12	
	two cycle parking space to be provided for every new or majorly refurbished residential building, where it has >3 parking spaces	Art 12	Section 3E, 4D
	EV charging provisions applied to residential building car parks with more than 3 (rather than 10) spaces in new builds and major renovations	Art 12	Section 3E, 4D
	charging points to be smart capable and, where appropriate, capable of bi-directional charging	Art 12	
	remove barriers to the installation of charge-points in residential buildings, including any need to obtain landlord permissions	Art 12	
Dec 2025 Dec 2024	Commission to adopt the Smart Readiness Indicator methodology for buildings with systems >290kW EUP amendment removes the 290kW limit	Art 13	EPB regs
Jan 2030	EUP amendments make adoption of SRI mandatory for non-residential buildings with system >70kW	Art 13	EPB regs
	building data access amendments	Art 14	EPB regs
	adopt measures to ensure that energy efficiency finance and lending products for building renovations are offered widely	Art 15	
	ensure the establishment of technical assistance facilities, including through one-stop-shops,	Art 15	
	EUP requires one-stop shops offering financial and technical advice at a rate of no less than one per 45,000 inhabitants and defines how they should operate	Art 15a	
	put in place measures and financing to promote education and training to ensure that there is a sufficient workforce with the appropriate level of skills corresponding to the needs in the building sector	Art 15	
Jan 2027 Jan 2024	removal of state aid for boilers using fossil fuels EUP amends this to Jan 2024	Art 15	
	incentivise deep renovation and sizeable programmes that address a high number of buildings with higher financial, fiscal, administrative and technical support EUP amendment emphasises need for sufficiency and circularity considerations in finance measures		

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Dec 2025	EPC A-G ratings to be communicated in primary energy. Recalibrate such that 'G' rating to equates to bottom performing 15% of buildings, 'A' to equate to new ZEB standard. EUP adds further rating a final energy use metric (kWh/m^2.y) as well as other numerical indicators– total annual energy consumption (kWh/year), annual energy needs for heating, cooling, ventilation and hot water, energy consumption per square metre per year (kWh/m^2.y), annual non-renewable primary energy use in kWh/m^2.y, and final energy for heating, cooling, domestic hot water, ventilation, built-in lighting and other building services.	Art 16	EPB regs
	EUP introduces an A+ rating where energy needs for heating, cooling, ventilation and hot water are ≤15 kWh/m^2/year, higher production of kWh renewable energy on-site, based on a monthly average and carbon positivity regarding the building's life-cycle GWP are all achieved	Art 16	EPB regs
	Commission to develop a tool for energy metering to strengthen EPCs with real time management	Art 16	
	revisions to EPC recommendations to cover (a) individual elements or services and (b) major renovation initiatives	Art 16	EPB regs
	EPC to be issued when a major renovation occurs EUP additionally requires issue of an EPC if a mortgage is refinanced	Art 17	EPB regs
	EPCs to be displayed in all public buildings (current 250m^2 threshold removed)	Art 18	EPB regs
	revised access provisions to EPC register databases EUP notes database is to be interoperable with other public databases	Art 19	EPB regs
	data uploads to the register to include all necessary data required for the calculation of the energy performance of the building	Art 19	EPB regs
Dec 2024	databases to be operable with EU Building Stock Observatory, and capable of real-time updates		EPB regs
	additional ventilation inspection regime required alongside air-conditioning and heating inspections (or an equivalent measures approach may be adopted)	Art 20	EPB regs
Dec 2029	building automation controls to be applied retrospectively to existing non-residential buildings with heating, ventilation, or air-conditioning systems of >70kW	Art 20	
Jan 2025	all new residential buildings and those undergoing a major renovation are to be fitted with continuous energy monitoring systems from Jan 2025	Art 20	Sections 3A, 3B, 5
	an ongoing public awareness campaign promoting renovation information required	Art 26	

Annex D: Non-domestic Notional Building Specifications; England Scotland and Wales

D.1 Full Notional Building specifications are provided in the relevant section of the NCM modelling guides for each administration as hosted by BRE NCM website[190]. The discussion below outlines their principal differences only. The differences seem tailored to suit the particular build mix in the different administrations in order to achieve desired emissions reductions, taking each particular stock profile into account.

Building fabric (U-values, psi-values, air permeability and glazing)

D.2 There are some differences between the Notional Building fabric specification for side-lit buildings, with Wales generally having less onerous U-value requirements. For example, Wales's Notional Building has U-values of 0.22 W/m^{2}K for walls compared to 0.18 W/m^{2}K and 0.15 W/m^{2}K for similar walls in England and Scotland respectively.

Table D.1 Principal Notional Building Fabric U-Values

SIDE-LIT NOTIONAL BUILDING ELEMENT TYPE	ENGLAND (JUNE 2022)	WALES (MARCH 2023)	SCOTLAND (MARCH 2023)
External Wall	0.18	0.22 (0.26)(1)	0.15
Floor	0.15	0.22	0.13
Roof	0.15	0.18	0.11
Windows, roof windows & glazed doors	1.4	1.6	1.2
Internal Wall	1.8	1.8	0.48
Air Permeability	5.0 @ 50 Pa	5.0 @ 50 Pa	5.0 @ 50 Pa

(1) 0.26 W/m^{2}K applies if building is cooled

D.3 Where mechanical cooling is provided, Wales has a higher U-value for walls at 0.26 W/m^{2}K in side-lit buildings, whereas no such easement is provided in England or Scotland.

D.4 Internal wall U- values (between zones) are lower under Scotland's methodology (0.48 W/m^{2}K, rather than 1.8 W/m^{2}K under England and Wales), but this may be balanced in some circumstances with an allowance for internal windows (3.85 W/m^{2}K) applied.

[190] NCM (uk-ncm.org.uk)

D.5 U-values for top-lit metal clad construction is reasonably consistent across administrations (Walls: 0.26 W/m^2K, Floor 0.22 W/m^2K Roof 0.18W/m^2K, Rooflights 2.1 W/m^2K), however there is some difference in the air permeability assumptions.

D.6 Psi-values for thermal bridging loses are consistent across the administrations' Notional Buildings

D.7 In terms of air permeability, England uses a value of 3m^3/m^2.h @50 Pa and 5 m^3/m^2.h @50 Pa for side and top lit buildings respectively. Scotland applies a value of 4 m^3/m^2.h @50 Pa to all building types. Wales applies similar values to England for large buildings, but eases this to 5 m^3/m^2.h @50 Pa on side lit buildings of ≤250m^2 floor area, whilst tightening the requirement to 3m^3/m^2.h @50 Pa on very large top lit buildings >10000m^2.

D.8 The anticipated extent of glazing applied to the Notional Building is the same in all administrations , with no change to current practice of 40% of the façade wall glazed in side lit buildings (up to a maximum of 1.5m in height per floor) and 12% of roof areas glazed in top lit buildings.[191]

D.9 However the specification of the glass now varies, with solar gain g-values in side lit buildings ranging from 29% in England to 40% in Wales and 55% in Scotland. Light transmittance specifications also vary accordingly. The lower g-value in England represents a lowering from previous Notional Building expectations and rebalances the focus to reduce cooling loads rather than benefitting from solar gain to reduce heat demand.

Table D.2 Glazing values

GLAZING NOTIONAL BUILDING	ENGLAND (JUNE 2022)	WALES (MARCH 2023) (as England prior to June 2022)	SCOTLAND (MARCH 2023)
Side lit g-value	29%	40%	50%
Side lit light transmittance	60%	71%	77%
Top lit g-value	40%	55%	52%
Top lit light transmittance	71%	60%	57%

D.10 Different glazing assumptions are presumed for checks to ensure solar gains are limited. These are detailed in the relative sections in each administration's NCM modelling guide and apply benchmark checks based

[191] These assumptions are different where the assessment is checking solar gain limits- see the relevant NCM Modelling Guide

on the Activity Database of the use[192]. England's latest uplift included a lowering of the g-values used in these checks from 0.68, 0.68 and 0.46 for the relevant benchmark situations 1[193],2[194], and 3[195] in 2013, to 0.48, 0.48 and 0.42 in 2022. Scotland's new NCM guide appears to have adopted the same new values in line with England while Wales has applied g-values of 0.48, 0.55 and 0.46. The new lower values apply a lower level of acceptable solar gain assessed over the period April - September only.

D.11 The extent of glass for the solar gain limits has remained the same, except in the case of 'benchmark 3', which applies top lit glazing at a rate of 10% of the projected floor area, rather than the previous 20% value. This benchmark applied to spaces taller than 6m without exposed facades. The change was applied in all regions. The NCM modelling guide provides detail on this, if needed.

Building services (space heating, water heating, lighting, on-site electrical generation, and ventilation)

D.12 The latest uplifts in GB have altered the previous assumption that the fuel use in the Notional Building should be the same as the actual fuels proposed. This change has a similar effect to the removal of 'fuel factors' previously applied in the guidance to dwellings when calculating the TER. The intention is to ensure that the impact of fuels with higher emission factors, such as oil and coal, should no longer be facilitated with commensurately higher emissions targets. Each of the administrations has taken their own approach to specific details on this however.

D.13 Wales has the most straightforward requirement with all fuels compared to a 86% SCoP boiler with natural gas for space heating requirements.

D.14 Scotland has taken a similar approach for most situations, but has set a SCoP of 91% for the comparative gas boiler. The exception is electrical heat pumps where an electrical heat pump is specified with a SCoP of 300% for space heating if a heat pump is proposed in the Actual Building.

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[192] See paragraphs 128-138 of England's NCM Modelling Guide for detail.

[193] façade glazing assumption

[194] para 136 of England's NCM guide suggests this is applied to spaces with no direct façade (i.e. internal areas that receive second hand solar)

[195] top-lit/unlit zones at 3 and 6m height respectively- see NCM modelling guide for detail

Presumably this is to ensure that solutions using a heat pump are not able to so exceed the targets that other aspects of performance could be unduly compromised.

D.15 England has set requirements such that buildings using fuels with carbon emissions factors worse than gas have to be measured against the mains gas fuelled building with a boiler of SCoP 86%. However their guide sets outcomes for other situations where the emissions factor for the fuel used is lower than gas. These are intended to reflect good/typical practice where such fuels are proposed.

D.16 For example, if the proposed fuel is a bio-fuel or waste heat, the comparative Notional Building is presumed to be heated with the same fuel as the Actual Building with a SCoP of 63%. If an electrical heat pump is proposed, the Notional Building is also presumed to use a heat pump, but a SCoP of 264% is specified. Further detail can be found in Table 7 of the relevant NCM Modelling Guide. This means that in the non-domestic sector, biofuels will not be restricted in the same way as occurs in the primary energy assessment for new dwellings.

Where district heating is proposed, England has proposed the same principle to that of domestic assessment should apply i.e. where the connection is to an existing heat network, the performance characteristics of that specific network can be applied to both the Notional and Actual buildings equally.

D.17 Where the heat network is new, the Notional building will use 0.23 $kgCO_2/kWh$ as the emission factor of heat delivered[196][197]. By contrast Wales and Scotland compare Notional Buildings to natural gas when connection to a heat network is proposed.

D.18 In all administrations, hot water assessment has been reformed so that buildings are assigned a High or Low hot water demand, based on Activity Class (high≥200 $l/m^2/y$). High demands are expected to be met with the principal heating fuel centralised system, whilst a low demand is modelled to be provided through direct point of use electric heating. The different

[196] These conversion factors represent a district heating network supplied by a gas-fired CHP with an electrical efficiency of 30% and a heat efficiency of 50%, supplying 80% of the heating load, with the remaining 20% assumed to be supplied by an electric heat pump with an efficiency of 264% (and a 15% uplift applied to the CO_2 content of heat to account for network heat losses).

[197] Primary Energy factors based on the above formula were removed in a 2023 amendment to the ADL2 guidance.

administrations have made slightly different assumptions on the expected efficiency of the high demand heating, on similar principles to the SCoPs and fuel types used for space heating. The Activity Database hot water demand assumptions have been amended in parts, and the anticipated demands in schools, in particular, have been reduced.

D.19 The NCM guides appear to be consistent on the auxiliary power and lighting requirements for the Notional Building. Lighting with an efficacy of 95 luminaire lumens/ circuit Watt is specified, which is a substantial improvement from the previous level of 60 luminaire lumens/ Watt in England's 2013 Notional Building and much higher than the 2010 guide applicable here. The 95 luminaire lumens/ circuit Watt applies as a new limiting service standard, for both new build and where lighting is part of the work done to an existing building.

D.20 There are additional expectations for on-site renewable electrical generation for Notional Buildings. England has set requirements based on foundation area (a proxy for roof area) such that the side lit Notional Building has 20% of the roof area provided with photovoltaic arrays whilst top-lit zones are provided at a rate of 40%.

D.21 Wales has similar provisions but sets the expectation on the basis gross floor area (GFA) such that 10% of the GFA should be provided with PV arrays, up to a maximum of 50% of the roof area. Scotland uses the same approach, but with a 15% GFA application subject to a 30% roof area maximum limit. In all regions, the PV arrays are expected to be provided facing south on a 30° pitch with a $0.2kW_p/m^2$ peak efficiency. These variabilities and the relative build mix variations influence the overall percentage carbon reductions reported in each region.

Annex E: Proposed limiting services efficiencies for non-domestic buildings (Phase 3)

Table E.1: Recommended minimum energy efficiency standards for building services [figures in square brackets show current provisions, applicable in NI since June 2022]			
Gas, oil and biomass-fired boilers: New buildings		**Seasonal efficiency (gross calorific value)**	
Natural gas	Single boiler ≤ 2 MW output	93% [91%]	
	Single boiler > 2 MW output	88% [86%]	
	Multiple-boiler system	88% for any individual boiler 93% for overall multi-boiler system [82%/86%]	
LPG	Single boiler ≤ 2 MW output	93% [93%]	
	Single boiler > 2 MW output	88% [87%]	
	Multiple-boiler system	88% for any individual boiler 93% for overall multi-boiler system [82%/87%]	
Oil	Single boiler system	93% [84%]	
	Multiple-boiler system	88% for any individual boiler 93% for overall multi-boiler system [82%/84%]	
Biomass – independent, automatic, pellet/ woodchip		75% [75%]	
Biomass - independent gravity-fed boilers < 20.5 kW		65%	
Gas, oil and biomass-fired boilers: Existing buildings		Seasonal efficiency (gross calorific value)	
Natural gas	Single boiler system ≤ 400 kW output	91% [82%]	
	Single boiler 401 kW to 2 MW	88% [82%]	
	Single boiler system ≤ 2 MW output	84% [82%]	
	Multiple-boiler system	84% for any individual boiler 91% for overall multi-boiler system [82%]	
LPG		As new buildings [83%]	
Oil		As new buildings [84%]	
Biomass – independent, automatic, pellet/ woodchip		75% [75%]	
Biomass - independent gravity-fed boilers < 20.5 kW		65% [n/a]	
Heat pump type		Minimum COP (BS EN 14511-2)	
All types (except air-to-air with output ≤ 12 kW, absorption, and gas-engine) for space heating		2.5 [2.5]	
All types (except absorption and gas-engine) for domestic hot water heating		2.0 [2.0]	
Absorption		0.5 [0.5]	
Gas-engine		1.0 [1.0]	
Gas and oil-fired warm air systems		Heat generator seasonal efficiency (net calorific value)	
Gas-fired forced convection		91% [91%]	
Direct gas-fired forced convection		100% [100%]	
Oil-fired forced convection		91% [91%]	
Radiant heaters		Heat generator seasonal efficiency	
		Thermal	Radiant
Luminous radiant heater (unflued)		86% [86%]	55% [55%]
Non-luminous radiant heater (unflued)		86% [86%]	55% [55%]
Non-luminous radiant heater (flued)		86% [86%]	55% [55%]

Table E.1: Recommended minimum energy efficiency standards for building services [figures in square brackets show current provisions, applicable in NI since June 2022]			
Multi-burner radiant heater		91% [91%]	N/A
CHP		CHPQA quality index	Power efficiency
All types		105 [105]	20% [20%]
Electric (primary) heating		Seasonal efficiency	
Boiler and warm air		N/A	
DHW system type	Fuel type	Heat generator seasonal efficiency (gross)	
Direct-fired circulator	Natural gas > 30 kW output	91% [90% (73% in existing buildings)]	
	Natural gas ≤ 30 kW output	91% [73%]	
	LPG > 30 kW output	92% [92% (74% in existing buildings]	
	LPG < 30 kW output	92% [74%]	
	Oil	91% [76% (75% in existing buildings)]	
Indirect-fired circulator	Natural gas	91% (boiler efficiency) [80%]	
	LPG	91% (boiler efficiency) [81%]	
	Oil	91% (boiler efficiency) [82%]	
Electrically-heated		assumed 100% thermally efficient	
Comfort cooling systems		Cooling unit SEER [current guidance is measured in terms of EER]	
Packaged air conditioners	Single duct type	3.0 [2.6]	
	Other types	3.0 [2.6]	
Split and multi-split air conditioners > 12 kW		5.0 [2.6]	
Split and multi-split air conditioners ≤ 12 kW		5.0 [SCOP 'D' rating for median temp range in EN 14825]	
Variable refrigerant flow/volume systems2		5.0 [2.6]	
Water-to-water chillers < 400 kW		5.0 [3.9]	
Water-to-water chillers 400 - 1500 kW		6.0 [3.9 where <750kW, 4.7>750kW]	
Water-to-water chillers ≥ 1500 kW		6.5 [4.7]	
Vapour compression cycle chillers, air-cooled < 400 kW		4.0 [2.55]	
Vapour compression cycle chillers, air-cooled ≥ 400 kW		4.5 [2.55 where <750kW, 2.7>750kW]	
Absorption cycle chillers		EER 0.7 [0.7]	
Gas-engine-driven variable refrigerant flow		1.6 [1.0]	
Air distribution systems		Maximum SFP (W/(l/s)) -additions may apply- see Table 6.2 ADL2) -allowances now include allowances for heat recovery filters in relevant systems	
		New buildings	Existing buildings
Central balanced mechanical ventilation system with heating and cooling		2.0 [1.6]	2.6 [2.2]
Central balanced mechanical ventilation system with heating only		1.9 [1.5]	2.2 [1.8]
All other central balanced mechanical ventilation systems		1.5 [1.1]	2.0 [1.6]
Zonal supply system where fan is remote from zone, such as ceiling void or roof mounted units		1.1 [1.1]	1.4 [1.4]
Zonal extract system where fan is remote from zone		0.5 [0.5]	0.5 [0.5]

Table E.1: Recommended minimum energy efficiency standards for building services [figures in square brackets show current provisions, applicable in NI since June 2022]		
Zonal supply and extract ventilation units, such as ceiling void or roof units serving single room or zone with heating and heat recovery	2.3 [1.9]	2.3 [1.9]
Local balanced supply and extract ventilation system such as wall/ roof units serving single area with heat recovery	2.0 [1.6]	2.0 [1.6]
Local supply or extract ventilation units such as window/ wall/ roof units serving single area (e.g. toilet extract)	0.3 [0.3]	0.4 [0.4]
Other local ventilation supply or extract units	0.5 [0.5]	0.5 [0.5]
Fan assisted terminal Variable Air Volume	0.5 [1.1]	0.5 [1.1]
Fan coil unit (rating weighted average)	0.3 [0.5]	0.3 [0.5]
Kitchen extract, fan remote from zone with grease filter	1.0 [1.0]	1.0 [1.0]
Heat exchanger type	Dry heat recovery efficiency	
Plate heat exchanger	50% [50%]	
Heat pipes	60% [60%]	
Thermal wheel	65% [65%]	
Run around coil	45% [45%]	
Internal lighting	Effective lighting efficacy	
General lighting (minimum efficacy)	95 [60] luminaire lumens per circuit-watt	
Display lighting (minimum efficacy)	22 [22] lamp lumens per circuit-watt	
Lighting system (LENI calculation)	≤ lighting energy limit (kWh/m2/year) specified in Table 28	
Building Automation and Control Systems	Minimum provision	
Installed systems	BS EN 15232 Class A Rated type system	

Annex F: Ventilation in non-domestic buildings other than offices and car parks.

Table F.1 Ventilation for buildings other than offices and car parks	
Building/space/ activity	Regulations and guidance (also see CIBSE's Guide A and Appendices D and E)
Animal rooms	CIBSE Guide B2 Ventilation and Ductwork (2016) Code of Practice for the Housing and Care of Animals Bred, Supplied or Used for Scientific Purposes (Home Office, 2014)
Building services plant rooms	Dangerous Substances and Explosive Atmospheres Regulations 2002 Provision for emergency ventilation to control dispersal of contaminating gas releases (e.g. refrigerant leak) is given in paragraphs 23 to 25 of HSE Guidance Note HSG 202 General Ventilation in the Workplace – Guidance for Employers. BS EN 378-3 Refrigerating systems and heat pumps. Safety and environmental requirements – Installation site and personal protection Follow manufacturers' guidance for adequate provision of air for service equipment.
Catering and commercial kitchens	HSE Catering Information Sheet No. 10: Ventilation in catering kitchens (2017) BESA DW 172 Specification for Kitchen Ventilation Systems (2018) CIBSE Guide B2 Ventilation and Ductwork (2016)
Cleanrooms	CIBSE Guide B2 Ventilation and Ductwork (2016)
Common spaces(1)	Either: a. natural ventilation by appropriately located ventilation opening(s) with a total opening area of at least 1/50 of the floor area of the common space b. mechanical ventilation installed to provide a supply of fresh air of 0.5 litres per second per m^2 of floor area.
Data centres	CIBSE Guide B2 Ventilation and Ductwork (2016)
Dealing rooms	CIBSE Guide B2 Ventilation and Ductwork (2016)
Factories and workshops	Control of Substances Hazardous to Health (COSHH) Regulations 2002 Factories Act 1961 Health and Safety at Work etc. Act 1974 BESA TR 40 Guide to Good Practice for Local Exhaust Ventilation (2020) CIBSE Guide B2 Ventilation and Ductwork (2016) NOTE: Requirements are often exceeded by other criteria, such as the ventilation requirements of the particular manufacturing process.
Farms	Welfare of Farmed Animals (England) Regulations 2007 BS 5502 Buildings and structures for agriculture
Gymnasiums	Sport England Design Guidance Note: Fitness and Exercise Spaces (2008)
Healthcare buildings: non- surgical	CIBSE Guide B2 Ventilation and Ductwork (2016) NHS Activity DataBase Health Technical Memorandum (HTM) 03-01 (Department of Health) Health Building Notes (HBN) – various (Department of Health)
Hospitals	CIBSE Guide B2 Ventilation and Ductwork (2016) NHS Activity DataBase Health Technical Memorandum (HTM) 03-01 (Department of Health) Health Building Notes (HBN) – various (Department of Health)
Hotels	CIBSE Guide B2 Ventilation and Ductwork (2016)
Industrial ventilation	Industrial Ventilation: A Manual of Recommended Practice for Design (American Conference of Government Industrial Hygienists, 2019) Industrial Ventilation: A Manual of Recommended Practice for Operation and Maintenance (American Conference of Government Industrial Hygienists, 2020) HSG 258 Controlling Airborne Contaminants at Work (HSE, 2017)
Museums, libraries and art galleries	BS 4971 Conservation and care of archive and library collections BS EN 16893 Conservation of Cultural Heritage. Specifications for location, construction and modification of buildings or rooms intended for the storage or use of heritage collections

Table F.1 Ventilation for buildings other than offices and car parks	
Building/space/ activity	Regulations and guidance (also see CIBSE's Guide A and Appendices D and E)
Places of assembly	CIBSE Guide B2 Ventilation and Ductwork (2016)
Prison cells	PSI 17/2012 Certified Prisoner Accommodation (Ministry of Justice, 2012)
Sanitary accommodation	Same as for offices in paragraph 1.26: sanitary accommodation should have an intermittent air extract rate of both of the following. a. 15 litres per second per shower or bath. b. 6 litres per second per WC pan or urinal. Extract ventilators in sanitary accommodation should be capable of continuous operation if required.
Schools and education	Education (School Premises) Regulations 1999 Building Bulletin 101 Guidelines on Ventilation, Thermal Comfort and Indoor Air Quality in Schools (ESFA, 2018) Building Bulletin 101 can also be used as a guide to the ventilation required in other educational buildings, such as further education establishments, where the accommodation is similar to that in schools, e.g. sixth form accommodation. However, the standards may not be appropriate for particular areas where more hazardous activities take place than are normally found in schools, e.g. some practical and vocational activities that require containment or fume extraction. Building Bulletin 101 can also be used for children's centres and other early years settings, including day nurseries, playgroups, etc.
Shops and general retail premises	CIBSE Guide B2 Ventilation and Ductwork (2016)
Sports centres and swimming pools	CIBSE Guide B2 Ventilation and Ductwork (2016) Sport England Sports Halls Design and Layouts: Updated and Combined Guidance (2012)
Supermarkets and food stores	CIBSE Guide B2 Ventilation and Ductwork (2016)
Transportation buildings and facilities	CIBSE Guide B2 Ventilation and Ductwork (2016)