Historic England

Adapting Historic Buildings for Energy and Carbon Efficiency

Historic England Advice Note 18 (HEAN 18)

Summary

Our historic buildings must continue to change and evolve if they are to both contribute to a greener future and be fit for purpose for the people who live in, experience and care for them. If done thoughtfully and carefully, these changes can achieve the complementary goals of protecting our heritage and adapting to a changing climate. Historic England has produced this Advice Note to provide clarity on key considerations and to support consistent decision making.

The world faces a climate emergency. Buildings are a major consideration in addressing this challenge. They are one of the largest contributors of UK carbon emissions and can emit carbon dioxide throughout their whole lifecycle, including during construction and demolition.

The country has an extraordinarily rich historic environment, including the oldest housing stock in Europe. By retaining, using and appropriately adapting our historic buildings, they can be a key part of the solution for lower carbon emissions.

Adapting historic buildings appropriately does not just mean employing the most effective means of reducing carbon emissions and reliance on fossil fuels. It also means doing so in ways that protect historic significance and character, which is pivotal to making beautiful places, supporting the economy and creating jobs.

Mitigating climate change and conserving historic buildings are compatible goals. However, achieving these goals can be challenging, particularly for local planning authorities (LPAs) when determining applications for planning permission and/or listed building consent.

Historic England has produced this Historic England Advice Note (HEAN) to provide clarity - in support of consistent decision making - on approaches to improve the energy efficiency and support carbon reduction of historic buildings, whilst conserving their significance. It is organised as follows:

Front cover: External awnings, shutters or blinds can prevent overheating in summer.

- Section 1 sets out the need for climate action.
- Section 2 outlines the general approaches that should be adopted when considering adapting historic buildings for energy and carbon efficiency.
- Section 3 considers permissions that may be needed and the approach to decision making.
- Section 4 explores what changes can be made to historic buildings through the planning process, and where caution is required. It is not exhaustive, but focuses on the most common types of changes in response to climate change.

This HEAN is primarily for LPAs, heritage consultants and other parties directly involved in the planning process. It is hoped that it may also be of use to applicants, building owners and occupiers. More general advice tailored for homeowners is available on Historic England's Your Home webpages.

The contents are broadly applicable to all historic building types, including residential and commercial. The one exception is places of worship, in part because some are managed through the parallel system of Ecclesiastical Exemption, rather than listed building consent. Nevertheless, the document's contents may still be helpful in considering interventions.

Signposting is included to other detailed technical advice already provided by Historic England. The HEAN will also be supplemented by other advice. For example, we intend to publish further advice on integrating historic environment and climate change strategies through local plan making, wind energy generation, and places of worship.

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HistoricEngland.org.uk/advice/planning/planning-system

Contents

1 The need for climate action

A heritage solution: adapting historic buildings

1. Climate change is one of the greatest challenges of our time. To avoid the worst impacts, we must act immediately to reduce greenhouse gas emissions that cause global warming, and we must plan for and respond to the impacts from further warming over the coming decades.

2. The UK government is committed under the Climate Change Act 2008 to reduce net greenhouse gas emissions by 100%, compared to 1990 levels, by 2050. This target is commonly referred to as Net Zero by 2050. The government must also establish legally-binding 'carbon budgets' to act as stepping stones towards the 2050 target. A carbon budget caps the amount of greenhouse gases emitted in the UK over a five-year period.

3. The Climate Change Committee reports[1] that buildings remain the UK's second highest carbon emitting sector, accounting for 76 MtCO2e or 17% of total UK operational emissions in 2022. Buildings are expected to play a significant role in delivering the carbon budgets already set out in law up to 2037, with just over half of the required reductions expected to be delivered by the end of the Sixth Carbon Budget period (2032-37)[2].

4. Around one quarter of the UK's building stock is at least 100 years old. These buildings can and must adapt, not only to support the transition to a Net Zero society, but also to improve energy/cost-efficiency and thermal comfort for occupants, and to ensure they remain safe, desirable and viable assets for future generations to enjoy.

5. By keeping historic buildings in use, we can further improve the potential to limit carbon emissions. The most sustainable building is one that already exists, because the continued repair, maintenance, use and re-use of historic buildings avoids unnecessary release of embodied carbon associated with materials, transport and processes required for demolition and new build. Furthermore, many historic buildings are constructed from and can be maintained and repaired using local, naturally sourced, low-carbon materials.

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1 2023 Progress Report to Parliament - Climate Change Committee (theccc.org.uk)

2 Sixth Carbon Budget - Climate Change Committee (theccc.org.uk)

6. Conservation and the sustainable use and reuse of the historic environment is critical to limiting further global warming and the impacts of climate change. It aligns entirely with the circular economy to reduce waste and avoidable carbon emissions.

Embodied carbon is the carbon released during construction, repair, maintenance, alteration or demolition phase of a building, including through the extraction, processing and transportation of materials.

Operational carbon is carbon released during the operational or in-use phase of a building. It includes the carbon released from the energy sources used to keep the building warm, cool, ventilated, lighted and powered, such as electricity, natural gas, fuel oil, propane and wood.

Whole-life carbon is the sum of a building's embodied and operational carbon combined. It is currently calculated over a set 'life time' period of 60 years.

When embodied carbon is accounted for, it is possible to increase the carbon emissions of a building even when energy efficiency is improved if interventions are not designed, installed and used correctly. This can lead to maladaptation with potentially high financial and carbon costs to remediate.

7. For more information on how adapting historic buildings can reduce carbon emissions and respond to the climate emergency, see:

- Heritage Counts, 2020. Know Your Home, Know Your Carbon: Reducing Carbon Emissions in Traditional Homes.
- Heritage Counts. 2019. Carbon in the Built Historic Environment.

2 Climate action through adapting historic buildings: an approach

The whole building approach

8. Historic England advocates a whole building approach when considering adapting historic buildings. This explores a building's context to find a range of effective solutions that save energy and carbon, sustain heritage significance, and provide a safe and comfortable indoor environment. It considers how these might work together to provide the most energy-, carbon- and cost-effective outcomes.

9. Our guidance sets out our whole building approach, which should be based on:

- An understanding of the building and how it performs;
- An understanding of the significance of a historic building, including the contribution of its setting;
- Prioritising interventions that are proportionate, effective and sustainable; and
- Avoiding and minimising harm and the risk of maladaptation.

10. A whole building approach does not mean doing everything all at once, and in many instances owners and occupants may only wish to carry out small-scale interventions as and when opportunities arise. As a general rule, small-scale interventions should be considered before more substantial ones, and should be reversible where possible.

11. Where multiple interventions are planned, work can be carried out in stages, but a holistic approach can ensure that each stage has considered the overall plan for the building so that one measure does not unintentionally adversely affect another.

12. Both technical considerations and significance vary greatly from building to building - there is no one-size fits all approach. Some works in response to climate change would be so harmful to a building's heritage significance that they should not be approved, but in other cases impact on significance should be balanced against the benefits of addressing climate change.

Understand the building and how it performs

13. Every building performs differently depending on its location, orientation, design, construction, engineering services, and the way it is used, managed and maintained. All these factors influence energy use and the effectiveness of energy efficiency measures.

14. Most historic buildings are constructed differently from modern buildings in that they use traditional materials, have solid walls and are vapour permeable. It is essential any proposed works that affect the movement of moisture in a building, such as insulation, take full account of these differences.

15. There are, however, many buildings of historic significance, particularly those constructed after 1945, which are of modern construction. This typically means they are built with cavity walls and rely on impermeable materials to prevent water ingress.

16. An assessment should be undertaken of how the building performs to ensure that interventions are compatible with its form (see: Minimise harm and the risk of maladaptation). Such an assessment should also include patterns of occupancy and energy use over time.

17. We strongly advise that Historic England's Energy Efficiency and Retrofit webpages are read at the start of any project.

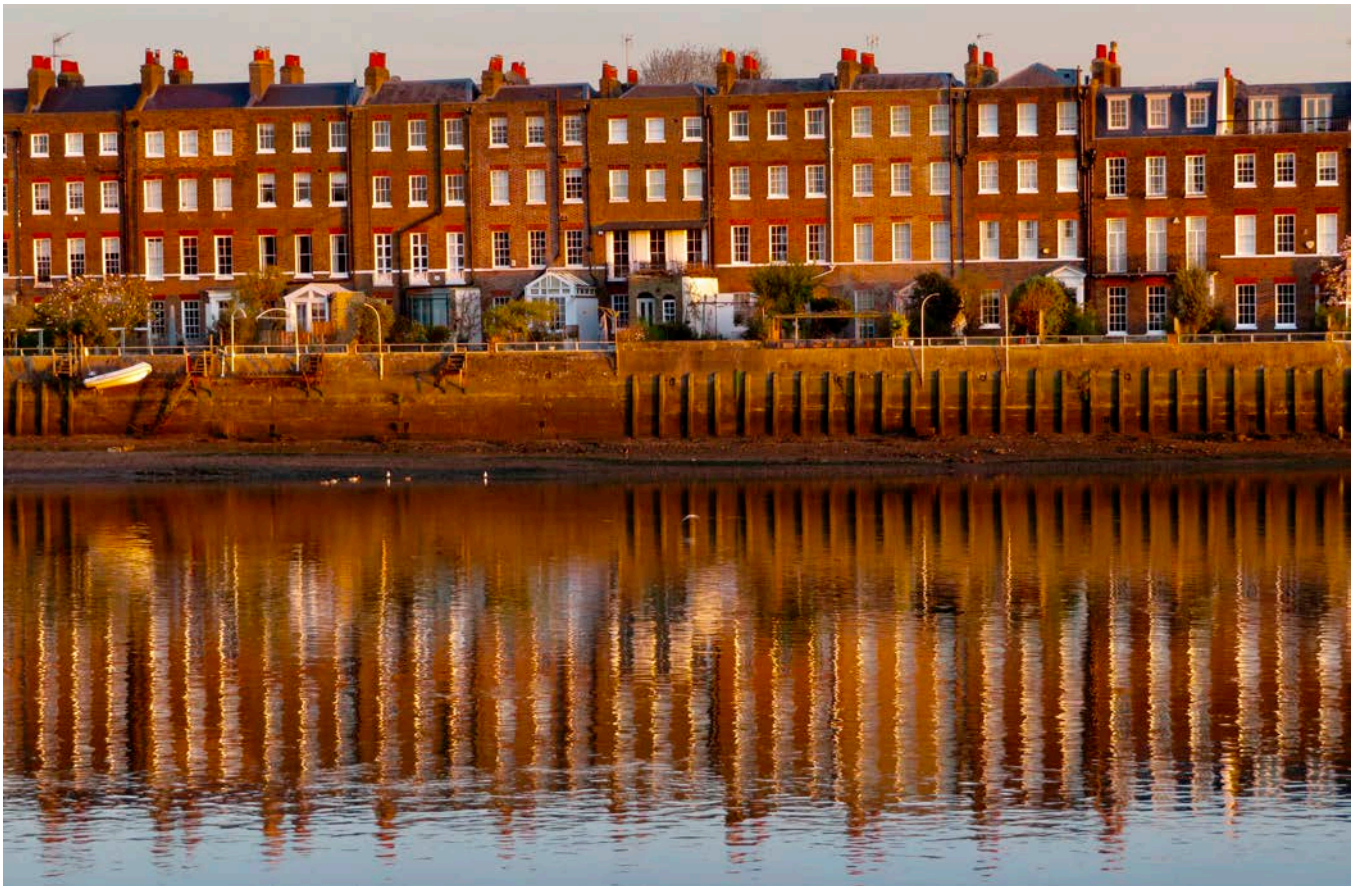

Figure 1: Understanding significance: a historic window may contribute to the significance of the listed building - both its interior and exterior appearance - and to the significance of neighbouring buildings and wider area of which it is a part.

Understand the building's significance

18. It is essential to understand the significance of the building and its setting. This should include consideration of the features of the individual building which would be affected by the proposed works, as well as its possible significance as part of a larger group, for example if a house is part of a unified terrace.

What is significance?

19. The concept of significance is central to the historic environment chapter of the National Planning Policy Framework (NPPF). The NPPF defines significance as 'the value of a heritage asset to this and future generations because of its heritage interest.' This interest may be archaeological, architectural, artistic or historic and it may derive 'not only from a heritage asset's physical presence, but also from its setting'.

20. To understand the significance of a building or other heritage asset, along with its historic or architectural interest, it is necessary to consider why it is valued. Historic England's Conservation Principles, Policies and Guidance identifies 'heritage values' as a mechanism for understanding and articulating significance. Historic buildings and areas embody some, or all, of these values, to varying degrees.

21. The list entry hosted on the National Heritage List for England identifies aspects of a building's special interest or significance. However, list entries do not always provide an exhaustive description and many do not include internal features, which may themselves be of significance.

22. For conservation areas, LPAs should have prepared a conservation area appraisal, which outlines the history of an area and explains its significance. Some appraisals include, or are accompanied by, guidelines on managing change and carrying out development in the conservation area.

23. Any assessment should also consider the contribution setting makes to the significance of the historic building, as well as any contribution the building itself makes to the setting of other nearby heritage assets. Historic England's The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning: 3 contains further information on how to understand and assess how setting contributes to the significance of heritage assets.

Prioritise interventions that are proportionate, effective and sustainable

24. Maintainance and repair of historic buildings are essential to support their long-term conservation and energy performance. Poor maintenance can contribute to damp, which reduces the thermal performance of historic buildings. Damp may also endanger the health of inhabitants. Further details on the role of maintenance and repair in a low carbon future can be found on our webpages.

25. In many cases, incremental and specific changes should be made when a building requires essential work or repair, or as other opportunities arise. Aligning energy efficiency improvements with other works, such as draught proofing a timber door at the point of repair, further reduces environmental impacts.

26. The lifespan of any intervention should also be considered, particularly where components have a limited life. For example, the service life of PVCu windows is relatively short (less than 25 years) compared to well-maintained historic windows (many of which survive for over 100 years), and a PVCu replacement window will have a higher carbon cost than a traditional window that has been upgraded to improve its energy efficiency.

27. Low impact interventions to reduce energy waste and demand should be pursued first. Changes in behaviour and how spaces are heated, such as installing smart thermostat controls and zoning to better regulate temperature, can save energy without the need for physical intervention. Many other interventions, such as putting insulation or draught proofing in unused chimney flues, can reduce energy loss with relatively little cost and without the need for planning permission or (in most cases) listed building consent.

28. More information on the whole building approach and a helpful checklist on the order of priority in which different interventions should be considered can be found on our webpages.

Minimise harm and risk of maladaptation

29. An understanding of how a building performs is essential to avoid proposals which result in maladaptation, such as increasing the likelihood of damp through providing inadequate ventilation. Certain retrofit strategies, particularly those designed specifically for modern construction, are not appropriate for historic buildings.

30. Tried and tested repairs and improvements are preferable. The impacts of some modern technologies or materials may not be fully understood over time, or they may have considerably shorter lifespan than traditional materials.

31. All potential impacts from an intervention should be considered. For example, whilst it might be possible to accommodate solar panels on a roof of a historic building, the impact of large batteries or additional kit within the building may require special consideration. Special consideration should also be given when retrofitting buildings at risk of flooding.

32. Works should be specified by suitably qualified professionals and installed by experienced contractors who understand how historic buildings perform technically. Details on finding the right help can be found on our webpages.

33. The Sustainable Traditional Buildings Alliance's Guidance Wheel sets out the advantages and potential risks of common retrofit interventions and draws together published technical guidance from a range of trustworthy sources.

34. The British Standards Institution's standards and guidance on retrofit in domestic buildings PAS:2035 2023 and PAS:2030 2023 may also be of use when planning retrofit projects. These take a whole house approach, are mindful of the different way in which traditional buildings function, outline the checks necessary to ensure adequate ventilation, and provide a process for monitoring post completion.

Other considerations

Domestic Energy Performance Certificates

35. Energy Performance Certificates (EPCs) provide information on a property's energy use, typical energy costs, and recommendations about how to reduce energy use and save money. They can helpfully identify where improvements can be made, but do not assess the building's performance as a whole. Recommendations should be considered carefully in the context of the significance and construction type of each individual historic building, and the way it is operated and used. More information on EPCs and traditional buildings is available here.

Protected species

36. Works to improve the energy efficiency of buildings may have an impact on protected species. In particular, works to roofs should consider bats and their roosts, which are protected by law. Further guidance on building work and bats can be found here.

3 Permissions and decision making

Figure 2: Photovoltaic panels were installed on the rear roof slope of the Grade II listed Gibson Mill (NHLE 1226169), West Yorkshire, a 19th-century cotton mill.

37. Some changes to improve energy efficiency or generate energy will constitute development and require planning permission, although certain types of development are permitted through the General Permitted Development Order. LPAs can remove these permitted development rights for particular types of works for specific buildings or areas using Article 4 Directions.

38. Works that would affect the special interest of a listed building (including internal works) will require listed building consent, irrespective of the need for planning permission. Some works to listed buildings, in response to climate change, will not affect their special interest and will not need listed building consent. Further advice on specific works where permission may be needed can be found in section 4. Scheduled monument consent is needed before undertaking any works to a scheduled monument.

39. Whilst not appropriate in all circumstances, there are other routes to both planning permission and listed building consent which LPAs might wish to consider which would enable owners to adapt historic buildings more easily. The relevant permissions processes for changes to historic buildings are set out below.

40. Approval through the building regulations process may be required for some alterations.

Planning permission

41. Planning permission is needed for works that constitute development. This includes building works, some kinds of demolition and changes of use of buildings. It does not include internal alterations and works that do not materially affect a building's external appearance. Accordingly, such internal works do not need planning permission, although other consents may be required (for example, listed building consent or building regulation approval).

42. Further advice is provided in the Planning Practice Guidance and the Planning Portal.

Permitted Development Rights

43. Certain works which constitute development may have been granted permission through Permitted Development Rights (PDRs), set out in the Town and Country Planning (General Permitted Development) (England) Order 2015 (as amended) (GPDO). PDRs are a national grant of planning permission and allow for a wide variety of works, although in most cases there are some restrictions and limitations. PDRs do not generally apply for works to listed buildings or scheduled monuments (i.e. planning permission is required) and there may also be additional restrictions through other designations such as conservation areas, World Heritage sites and national parks.

44. The GPDO is often amended and you are strongly advised to ensure you have the latest version. Additional government advice is available on the permitted development rights that apply.

45. Permitted development rights can be removed by an LPA by using an Article 4 Direction. These are used to protect the special character of a building or place. Where an Article 4 Direction is in effect, a planning application may be required for development that would otherwise have been permitted development. Information on Article 4 Directions should be available on each LPA's website.

Listed building consent

46. Listed building consent is required for the demolition of a listed building or for its alteration or extension in any manner which would affect its special architectural or historic interest under the Planning (Listed Buildings and Conservation Areas) Act 1990, irrespective of the need for planning permission. Where both planning permission and listed building consent are needed, they should be considered at the same time. Historic England's Advice Note 16: Listed Building Consent gives further advice on the operation of this consent regime, and section 4 of this advice note considers the need for listed building consent for a variety of common climate change related interventions.

Listed buildings and conservation areas

The Planning (Listed Buildings and Conservation Areas) Act 1990 allows for the designation and protection of listed buildings and conservation areas.

There are other categories of designated heritage assets, such as World Heritage sites, scheduled monuments, registered parks and gardens and registered battlefields.

All listed buildings are nationally important and are classified into three grades:

Grade I for buildings of exceptional interest and the highest significance.

Grade II* for buildings of more than special interest.

Grade II for buildings of special interest.

There are around 400,000 entries on the National Heritage List for England, accounting for around 2% of the building stock in England.

Grade II buildings make up 92% of all listed buildings. The other 8% of buildings, those of the highest significance, are listed at Grade I and II*, and therefore represent a very small proportion of England's building stock.

A listed building includes any object or structure fixed to the building, or any object or structure within the curtilage of the building which, although not fixed to the building, forms part of the land and has done so since before 1 July 1948. The interior, as well as the exterior, of a listed building is protected unless it has been expressly excluded. Curtilage is a complex area and more information on it is available in Historic England Advice Note 10: Listed Buildings and Curtilage.

A conservation area is an area of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance. The character or appearance of a conservation area is derived from a variety of factors including the buildings and spaces within it.

There are around 2.8 million homes in conservation areas in England.

Certificate of Lawfulness of Proposed Works

47. Where more substantive works are proposed that do not affect a listed building's special interest, confirmation that listed building consent is not required can be obtained by applying for a Certificate of Lawfulness of Proposed Works (CLPW) from an LPA. It should describe the works proposed to the building, and if the LPA is satisfied that the works would not affect its special interest, it must then issue a Certificate to that effect. There is no charge for an application for listed building consent or a CLPW.

48. In some instances, a building or structure may be scheduled in addition to, or instead of, being listed. Scheduled monuments are nationally important monuments that are added to the 'Schedule' (the list of legally-protected monuments) by the Secretary of State for Culture, Media and Sport, under powers contained in the Ancient Monuments and Archaeological Areas Act 1979.

49. Scheduled monument consent must be obtained from the Secretary of State for Culture, Media and Sport before any works to a scheduled monument are undertaken. Where an asset is both listed and scheduled, the scheduled monument statutory regime takes priority over the need for listed building consent. In some circumstances, parts of a site may be scheduled (e.g. below ground vaults) and other parts listed (e.g. above ground structures), in which case it will be necessary to apply for the relevant consent.

Other routes to permission

Local and Neighbourhood Development Orders

50. **Local Development Orders** grant planning permission for specific types of development in a defined area. They remove the need for repetitive planning applications to the LPA and can be used in response to climate change proposals that are appropriately specified and supported by a LPA. Listed building consent would still be required for works to demolish a listed building or to alter or extend listed buildings within the Local Development Order area.

51. **Neighbourhood Development Orders** are similar in scope and can grant planning permission for specific types of development within a neighbourhood area.

Local Listed Building Consent Orders and Listed Building Heritage Partnership Agreements

52. Local Listed Building Consent Orders (LLBCOs) and Listed Building Heritage Partnership Agreements (LBHPAs) clarify to listed building owners what works are permissible - including those in response to climate change - and reduce the number of listed building consent applications for LPAs to process.

53. An LLBCO allows the LPA to grant listed building consent for routine or minor changes to any identified listed buildings in their area, over an extended period of time.

54. For example, an LLBCO could cover the fitting of solar panels or double-glazing, outlining the circumstances in which such an item can be fitted, and detailing any conditions such as location, materials and fixings. In considering an LLBCO, an LPA would need to apply the same tests required for determining a listed building consent application (see Introduction to decision making).

55. LBHPAs are similar to LLBCOs but are intended for use in relation to complex buildings, or groups of related buildings in single ownership. They allow the owner and LPA to agree on significance of the building(s) and what long term packages of work might be granted listed building consent. For example, an LBHPA might include long-term consents for changes to windows in a large group of buildings with one owner.

Introduction to decision making

56. This section sets out the approach to decision making and highlights the key considerations needed to judge the planning balance for climate change and the historic environment. Section 4 of this advice note seeks to provide clarity as to what may or may not be acceptable in particular scenarios. It forms the basis for Historic England advice and should inform LPA decision making.

Relevant legislation and policies

57. When deciding planning or heritage consent applications, LPAs should assess the proposal and supporting information in the application against the following legislation and policy.

58. Decisions on planning applications must be taken in accordance with the development plan unless there are material considerations that indicate otherwise as required by the Town and Country Planning Act 1990 and section 38(6) of the Planning and Compulsory Purchase Act 2004. The Climate Change Act 2008 (2050 Target Amendment) requires that the UK reaches Net Zero by 2050.

59. The Planning (Listed Buildings and Conservation Areas) Act 1990 requires that in decision making special regard is given to the desirability of preserving the architectural or historic interest of listed buildings and their settings. Special attention should be paid to desirability of preserving or enhancing the character or appearance of conservation areas. The Ancient Monuments and Archaeological Areas Act 1979 applies in those cases where historic buildings are also scheduled monuments.

60. For listed buildings and conservation areas, 'significance' is another way of understanding what the Planning (Listed Buildings and Conservation Areas) Act 1990 describes as architectural or historic interest. In decision making, this Act requires that 'special regard' is given to preserving the architectural or historic interest (i.e. the significance) of listed buildings and their settings. 'Special attention' needs to be paid to the preservation or enhancement of the 'character or appearance' (i.e. the significance) of conservation areas.

61. **Policy:** The NPPF aims to deliver sustainable development through economic, social and environmental objectives. There are climate change and heritage references throughout the NPPF, as well as specific chapters on both topics:

- Chapter 14 - Meeting the challenge of climate change, flooding and coastal change.

- Chapter 16 - Conserving and enhancing the historic environment.

62. These chapters emphasise the importance of shaping places in ways that respond to their existing environments, be they historic and/or natural. Decisions need to balance the inevitable need for change with the impact that change has on that environment. These factors need to be balanced through the planning and listed building consent processes.

63. Paragraph 164 of the NPPF is of particular relevance and states:

'In determining planning applications, local planning authorities should give significant weight to the need to support energy efficiency and low carbon heating improvements to existing buildings, both domestic and non-domestic (including through installation of heat pumps and solar panels where these do not already benefit from permitted development rights). Where the proposals would affect conservation areas, listed buildings or other relevant designated heritage assets, local planning authorities should also apply the policies set out in chapter 16 of this Framework.'

Decision making

64. Where proposals to improve the energy efficiency of historic buildings require planning and/or listed building consent applications, their determination by the LPA will be guided by planning legislation, the policies in the local development plan and the NPPF.

65. In weighing applications that directly or indirectly affect non-designated heritage assets, paragraph 209 of the NPPF states a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.

66. NPPF paragraph 205 requires that 'great weight' is given to a designated heritage asset's conservation, noting that the more important the asset the greater the weight should be. To understand the potential impact from adapting historic buildings for energy and carbon efficiency on the significance of historic buildings and areas, the following steps are advised:

- Understand the impact of the proposal on significance.
- Avoid, minimise and mitigate harmful impact in a way that meets the objectives of the NPPF.
- Look for opportunities to better reveal or enhance significance.
- Justify any harmful impacts in terms of balancing the sustainable development objectives of conserving significance and the need for change.
- Understand the public benefits.

67. **Understand the impact of the proposal on significance.**

- The effect on significance of the historic building(s) and areas affected, including any contribution made by setting, must be properly identified, understood and articulated.
- The level of detail required should be proportionate to the individual case. For major cases, a Statement of Heritage Significance should be prepared by an appropriately qualified specialist. An archaeological desk-based assessment may also be needed if disturbance of buried archaeology is anticipated.
- More information on assessing significance is available in Historic England's Advice Note 12: Statements of Heritage Significance and in the Chartered Institute for Archaeologists' Standard and guidance for historic environment desk-based assessment.
- Where a proposal causes harm, the level of harm to the significance (including any contribution made by setting) of the building(s) or conservation area should also be properly established.
- The potential harm to the significance of a historic building through maladaptation (for instance, incorrectly specified insulation that would trap moisture and accelerate decay) should be considered at this point.[3]

3 This is informed by the approach in the chapter 16 of the NPPF, accompanying Planning Practice Guidance and Historic England's Good Practice Advice Note 2: Managing Significance in Decision Taking in the Historic Environment.

68. Avoid, minimise and mitigate harmful impact in a way that meets the objectives of the NPPF.

- The proposal should be designed and/or modified to avoid, minimise and then mitigate harm to the significance of the historic building(s) and area.

- Where possible, the proposed works should be reversible on the basis that the intervention may be no longer be needed or desirable in the future.

69. Look for opportunities to better reveal or enhance significance.

- Opportunities should be taken to better reveal or enhance the significance of the historic building(s) or conservation area, or the appreciation of that significance.

70. Justify any harmful impacts in terms of balancing the sustainable development objectives of conserving significance and the need for change.

- The proposal should justify any remaining harm to the significance of the historic building(s) or conservation area in a clear and convincing way. If less harmful options that would achieve a similar result are available, it should be clear why these have been discounted.

- Part of any justification for works to mitigate climate change should be demonstrating that they would make a meaningful improvement to the building's performance in terms of energy and carbon efficiency. The likely effectiveness of the interventions in reducing energy consumption, their lifespan and the expected time needed for the energy saved to outweigh the carbon used to create, transport and install them, could all form part of the justification.

- It is important to demonstrate that proposals would not harm the building through maladaptation.

- Information required to justify proposals should be proportionate to their impact on the significance of the building. For instance, a deep retrofit involving major interventions into historic fabric should require a much more thorough and detailed justification than works which would only have a minor impact on a building's significance.

71. Understand the public benefits.

- The proposal should offer public benefits, as defined in the Planning Practice Guidance (Paragraph 020 Ref ID: 18a-020-20190723), that are understood and clearly articulated.

- Paragraph 20 recognises that delivering environmental objectives is a public benefit, but that they 'should flow from the proposed development. They should be of a nature or scale to be of benefit to the public at large and not just be a private benefit.' It also recognises that heritage benefits are public benefits, and that these might include securing the long-term conservation of a heritage asset.

- Questions of scale and balance are important. A proposal which causes a high degree of harm for minimal, or questionable, environmental gains is unlikely to be acceptable, especially if those benefits could be achieved in other, less harmful ways. However, the balance is likely to favour proposals which offer meaningful, long term environmental benefits (such as improving energy efficiency, thus reducing carbon emissions and helping to achieve Net Zero) whilst having a minimal impact on significance.

72. The decision-maker, having carried out the exercises in 63-70, should then balance the public benefit against the harm.

73. Section 4 of the document offers general advice on the likely impact on significance of different interventions and what permissions may be needed.

4 Climate action through adapting historic buildings: common interventions

Advice on changes through the planning system

74. This section provides advice on the acceptability of changes to historic buildings in response to climate change, as managed through the planning process. It is designed for all types of listed buildings and unlisted buildings in conservation areas and World Heritage sites, as well as scheduled monuments, with the exception of places of worship managed through the Ecclesiastical Exemption system.

75. We believe it is possible to improve the energy efficiency of all buildings to some extent without unacceptably harming their significance. We encourage interventions which are reasonably low risk (and often happen to be low cost), and do not always require planning approval, to be considered first, before more potentially harmful interventions are explored.

76. For works that do require planning approval, balancing harm and public benefit, as set out in section 3, can be complex. Some works which would help mitigate or adapt to climate change would be so harmful to special interest or character that they should not be approved. Other works, which may result in a relatively low level of harm, could, in particular cases, prove counter-productive by actually reducing performance and efficiency, harming the health of occupants or increasing carbon emissions.

77. The advice below outlines when approvals are required and what Historic England considers likely to be, and not to be, acceptable in most instances. It is not an exhaustive list of interventions and focuses primarily on achieving energy efficiency and solar energy generation. It cannot cover every eventuality and decisions must be made on a case-by-case basis. In all instances, we would encourage specialist, professional advice to be obtained when considering and specifying works.

Works to listed buildings

78. Listed buildings of the highest significance are recognised through being designated at Grade I or II*. These buildings are likely to be more sensitive to change and therefore may need different approaches. Similarly, there may be Grade II buildings - or parts of such buildings - which are more sensitive to change.

Windows

79. **Draught-proofing of windows will almost invariably be acceptable.**

- Draught-proofing - one of the simplest and most cost-effective means of improving a building's thermal performance - can usually be achieved with only a negligible effect on a building's special interest.
- Well maintained windows will be less draughty than windows in poor repair. Before draught-proofing windows, it is always advisable to make sure they are in a good state of repair.
- Whilst draught-proofing works can entail the cutting of grooves in historic joinery to accommodate draught strips, this can generally be done in a way that does not harm the building's special interest.
- Exceptions are rare, but may include windows of exceptional delicacy, or windows which cannot be unobtrusively draught proofed.
- Listed building consent is unlikely to be required for all other draught proofing works.

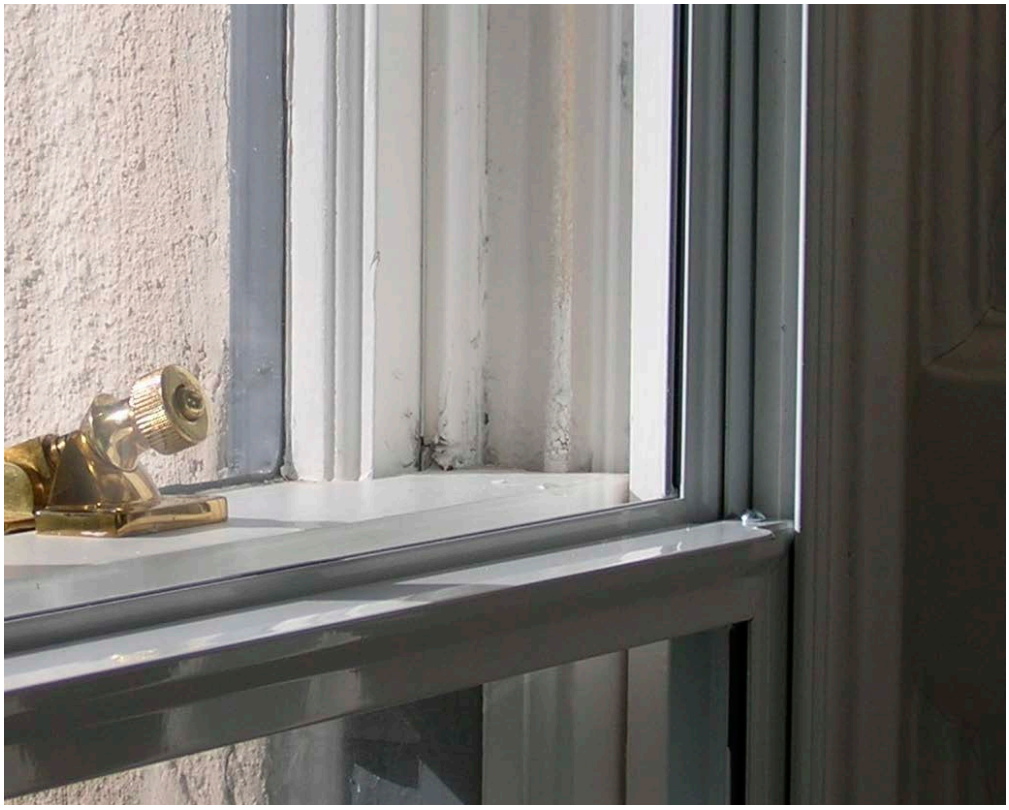

Figure 3: Secondary glazing can provide very effective draughtproofing as well as improved thermal efficiency.

80. Installation of secondary glazing to the windows will generally be acceptable.

- Secondary glazing will provide considerable improvements to thermal performance and energy conservation. In respect of multi-pane windows, it often outperforms double-glazing.
- In most cases, the impact of its installation on significance will only cause minimal harm to historic fabric and architectural interest, which will generally be acceptable in view of the benefits obtained.
- Exceptions may include interiors of exceptional architectural quality (such as the finest state rooms of a great house), buildings with historic shutters which would be damaged or rendered inoperative by the installation, and buildings with glazing of exceptional significance which should not be obscured. In many of these cases, temporary secondary glazing used seasonally will generally be acceptable.
- Listed building consent is unlikely to be required for all other secondary glazing works.

81. Installation of slim-profile or vacuum double-glazing within historic frames will generally be acceptable.

- The use of slim-profile or vacuum double-glazing can allow the installation of double-glazing in historic buildings alongside the retention of existing window frames.
- Many historic window frames will be capable of accommodating such glazing. Original glazing bars should be retained, and windows should be refurbished and draught proofed at the same time to fully benefit from double-glazing. Sash windows may need heavier weights to balance the increased weight of the glass.
- Exceptions in which such installations are unlikely to be acceptable will include windows which retain historic glass of interest, windows of historic or architectural interest whose frames / glazing bars cannot support slim-profile or vacuum double-glazing, and windows with leaded lights.
- Listed building consent is likely to be required, unless replacing panes in modern windows.

Figure 4: In this Grade I listed building, a number of existing metal-framed windows were replaced with either mono-laminated glass or slim-profile double glazing. © Paul White

82. Replacement of windows which do not contribute to the architectural or historic interest of a building with double-glazed windows of appropriate material and pattern, will generally be acceptable.

- Many historic buildings have windows which are relatively recent and do not contribute to a building's special interest. In such cases, their replacement with double-glazed windows of an appropriate material, glazing bar pattern and detailing is likely to either have a neutral impact or to enhance significance.
- This will not be so in the case of original or other windows which contribute positively to a building's special interest through both historic fabric and design. Such windows should not be replaced (although their panes could be replaced with slim-profile or vacuum double-glazing within the existing frames - see above). Stuck-on or applied glazing bars rarely replicate the character of historic windows and are unlikely to be acceptable.
- Listed building consent is likely to be required, as such works will normally affect the special interest of the building.

83. See our webpages for further detailed advice on windows.

Doors

84. Draught-proofing of doors will generally be acceptable.

- The same considerations apply as for windows - see paragraph 78 above.

Insulation

85. Loft insulation will generally be acceptable.

- Loft insulation, when specified and installed appropriately, is a relatively easy way to improve a building's thermal performance.
- In buildings with open lofts, it is usually possible to lay removable insulating material between and over the ceiling joists.
- Exceptions will include the spraying adhesive foam insulation to the underside of the roof covering, as this is likely to harm the fabric of the building and is not easily removed.
- However insulation is installed, permeable materials should be used and the loft should remain ventilated to avoid condensation.
- Listed building consent is unlikely to be required, as the installation of insulation is unlikely to affect the special interest of the building, unless the works entail the loss of existing fabric or sprayed adhesive foam insulation

86. Insulation within the roof plane will be acceptable in some cases.

- Roof spaces can often be insulated above, between or below the rafters.
- Exceptions will include cases in which this would require the loss of historic plasterwork or obscure significant elements of the roof structure.
- Care needs to be taken when insulating above rafters to protect the historic character of the roof.
- However insulation is installed, permeable materials should be used and the roof should remain ventilated to avoid condensation.
- Listed building consent is normally required.

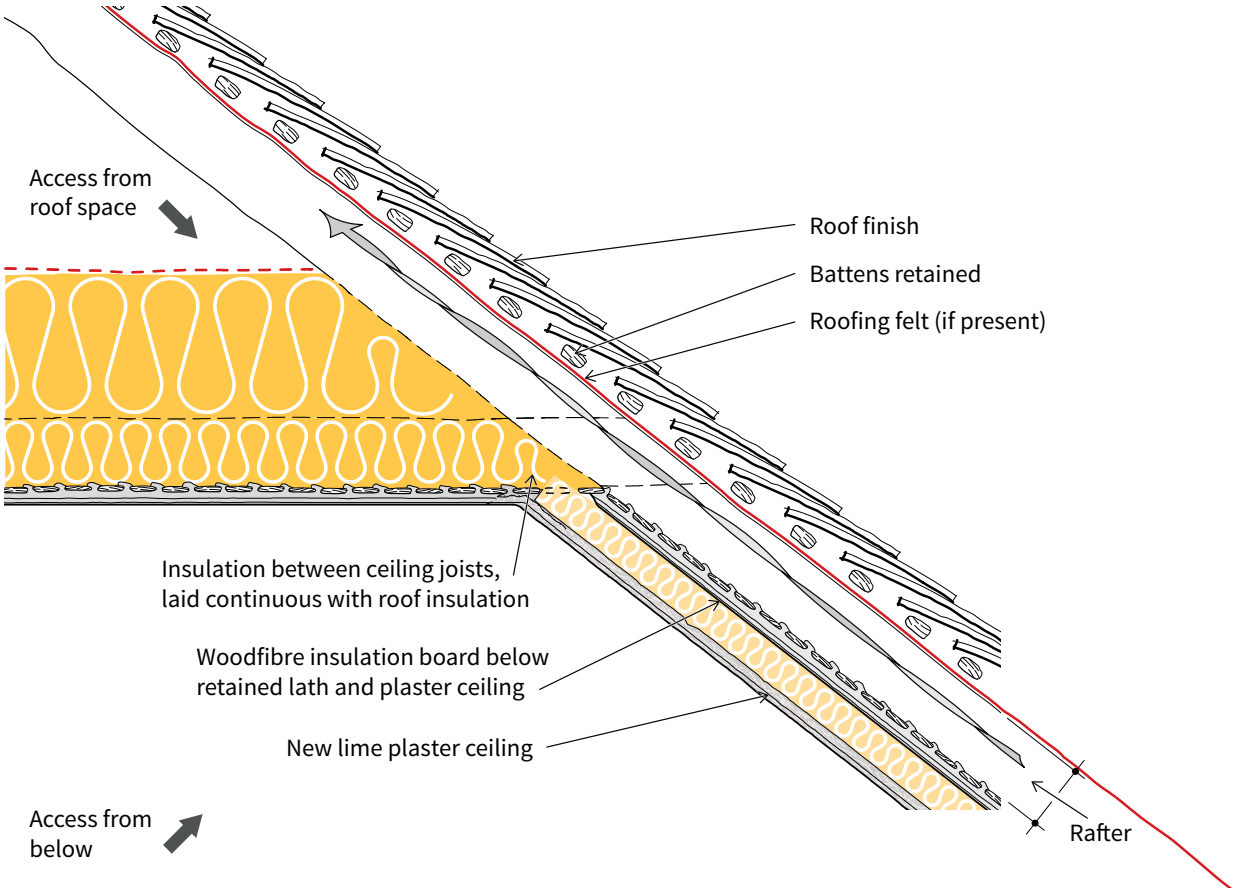

Figure 5: Insulating short sloping ceilings from above. (Rigid insulation pushed down from roof space.) It may be possible to access short sloping ceilings from the open roof space above. If this is the case, rigid batts of insulation can be pushed down into place between the ceiling and roof finish. © Historic England

87. Insulation between, or under, floors will generally be acceptable.

- Insulation within the floor void - where the floorboards are removed, insulation fitted, and the boards replaced - will generally be acceptable provided it can be accommodated without changing floor levels and without undue harm to any historic floor surfaces.
- Underfloor insulation - for example where a timber ground floor is suspended over bare earth - will generally be acceptable, unless the underfloor layer or finishes are particularly significant and are directly impacted upon by the works.
- Insulating under solid floors may not be appropriate where surviving historic floor surfaces or other archaeological remains may exist just under the current floor, or where shallow foundations could be compromised.
- Where ceilings are of plain plaster with no cornice or decorative features, replacing the plaster and adding a layer of insulation to its underside may be acceptable if it is the least harmful practical way to insulate the space.
- Permeable materials should be used, and sufficient ventilation maintained.
- Listed building consent may be required; if in doubt, a Certificate of Lawfulness of Proposed Works should be sought.

Figure 6: An insulated hydraulic lime floor being laid. © Matthew Clements/Mike Wye Ltd

88. **Internal wall insulation will be acceptable in some cases.**

- The special interest of most listed buildings owes much to the character of their interiors. This includes their finishes, such as historic plaster, joinery, cornices, chimneypieces and other fittings. The introduction of internal wall insulation will generally disrupt these, to harmful effect. Internal wall insulation may be acceptable in buildings whose historic interiors have been lost or largely compromised and in some buildings whose interiors may not be sensitive to such changes.
- If it is appropriate to line previously unplastered internal walls as part of a conversion, then the opportunity to introduce insulation will exist.
- In the case of buildings of traditional construction, internal wall insulation may also lead to maladaptation, particularly through lack of ventilation, cold bridging and condensation on the wall. It is strongly recommended that permeable materials are used to avoid damage to the building, and specialist professional advice is sought for such buildings.
- Listed building consent is almost always required.

89. External wall insulation is unlikely to be acceptable.

- The external appearance of listed buildings is an important component of their special interest. This is due both to the historic materials of their walling and the relationship between eaves, windows, doors, other architectural detail and wall surfaces. The addition of external insulation will generally disrupt these, to harmful effect.
- Exceptions may include buildings whose exteriors have been severely compromised (for example, by the addition of inappropriate renders or unsympathetic general alterations) and some modernist buildings, finished in modern renders, providing that the work does not disrupt the relationship between wall surfaces and details.
- External wall insulation may also lead to maladaptation, particularly through lack of ventilation, cold bridging and condensation on the wall. It is strongly recommended that permeable materials are used and specialist professional advice is sought for such buildings.
- Listed building consent is always required.

90. Installation of insulation within external walls will be acceptable in some cases.

- Some types of listed building may be capable of accommodating insulation between their outer protective surface and their inner wall surfaces to improve thermal performance. Examples include those which are timber-framed, clad with finishes such as weather-boarding or built with cavity wall construction.
- Historic timber-framed buildings have infill panels of various materials. In situations where the historic infill has been replaced with modern materials, it may be appropriate to renew the infill with a material that enhances the thermal performance of the building.
- Similarly, it may be possible to accommodate insulation between the outer cladding and the internal plaster of weather-boarded houses, or other historic buildings with forms of external cladding, so long as an air gap can be maintained and detailing can mitigate moisture risk.
- Should the attempt to do this entail thickening the walls, consideration will need to be given to the relationship between wall surfaces and historic details, and a case-by-case assessment of appropriateness will be required.
- Modern cavity walls (in post-Second World War buildings) often provide a good opportunity for insulation. Such insulation is invisible, cheap and quick to install, with no reduction to room sizes.
- Standard cavity insulation is not suitable in every case, however. For example, for those classed as 'early cavity walls' the construction needs to be treated as a solid wall, insulated either internally or externally.
- Listed building consent is required for these works, with the exception of modern cavity walls.

Figure 7: Battens have been added at the sides of the joists to support boarding to carry compressible sheep's wool insulation. © Oxley Conservation

Figure 8: Insulation has been laid into the space between the floor joists.
© Oxley Conservation

91. Reinstatement of historic render finishes removed from listed buildings will improve their thermal performance and is almost invariably desirable.

- Rubble stone and timber-framed buildings were sometimes intended to be rendered, for practical and aesthetic reasons. In the 20th century in particular, historic render was often removed.
- Where there is clear evidence that a building was originally intended to be rendered, the reinstatement of missing renders (using appropriate and compatible materials) will improve the thermal performance, by protecting the walls from damp, while also restoring lost appearance. It is therefore likely to be desirable for both environmental and historic significance reasons.
- It may be possible to introduce insulation beneath the new render. Should this entail thickening the walls, consideration will need to be given to the relationship between wall surfaces and historic details, and a case-by-case assessment of appropriateness will be required.
- Listed building consent is required.

92. See Historic England's webpages for further detailed advice on insulating walls, roofs and floors.

Mechanical ventilation and heat recovery systems

93. Mechanical ventilation and heat recovery systems may be acceptable in some cases.

- Improved insulation has the potential to cause humidity issues even when permeable materials have been used and passive ventilation measures installed. Installing mechanical ventilation and heat recovery systems can sometimes be the best way of managing this.
- The impact of these systems on the significance of a building can normally be minimised by careful siting of equipment and ductwork.
- Mechanical ventilation and heat recovery are unlikely to be appropriate in high quality historic interiors.
- Listed building consent is normally required, depending on extent and position.

Figure 9: An exterior view of Hoggerstone Hill Farm, showing the converted barn and the outhouse containing the ground source heat pump. © Historic England

Figure 10: Interior of the outhouse at Hoggerstone Hill Farm, showing the ground source heat pump mechanics, with a view towards the converted farmhouse. © Historic England

Heating systems and heat pumps

94. Changing boilers, heating and hot water systems to low carbon alternatives, such as heat pumps, will generally be acceptable.

- Having an effective low carbon heating system is one of the best ways of enhancing an historic building's energy efficiency. In the majority of cases, replacement of existing systems will not cause harm to special interest.
- There may be very rare exceptions where the existing heating system, or components of it, has architectural or historic significance (for example, original cast- iron radiators) and remains functional.
- The impact of heat pumps can generally be minimised through careful siting, design and screening. Routing pipework may damage historic fabric, with additional archaeological considerations in some sites.

- The opportunity should be taken to remove unsightly plant equipment made redundant by the heat pump, for instance oil tanks. This can sometimes offset any harmful impact of installing a pump.
- Listed building consent is generally not required for replacement of boilers with more efficient versions. Listed building consent is normally required for the installation of heat pumps which are fixed to a building.

95. See Historic England's webpages for further detailed advice on heating systems, including heat pumps.

Figure 11: An air source heat pump has been installed in an inconspicuous location behind a barn next to the Grade II listed farmhouse.
© National Trust

Photovoltaic and solar thermal panels

96. Installation of photovoltaic and solar thermal panels will be acceptable in some cases.

- Their installation can often be designed in a way that avoids harm to the special interest of listed buildings. Yet, they have the potential to be visually incongruous and harm a building's architectural qualities. Care is required, especially in considering the aesthetic impact of panels on significant views of the building.
- The physical work necessary to install and maintain panels (e.g. fixings, wiring and/or pipework) will generally not preclude their installation, provided care is taken not to harm special interest.
- Specialist consideration should be given to the impact on the roof of the additional weight of the panels, weather-tightness and risks of fire.
- Certain buildings may require the sensitive installation of safe working systems, for example to enable panels to be maintained.
- Listed building consent is always required for the installation of photovoltaic and solar thermal panels.
- Below is a series of specific circumstances to take into account when considering proposals.

97. Installation of panels will generally be acceptable if hidden from view.

- Locations which will normally have very minimal or no impact include valley roofs and behind parapets on flat or low-pitched roofs.

98. Installation of panels will generally not be acceptable on principal roof slopes, if they would be visible and would detract from the building's special interest.

- As the front elevations of buildings are generally the most important and the most prominent, they will usually be the most sensitive place to site photovoltaic and solar thermal panels. In some cases, other elevations and their associated roof slopes will be equally, or more, sensitive.
- Exceptions may include buildings whose significance may be less sensitive to the installation of such panels (for example, certain industrial buildings). Steps should be taken to reduce the visual impact of panels in these locations as far as is possible. For example, using black frames, avoiding silvered or reflective panels and avoiding irregular or stepped panel layouts.

99. Installation of panels on roof slopes of less prominence will generally be acceptable, even if they would be visible.

- Roof slopes of less prominence will generally provide the more acceptable place to install panels, as their impact will be limited.
- Roof slopes to subordinate parts of a complex building (for example, lower wings or rear ranges) may provide the most appropriate place for such installations: by respecting the hierarchy of the building in the location of installation, any harm to the building's special interest will be reduced.
- Exceptions may include highly graded listed buildings (Grade I and II*) whose significance may be such that the installation of panels on roof slopes of less prominence would not be appropriate.

100. Mounting panels on outbuildings or land associated with a listed building, provided they are not of greater prominence, will generally be preferable to installation on the main building.

- The installation of panels away from the listed building can often be done without any direct harm to the building's special interest.
- However, consideration will still need to be given to the effect of an installation on the setting of the listed building.
- Where an installation can be made away from the listed building, and would cause no, or less, harm to its special interest, there will be less justification to install panels on the building itself.
- Consideration should be given to reducing the visual impact of ground mounted panels in the setting of listed buildings, for instance using hedges to screen them and designing unobtrusive security measures.
- Planning permission is required.

Figure 12: Ground mounted solar panels set behind a hedge at Chippenham Hall, Cambridgeshire.
© Historic England

Solar slates

101. The installation of solar slates will be acceptable in some cases.

- Solar slates replace existing roof coverings and are an alternative solution to photovoltaic and solar panels.
- As they do not usually convincingly replicate the look of traditional slates, they would not be suitable for prominent roof slopes where panels would also be unacceptable.
- They may have a considerably shorter life than traditional materials. Therefore, sound or repairable roof coverings should not be removed to accommodate them. They are also more difficult to maintain and replace than standard photovoltaic panels.
- Solar slates might be considered for use on roof slopes of low significance and visibility at the point of a roof repair project.
- Listed building consent is always required for their installation.

102. For further information see:

- Generating Energy in Your Home
- Installing Solar Panels
- Installing Electrical Energy Storage Systems and Batteries in Historic Buildings

Wind power

103. Wind power is an increasingly popular source of energy generation. This may range from large-scale wind turbines that affect the setting of listed buildings through to the installation of micro wind turbines on listed buildings themselves. Historic England will be publishing separate guidance on this topic.

Electric vehicle charging points

104. Domestic off-street electric vehicle charging points will generally be acceptable.

- The demand for off-street vehicle charging points is likely to increase significantly as more electric vehicles are manufactured. In the majority of cases, charging points can be accommodated without harm to special interest provided they are located in discreet places.
- Consideration should be given to archaeological remains when considering ground works and service runs.
- Listed building consent is required for fixings to listed buildings, alongside planning permission.

Figure 13: At this barn conversion, a freestanding electric vehicle charging point is attached to an external light.

Figure 14: Rooms on the southwest elevation of this Grade II* house increasingly suffered from overheating in summer. Historic fixings for external awnings were identified in the window reveals and replacement blinds were fitted.
© Historic England

Other external works

105. Changing weather patterns, such as hotter summers and increased rainfall, may place additional pressures on building fabric.

106. There are a number of ways in which buildings can be adapted to deal with these issues. Those discussed are likely to need listed building consent and, if they materially affect the external appearance of a building, they are also likely to need planning permission. Examples that will generally be acceptable include:

- Installation of external awnings, blinds and shutters to reduce overheating, where they do not adversely impact on the architectural interest of the building, or group of buildings. These features were common in the later 19th and early 20th centuries. There may be evidence that they were fixed to a building in the past, as well as appropriate historical precedents in the surrounding area or on similar listed buildings.
- Changes to rainwater goods to accommodate increased rainfall are likely to be acceptable in most cases. However, care should be taken to consider management strategies or designs that minimise impact on historically significant rainwater goods, with changes limited to those necessary to maintain function. Appropriate materials (for example, normally cast iron or lead for traditional buildings) should be used for new works.

Works to unlisted buildings in conservation areas

107. Where planning permission is required, the same general approach should be taken with works to unlisted buildings in conservation areas as with listed buildings. The significance of the heritage asset should be properly understood and works should aim to avoid or minimise harm to this significance. Consideration also needs to be given to the impact of any external works on the character or appearance of the conservation area.

108. Planning permission will be required for many external works affecting buildings which do not benefit from permitted development rights (such as flats or commercial buildings) and buildings in conservation areas with Article 4 directions (where certain permitted development rights have been removed). Such works will include external insulation, or mounting solar panels, wind turbines or heat pumps on walls fronting a highway or in a front garden.

109. In conservation areas without Article 4 directions, dwelling houses have certain permitted development rights. This means that planning permission will not be needed to change windows, doors or rainwater goods if they are of similar appearance to those used in the construction of the existing building. Solar and photovoltaic panels can also be fixed to roofs without planning permission in certain situations.

110. Internal works to unlisted buildings in conservation areas do not require planning permission, although building regulation approval may be required for substantial internal works.

Works to unlisted buildings in World Heritage sites

111. World Heritage sites have the same restrictions on permitted development as conservation areas. In some World Heritage sites, Article 4 directions further restrict permitted development.

112. The protection of World Heritage sites is managed through the planning system, through which the potential impact on their Outstanding Universal Value needs to be considered. Unless the building involved is one of the key buildings within the World Heritage site, changes to individual buildings to mitigate climate change are unlikely to affect its Outstanding Universal Value.

113. For further information see:

- Planning Practice Guidance (Paragraph 026 Reference ID: 18a-026-20190723)
- Guidance for World Heritage management

5 Glossary

Adaptation - adjustment to actual or expected climate and its effects to moderate or avoid harm or exploit beneficial opportunities.

Article 4 direction - a direction made under Article 4 of the Town and Country Planning (General Permitted Development) (England) Order 2015 which withdraws permitted development rights granted by that Order.

Blue infrastructure - see green and blue infrastructure.

Carbon - shorthand term for carbon dioxide (CO2), which is a greenhouse gas and is the most prominent in causing climate change. The impact of the other four gases - water vapour (H2O), nitrous oxide (N2O), methane (CH4) and ozone (03) - is often expressed as carbon dioxide equivalent or CO2e.

Circular economy - a system where materials never become waste and nature is regenerated. In a circular economy, products and materials are kept in circulation through processes like maintenance, reuse, refurbishment, remanufacture, recycling, and composting. The circular economy tackles climate change and other global challenges, like biodiversity loss, waste, and pollution, by decoupling economic activity from the consumption of finite resources.

Climate action - action that helps reduce emissions and adapt to climate change.

Climate change - a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. (United Nations Framework Convention on Climate Change, article 1).

Conservation (for heritage policy) - the process of maintaining and managing change to a heritage asset in a way that sustains and, where appropriate, enhances its significance (NPPF).

Designated heritage asset - a World Heritage site, scheduled monument, listed building, protected wreck site, registered park and garden, registered battlefield or conservation area designated under the relevant legislation.

Embodied carbon - the carbon emitted over the whole lifecycle of a building, including during construction, maintenance, refurbishment, and demolition. It considers carbon emissions released throughout the supply chain including extraction of materials from the ground, transport, refining, processing and assembly, and end of life.

Energy efficiency - measures to reduce the amount of energy required for products and services.

Greenhouse gases (GHGs) - a gas that absorbs and emits radiant energy at thermal infrared wavelengths, causing the greenhouse effect. Primary greenhouse gases in Earth's atmosphere are water vapour (H20), carbon dioxide (CO2), methane (CH4), nitrous oxide (N20), and ozone (03). Human generated GHGs are the primary cause of global warming and climate change.

Green and blue infrastructure - a network of multi-functional green and blue spaces and other natural features, urban and rural, capable of delivering a wide range of environmental, economic, health and wellbeing benefits for nature, climate, local and wider communities and prosperity.

Heritage asset - a building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage assets are of two types: 'designated heritage assets' and 'non designated heritage assets'.

Historic environment - all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora (NPPF).

Maladaptation - changes to a building which prevent it from performing appropriately in relation to energy efficiency, carbon reduction, building performance, or the health, safety, well-being and comfort of occupants.

Mitigation (for climate change) - an intervention to reduce, absorb or remove greenhouse gases from the atmosphere with the primary function of limiting global warming to avoid the worst impacts of climate change.

Net Zero - the reduction of greenhouse gas emissions by 90% or more compared to a set baseline year, with the remaining emissions balanced by absorbing or removing them. The UK's Net Zero baseline year is 1990. The UK is committed to a target of Net Zero by 2050.

Net Zero carbon operational energy - when the amount of carbon emissions associated with the building's operation on an annual basis is

zero or negative. A Net Zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable/green energy sources, with any remaining carbon balance offset.

Net Zero carbon construction (for major renovations and for new buildings) - when the amount of carbon emissions associated with a building's materials and construction stages, up to practical completion, is zero or negative, through the use of offsets or the net export of on-site renewable energy.

Net Zero carbon whole life - when the amount of carbon emissions associated with a building's construction, operational and demolition stages over the life of the building, including its disposal, are zero or negative.

Operational carbon - the carbon associated with the in-use operation of a building. This usually includes carbon emissions associated with heating, hot water, cooling, ventilation, and lighting systems, as well as those associated with cooking, equipment, and lifts (that is both regulated and unregulated energy uses), but can account for any activities that expend carbon, for example the materials and processes involved in maintaining and repairing a building.

Overheating - discomfort, and possible health risks to occupants caused by the accumulation of warmth within a building.

Resilience - the capacity to withstand or recover quickly from a hazardous event or change in climate while retaining functionality and/or significance.

Retrofit - the addition of new technologies or features to an existing building to change the way it performs or functions.

Secondary glazing - a fully independent window system installed to the room side of existing windows. The original windows remain in position in their original unaltered form. Secondary glazing is available as openable, removable or fixed units.

Setting of a heritage asset - the surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral (NPPF).

Significance (for heritage policy) - the value of a heritage asset to this and future generations because of its heritage interest. The interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting. For World Heritage sites, the cultural value described within each site's Statement of Outstanding Universal Value forms part of its significance (NPPF).

Traditional building/construction - traditional buildings are generally of solid wall (that is not cavity walls) or timber-frame construction. Most buildings built before 1919 tend to be of traditional wall construction, although narrow cavity walls are known to have been used as early as the late 19th century. Traditional construction differs significantly from modern construction, having different materials, construction methods and design. Traditional buildings make up about 21.5% of the UK's total building stock.

Unlisted building (in a conservation area or World Heritage site) - in this Advice Note this term is used to denote a building in conservation area, or World Heritage site, that is not included on the national list of buildings identified as being of special architectural or historic interest.

Whole Building Approach - considers a building's context to find balanced solutions that save energy, sustain heritage significance, and maintain a comfortable and healthy indoor environment. It also considers wider environmental, cultural, community and economic issues, including energy supply. It can help to manage the risks of maladaptation.

6 Abbreviations

CLPW - Certificate of Lawfulness of Proposed Works

EPC - Energy Performance Certificate

GPDO - Town and Country Planning (General Permitted Development) (England) Order 2015 (as amended)

HEAN - Historic England Advice Note

LBHPA - Listed Building Heritage Partnership Agreement

LLBCO - Local Listed Building Consent Order

LPA - Local Planning Authority

NPPF - National Planning Policy Framework

PDR - Permitted Development Rights

Contact Historic England

East of England
Brooklands
24 Brooklands Avenue
Cambridge CB2 8BU
Tel: 01223 582749
Email: eastofengland@HistoricEngland.org.uk

Fort Cumberland
Fort Cumberland Road
Eastney
Portsmouth PO4 9LD
Tel: 023 9285 6704
Email: fort.cumberland@HistoricEngland.org.uk

London and South East
4th Floor
Cannon Bridge House
25 Dowgate Hill
London EC4R 2YA
Tel: 020 7973 3700
Email: londonseast@HistoricEngland.org.uk

Midlands
The Foundry
82 Granville Street
Birmingham B1 2LH
Tel: 0121 625 6888
Email: midlands@HistoricEngland.org.uk

North East and Yorkshire
Bessie Surtees House
41-44 Sandhill
Newcastle Upon Tyne NE1 3JF
Tel: 0191 269 1255
Email: northeast@HistoricEngland.org.uk

37 Tanner Row
York YO1 6WP
Tel: 01904 601948
Email: yorkshire@HistoricEngland.org.uk

North West
3rd Floor,
Canada House
3 Chepstow Street
Manchester M1 5FW
Tel: 0161 242 1416
Email: northwest@HistoricEngland.org.uk

South West
Fermentation North
(1st Floor)
Finzels Reach
Hawkins Lane
Bristol BS1 6JQ
Tel: 0117 975 1308
Email: southwest@HistoricEngland.org.uk

Swindon
The Engine House
Fire Fly Avenue
Swindon SN2 2EH
Tel: 01793 445050
Email: swindon@HistoricEngland.org.uk

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