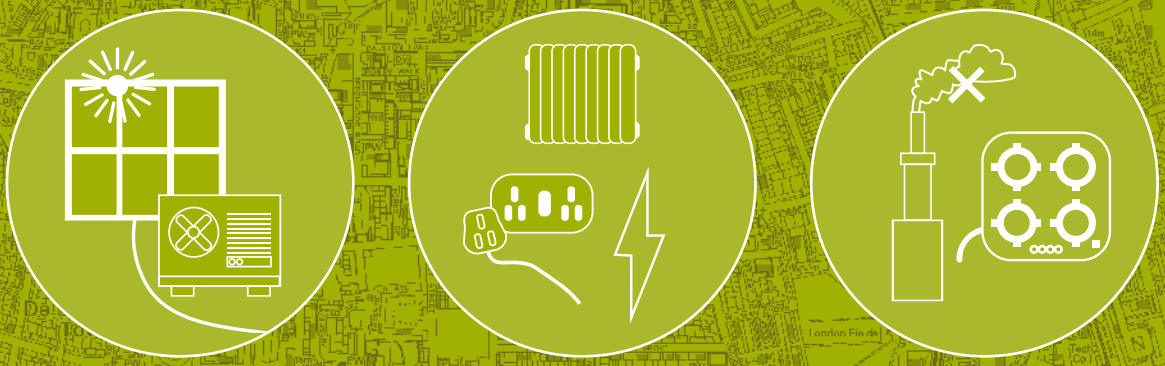
Hackney



Supplementary Planning Document:

Draft Retrofit

September 2025

Accessibility statement

If you require this document in a different format, please email

planmaking@hackney.gov.uk

We will consider your request and get back to you in the next five working days.

Contents


1

1. Introduction

1.1 In 2019, Central Government signed into law a target for England to become net zero by 2050, the National Planning Policy Framework (NPPF) was subsequently amended to support the transition to net zero by 2050. Following this in 2022 the Mayor of London adopted a more ambitious target of achieving net-zero carbon emissions by 2030.

1.2 In 2019, Hackney Council also declared a climate emergency and subsequently adopted the Hackney Local Plan 2033 (LP33) which outlined how planning decisions in the borough should seek to mitigate and build resilience to climate change. The Council also published the Climate Action Plan in 2022 which outlined the borough's decarbonisation strategy between 2023 and 2030:

hackney.gov.uk/rebuilding-a-greener-hackney

A number of actions have been identified to mitigate climate change and to improve the quality of life in Hackney, to reduce fuel poverty and keep our homes well-maintained and running at a comfortable temperature. One of these main measures proposed is for the 'retrofit of public and private buildings'.

1.3 This document sets out the Councils guidance on retrofitting of buildings in all uses to contribute towards meeting the Council Climate Change objectives as set out in the Strategic Plan. Retrofit can be understood as the 'introduction of new materials, products and technologies into an existing building to reduce the energy needed to occupy that building.' It provides a crucial pathway to decarbonising Hackney's energy consumption and building resilience to climate change. The aim of this document is to provide clear guidance to support the delivery of retrofit projects within the borough by outlining the key concepts within retrofitting.

1.4 Some of the terms within the document can be technical for users of this document, please refer to the glossary within **Appendix 4.**

1.5 This document provides advice on the following:

- **Key considerations for retrofitting.**
- **Retrofit measures.**
- **Embodied Carbon.**
- **Circular Economy.**

1.6 Each section of the document provides design principles to be applied to proposals with a design guide response and examples to support the design approach.

PURPOSE OF THIS DOCUMENT

1.7 The purpose of this document is to support and encourage Hackney's residents and businesses to improve their buildings to become more energy efficient. By guiding residents and businesses to make their buildings more energy efficient it contributes to the decarbonisation of the borough's building stock.

Energy efficiency

Energy efficiency means using less energy but achieving the same output and reducing energy waste. Examples include installing insulation to heat a home for longer or installing LED bulbs to achieve the same amount of brightness but with less electricity.

Decarbonisation

Decarbonisation refers to the process of decreasing carbon emissions resulting from human activity. This is primarily achieved by switching energy generation away from sources which rely on burning of fossil fuels but it can also be expanded to include any process that releases carbon into the atmosphere.

1.8 This document now expands on the

Residential Retrofit Guidance webpage

which provided residents with the technical and planning guidance on how they could improve the energy efficiency of their homes by creating guidance on how to best retrofit both residential and commercial buildings.

1.9 It is estimated that more than 80 %[1] of the buildings that will exist in 2050 already exist. Hackney's built environment creates 21 %[2] of the borough's greenhouse gas emissions, with 11 % arising from gas use in buildings, as shown in Figure 1.1 below. The need for retrofit is urgent, with the impacts of Climate Change already being felt. Retrofit offers valuable opportunities to enhance internal building conditions. It is therefore essential to adapt existing buildings to not only reduce energy consumption and to decarbonise emissions, but to improve indoor environments whilst addressing climate risks and supporting healthier, more resilient places for people.

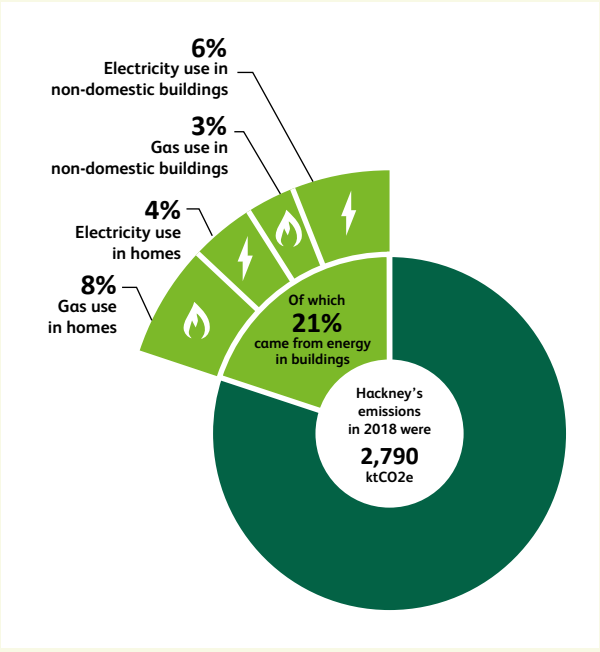


Figure 1.1 – Hackney Climate Action Plan Emissions breakdown.

HOW DOES THE SUPPLEMENTARY PLANNING DOCUMENT (SPD) FIT WITH OTHER PLANNING POLICY

1.10 The following planning policies and guidance have been used to inform this SPD. The SPD forms part of a wider planning police framework (see Figure 1.2 below). Any planning application must be consistent with the Development Plan Documents. These include the National Planning Policy Framework (NPPF), London Plan, Hackney Local Plan and the London Legacy Development Corporation Local Plan.

1.11 The SPD builds upon and provides more detailed advice and guidance on policies located within the Hackney Local Plan which align with the NPPF and London Plan. An SPD cannot introduce new planning policies as it does not form part of the Development Plan. On adoption, the SPD will be a material consideration in the determination of planning applications, together with the NPPF, London Plan, Local Plan and emerging Area Action Plans and other Supplementary Planning Documents.

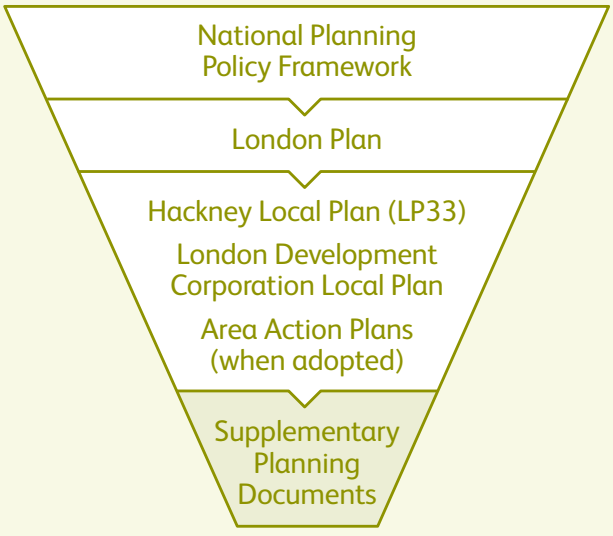


Figure 1.2 – Showing the wider planning framework hierarchy.

National Planning Policy Framework (2024)

1.12 The NPPF sets out the Governments planning policies for England and how these should be applied. The most relevant parts of the NPPF for the purposes of this document are:

- **Chapter 14 Meeting the challenge of climate change, flooding and coastal change**
- **Chapter 16 Conserving and enhancing the historic environment**

1.13 The NPPF is available on the Gov.uk website:

bit.ly/NppF

London Plan

1.14 The London Plan (2021) sets out a framework for how London will develop over the next 20–25 years and the Mayor's vision for good growth. It contains a number of policies which relate to high quality of design. These include:

- **GG6 Increasing efficiency and resilience**
- **HC1 Heritage conservation and growth**
- **SI 2 Minimising greenhouse gas emissions**

1.15 Additional policies which can be used to determine a planning application for the retrofit of buildings include but are not limited to:

- **SI 4 Managing heat risk**
- **SI 5 Water infrastructure**
- **SI 7 Reducing waste and supporting the circular economy**

1.16 The London Plan is available on the Mayor of London's website:

london.gov.uk/programmes-strategies/planning/london-plan

Hackney Local Plan 2033 (LP33)

1.17 The Hackney Local Plan 2033 (2020), also known as LP33, is the key strategic planning document used to direct and guide development in the Borough up to 2033. It contains a number of policies which relate to retrofit. These include:

- **LP1 Design Quality and Local Character**
- **LP3 Designated Heritage Assets**
- **LP4 Non Designated Heritage Assets**
- **LP54 Overheating and Adapting to Climate Change**
- **LP55 Mitigating Climate Change**

1.18 Additional policies which can be used to determine planning applications which include retrofit measures include but are not limited to:

- **LP2 Development and Amenity**
- **LP53 Water and Flooding**
- **LP57 Waste**

1.19 The Hackney Local Plan is available on the Councils website:

hackney.gov.uk/lp33

London Legacy Development Corporation Local Plan 2020 to 2036

1.20 On 1 December 2024, planning powers returned from the London Legacy Development Corporation (LLDC) to the London Borough of Hackney. This means Hackney will be responsible for processing and assessing all planning applications within this area.

1.21 The London Development Corporation Local Plan and Supplementary Planning Guidance will still apply to the area that the London Development Corporation covered until we replace them with a future Hackney Local Plan. These Policies include but are not limited to:

- **Policy BN.3: Maximising biodiversity**
- **Policy BN.17: Conserving or enhancing heritage assets**
- **Policy S.2: Energy in new development**
- **Policy S.3: Energy infrastructure and heat networks**
- **Policy S.4: Sustainable design and construction**
- **Policy S.8: Waste reduction**
- **Policy S.9: Overheating and urban greening**
- **Policy S.10: Flood risk**

WHO IS THIS DOCUMENT FOR?

1.22 The document is designed to be used by a range of audiences who play a key role in creating and assessing planning applications including:

- **Owners and/or occupiers of buildings who are interested in extending and altering their properties.**
- **Architects, Planning Agents and Developers when designing proposals.**
- **Development Management Officers when considering planning applications and pre-applications.**
- **Conservation and Urban Design Officers, when commenting on planning applications.**
- **Organisations that the Council consults on planning applications such as Conservation Area Advisory Committee, local amenity groups and Historic England.**
- **Members of the public who which to comment and review planning applications.**
- **Planning Inspectors when considering a planning application at appeal.**

WHAT PLANNING PERMISSIONS DO I NEED?

1.23 It's likely you will need planning permission if you're:

- **Building something new**
- **Extending or altering a building used as flats or a commercial building.**
- **Changing the use of all or part of a building.**

1.24 In addition to planning permission, Listed Building Consent will be required for any external or internal works to a listed building.

Pre Application and Planning Performance Agreements

1.25 Applicants are advised to seek pre-application advice on development proposals to ensure they are well designed and comply with planning policies to increase your chances of making a successful planning application. In submitting for pre-application advice it will:

- **Help with getting a quicker decision on your application.**
- **Identify elements of the proposal that may require amending.**
- **Identify additional information to submit with any application.**
- **Ensure you understand the policies under which your application would be assessed against.**
- **Identify what consultations you should carry out before applying.**
- **Inform you of any planning obligations that may be relevant.**

1.26 More information regarding the pre-application service and how to use the service is available on the Councils website. Please visit:

hackney.gov.uk/pre-application

1.27 Planning performance agreements (PPAs) are generally used on major applications or applications which are more complex. More information regarding PPAs and how to use the service is available on the Councils website. Please visit:

hackney.gov.uk/ppa

Submitting an Application

1.28 Before submitting an application you should discuss the proposals with your immediate neighbours who may be affected. This may help to resolve any objections or concerns they may have, which otherwise might be raised when you submit your application.

1.29 To apply for planning permission you need to submit a planning application. All planning applications are required to be submitted on a standard form and can be submitted online through the Planning Portal. Please visit:

planningportal.co.uk/applications

1.30 Additionally, further information on how to submit a planning application can be found on our website. Please visit:

hackney.gov.uk/submit-planning-application

Building Control

1.31 Some works will be subject to building control regulations, particularly with regards to foundations, lateral restraint and fire protection. A separate application must be made for the necessary approvals, this can be done via the Council. For more information, please visit:

hackney.gov.uk/building-control

1.32 To check if your property requires Building Regulations Approval please visit:

gov.uk/building-regulations-approval/when-you-dont-need-approval

1.33 When applying for planning permission it is essential to remember that, in order to ensure that your proposal can be built, it must also comply with the Building Regulations.


2

2. What is retrofitting?

2.1 Retrofit is commonly defined as the introduction of new materials, products and technologies into an existing building to reduce the energy needed to occupy that building. A retrofit goes further than a general repair, renovation, refurbishment and/or restoration of a building, as these efforts may not prioritise energy-saving, although aspects of these wider improvements may be incorporated in a retrofit.

2.2 Retrofit works may also be used to adapt buildings for our changing climate and be more resilient to extreme weather, including temperatures, wind and rainfall. Similarly retrofitting works can be undertaken as part of a change of use, this process is known as adaptive reuse. There are a number of key benefits of retrofitting buildings, which are shown in Figure 2.1 below:

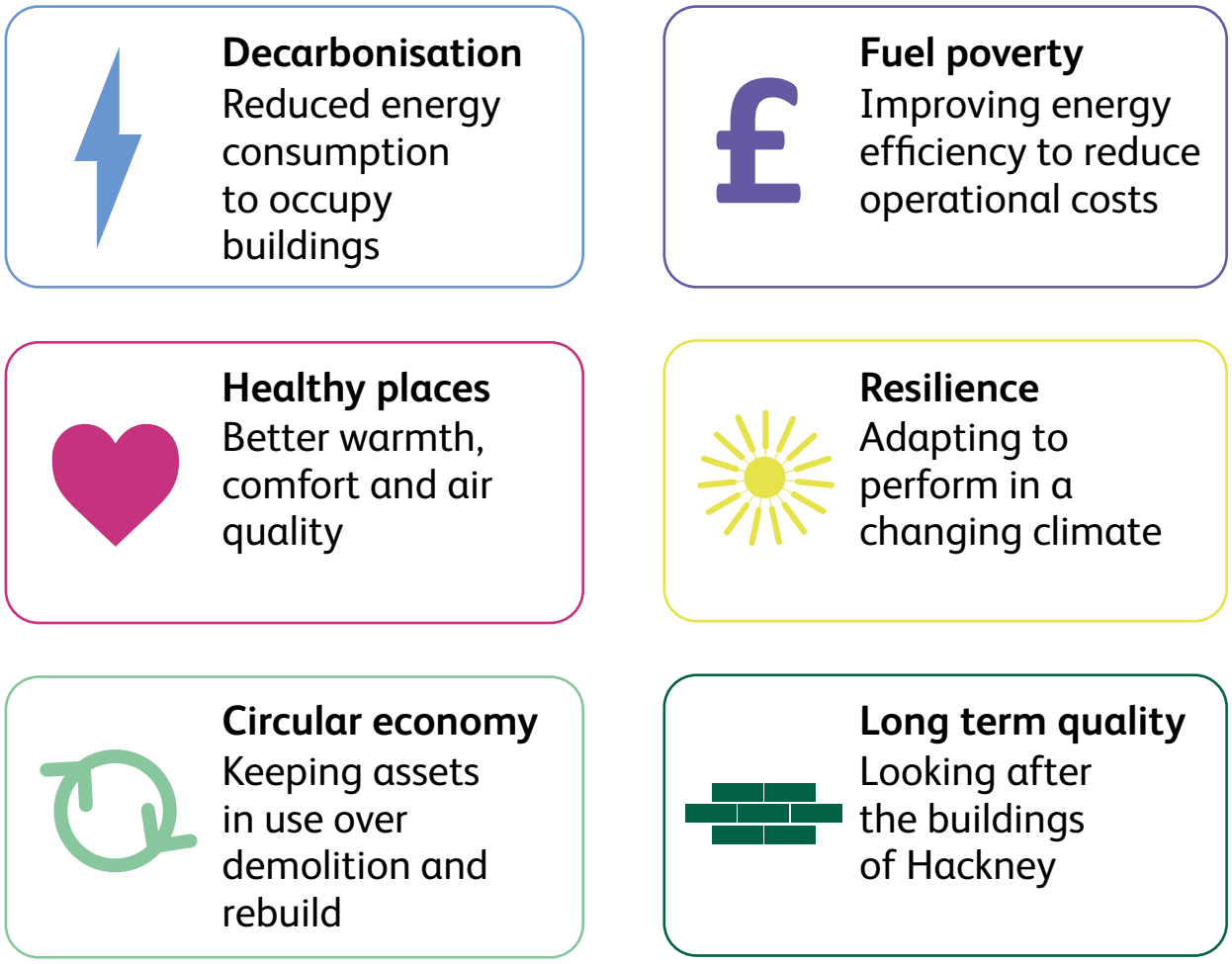


Figure 2.1 – Benefits of Retrofit.


3

3. Key considerations

3.1 This section presents key considerations that applicants are encouraged to consider at the start of the project. The points below are a guide in how to use this document to get the most from your retrofit project:

- **Look at a whole building approach to retrofit.**
- **What are the heritage considerations for retrofit.**
- **Consider the effect of different uses and users.**

A WHOLE BUILDING APPROACH TO RETROFIT

3.2 The whole-building approach to retrofit works on a case-by-case basis, looking at the specifics of an individual building to determine how it can be retrofitted to ensure that sustainability and the quality of life for the occupiers is maximised and that no negative unintended consequences arise, while ensuring that other planning considerations with respect to conservation and heritage are observed fully.

Whole building approach to retrofit

'The whole building approach is a systematic process for devising and implementing suitable, coordinated, balanced and well-integrated solutions that:

- **are based on a thorough understanding of the building in its context and how it performs.**
- **avoid harm to the significance of the building.**
- **minimise the risks of negative or unintended consequences.**
- **ensure a healthy and comfortable internal environment.**
- **increase climate resilience and minimise environmental impact.**
- **are proportionate, effective, and cost efficient.'**[3]

3.3 While the whole-building approach to retrofit requires looking at each existing building and the project particulars to find the most suitable solutions, as shown in Figure 3.1 below, there are three consistent principles that underpin all retrofit works for any retrofit project looking to maximise carbon savings, regardless of the building specific circumstances;

1/ **Reduce energy demand –** improvements to the structure, fittings and fixtures of a building to limit heat loss and energy consumption. This will reduce energy demands on the National Grid and support the ability for the following two steps;

2/ **Fossil-fuel free –** replacing and decommissioning fossil-fuel based fittings and fixtures with electric-based alternatives to support decarbonisation of energy more widely and to support the integration of;

3/ **Generating renewable energy –** producing as much renewable energy as reasonably possible on site to support the decarbonisation of energy more widely and reduce demands on the energy grid.

Reduce energy demand

3.4 **Benefits**

Upgrading buildings to be more energy efficient is one of the best things that can be done to tackle climate change and cut energy costs. One of the main drivers for retrofitting buildings is to reduce the energy demand for operating the buildings, including the energy involved in heating, cooling, hot water and cooking. Reducing energy demand supports;

- **Addressing fuel poverty and helping to reduce fuel bills.**
- **Mitigating climate change by reducing the demands upon the National Grid and fossil fuel consumption (see section 3.1.2 for more on this) and avoiding wasteful energy consumption.**
- **Improving compatibility with renewable energy generation on site.**
- **Improving the likelihood of future connectivity to heat networks that require more efficient buildings to function well.**
- **Create more comfortable homes that promote better physical and mental health and wellbeing for the residents/occupants.**

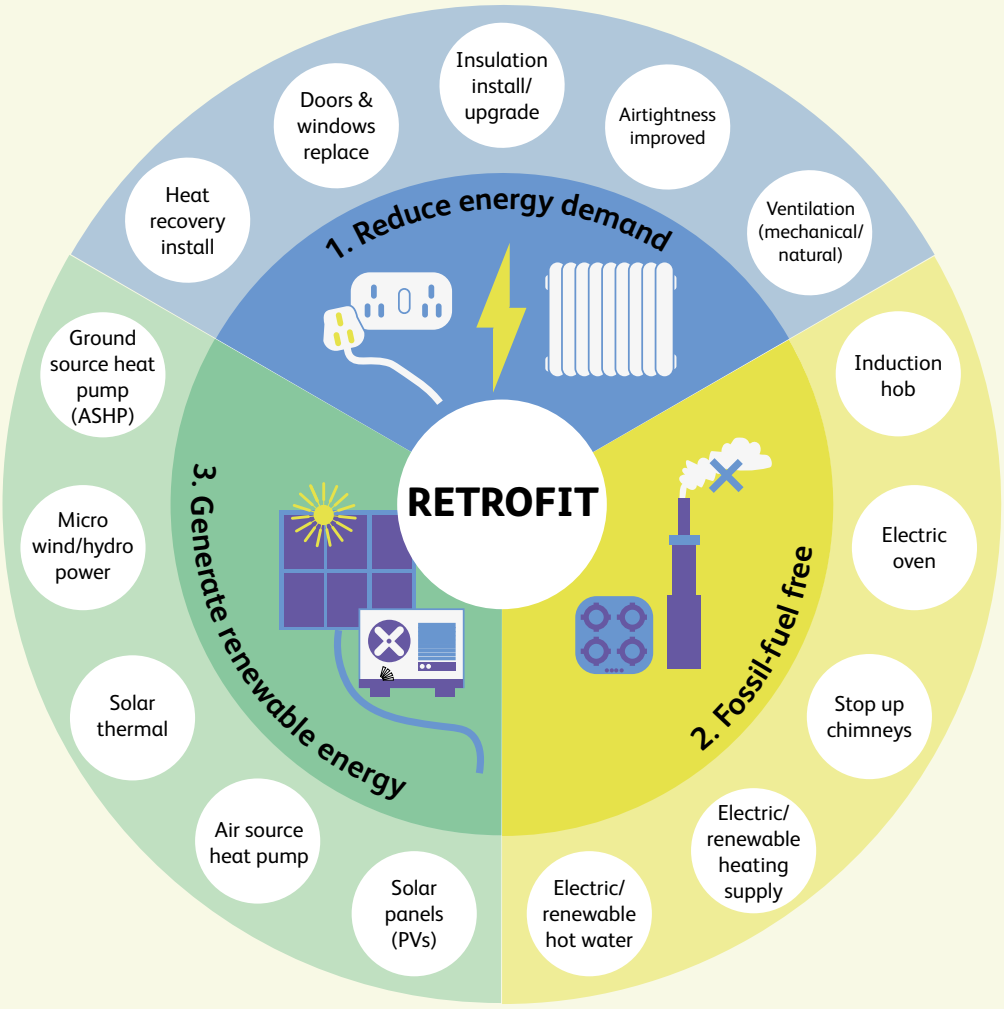


Figure 3.1 – A whole-building approach to retrofit.

3.5 **Considerations**

Before undertaking any retrofit works with the aim of reducing energy consumption all of the following factors need to be considered as part of a comprehensive retrofit plan:

- **Adoption a whole building approach that is specific to the site –** the main sources of energy consumption for a building and the occupiers should be identified through the use of site specific information like thermal imaging (see figure 3.2 below), analysing energy bills or smart meter data and surveys of building occupiers. Following this a phased plan to reduce energy demand should be developed with the incorporation of measures like:
  - **Addressing building fabric issues –** for airtightness, damp and moisture issues, thermal bridges and other deficiencies can be resolved to reduce unwanted heat losses/gains.
  - **Upgrading or replacing doors and windows –** to improve their thermal efficiency and airtightness reducing unwanted heat losses/gains.
  - **Upgrading or installing entire insulation systems for walls/ floors/roofs –** to improve the thermal efficiency and airtightness performance reducing unwanted heat losses/gains.
  - **Installing mechanical ventilation systems or improving natural ventilation –** this may also involve adding mechanical heat recovery to harness heat otherwise being lost from the building to further reduce energy demands.
- **Futureproofing –** energy efficiency measures tend to prioritise the provision of warmth in the cooler months of the year, as this is where the majority of energy consumption associated with buildings arises at present. However, a well-insulated and airtight building can also help maintain a healthy and comfortable temperature and humidity level in the summer months during extreme heat without having to resort to high-energy cooling systems. Ventilation will need to be considered as part of this strategy to ensure heat does not become trapped within the building fabric.
- **Moisture and ventilation –** buildings are required to regulate increasingly humid air from activities like cooking and showering contributing to higher levels of evaporation of water in the air than was historically the case. While recently constructed buildings may have been designed to anticipate this and provide appropriate ventilation, older buildings may not. This, coupled with any cold surfaces, such as uninsulated walls, poor performing windows or thermal bridges can lead to the build up of areas of damp and eventually mould.
- **Other sources of damp –** failing rainwater goods, changes in the building layers through movement over time, cracks and loss of airtightness can also cause damp. The reason that damp and moisture is important for energy efficiency considerations is that damper materials are more thermally conducive, and therefore contribute to unwanted heat losses and gains. It is therefore important to identify any sources of moisture and dampness in buildings before embarking on deeper retrofit works, as otherwise efforts to insulate may be ineffectual compared to design estimates.

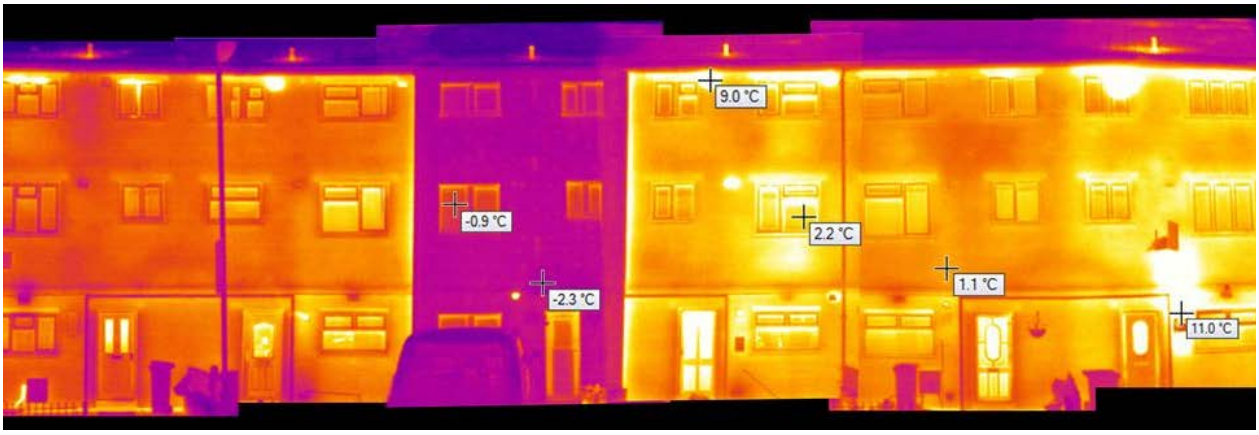


Figure 3.2 – Thermal imaging of a retrofitted home showing significant improvements to reducing heat loss in a terrace. The property with retrofit shown clearly in purple 'low heat loss'. (Photo Credit: bere:architects)

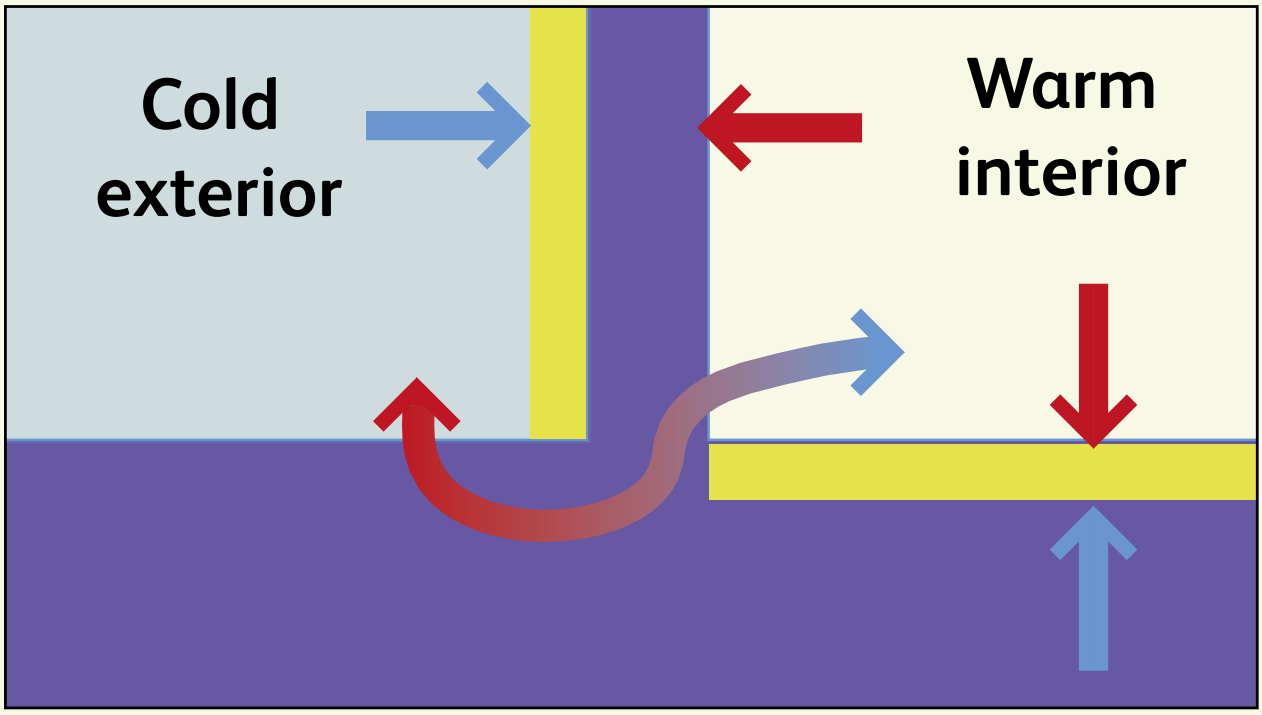


Figure 3.3 – Showing thermal bridging.

Key concepts to reduce energy demand

Insulation

Insulation is an effective way of maintaining a comfortable temperature in a building by limiting the transfer of heat from the inside of the property to the outside (and vice versa). This is generally achieved by introducing layers of materials of a lower thermal conductivity.

Additional information on insulation can be found in **Section 4.**

Thermal bridging

Figure 3.3 The break between the floor insulation and the external wall insulation creates a thermal bridge allowing heat to move from inside the building through the junction and reduces fabric performance.

Thermal bridges are where connections and junctions lead to heat being passed around otherwise insulated elements. They reduce the overall thermal performance by allowing unwanted heat losses/gains and can lead to issues such as damp and mould.

Fossil-fuel free

3.6 Fossil fuels are a primary contributor to climate change and one of the key parts of reaching net zero is reducing fossil fuel consumption as far as possible, as quickly as possible. Introducing alternative forms of energy generation and usage for buildings will help reduce the consumption of fossil fuels and thereby the release of greenhouse gasses into the atmosphere.

3.7 Gas boilers are currently the dominant heating system within Hackney. Moving away from fossil fuel based energy systems for heating and hot water is an important part of Hackney's Climate Action Plan. Retrofitting buildings to move away from fossil fuel combustion on site has multiple benefits including:

- **Addressing climate change –** by moving towards greener and more sustainable energy sources locally and/or nationally.
- **Improving internal air quality –** gas combustion for cooking and heating is known to contribute to worsened indoor air quality and this impacts human health and wellbeing.
- **Less reliance on imported energy sources –** which tend to be vulnerable to international market volatility and increasing scarcity challenges owing to the finite nature of these resources.

3.8 There are many alternative systems to provide these functions without requiring on-site combustion of fossil fuels, including;

- **Direct electric radiators and boilers/hot water points –** can replace traditional boilers with minimal invasiveness and simply draw energy from the electricity grid or on-site renewable energy generation.
- **Stopping up chimneys/gas fires –** and replacing with electric based fires/display units for the same aesthetic and warmth features rather than combusting coal/wood directly.
- **Replacing gas hobs and cookers with electric based induction hobs/cookers –** this is applicable in both domestic and commercial settings.
- **Renewable energy solutions –** more in the next section. In general renewable energy solutions seek to avoid the need to use energy from the grid to provide a direct on-site solution for heating, cooling and hot water.
- **Connections to District Heat Networks and Central Heat Plants –** where these systems become available, it may be possible to connect and draw energy from more efficient sources at a network level. Currently many of these systems rely still on fossil-fuel combustion, but over time it is expected that these will also decarbonise and move towards renewable energy sources, sharing the efficiencies that larger scale energy generation can provide.

3.9 To further support decarbonisation of the grid, it is important to reduce any waste in the electricity demand placed upon the grid. As has been identified in the previous section, buildings are an area where improvements can be made to energy efficiency towards further supporting the decarbonisation of the grid. The less energy we all consume, the faster we will be able to decarbonise the grid.

Generating renewable energy

3.10 The last of the three principles of retrofitting buildings is to incorporate renewable energy generation on site. This can be achieved by incorporating the following technologies;

- **Solar Photovoltaics**
- **Solar thermal**
- **Air Source Heat Pumps**
- **Ground Source Heat Pumps**
- **Micro turbines**
- **Water-sourced heat pumps**[4]

3.11 The advantage of increasing renewable energy generation on and within buildings in Hackney include;

- **Reducing the demand on the National grid –** supporting decarbonisation more rapidly and helping to alleviate the need to import fossil fuel based or other energy sources from abroad when at times of peak energy demand.
- **Reducing energy bills –** generating energy needs on site provides an alternative to paying for energy supply and potentially can even generate an income from the renewable energy system if the energy generation exceeds demand.
- **Making use of space that otherwise is not performing a useful function –** this allows land elsewhere to be put to other uses, e.g. roofspaces in Hackney can be put to use to provide the energy we need, freeing up demands on land in rural areas to be used for agricultural land uses and other societal needs.
- **Reducing the need to import energy from afar –** wherever energy has to be transported long distances there are losses and inefficiencies that will arise, as well as impacts on landscapes from overhead electricity transport and on biodiversity accordingly where the energy is transported over long distances.

Risks

3.12 Achieving these three goals together is not always possible at the same time due to budgetary or time constraints. Instead, depending on the building or project circumstances, it may be necessary or useful to phase retrofit works, especially around other necessary maintenance works. It is also important to be aware of the potential risks that can arise from retrofit works not being undertaken in line with whole-building retrofit approaches, including;

- **Disruption –** phasing being undertaken in an unplanned way can result in unnecessary repetitive disruption.
- **Damp and mould –** single-measure retrofit or poorly designed and executed retrofit can result in damp and mould, particularly where there are thermal bridges or where there is inadequate ventilation. This can be harmful to human health and result in less effective retrofit measures as damp walls facilitate the loss of heat.

- **Counterproductive works –** works that needs to be undone in order to enable future retrofit works such as the installation of photovoltaic panels which then require removal and reinstallation at a later date to enable external roof insulation would be an example of this.
- **Maladaptation –** works that do not consider future climate change risks and lead to unintended negative effects for occupants. While generally retrofit tends to focus on energy and thermal efficiency increasingly it is possible to simultaneously address issues around excess heat in summer months. Passive and mechanical strategies can be incorporated through retrofit works and many retrofit approaches will help properties to be warmer in the winter and cooler in the summer.
- **The building's unique context and construction –** different buildings are more challenging than others to retrofit. This is due to the nature of the form, scale and massing of the buildings, including how exposed or not they are to the sun, alongside how they were actually built and when, or if they've been altered or adapted over time.

Retrofit plan

3.13 It is generally advisable to develop a Retrofit Plan, as part of considering the whole building approach to retrofit to ensure that the best outcome is achieved, that all risks are considered and that all three principles are considered. A Retrofit Plan should be considered even if works are planned to be phased as a sequence of works over months or years:

Retrofit Plan

A Retrofit Plan is a comprehensive plan for retrofit improvements, with the aim of maximising energy savings and ensuring retrofit measures are phased and delivered to be complementary to one-another.

A retrofit plan should include:

- **Key building information ie – heritage assets risks, and opportunities;**
- **Main retrofit measures proposed along with related strategies and details;**
- **The sequence of work; and**
- **A plan for monitoring and reporting energy consumption.**

More detail on the main considerations for a retrofit plan as well as what information should be included within a retrofit plan can be found in **Appendix 01.**

More detail on how to effectively monitor the outcomes of a retrofit plan can be found in **Appendix 02.**

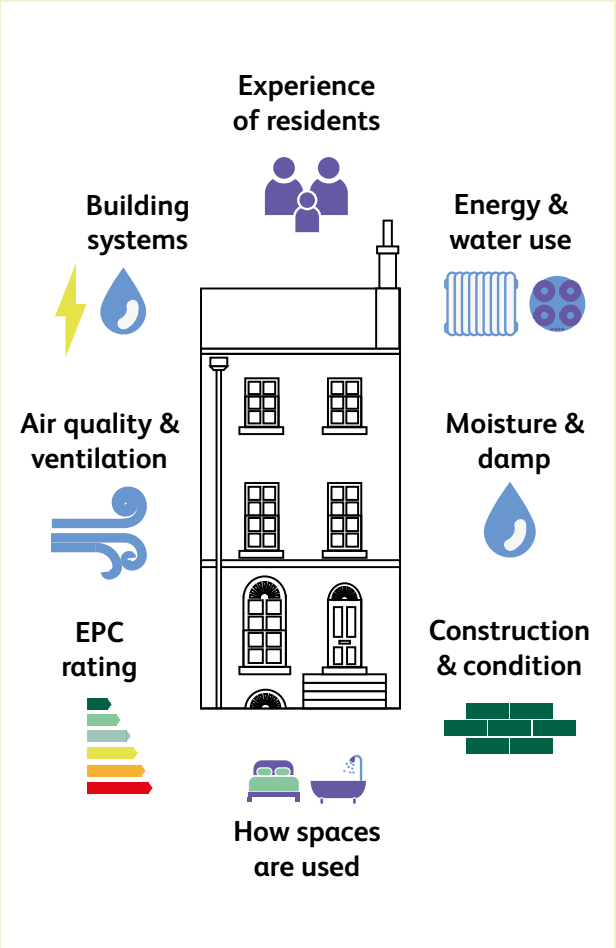


Figure 3.4 – Examples of considerations for developing an appropriate retrofit plan.

3.14 For more information on how different retrofit measures potentially interact and what the risks of different measures are, see the SBTA's Guidance Wheel which can be viewed on their website. It is generally advisable to work with certified professionals adept at developing appropriate Retrofit Plans, for instance those with PAS 2035 accreditations.

3.15 There are certifications available for retrofit works to ensure that quality is delivered as designed for. The built environment sector has been developing guidance on Retrofit best practice approaches, with the following resources available for free online:

- **The Climate Emergency Retrofit Guide on the LETI website.**
- **The National Retrofit Hub has released many guides including documents, webinars and podcasts which can be found on their website.**

HERITAGE CONSIDERATIONS FOR RETROFIT

3.16 In traditional, particularly pre-1920s, buildings there is an even greater need to develop whole-building retrofit approaches that are specific to the fabric and use of that building. Older buildings were generally made with different construction methods and materials than we tend to use today, with associated different qualities that can be supported or harmed through interaction with modern methods of construction. Older buildings may have already undergone multiple adaptations and alterations over their lifetime, with potential for a variety of constructions and systems, meaning that there may not be a one-size-fits-all even for similar buildings along the same street, or even apartments/units within the same building.

3.17 Key considerations for older buildings:

- **Ventilation and moisture –** older buildings are often made of more 'breathable' materials and are generally of a less airtight construction than modern methods of construction. This means that older buildings generally have higher levels of ventilation than modern buildings, however, the ventilation in older buildings is often uncontrolled leading to higher levels of heat loss than may be desired. The introduction of new layers of materials to address unwanted heat losses needs to be carefully considered to ensure that moisture does not become trapped in the construction build-up. For instance, some insulation materials are not compatible with older buildings, as they block the passage of moisture. Older buildings also may rely on features including chimneys to contribute to ventilation systems, and so blocking off of chimneys can create a need for new ventilation pathways;
- **Heritage significance –** retrofit proposals should be designed to preserve the heritage significance of historic buildings. Depending on the retrofit proposal and the building, planning permission and listed building consent may be required. More information is provided in following sections where this may be the case;
- **Complexity and historic interventions –** with older buildings there is a likelihood that changes will have occurred over time with different systems and methods of construction working together. Working with professionals who have an understanding of what to look for in older buildings is recommended;

- **Potential for issues with the building fabric –** older buildings by their nature may be in need of maintenance and upkeep to address movement issues, degraded fabrics and so on if they haven't been looked after well enough. When retrofitting, opening up works may identify unknown issues within the building fabric and provide an opportunity for ensuring that the building is kept in good condition for future generations to enjoy.

3.18 While retrofitting older buildings can be challenging, it is important that all buildings are made as energy efficient as possible to support decarbonisation. There are increasingly more solutions and case studies available for most scenarios and there are many useful sources of information. Working with reputable professionals, construction teams and historic building experts is advisable.

EFFECT OF DIFFERENT USES AND USERS

3.19 Different building use types present different challenges and opportunities when retrofitting. Considerations include:

- **Peak energy demand times and variation –** different building uses have different typical energy load demand cycles. For instance, commercial workplace buildings and schools tend to use more of their energy during the working day and during the week, while in our homes we tend to use more energy in evenings and weekends. This means that retrofit can be tailored to maximise the benefits these patterns present e.g a commercial workspace or school building may lend well to nighttime purge ventilation being built in, to ensure the workspace is cooler in the morning, while residential accommodation might suit installation of battery storage for daytime PV energy generation to be stored readily for evening demand. Tailoring the retrofit plan around the specific uses of the building can help to further maximise carbon savings and ensure retrofit works are beneficial. Conversely, the speculative nature of some commercial workspaces can be challenging as there is a need to cater for a wider spectrum of energy and performance needs, which can lead to overengineered solutions.
- **Tenancy types –** it can be hard to undertake deep retrofit works while residents or tenants are in situ, and alternative accommodation may need to be provided. Commercial and residential buildings for instance have opportunities at the end of tenancies for deeper retrofit works to be undertaken, however if there are multiple tenants in the same building there may need to be a phasing of works to support this.
- **Incentives and payback –** some retrofit interventions have a fast payback period, with others taking decades for the investment to be repaid through reduced energy bills. Those living and working in buildings that benefit from retrofit works will see a benefit to reduced bills and improved cost of living quickly if the right retrofit interventions are implemented. Different ownership types of buildings and estates will incentivise different retrofit actions therefore.
- **Logistics –** it is important to consider what the impact of retrofit works will be while under construction. Some of the deeper retrofit interventions will be better planned as part of a building's regular maintenance cycle; e.g. if you are planning to redecorate or replace floorings, it is worthwhile undertaking retrofit works in advance of these works to avoid waste. Schools and universities have in-built periods of study leave/ terms that help with undertaking invasive works, but ongoing services like healthcare and infrastructure will need robust planning for avoiding impacts on those using the services.


4

4. Retrofit measures

4.1 To retrofit your home you may prioritise one measure, or a combination of measures. If one measure is not possible in your home context, there will almost always be another way to improve your home's performance. This section expands upon retrofit measures that would be in your retrofit plan giving guidance on whether they would require planning permission. The table below expands upon each measure using a colour coded system to identify if planning permission and listed building consent is required and the likelihood of it being granted.

4.2 It should be noted across all measures that buildings have other performance requirements, including for accessibility and fire safety that must also be considered. It is recommended that professional advice is sought to ensure compliance with the full range of regulations and best practice approaches that each measure relates with. Where risks are flagged in this document, these should be seen to be not necessarily

4.3 Before undertaking any retrofit measures which fall under permitted development be aware that permitted development works are subject to certain requirements and conditions which change if legislation is updated. Please refer to the guidance on

bit.ly/PPPDR

for the most up to date legislation.

INSULATION

4.4 Insulation is an effective way of maintaining a comfortable temperature in a building by limiting the transfer of heat from the inside of the property to the outside (and vice versa). This is generally achieved by introducing layers of materials of a lower thermal conductivity.

4.5 In the UK generally insulation is developed to limit heat losses in winter months, increasingly though, with climate change, insulation is also helpful to address unwanted heat gains in summer months at times of extreme heat.

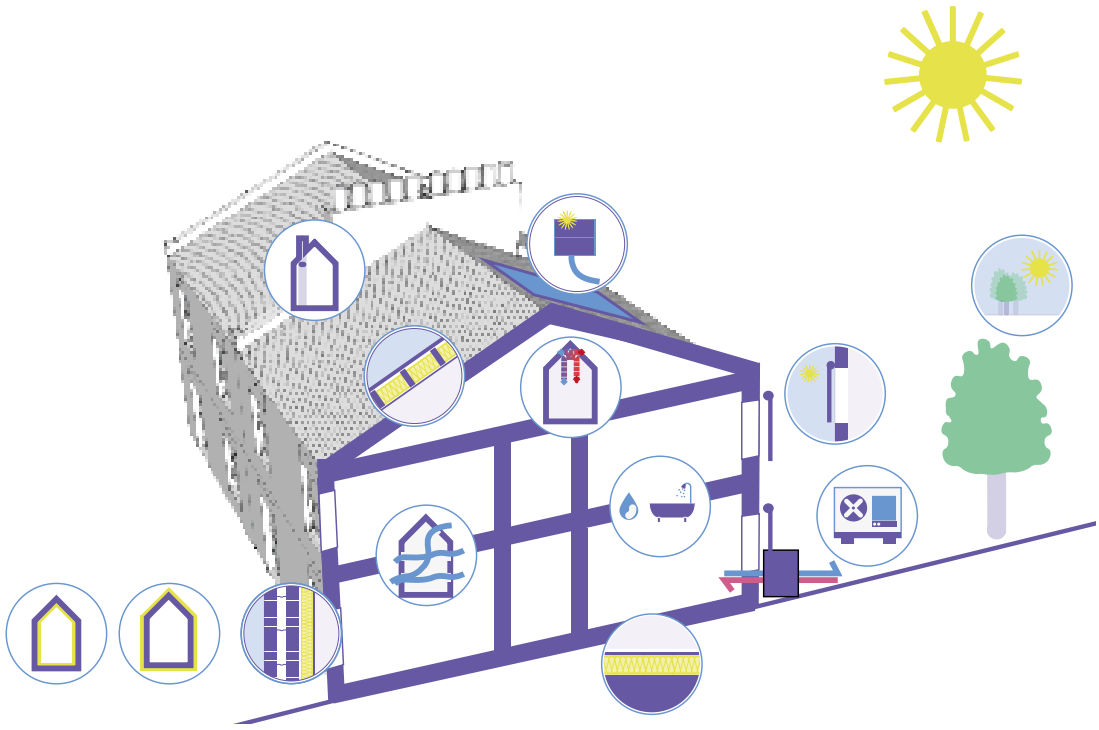


Figure 4.1 – Examples of retrofit measures on a building.

4.6 Air has a lower thermal conductivity than many hard materials such as glass or brick, so sometimes systems rely on cavities of air to avoid gaining or losing heat.

4.7 It must be noted that risks associated with additional insulation greatly depend on the project specific circumstances and that finding the right insulation for a particular application will depend on space available, budget constraints, desired performance and combustibility needs. Therefore adequate professional advice and careful detailing and material specifications must be obtained.

- **Insulation performance considerably depends on its specifications (material, product type and thickness) and construction approach. There are a number of products with different performance outcomes for combustibility, thermal energy control and embodied carbon, further information can be seen in Appendix 06.**

4.8 Some of the insulation products available are of a high embodied carbon, others are able to have very low embodied carbon impact due to storing biogenic carbon associated with the production of that material (e.g. those that use wood or other naturally grown materials store carbon as they grow). Please refer to Section 5. Embodied carbon measures for further information on this topic.

4.9 Insulation can be installed in the floor, the walls and the roof. The general principle when insulating is to form a continuous line of insulation as far as possible and to limit thermal bridges where there is disruption to insulation whilst eliminating the risk of trapped moisture, interstitial condensation and overheating. As seen in Figure 4.1 the two main forms of insulation are external insulation (adding insulation to the outside of the building and applying a new external finish) and internal insulation (adding insulation to the inside of the building and applying a new internal finish). Depending on the building's construction and context one or a combination of these may be more appropriate.

4.10 When insulating buildings and making repairs to the building fabric, it is important to be aware of and protect nesting birds, such as swifts, which commonly nest in structural openings. Nests are protected and disturbing active nests may constitute a wildlife crime if the right requirements are not followed. It is encouraged to provide swift boxes or swift bricks as part of repair works to reprovide and enhance provision of nesting spaces for birds and other species.

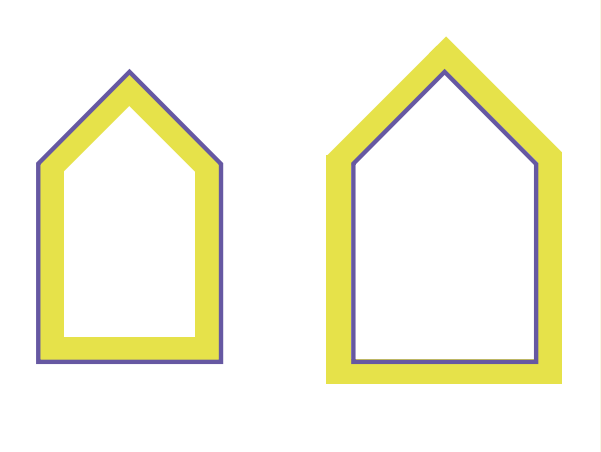
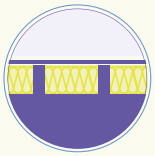


Figure 4.1 – Internal vs external insulation.

4.11 This section below outlines the following insulation methods:

- **Floor insulation: suspended timber floors**
- **Floor insulation: solid ground floors**
- **External wall insulation (EWI)**
- **Cavity wall insulation**
- **Internal wall insulation (IWI)**
- **Roof insulation between rafters**
- **Roof insulation between joists**
- **External roof insulation**

FLOOR INSULATION: SUSPENDED TIMBER FLOORS



How does it work?:

Suspended timber floors can be a significant source of heat loss particularly if there are gaps between floorboards allowing draughts. Draughts between boards and skirting can be eliminated relatively easily by sealing gaps.

Insulation would typically be inserted below the existing floorboard - either by lifting them or by accessing from below – the insulation would typically match the joist thickness and be supported with a net.

Care needs to be taken when lifting boards to minimise damage.

Technical considerations:

Older floors can be easily damaged when lifting and/or replacing boards.

Airbricks should not be blocked when draught proofing or when insulating, and take care to maintain cross ventilation beneath suspended timber floors to avoid unintended consequences including rotting floor timbers.

Further guidance:

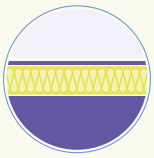
Please view the **Historic England webpage** on Insulating floors in historic buildings.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PERMISSION NOT REQUIRED Acceptable and permission not required as it is an internal alteration.	**PERMISSION NOT REQUIRED** Acceptable and permission usually not required as it is an internal alteration.	**LISTED CONSENT REQUIRED** Potentially acceptable subject to details on how it will impact any historic fabric including floor boards etc

KEY:

- Acceptable
- Likely acceptable
- Likely not acceptable

FLOOR INSULATION: SOLID GROUND FLOORS



How does it work?:

Solid ground floors are where the construction of the building is based upon a slab type foundation which floor finishes are built off of. In some instances, the floor finishes may be even directly laid upon made up from the natural ground. Existing ground bearing floors already provide a degree of thermal regulation, as the soil below tends to maintain a stable temperature. Insulating onto solid ground floors is one approach, where the floor finish is essentially raised by insulation, with the slab remaining intact. Where an existing ground bearing floor is able to be removed, partially dug into or repaired, a thicker layer of insulation may be added within and below the slab to improve its thermal performance.

Technical considerations:

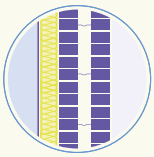
The thickness of insulation that can be added on top of any slab will be limited by level access requirements in tying into existing thresholds and in ensuring sufficient headroom in the rooms affected. There may be a potential loss of historic fabric. There is also the potential for thermal bridging at junctions with walls.

Further guidance:

Please view the **Historic England webpage** on Insulating solid ground floors.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required as it is an internal alteration.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission not required as it is an internal alteration.	**LISTED CONSENT REQUIRED** Potentially acceptable subject to detail including what historic fabric and finishes survive. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

EXTERNAL WALL INSULATION (EWI)



How does it work?:

External Wall Insulation (EWI) consists of applying insulation which is typically finished with render but can also be cladded (e.g. brick slips, render). There are a number of supporting systems available, mechanically fixed, bonded or introducing a cavity to suit the condition and build of the existing wall.

Technical considerations:

By adding thickness to the external walls, EWI will have an impact visually on the relationship between the newly insulated facade facade and the rest of the envelope such as windows, roof eaves, service penetrations, as well as with the adjacent buildings, this is particularly noticeable within terraces and semi-detached buildings.

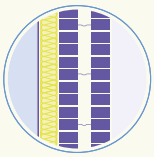
In addition to the visual impact, EWI can create additional thermal bridges for moisture which can result in damp and rot problems in localised areas.

Risks associated with this measure greatly depend on the project specific circumstances – for instance, vapour permeable insulation may be suitable for traditional buildings but not adequate for modern construction. Therefore adequate professional advice and careful detailing and material specifications must be obtained.

Further guidance:

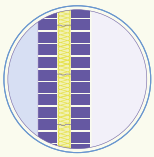
- **Historic England's webpage** on Insulating walls in historic buildings.
- The **Gov.uk webpage** on Understanding best practice in deploying external solid-wall insulation and internal wall insulation in the UK.
- **The Energy Saving Trust's** webpage on Solid wall insulation.

EXTERNAL WALL INSULATION (EWI) continued



PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT MAY BE REQUIRED Planning permission is normally required for EWI on dwellinghouses where it is unlikely that any external insulation will adequately match existing brick buildings as required by permitted development. Planning Permission is required for flats and works on commercial properties above the ground floor level. EWI installed on less visible facades such as the rear elevations, and in enclosed locations might be acceptable subject to adequate detailing, safeguarding of architectural features and material specification. Considerations should be taken to ensure key architectural features are retained or are accurately replicated. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.	**PLANNING CONSENT REQUIRED** EWI installed on less visible facades such as the rear elevations, and in enclosed locations might be acceptable subject to adequate detailing, safeguarding of architectural features and material specification. Considerations should be taken to ensure key architectural features are retained or are accurately replicated. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.	**LISTED CONSENT AND PLANNING CONSENT REQUIRED** Unlikely to be acceptable as this will change the external appearance especially in relation to window reveals and cornices.

CAVITY WALL INSULATION



How does it work?:

Cavity wall insulation is more common on post 1919 buildings where the external facade consists of 2 layers of masonry separated by a cavity. Loose insulation is typically injected between the 2 layers of masonry. Cavity wall insulation is typically non-invasive and doesn't alter the external aspect of the existing building.

Technical considerations:

The installation of cavity wall insulation needs to be carried out by a suitable professional and the necessary repairs to the existing walls are carried out so damp issues are eliminated. It is recommended to follow up with a thermal survey to confirm the cavity has been fully filled and avoid unsuspected thermal bridges.

Ventilation is required otherwise there is a condensation risk. Highly exposed walls may not be suitable for cavity wall insulation.

Overtime, the loose insulation may sag and leave some area exposed – it is recommended that cavity wall insulation is regularly checked and topped up as necessary.

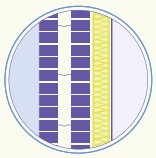
Further guidance:

Please view the following guidance for additional information:

- **Historic England's webpage** on Insulating walls in historic buildings.
- The **Energy Saving Trust's** Guidance on cavity wall insulation in existing dwellings.
- The **Gov.uk webpage** Cavity wall insulation (CWI): consumer guide to issues arising from installations.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required as it is an internal alteration.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission not required as it is an internal alteration.	**LISTED CONSENT REQUIRED** Unlikely to be acceptable as this could represent an irreversible change to the fabric of the historic building.

INTERNAL WALL INSULATION (IWI)



How does it work?:

Internal wall insulation is typically applied directly to the inner face of the external wall with a finish applied to the internal side such as plaster or plasterboard. There are a number of systems available ranging from rigid insulation boards fixed directly to the existing wall, or a secondary structure with loose insulation fitted in. Thickness varies with the performance required and the specification, it can be as low as 50 mm.

Technical considerations:

IWI will take up internal floorspace and alter relationships with existing openings and features – on heritage buildings, careful considerations must be given to the affected area as removal of historic cornices and panelling is unlikely to be acceptable.

In addition, there is an inherent risk of creating condensation between the existing wall and the added which is called 'interstitial condensation' which can lead to damp and mould issues compromising both the users health as well as the integrity of the existing building

Adequate professional advice, careful detailing and material specifications are necessary – For instance, breathable materials are required for traditionally constructed buildings and insulation carried out over lintels and into floor voids.

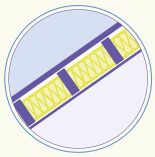
Further guidance:

Please view the following guidance for additional information:

- **Historic England's webpage** on Insulating walls in historic buildings.
- The **Gov.uk webpage** Retrofit internal wall insulation: best practice.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required as it is an internal alteration.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission not required as it is an internal alteration.	**LISTED CONSENT REQUIRED** Unlikely to be acceptable as the use of IWI could result in the loss of historic features including skirting boards, dado rail, architraves and historic relationships with windows and doors.

ROOF INSULATION BETWEEN RAFTERS



How does it work?

In buildings with a timber roof structure, insulation such as breathable wool based materials can easily be fitted between rafters and/or fixed to their underside. An air gap must be left around the margins of the building to allow air to circulate.

Technical considerations:

Considerations to fire hazard such as electric cables should be given by installing a non-combustible sleeve and/or leaving adequate space left for fittings so they don't heat up. Access hatches should be insulated to reduce the risk of draught. It is important adequate ventilation is maintained to avoid moisture build up and consequent damp problems.

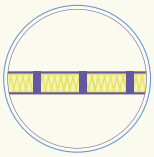
Further guidance:

Please view the following guidance for additional information:

- **Historic England's** guidance on Insulating pitched roofs at rafter level.
- The **Gov.uk guidance** on Retrofit room in roof insulation.
- The **CNC guidance** on Technical guidance and advice on warm and cold roofs.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required subject to no external change in appearance.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission not required subject to no external change in appearance.	**LISTED CONSENT REQUIRED** Likely to be acceptable only where original/historic floor finishes do not survive. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

ROOF INSULATION BETWEEN JOISTS



How does it work?:

Where the loft is not inhabited, insulation such as breathable wool based materials can be installed in between the existing joists with an additional layer spread heavenly on top. This approach is also called cold roof and is typical of buildings where the primary structure is outside of the thermal envelope.

Technical considerations:

Breathable natural insulation materials such as wool-based insulation are typically recommended to reduce the possibility of moisture being trapped.

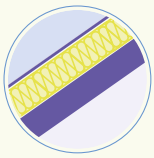
Consideration of fire hazard such as electric cables should be given by installing a non-combustible sleeve and/or leaving adequate space left for fittings so they don't heat up. Access hatches should be insulated to reduce the risk of draught. It is important adequate ventilation is maintained to avoid moisture build up and consequent damp problems.

Further guidance:

Please view the **CNC guidance** on Technical guidance and advice on warm and cold roofs.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required subject to no external change in appearance.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission not required subject to no external change in appearance.	**LISTED CONSENT REQUIRED** Likely to be acceptable subject to detail and no historic fabric being removed. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

EXTERNAL ROOF INSULATION



How does it work?:
Insulation can be installed on top of the roof primary structure – either by lifting and reinstating the original roof covering, or by replacing those.

Technical considerations:
This approach will alter the visual impact and increase the building height, as it will likely result in a loss of fabric either through replacement or damages due to the handling of existing materials; it would not be typically recommended within a heritage context or for a listed building.

Further guidance:

- Please view the **CNC guidance** on Technical guidance and advice on warm and cold roofs.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT REQUIRED Planning permission is needed to change the external appearance of the roof e.g. increase the overall height of the roof and is unlikely to be given where the property forms part of a terrace of a group of uniform buildings. Care should be given for the materials to match the existing. Considerations should be taken to ensure key architectural features are retained.	**PLANNING CONSENT REQUIRED** Planning permission is needed to change the external appearance of the roof e.g. increase the overall height of the roof and is unlikely to be given where the property forms part of a terrace of a group of uniform buildings. Care should be given for the materials to match the existing. Considerations should be taken to ensure key architectural features are retained.	**LISTED CONSENT AND PLANNING CONSENT REQUIRED** Unlikely to be acceptable as it could result in a considerable loss of historic fabric and change the external appearance of the building.

WINDOWS AND DOORS

4.12 A significant amount of heat is lost through windows and doors, both the glass and the gaps in and around the frames. Window and door upgrades are often the first port of call when it comes to improve the thermal performance of a building. However, beyond the alterations to the original appearance, those measures must always be considered within the context of a wider retrofit plan so their implementation in isolation doesn't lead to unintended consequences, such as: thermal bridges, condensation and mould.

4.13 Remedial works to existing windows and doors must be carried out before their replacement is considered. Poorly fitted and maintained windows and doors can lead to significant heat loss and make rooms feel uncomfortable.

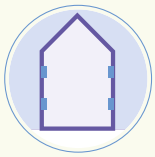
4.14 The risks associated with upgrading windows and doors greatly depend on the project specific circumstances. Therefore, adequate professional advice, careful detailing and material specifications should be obtained.

4.15 Additionally, applicants are advised to refer to both the Commercial Alterations and Extensions SPD and Residential Alterations and Extensions SPD on the Council's website to consider the design of windows and doors to their properties. In particular, with reference to properties located in Conservations Areas where windows and doors are considered to be important components of a building's architectural composition and unsympathetic alterations to these features can have a gradual and cumulative adverse impact on an area's character and appearance and local distinctiveness.

4.16 The section below outlines the following works that can be used to improve the thermal performance of windows methods:

- **Draught proofing**
- **Secondary glazing**
- **Glazing replacement in existing frames**
- **Window replacement**
- **Door replacement**

DRAUGHT PROOFING



How does it work?:

Draught proofing is a reactive and accessible approach to increase thermal comfort with a minimum impact on the original fabric but will have a limited effect on reducing the overall energy consumption. It works by creating a barrier to limit the air flow from the outdoor to the indoor without sealing it totally. Measures can be temporary and fully removable including:

- thick curtains in front of openings such as doors and windows
- draught excluders which can be added on to existing elements such as brushes for doors and letter boxes, key holes cover, foam strips
- Floorboard slivers which can be fitted in between floorboards, a number of alternatives exist such as sawdust mix, cork strips or latex based products
- professionally fitted compression seals or carrier seals that fit within frames and suitable for different types of openings
- sealing draughts in any cracks or openings around windows and doors with mastic or similar

Technical considerations:

Before draughtproofing, windows need to be in a good state of repair. They may need re-hanging and repairing professionally. Moisture risk should be avoided by maintaining existing air-flows and using air-bricks or trickle vents.

Foam strips or compression seals are generally not recommended for sash windows due to wear and tear – instead, brush seals should be used. Compression seals are best suited for casement windows or doors.

There may already be draught strips present. If so, ensure these are kept in a good state of repair and check for any leaks. Consider replacement of defective strips.

Further guidance:

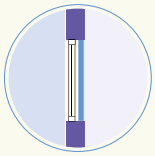
Please view the following guidance for additional information:

- **Historic England's webpage** on Draught-proofing
- **Historic England's guidance** on Draught-proofing windows and doors
- **RICS's webpage** on Retrofitting and improving the energy efficiency of your home
- **Beama's webpage** Guidance for improving indoor air quality in existing homes

PLANNING REQUIREMENTS:

Unlisted outside of CA	Unlisted within a CA	Listed building
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required subject to no external change in appearance.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission not required subject to no external change in appearance.	**LISTED BUILDING CONSENT NOT REQUIRED** Unless the windows are particularly ornate such as stained glass windows.

SECONDARY GLAZING



How does it work?:

Secondary glazing consists of a layer of glazing with a low emissivity (Low-E) hard coating facing the outside fitted internally – it comes within a variety of systems either fixed and removable or openable – hinged or sliding

Technical considerations:

Careful considerations should be given to access to original windows for cleaning and maintenance.

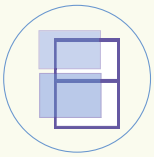
The ventilation strategy should be revised so the secondary glazing doesn't hinder the necessary air flow – for instance draught proofing should not be applied to the original window to maintain ventilation and avoid condensation

Further guidance:

- Please view **Historic England's webpage** Modifying historic windows as part of retrofitting energy saving measures

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required subject to no external change in appearance.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission not required subject to no external change in appearance.	**LISTED BUILDING CONSENT NOT REQUIRED** Unless the windows are particularly ornate such as stained glass windows.

GLAZING REPLACEMENT WITHIN ORIGINAL FRAME



How does it work?:

Where original window frame profiles and glazing bars are thick enough, it may be possible to fit slim-profile or vacuum double glazing into existing sashes or casements with only minimal alterations.

Thermal single glazing could also be acceptable where the existing window cannot be adapted to take double glazing.

Whilst this measure is more commonly used for traditional buildings, it remains an option for post war buildings where the original frames are still in good condition.

Technical considerations:

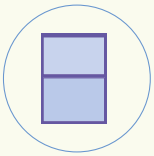
Care is needed where the glazing bars are very fine and should still be finished in putty externally.

Further guidance:

- Please view **Historic England's webpage** Modifying historic windows as part of retrofitting energy saving measures

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Replacement solely of the glass and no alterations to the frames would not require planning permission for any type of building.	**PLANNING CONSENT NOT REQUIRED** Replacement solely of the glass and no alterations to the frames would not require planning permission for any type of building.	**LISTED BUILDING CONSENT NOT REQUIRED** Likely acceptable where the glazing is not of historical interest and the window frames are retained and repaired.

WINDOW REPLACEMENT (DOUBLE, TRIPLE AND VACUUM GLAZING)



How does it work?:

Use of energy efficient glazing such as modern double or triple glazed windows can achieve improved thermal performance as well as security and acoustic benefits.

There are slim profile options as well as those with low emissivity (Low E) coatings and vacuum glazing which further improves performance without increasing the overall thickness. Replacement of historic windows or panes with double or triple glazing could affect the special interest of listed buildings and the character and appearance of conservation areas and so care needs to be taken to identify where historic windows survive.

Technical considerations:

Care is needed to ensure that the new windows accurately replicate historically accurate windows with accurate horn and glazing bar details.

Replacement of original features such as glazing bars must be carefully detailed so it aligns with the original design intent - strips stuck on or inserted within the glazing is unlikely to be appropriate, instead, structural glazing bars separating panes of glass should be specified. This likely requires the use of either vacuum glazing or glazing with a maximum depth of 14mm.

Putty finish rather than timber beading is likely to be more appropriate for heritage building and context.

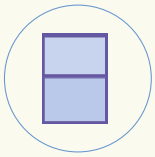
The use of PVCu (unplasticised polyvinyl chloride) rigid plastic replacement windows are not appropriate as these often fail to replicate timber windows, are generally lower quality and cannot be repaired.

Additional windows especially when installed in ceilings and roofs may increase the risk of overheating – careful consideration should therefore be given when specifying and locating those.

Further guidance:

- Please view **Historic England's webpage** Modifying historic windows as part of retrofitting energy saving measures'

WINDOW REPLACEMENT (DOUBLE, TRIPLE AND VACUUM GLAZING) continued



PLANNING REQUIREMENTS:

Unlisted outside of CA	Unlisted within a CA	Listed building
PLANNING CONSENT NOT REQUIRED For single dwellinghouses replacement windows likely to be permitted development and planning permission will not be required subject to the materials being of a similar appearance to those in the host building. Planning consent will be required for flats, shopfronts and any windows on commercial buildings above ground floor level where replacement windows materially affect the external appearance of the building, e.g. material, design, size, profile and detailing of the replacement window(s).	**PLANNING CONSENT NOT REQUIRED** For single dwellinghouses replacement windows likely to be permitted development and planning permission will not be required subject to the materials being of a similar appearance to those in the host building. Planning consent will be required for flats, shopfronts and any windows on commercial buildings above ground floor level where replacement windows materially affect the external appearance of the building, e.g. material, design, size, profile and detailing of the replacement window(s).	**LISTED CONSENT AND PLANNING CONSENT REQUIRED** Likely acceptable where neither the frame nor the glazing is not of historical interest subject to details. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

DOOR REPLACEMENT

How does it work?:

The replacement of existing external doors with thicker, better insulated, and draught proof alternatives can provide improved thermal performance as well as security and acoustic benefits.

However, historic doors on older properties are often higher quality than many modern alternatives as they are made from thicker and better timber. Therefore, prior to replacement residents should prioritise measures to maintain, repair and upgrade their existing doors.

Historic doors in Hackney generally consist of paneled timber doors contributing to the uniformity and character of historic buildings and streetscapes. Therefore, the replacement of historic doors in older buildings, conservation areas or Listed Buildings could affect the special interest of listed buildings and the character and appearance of conservation areas and so care needs to be taken to identify where historic doors survive.

Doors often incorporate features such as letter boxes and cat flaps. These can worsen the performance of a building's airtightness and the thermal performance of the door itself. Consider installing postboxes outside the property (with consideration to heritage and streetscape) and installing high-performance insulated cat flaps where required.

For glazed doors, see the section on windows for more information on improving the performance of glazed areas, as the same principles apply.

Technical considerations:

On historic properties where replacement is the only option, replacement doors should accurately replicate the appearance of the original door. This should include materials as well as features such as panelling and glazing pattern and door furniture like doorknobs, knockers and letterboxes.

Thought should be given as to how replacement doors will fit into the opening as many standard sized doors will not fit within historic openings and cutting them down may compromise their performance and appearance.

The seal around the door is important – a badly installed door can still create draughts. Over time in existing buildings, openings may have changed form through building movement meaning a door no longer provides an airtight seal. If door replacement isn't possible, consider upgrading gaskets and seals, introducing draught excluders and potentially through re-hanging the door to better fit the opening.

Further guidance:

Please view the following guidance for additional information:

- **Historic England's webpage** I want to alter a door.
- **S.P.A.B's webpage** on doors.

DOOR REPLACEMENT
continued

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT MAY BE REQUIRED For single dwellinghouses replacement of external doors are likely to be permitted development and planning permission will not be required subject to the materials being of a similar appearance to those in the host building. Planning consent will be required for flats, shopfronts and any doors on commercial buildings where replacement doors materially affect the external appearance of the building, e.g. material, design, size, profile and detailing of the replacement door(s).	**PLANNING CONSENT MAY BE REQUIRED** For single dwellinghouses, you are encouraged to prioritise measures to maintain, repair and upgrade existing doors. Any replacement of external doors are likely to be permitted development, subject to the materials being of a similar appearance to those in the host building. Sensitive replacement doors are recommended where the design is similar to that of the existing to safeguard the character and appearance of the Conservation area Planning consent will be required for flats, shopfronts and any doors on commercial buildings where replacement doors materially affect the external appearance of the building, e.g. material, design, size, profile and detailing of the replacement door(s).	**LISTED CONSENT AND PLANNING CONSENT REQUIRED** Unlikely to be acceptable for the front door as this often forms a key part of the historic character of a building and its replacement would result in a loss of historic fabric and change the external appearance of the building. Replacement will therefore only be considered where it is demonstrated that the original door is beyond repair. In this situation any replacement door must match the existing in terms of Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

AIR PERMEABILITY AND VENTILATION

4.17 Airtightness improvement is a positive enhancement for improving energy efficiency by reducing draughts. Airtightness improvements should be made in conjunction with effective ventilation strategies to compensate for the loss of air circulation. Furthermore a clear understanding of the specific building physics of the site is needed before commencing retrofit works so air tightness measures can be adequately installed without compromising the integrity of the original envelope.

4.18 It must be noted that risks associated with change in permeability depend on the project specific circumstances. Therefore adequate professional advice and careful detailing and material specifications must be obtained. There are a number of ways to increase the airtightness and improve the ventilation of a building with varying levels of complexity and impact on the original fabric.

4.19 This section below outlines the various works that can be undertaken to improve the airtightness and ventilation of a building:

- **Airtightness**
- **Natural ventilation**
- **Mechanical ventilation**
- **Mechanical ventilation with heat recovery**

AIRTIGHTNESS

How does it work?:

Air tight layers must be impermeable to air, continuous, durable and accessible.

Air barriers can be vapour open but require careful specification of adjoining construction and insulation materials.

Plastic membranes are commonly used as airtight layers, however, a coat of plaster or air tight paint can also be applied directly to masonry walls.

Sealing the air tight layer is critical – products such as tape for joint and corner and gaskets for penetrations are necessary

Technical considerations:

Poor moisture control between the cold and heated space may lead to condensation, damp and mould which ultimately can compromise the existing fabric as well as the structural integrity of a building.

Presence of mould can also result in health complications such as respiratory disease.

Airtight layers should not be installed without a careful analysis of the existing building physics and understanding of the existing fabric.

Adequate professional advice must be sought prior to air tightness works to be considered – it is recommended to carry out an air test before and after the measures are installed.

Traditional buildings have typically been conceived to allow all air to flow in an uncontrolled manner – this means it is more challenging to make them airtight than it is for more modern equivalents.

Further guidance:

- Please view **Historic England's webpage** Air and vapour control layers (AVCLs) in buildings of traditional construction. A literature review to understand appropriate use.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required subject to no external change in appearance.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission not required subject to no external change in appearance.	**LISTED CONSENT REQUIRED** Likely unacceptable where internal decor is of historical interest. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

NATURAL VENTILATION

How does it work?:

Natural ventilation consists of allowing an uncontrolled, unfiltered and unheated air flow through the building – this is enabled by introducing openings in the building envelope such as doors, windows, chimneys.

Cross ventilation is an effective way of enabling natural ventilation - openings must be positioned on opposed surfaces allowing the outside air to flow through the length of the building.

Buoyancy ventilation or stack effect is enabled by pressure difference, where the hot air is sucked upwards and evacuated through a roof opening – this is due to hot air having a lower pressure and therefore rising above cold air.

Technical considerations:

The air flowing through natural ventilation is uncontrolled, unheated/cooled and unfiltered - this means that comfort and health of occupants depend on external factors such as wind, outside temperature and levels of pollutants.

Security considerations may limit the opportunity for natural ventilation to be relied upon 24/7.

The extent of how far windows can be opened may be also limited for safety reasons to limit risks of falling.

Windows with trickle vents may have inadvertently been closed. Where they have been incorporated, it may be worth keeping these open to provide continuous airflow and intake of fresh air without needing to open the windows.

Further guidance:

Please view the following guidance for additional information:

- **CIBSE** top tips 1: Ventilation in buildings.
- **Historic England's webpage** on Overheating in historic buildings.
- **The RIBA Journal's website** on How to retrofit houses to reduce overheating.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission usually not required as it is an internal alteration. Where new windows and doors are proposed – refer to the windows and doors section above.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission usually not required as it is an internal alteration. Where new windows and doors are proposed – refer to the windows and doors section above.	**LISTED BUILDING CONSENT NOT REQUIRED** Acceptable and permission not required. Where new windows and doors are proposed – refer to the windows and doors section above.

MECHANICAL VENTILATION

How does it work?:

Mechanical ventilation consists of forcing an air flow through a building either through basic means such as electric and ceiling fans or more sophisticated such as installing a Mechanical Extract Ventilation (MEV).

MEV works by extracting the air from the polluted sources e.g. kitchen, bathroom, toilets and utility rooms and supplying air to the 'living' rooms e.g. bedrooms, living rooms, studies etc. – the stale air is then extracted to the outside whilst cold supply air is drawn in through a separate vent. This system is best combined with trickle vents installed to the windows.

Technical considerations:

MEV systems are typically installed within ceiling voids to conceal the ductwork and venting units - this means it is unlikely to be appropriate for listed properties with internal decor of historical interest.

Whilst the air flow is controlled and can also be filtered, it remains unheated/cooled – there is a risk of heat transfer between the outside and the inside.

Airtightness measures should always be combined with a form of mechanical ventilation such as MEV.

Adequate professional advice must be sought prior to MEV to be considered.

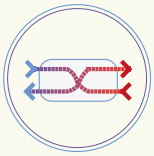
Further guidance:

Please view the following guidance for additional information:

- **CIBSE** top tips 1: Ventilation in Buildings.
- **Historic England's webpage** on Overheating in historic buildings.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required for dwellinghouses subject to the limitations within permitted development. Permission will be required for service penetrations on flats or commercial buildings above the ground floor level	**PLANNING CONSENT MAY BE REQUIRED** Acceptable and permission not required for dwellinghouses so long as the service penetrations are located on the rear elevation. Permission will be required on flats or commercial buildings above the ground floor level.	**LISTED CONSENT AND PLANNING PERMISSION REQUIRED** Likely unacceptable where internal decor is of historical interest subject to details and where changes to the front or side elevations are proposed such as services penetrations. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

MECHANICAL VENTILATION WITH HEAT RECOVERY



How does it work?:

Mechanical Ventilation with Heat Recovery (MVHR) works the same way as MEV system, however, the extracted air is taken through a central exchanger where its heat is transferred to the air drawn in from the outside, and contributes to raising the indoor temperature.

MVHR works both ways, if the air temperature inside the building is colder than the outside air temperature then the cold is transferred to the supply air and contributes to lowering the indoor temperature

MVHR delivers filtered, controlled and pre-heated/cooled air indoors.

Technical considerations:

Like MEV systems, MVHR systems are typically installed within ceiling voids - although the central unit exchanger is bulkier, it can also be installed within cupboards. Where large extents of historic fabric survive on Listed Buildings the installation of a MVHR system has the potential to be harmful to the building's significance.

Whilst the air flow is controlled and can also be filtered, it remains unheated/cooled – there is a risk of heat transfer between the outside and the inside.

Airtightness measures should always be combined with a form of mechanical ventilation such as MVHR.

Adequate professional advice must be sought prior to MVHR to be considered.

Further guidance:

Please view the following guidance for additional information:

- **The Passivhaus Learning Hubs webpage** on the case for MVHR.
- **Passivhaus Learning Hubs webpage** on MVHR for single dwellings.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission not required for dwellinghouses subject to the limitations within permitted development. Permission will be required for service penetrations on flats or commercial buildings above the ground floor level.	**PLANNING CONSENT MAY BE REQUIRED** Acceptable and permission not required for dwellinghouses so long as the service penetrations are located on the rear elevation. Permission will be required on flats or commercial buildings above the ground floor level	**LISTED CONSENT AND PLANNING PERMISSION REQUIRED** Likely unacceptable where internal decor is of historical interest subject to details and where changes to the front facade are proposed such as services penetrations. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

OVERHEATING AND SHADING

4.20 Overheating occurs when the indoor temperature is no longer comfortable, typically above 26C. Sources of overheating include a mix of external heat gains, such as high outdoor temperatures exacerbated by climate change and the urban heat island effect, combined with internal heat gains such as that generated by body heat, poorly insulated services, electrical devices etc. It is not a homogenous phenomenon and varies across different spaces within the building thermally and temporally.

4.21 Overheating can be mitigated passively and actively by following the Cooling Hierarchy principles. This means that mitigating passive measures must be implemented first so the reliance on active measures such as air conditioning is reduced or eliminated altogether.

4.22 Limitations of an existing setting makes it challenging to retrospectively mitigate the risk of overheating through massing, orientation and glazing, however, there are ample opportunities to consider before energy intensive active measures such as active cooling is considered. Passive measures which could be retrofitted to mitigate against overheating include:

- **High performance envelope –** a well insulated, air tight and ventilated envelope is key to successfully control internal temperature
- **External shading –** additional features either fixed or dynamic on the outside of the envelope successfully reduce the heat from direct sunlight to enter the building, reducing the effect of solar radiation
- **Internal shading –** whilst they are easier to install, internal shadings such as blinds do no deal with the heat from solar radiation already trapped inside

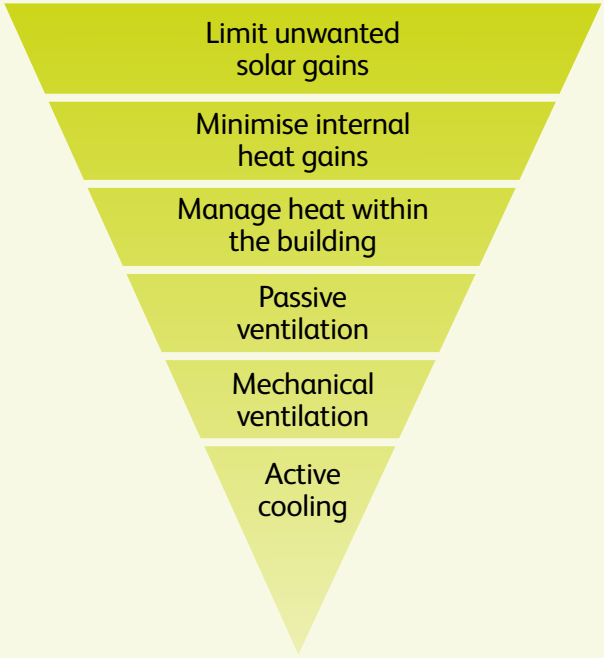


Figure 4.2 – showing the cooling hierarchy[5].

4.12 It must be noted that risks associated with overheating mitigation measures greatly depend on the project specific circumstances Therefore adequate professional advice and careful detailing and material specifications must be obtained.

4.12 Delivering a building resilient to overheating risk requires a combination of measures fabric improvement as detailed in the previous sections with external and internal shading - the most common measures are described below:

- **External shading: shutters**
- **External shading: awnings and roller blinds**
- **External shading: planting**
- **External shading: window film (fixed)**
- **External shading: overhangs and fins**
- **Internal shading: shutters and blinds**

EXTERNAL SHADING: SHUTTERS

How does it work?:

Shutters can be sliding, hinged or folding, they are typically made of waterproof, hardwearing materials (metal, timber) and attached to building façades.

They can be slid and/or folded to fully reveal an opening or obscure it completely and limit the solar gains. As well as activating a façade's appearance.

When opened, shutters typically stack behind each other, while multiple shutters can be overlapped within the same track to fully shade wider windows.

Technical considerations:

Occupants would typically lean out of openings to close the shutters, posing a safety risk when installed at higher levels.

As any dynamic element, maintenance is key to ensure optimal performance is delivered throughout the building lifespan.

Hackney does not have a history of the installation of external shutters and so within areas of historic townscape and conservation areas the addition of shutters would need careful consideration. In these situations consideration should be given to the use/reinstatement of internal shutters.

Further guidance:

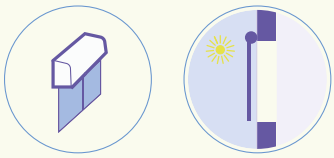
Please view the following guidance for additional information:

- **The Good Homes Alliance's guidance** on Overheating in retrofit and existing homes.
- **British Red Cross and Shade the UK guidance** on Overheating adaption guide for homes.
- **The RIBA Journals webpage** on how to retrofit houses to reduce overheating.

PLANNING REQUIREMENTS:

Unlisted outside of CA	Unlisted within a CA	Listed building
PLANNING CONSENT REQUIRED Planning consent will be required where new external features materially affect the external appearance of the building. Where the building forms part of a uniform group or a consistent part of the historic townscape the proposal is unlikely to be acceptable. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.	**PLANNING CONSENT REQUIRED** Planning consent will be required where new external features materially affect the external appearance of the building. Where the building forms part of a uniform group or a consistent part of the historic townscape the proposal is unlikely to be acceptable. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.	**LISTED CONSENT AND PLANNING PERMISSION REQUIRED** Unlikely to be acceptable unless it can be demonstrated that the property historically had external shutters. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

EXTERNAL SHADING: AWNINGS AND ROLLER BLINDS



How does it work?:

Roller blinds and awnings are typically made of a weather-resistant fabric and folded within a box installed in the window head.

They can be coloured and/or have different levels of opacity, providing a degree of glare control and views out.

At higher levels, they are typically operated from within the building without requiring windows to be opened.

Technical considerations:

As any dynamic element, maintenance is key to ensure optimal performance is delivered throughout the building lifespan.

Consideration will need to be how these additions relate to the wider townscape, in areas of uniformity internal shutters are likely to be more appropriate.

Further guidance:

Please view the following guidance for additional information:

- **The Good Homes Alliance's guidance** on Overheating in retrofit and existing homes
- **British Red Cross and Shade the UK guidance** on Overheating adaption guide for homes
- **The RIBA Journals webpage** on how to retrofit houses to reduce overheating

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT REQUIRED Planning consent will be required where new external features materially affect the external appearance of the building. Where the building forms part of a uniform group or a consistent part of the historic townscape the proposal is unlikely to be acceptable. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.	**PLANNING CONSENT REQUIRED** Planning consent will be required where new external features materially affect the external appearance of the building. Where the building forms part of a uniform group or a consistent part of the historic townscape the proposal is unlikely to be acceptable. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.	**LISTED CONSENT & PLANNING PERMISSION REQUIRED** Unlikely to be acceptable unless it can be demonstrated that the property historically had external awnings. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

EXTERNAL SHADING: PLANTING

How does it work?:

Deciduous plants, including trees or vertical wall climbing varieties (e.g. ivy), are a natural way to increase biodiversity and lend social value while providing shade and allow for winter solar gain by shedding their leaves.

Planting typically reduces temperature locally providing additional relief from heat.

Technical considerations:

Planting should not be taken into account for Building Regulations overheating compliance.

As any organic element, maintenance is key to ensure optimal performance is delivered throughout the building lifespan. Care is needed to ensure that the plants do not damage the building fabric, including through roots damaging the fabric or subsidence. Positioning plants a sensible distance from the building to allow for future above ground and root growth is recommended

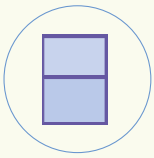
Further guidance:

Please view the following guidance for additional information:

- **The Ignition Project's guidance** on Nature-based solutions to the climate emergency.
- **Trees and Design Action Group's webpage** First Steps in urban heat.
- **British Red Cross and Shade the UK guidance** on Overheating adaption guide for homes.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PERMISSION NOT REQUIRED Acceptable and permission not required.	**PERMISSION NOT REQUIRED** Acceptable and permission not required.	**LISTED CONSENT AND PLANNING PERMISSION MAY BE REQUIRED** Planting in itself does not require planning or listed building consent, however any support structures such as frames or trellis may require Listed Building, you are advised to consult with the Council ahead of installation.

EXTERNAL SHADING: WINDOW FILM (FIXED)



How does it work?:

Window film is a self-adhesive film with solar control properties that is applied to the surface of the glass.

Depending on the product, it can significantly change glazing and daylight colour.

Technical considerations:

Some films are permanent, while there are other temporary or removable coatings and films available.

Permanently fixed films can also compromise the wellbeing of the building occupiers, especially when daylight is limited - in the winter months for instance.

In times of extreme heat, temporary reflective films or paints may be useful.

Further guidance:

Please view the following guidance for additional information:

- **British Red Cross and Shade the UK guidance** on Overheating adaption guide for homes.
- **The RIBA Journals webpage** on how to retrofit houses to reduce overheating.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PERMISSION NOT REQUIRED Acceptable and permission not required.	**PERMISSION NOT REQUIRED** Acceptable and permission not required.	**LISTED CONSENT REQUIRED** May be acceptable subject to detail and impact on historic glass.

EXTERNAL SHADING: OVERHANGS AND FINS

How does it work?:

Overhangs, also known as brise soleil, are installed directly above windows, vertical fins are fitted alongside windows, both features can be combined and provide shade without obstructing views.

They can be designed in a variety of ways, with timber or metal slats, solid or perforated metals.

Technical considerations:

Overhangs can strongly influence a building's 'look' and must be carefully integrated into a façade's design. Rainwater runoff, wind microclimates and the impact of birds (they perch upon them), must also be factored into an overhang's design, installation and maintenance regime. In areas of surviving historic townscape the additions have the potential to appear incongruous but on more modern buildings have the potential to be successfully integrated into the facade subject to a suitable design.

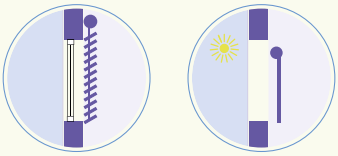
Further guidance:

Please view the following guidance for additional information:

- **British Red Cross and Shade the UK guidance** on Overheating adaption guide for homes.
- **The RIBA Journals webpage** on how to retrofit houses to reduce overheating.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT REQUIRED Planning permission will be required where new external features materially affect the external appearance of the building. Where the building forms part of a uniform group or a consistent part of the historic townscape the proposal is unlikely to be acceptable. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.	**PLANNING CONSENT REQUIRED** Planning permission will be required where new external features materially affect the external appearance of the building. Where the building forms part of a uniform group or a consistent part of the historic townscape the proposal is unlikely to be acceptable. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.	**LISTED CONSENT AND PLANNING PERMISSION REQUIRED** Unlikely to be acceptable as most historic properties will not have had overhangs or fins.

INTERNAL SHADING: SHUTTERS AND BLINDS



How does it work?:

Internal roller blinds and shutters come in multiple textures, colour and patterns and are fixed to the ceiling or wall above windows. Fabric can be opaque and provide blackout function, and slates can be oriented to provide varying degrees of transparency

Fully opaque internal shutters are typically appropriate for heritage property. These can often be found painted shut within early-mid 19th century buildings.

Blinds can also be fully integrated into the windows casement (integral shading)

Technical considerations:

Internal shading should not be taken into account for Building Regulations overheating compliance.

Careful consideration to the ventilation strategy must be given when specifying internal shading so they do not compromise the air flow.

As any dynamic element, maintenance is key to ensure optimal performance is delivered throughout the building lifespan.

Further guidance:

Please view the following guidance for additional information:

- **British Red Cross and Shade the UK guidance** on Overheating adaption guide for homes.
- **The RIBA Journals webpage** on how to retrofit houses to reduce overheating.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission usually not required.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission usually not required.	**LISTED CONSENT MAY BE REQUIRED** Likely to be acceptable where internal features around the windows are not of historical interests. Where historic shutters survive these should be retained and refurbished. Where historic shutters have been removed the reinstatement could enhance the listed building. Pre-app advice should be sought before proceeding to confirm the proposed measures are acceptable.

CHIMNEYS

4.25 Limiting the air flow through chimneys typically is an easy win that could reduce energy and improve thermal comfort. In most historic building typologies, chimneys are part of the character of the host building and therefore should not be removed. For newer properties, a case by case approach of removing the chimneys will be adopted.

4.26 Making use of existing fireplaces as a source of heat in your home should be considered carefully. There are regulations in place for the use of firewood in urban places. The smoke released by combustion of wood, coal and even gas releases particulates and gases that are bad for human health inside the home and contribute to pollution in our city.

4.27 This section below outlines the various works that can be undertaken to retrofit chimneys:

- **Repair of disused existing chimneys**
- **Chimney draft excluder**

REPAIR OF DISUSED EXISTING CHIMNEYS

How does it work?:
Where a chimney pot is missing, cracked or badly spalled it should be replaced with a new pot including integral bird guard fitting. Where it is proposed to block a chimney, it must be capped off with a vented hood fitted to each pot to restrict water ingress and prevent damp occurring within the existing flues.

Technical considerations:
The ventilation of the existing building must be carefully reconsidered so the blocking up of the chimney doesn't have any unintended consequences.

Consider structural modifications to chimney breasts carefully internally. Some chimneys act as part of the building's structure and the interface with neighbouring properties should be considered as part of the party wall.

Further guidance:
Please view the following guidance for additional information:

- **Historic England's webpage** Open fires, chimneys and flues.
- **The Energy Saving Trust's webpage** on How to draught-proof your chimney.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission usually not required.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission usually not required.	**LISTED CONSENT MAY BE REQUIRED** Likely to be acceptable but details may be required on the method and extent of repair. Work would need to be carried out on a like by like basis in order to preserve the special architectural and historic interest.

CHIMNEY DRAFT EXCLUDER

How does it work?:

A chimney balloon or draught excluder is a simple DIY installation fitted within easy reach at the foot of the flue. The airbag or excluder adopts the shape of the flue as it is inflated/ installed and provides an air cell/barrier which acts as a thermal buffer to insulate against heat loss, as well as a physical barrier to reduce draughts.

The existing flue remains unaltered and capable of functioning normally when the chimney balloon is deflated.

Technical considerations:

It is recommended consideration is given to ventilation of the chimney in order to ensure that there is no build up of damp internally. Although this is a DIY solution the manufacturers guidance should be consulted prior to installation.

Further guidance:

- Please view **the Energy Saving Trust's webpage** on How to draught-proof your chimney

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission usually not required.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission usually not required.	**LISTED BUILDING CONSENT NOT REQUIRED** Acceptable and permission not required.

DECARBONISATION MEASURES

Heat and hot water

4.28 Buildings can also reduce their operational carbon footprint by generating their own energy in the form of heat or electricity using low carbon and renewable technologies.

4.29 It must be noted that risks associated with upgrading of heat and hot water systems greatly depend on the project specific circumstances. Therefore, adequate professional advice and careful detailing and material specifications must be obtained.

4.30 The section below outlines the various decarbonisation measures that can be implemented as part of retrofit works:

- **Heating system upgrade**
- **New electric boiler**
- **Electric radiators (direct electric)**
- **Solar thermal**
- **Air source heat pump (ASHP)**
- **Ground source heat pump (GSHP)**

HEATING SYSTEM UPGRADE

How does it work?:

Existing heating systems can be easily upgraded to deliver heat more efficiently throughout a building. Simple thermostatic valves can be installed to manually regulate the temperature for each unit, whilst thermostats can be installed as part of a more sophisticated system to regulate the temperature remotely.

Adjustments can be made to the temperature of your hot water (e.g. to 60o) and flow water temperature. This may offer benefits in terms of energy savings, but isn't typically considered a full 'retrofit' measure on its own.

Technical considerations:

Any upgrade to the boiler system should also have the circulating pipework insulated to reduce heat loss. Homes often have radically different heat loss rates in different rooms of the home. This means some rooms may require more heating from their radiators or underfloor heating systems for a longer time than other rooms in the home.

Maintaining your heating system regularly will help to ensure the systems are working efficiently.

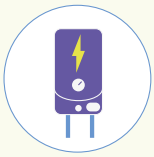
Simple additional considerations towards ensuring your heating appliances are as efficient as possible include considering the positioning of furniture and avoiding blocking radiators or other heating appliances. Frost or off settings can be used in rooms that are unoccupied.

Further guidance:

- Please view **the RICS webpage** on Retrofitting and improving the energy efficiency of your home

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission usually not required.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission usually not required.	**LISTED BUILDING CONSENT MAY BE REQUIRED** Likely to be acceptable subject to detail and no historic fabric being removed.

NEW ELECTRIC BOILER



How does it work?:

Similarly to their gas counterpart, electric boilers also work in combination with a water based heating system.

However, they have the advantage of not requiring a main gas connection, this means that there is more flexibility in their location as no flues are required, and there is no greenhouse gas emission at the point of use – if paired with PV panels, they can therefore provide heating and hot water in a fully renewable way.

Their efficiency is slightly better than a gas boiler, with a coefficient of performance of 0.99 – this means that for every unit of energy in, just under one unit of heat is generated.

Technical considerations:

As the water is distributed through the pipework it loses heat which reduces the efficiency of the heating system. Similarly, the water store in the insulated hot water cylinder would also lose heat.

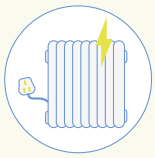
It is important to be mindful that installing a direct electric boiler will not provide any on-site carbon savings in line with the energy hierarchy and it is likely to result in higher energy bills[6]. Renewable energy systems would offer on-site carbon savings and have the potential to reduce energy bills.

Further guidance:

- Please view the **Mayor of London's guidance** on Energy assessments

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission usually not required.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission usually not required.are acceptable.	**LISTED BUILDING CONSENT MAY BE REQUIRED** Likely to be acceptable subject to detail and no historic fabric being removed or new external openings being made.

ELECTRIC RADIATORS (DIRECT ELECTRIC)



How does it work?:

It is possible to replace traditional 'wet' radiators with direct electric-based solutions. These dry systems use electricity to generate heat through a conductive material. The Coefficient of Performance is generally 1 – this means that for every unit of energy in, one unit of heat is generated. This system does not provide hot water.

Technical considerations:

This technology can be an easy swap for an existing gas boiler, however, it is not the most efficient system.

It is important to be mindful that installing a direct electric radiator system will not provide any on-site carbon savings in line with the energy hierarchy and it is likely to result in higher energy bills[7]. Renewable energy systems would offer on-site carbon savings and have the potential to reduce energy bills. Direct electric systems are also not compatible with connection to district heating networks which may be a consideration depending on proximity to current or future networks.

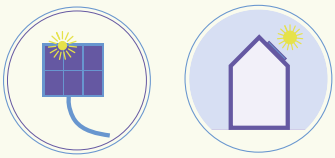
Other options include direct electric underfloor heating and skirting board based systems which may be of interest in wanting to keep wall space free of fixed radiators internally.

Further guidance:

- Please view **the NHBC's webpage** on Transition to electric heating.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission usually not required.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission usually not required.	**LISTED CONSENT MAY BE REQUIRED** Likely to be acceptable subject to detail and no historic fabric being removed or new external openings being made.

SOLAR THERMAL



How does it work?:

Solar Thermal Panels use the radiant heat of the sun to warm water in solar collectors which is pumped to a thermal store.

Note that they are different from Solar Photovoltaic Panels (PV Panels) which convert energy from the sun into electricity, these are discussed on page 67.

Technical considerations:

Due to the climate condition in the UK, it is most likely to be used to top-up or supplement a main system, rather than meet all of a building's water heating demand. This technology is typically suitable for buildings with low water demand and large roof area.

Further guidance:

Please view the following guidance for additional information:

- **Energy Saving Trust's guidance** on Solar water heating systems
- **The London Solar Opportunity Map** can be used to estimate the potential for both photovoltaic solar panels and solar thermal installations on buildings and open land around the capital.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission usually not required Even on the roofs of principal elevations of dwellinghouses and flats in conservation areas, subject to PV being 'sited so as to minimise its effect on the external appearance of the building and the amenity of the area' Similar limitations also exist for non-domestic properties.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission usually not required Even on the roofs of principal elevations of dwellinghouses and flats in conservation areas, subject to PV being 'sited so as to minimise its effect on the external appearance of the building and the amenity of the area' Similar limitations also exist for non-domestic properties.	**LISTED BUILDING CONSENT MAY BE REQUIRED** Potentially acceptable subject to the location and significance of the existing roof. Generally when located on less significant elevations, even when visible the installation will be acceptable.

AIR SOURCE HEAT PUMP (ASHP)

How does it work?:

Air source heat pumps take warmth from the air to heat up water or air. The system generally consists of an external unit, usually near a wall and an internal unit which stores and distributes the hot water throughout the building.

Emerging evidence suggests that a majority of the UK housing stock may well be heat pump ready with little to no fabric improvement measure required prior to the heat pump installation - this must be confirmed on a case by case basis and suitable professional advice must be sought as part of the retrofit plan.

Technical considerations:

The visual impact of the outdoor condenser unit and the need for a clear unobstructed air path will need to be considered.

Flooding risk must be considered to ensure that the external unit will not be damaged by flood water. The existing supply should be checked prior to the installation to ensure it is adequate – local upgrade might be required, for further guidance, please refer to **UK Power Networks webpage** on Electric Vehicles, solar, storage and heat pumps.

When located within Conservation Areas and on Listed Buildings the ASHPs location should be carefully considered in order to minimise the impact. Potential locations include front lightwells and rear gardens.

Further guidance:

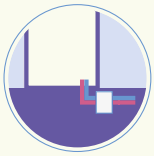
- Please view the **Historic England's webpage** on Installing heat pumps in historic buildings.

AIR SOURCE HEAT PUMP (ASHP) continued

PLANNING REQUIREMENTS:

Unlisted outside of CA	Unlisted within a CA	Listed building
PLANNING PERMISSION MAY BE REQUIRED To qualify under permitted development, heat pumps on domestic properties must meet certain conditions as set on the **Planning Portal's webpage** Planning Permission: Air source heat pump. Heat pumps must also comply with **The Microgeneration Certification Scheme,** please see further information on the Planning Portal website. Planning permission will be required for ASHPs on non-domestic properties. Noise assessment may be required and advice from the Hackney Environmental Health team must be sought. Air Source Heat Pumps which are not permitted development should be located in back gardens, lightwells, roofs and terraces that are hidden from the street. Where located in front gardens they should be set back from the front boundary wall and effectively screened.	**PLANNING PERMISSION MAY BE REQUIRED** To qualify under permitted development, heat pumps in conservation areas on domestic properties must meet additional conditions as set on **Planning Portal's webpage** Planning Permission: Air source heat pump. Heat pumps must also comply with **The Microgeneration Certification Scheme,** please see further information on the Planning Portal website. Planning permission will be required for ASHPs on non-domestic properties. Noise assessment may be required and advice from the Hackney Environmental Health team must be sought. Air Source Heat Pumps which are not permitted development should be located in back gardens, lightwells, roofs and terraces that are concealed from the street.	**LISTED BUILDING CONSENT REQUIRED** Likely acceptable subject to location not impacting the main elevations such as in back gardens, lightwells and terraces that are hidden from the street. Details of any internal changes required should also be provided at application stage.

GROUND SOURCE HEAT PUMP (GSHP)



How does it work?:

Ground source heat pumps consist of pipes underneath the ground which extract warmth to heat up water.

The system consists of an external unit, usually near a wall and an internal unit which stores and distributes the hot water throughout the building.

Technical considerations:

The design and installation of a ground source heat pump should consider the ground area available, as well as access, geological conditions and amenity impacts – boreholes as deep as 100 m may be required.

Flooding risk must be considered to ensure that the external unit will not be damaged by flood water.

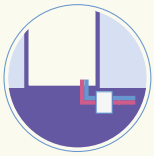
Depending on the GSHP specifications, update to the existing radiator and/or underfloor heating might be required to size them accordingly.

The existing supply should be checked prior to the installation to ensure it is adequate – local upgrade might be required, for further guidance, please refer to **UK Power Networks webpage** on Electric Vehicles, solar, storage and heat pumps.

Further guidance:

- Please view the **Historic England's webpage** on Installing heat pumps in historic buildings.
- Adequate installation and electricity tariff strategy must be implemented for the heat pump to run efficiently – suitable professional advice must be sought. Please view **the Energy Saving Trust's webpage** on Ground source heat pumps.

GROUND SOURCE HEAT PUMP (GSHP) continued



PLANNING REQUIREMENTS:

Unlisted outside of CA	Unlisted within a CA	Listed building
PLANNING CONSENT MAY BE REQUIRED To qualify under permitted development, heat pumps on domestic properties must meet certain conditions as set on the Planning Portal – Ground Source Heat Pump To qualify under permitted development, heat pumps on non-domestic properties must meet certain conditions as set on **the Planning Portal's webpage** Planning permission: Ground source heat pumps. Heat pumps must also comply with **The Microgeneration Certification Scheme,** please see further information on the Planning Portal website.	**PLANNING CONSENT MAY BE REQUIRED** To qualify under permitted development, heat pumps on domestic properties must meet certain conditions as set on the **Planning Portal's webpage** Planning Permission: Ground source or water source heat pump. To qualify under permitted development, heat pumps on non-domestic properties must meet certain conditions as set on **the Planning Portal's webpage** Planning permission: Ground source heat pumps. Heat pumps must also comply with **The Microgeneration Certification Scheme,** please see further information on the Planning Portal website.	**LISTED BUILDING CONSENT REQUIRED** Likely acceptable subject to location not impacting the main elevations such as in back gardens, lightwells and terraces that are hidden from the street. Details of any internal changes required should also be provided at application stage.

ELECTRICITY

4.12 Electric alternatives should always be considered as part of a retrofit plant. Lighting and appliances should be specified with their energy performance in mind, so they do not increase the energy consumption or internal heat gains.

The section below outlines various electric alternatives to be considered as part of a retrofit plan:

- **Replacement of existing lighting bulbs and tubes.**
- **Replacement of existing gas appliances with electric alternatives.**

REPLACEMENT OF EXISTING LIGHTING BULBS AND TUBES

How does it work?:

LED lighting is more energy efficient than conventional incandescent and fluorescent lighting as they do not generate heat they create the same brightness but with less energy.

LED lighting comes in a wide range of size, brightness and colours.

When purchasing new lightings, careful considerations should be given to their efficiency rating – it may be an option to consider refurbished alternatives

Technical considerations:

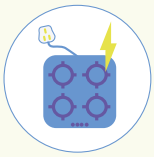
LED upgrade is typically straightforward to implement and does not require professional support.

Further guidance:

- Please view the **Energy Saving Trust's webpage** on Home appliances

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED	**PLANNING CONSENT NOT REQUIRED**	**LISTED BUILDING CONSENT NOT REQUIRED**

REPLACEMENT OF EXISTING GAS APPLIANCES WITH ELECTRIC ALTERNATIVES



How does it work?:

There are a number of widely available decarbonised alternatives to the traditional gas cookers and gas ovens such as fan ovens, and electric hobs (ceramic or induction). Whilst performance may vary from one manufacturer to another, electric alternatives tend to use less energy than their gas counterparts. Air fryers can also provide an alternative to traditional ovens.

Technical considerations:

Decommissioning of existing gas services will need to be carried out by a suitable professional.

Further guidance:

- Please view **the Energy Saving Trust's webpage** on Home appliances

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED	**PLANNING CONSENT NOT REQUIRED**	**LISTED BUILDING CONSENT NOT REQUIRED**

ELECTRICITY GENERATION

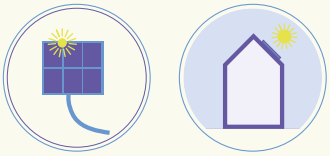
4.32 In the UK climate, there are a number of opportunities to generate electricity through harnessing renewable energy at both mass and more domestic scale.

4.33 It must be noted that risks associated with electricity generation measures greatly depend on the project specific circumstances. Therefore adequate professional advice and careful detailing and material specifications must be obtained.

4.34 The section below outlines various ways of generating electricity onsite:

- **Photovoltaic (PV) panels**
- **Micro wind turbine**

PHOTOVOLTAIC (PV) PANELS



How does it work?:

Solar Photovoltaic Panels (PV Panels) convert energy from the sun into electricity. PV Panels come in a wide variety of systems, colours, thicknesses, and glazing options, allowing for visual impact mitigation through careful siting.

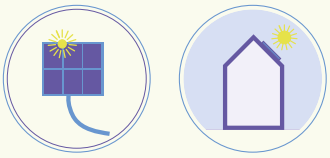
Note that they are different from Solar Thermal Panels which use the radiant heat of the sun to warm water in solar collectors which is pumped to a thermal store, these are discussed on page 60.

There are alternatives to conventional solar PV panels are solar roof tiles, which are designed to look similar to normal slate roof.

When installing solar panels, considerations should be given to reduce their impact on the streetscene, and wider area;

- Ensure panels are spaced evenly on the roof slope and not in an irregular pattern.
- Ensure the position of the panels would retain even distances to the roof margins (ridge, eaves, party walls) and/or wall margins;
- Place panels behind parapets or roof features where possible (such as within the valley of butterfly roofs), and where these features do not cause shading issues; The electricity generated can either be used on site, stored in batteries for future use or sold back to the national electricity grid.

PHOTOVOLTAIC (PV) PANELS continued



Technical considerations:

The orientation of the roof is the critical factor in determining maximum operational efficiency of solar PV panels. They should be as close to south facing as possible, and work best at an angle of 30˚ to the horizontal.

Whilst full sunshine is not required for the panels to function, overshadowing, dust and dirt will considerably reduce the efficiency of the PV panels – adequate positioning and maintenance must be considered to maximise their performance.

Specialist installation advice needed and possibly a feasibility study or structural survey to ensure the roof structure will bear the weight of the panels. It is recommended a supply of replacement roof tiles is kept in case these are broken during installation.

PV installation may negatively impact the character of an area and or may damage the original fabric – For more guidance please refer to: **Historic England's webpage** on Low and zero carbon technologies.

If the installation will harm significance, alternative options should be considered. Some heritage assets will not be suitable for PV installations, for instance listed buildings where the only practical location for panels is a prominent roof-slope. For more guidance, please refer to: **Historic England's webpage** on Installing solar panels.

Further guidance:

- Please view **the Energy Saving Trust's webpage** on home appliances.

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING CONSENT NOT REQUIRED Acceptable and permission usually not required, subject to the limitations within permitted development. Even on the roofs of principal elevations of dwellinghouses and flats in conservation areas, subject to PV being 'sited so as to minimise its effect on the external appearance of the building and the amenity of the area'. Similar limitations also exist for non-domestic properties.	**PLANNING CONSENT NOT REQUIRED** Acceptable and permission usually not required, subject to the limitations within permitted development. Even on the roofs of principal elevations of dwellinghouses and flats in conservation areas, subject to PV being 'sited so as to minimise its effect on the external appearance of the building and the amenity of the area'. Similar limitations also exist for non-domestic properties.	**LISTED BUILDING CONSENT MAY BE REQUIRED** Potentially acceptable subject to the location and significance of the existing roof. Generally when located on less significant elevations, even when visible the installation will be acceptable.

MICRO WIND TURBINE

How does it work?:

Micro wind turbines convert energy from the wind into electricity. There are a growing number of micro wind turbines developed for use in urban contexts, which range in appearance and efficiency. The electricity generated can either be used on site, stored in batteries for future use or sold back to the national electricity grid. Micro wind turbines can be more effective in whole life carbon terms as compared to other renewable energy generation. These are much less commonly used than solar PVs.

Technical considerations:

For a densely populated urban context such as the one in Hackney borough, the wind flow profile varies site to site, and for many sites may not generate c high annual yields.

Mounting wind turbines on the roof of the building could result in unacceptable vibration and resonance being felt within occupied spaces if this is not considered fully in the design process The weight should be considered in relation to the existing building structural capacity.

The turbines may generate noise which may be a nuisance to neighbouring buildings depending on the project particulars. Noise concerns will be required to be addressed.

There are complexities of installing this technology. The use of micro wind turbines would require substantial justification to address the challenges to support any application.

Further guidance:

- Please view **the Planning Portal's webpage** on Building Regulations for wind turbines.

Planning requirements:

- Please view **the Planning Portal's webpage** Planning Permission: Building-mounted wind turbines.

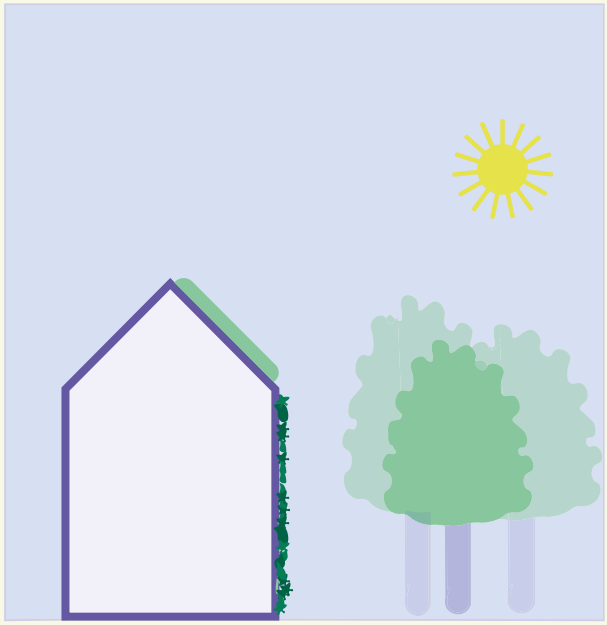
MICRO WIND TURBINE
continued

PLANNING REQUIREMENTS:		
Unlisted outside of CA	**Unlisted within a CA**	**Listed building**
PLANNING MAY BE CONSENT REQUIRED Micro wind turbines may be permitted development on some domestic buildings however strict limitations apply for wind turbines and standalone turbines. You are advised to consult the legislation and seek pre-application advice. Currently non-domestic properties do not benefit from any permitted development rights relating to wind turbines, therefore planning permission will be required. When planning permission is required, wind turbines may be acceptable subject to the location and significance of the existing roof. Generally when located on less significant elevations, even when visible from the public realm the installation will be acceptable.	**PLANNING MAY BE CONSENT REQUIRED** Micro wind turbines may be permitted development on some domestic buildings however strict limitations apply for wind turbines and standalone turbines. You are advised to consult the legislation and seek pre-application advice. Currently non-domestic properties do not benefit from any permitted development rights relating to wind turbines, therefore planning permission will be required. When planning permission is required, wind turbines may be acceptable subject to the location and significance of the existing roof. Generally they should be located to the rear of the property and not visible from the public realm within Conservation Areas.	**PLANNING AND LISTED BUILDING CONSENT REQUIRED** Potentially acceptable subject to the location and significance of the existing roof. Generally they should be located to the rear of the property and not visible from the public realm.

BIODIVERSITY MEASURES

4.35 Opportunities to enhance biodiversity should be explored as part of any retrofit plan as these will not only help to enhance local ecosystems but they can also provide numerous benefits for the building they are installed on as well.

4.36 There is potential for some retrofit measures to create unintended consequences for natural species and biodiversity. For instance, swifts rely entirely on spaces in buildings for nesting, returning to the same nesting places for decades. Where those spaces are lost, birds can be unable to reproduce, affecting wider ecosystems. When undertaking retrofit works it is important to be aware of any protected species and activities and how retrofit measures may impact those, to mitigate and avoid any harm fully.



There is also opportunity to reprovide or enhance biodiversity features through retrofit works. An example would be integrating swift bricks and nesting boxes in any building works, especially as these need to be installed at height, they can be easily integrated into works to facades and chimneys. Swift boxes and bricks are low cost and have a significantly positive impact.

GREEN ROOF

How does it work?:

Green roofs are now a common feature of the UK building landscape. In addition to supporting local ecosystems, biodiverse roofs have multiple benefits such as:

- Enhancing insulation to your roof
- Absorbing water runoff
- Support biodiversity
- Supporting habitat connectivity, particularly in urban areas
- Reducing air and noise pollution
- Reducing urban heat island effect through increase in evapotranspiration rate from the soil and plants
- Aesthetic benefits

There are a variety of green roofs that can be used within a project. These include:

- **Extensive green roof:** Low nutrient and low maintenance, also often designed to be lightweight. Not irrigated. Usually shallow substrate, typically less than 100mm, and often vegetated with sedum.
- Biodiverse roof: Wildlife roof designed to either replicate the habitat for a single or limited number of species or to create a range of habitats to maximise the array of species which inhabit the roof.
- **Semi intensive green roof:** Intermediate green roof type with characteristics of both extensive and intensive green roofs. Typically 100mm to 200mm substrate depth, sometimes irrigated, occasionally managed, and usually planted with a range of species.
- **Intensive green roof:** A green roof that requires intensive maintenance. Usually irrigated and usually with more than 200mm depth of substrate. Equivalent to a garden and usually referred to as a roof garden.

Technical considerations:

Suitable professional advice must be sought when designing a green roof to be incorporated onto existing buildings.

A feasibility study or structural survey may be required to ensure the roof structure will bear the weight of the substrate (when wet and dry and the plants themselves (including when at full maturity).

It is important to ensure there are adequate protections from falling while installing and maintaining green roofs. They may not be appropriate on inclined roofs.

It can be possible to integrate a green biodiverse roof with solar PVs or other renewable energy systems.

A robust maintenance plan should be prepared and fire safety requirements may also be applicable.

Further guidance:

- Please view the documents and membership information webpage on **Gro's website.**

GREEN ROOF
continued

PLANNING REQUIREMENTS:

Unlisted outside of CA	Unlisted within a CA	Listed building
PERMISSION MAY BE REQUIRED Acceptable on flat roofs and permission usually not required for dwelling houses where the build-up is less than 150mm and doesn't exceed the highest part of the existing roof this is likely to be permitted development, but this would be for flat roofs in a discreet location (not pitched roofs). Proposals for 'intensive' living roofs which can be used as an amenity space would be less likely to receive permission. Permission would be required for a green roof which projects above the roof by more than 150mm or if the green roof is installed on a flat or non-domestic building.	**PERMISSION MAY BE REQUIRED** Potentially acceptable on flat roofs and permission usually not required for dwelling houses where the build-up is less than 150mm and does not exceed the highest part of the existing roof subject not being located with a discreet location (not pitched roofs). Proposals for 'intensive' living roofs which can be used as an amenity space would be less likely to receive permission.' Permission would be required for a green roof which projects above the roof by more than 150mm or if the green roof would be installed on a flat or non-domestic building. Should permission be required the acceptability will depend on the location and whether the existing roof positively contributes to the character and appearance of the conservation area.	**LISTED BUILDING CONSENT REQUIRED** Potentially acceptable subject to the location and significance of the existing roof. Generally when located on less significant elevations, even when visible the installation will be acceptable.


5
Upper Clapton
Stoke Newington
Lower Clapton
Hackney
Kingsland
De Beauvoir Town
Haggerston
Hoxton

5. Embodied carbon

EMBODIED CARBON

5.1 Embodied carbon refers to the emissions associated with materials and construction processes throughout the whole lifecycle of a building.[8] Retrofit would typically be considered to have a lower embodied carbon footprint than the newbuild equivalent requiring demolition and rebuild. This is because the embodied carbon emissions in a retrofit will be limited to those generated by the additional materials required by the proposed retrofit measure. However, embodied carbon is rarely considered in business as usual practice.

5.2 Even when retrofitting, there is still an embodied carbon impact arising from the specification of new products and materials, alongside any end of life recycling or disposal of products that no longer are fit for purpose. There are however a number of easy swaps and design strategies that would contribute to significantly reducing the levels of embodied carbon associated with retrofit without compromising the levels of energy and thermal performance delivered. This can include:

- **Reusing existing materials and products either from your own existing building or elsewhere as part of a circular economy. Being careful to deconstruct components carefully will help to maximise the potential for reuse –** e.g. unscrewing elements rather than forcing or cutting apart;
- **Specifying lower carbon impact materials or products – i**ncluding those with recycled material content or natural materials (e.g. wood, hemp, cork based products which can store biogenic carbon while the material is grown);
- **Reducing the quantum of materials and products required as part of any retrofit works through leaner and efficient design approaches –** the less stuff you use, generally the better (e.g. avoiding painting surfaces and leaving materials exposed is one way – paints can be surprisingly high embodied carbon over a whole life);
- **Any materials or products that cannot be reused should be disposed of carefully, prioritising recycling and avoiding landfill disposal where possible;**
- **Considering carefully the high-embodied carbon impact elements such as MEP equipment and how to reduce impacts;**
- **If specifying any kit that uses refrigerants (e.g. Heat Pumps), looking to use low global warming potential refrigerants to reduce the whole life embodied carbon associated with operating the equipment.**

5.3 Environmental Product Declarations can tell you how much carbon is associated with a product and are increasingly available across a range of materials. It may be beneficial to employ a suitably certified professional to undertake Life Cycle Assessment to ensure that any retrofit works perform as intended in both reducing energy demand and also having a low whole life carbon impact.


6
Upper Clapton
Stoke Newington
Lower Clapton
Hackney
Kingsland
De Beauvoir Town
Haggerston
Hoxton

6. Circular economy

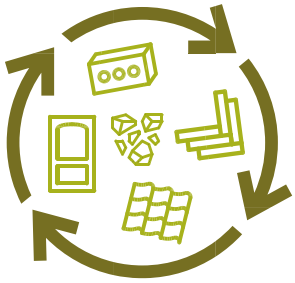
CIRCULAR ECONOMY

6.1 Retrofit inherently involves the retention of existing materials through keeping existing buildings in use for longer. However, business as usual practices tend to be waste intensive and discarded materials are typically sent to landfills. Retrofit measures should be considerate of supporting a circular economy through interventions that are made to limit waste generated from the works.

6.2 In the context of materials scarcity, it is critical to implement circular economy principles regardless of the scale of the proposed works. There are a number of opportunities to enhance the circularity of your retrofit.

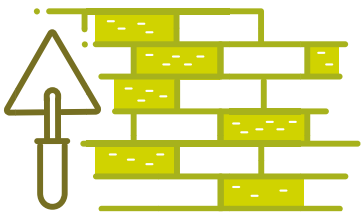
Produce less waste

Knocking walls down, and replacing windows rather than repairing them creates a considerable amount of waste. Incorporating existing elements will always result in less waste and may reduce the costs of the works.



Reuse existing materials

Where possible, existing materials must be incorporated in the design. When the required materials are not directly available on site, they should be sourced offsite, there a number of Circular Economy Hubs now available in London such as the **Enfield – Excess Material Exchange** platform which offer a wide range of re-used products from steel beams to deadstock of tiles.



Recycle what can't be reused

Removal of existing materials may compromise their integrity and make them unsuitable for reuse, in this case, considerations should be given to find a new purpose, for instance, damaged bricks could be crushed and used to create tiles.

Glossary

FOOTNOTES

1. **https://www.weforum.org/stories/2022/11/net-zero-cities-retrofit-older-buildings-cop27/#:~:text=Around%2080%25%20of%20the%20buildings,warming%20to%201.5%C2%B0C**

2. **https://hackney.gov.uk/rebuilding-a-greener-hackney**

3. **https://historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/whole-building-approach-for-historic-buildings/**

4. Not covered in depth in this guidance given the limited viability on a majority of retrofit projects. If there is a river, canal or other large body of water on or near to a site this might be feasible. Any Water Source Heat Pump will require engagement with a range of relevant stakeholders at an early stage.

5. **https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_june_2022_0.pdf**

6. **https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_june_2022_0.pdf** page 32

7. **https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_june_2022_0.pdf** page 32

8. **https://ukgbc.org/our-work/topics/advancing-net-zero/embodied-carbon/**

9. **https://www.gov.uk/government/consultations/the-future-homes-and-buildings-standards-2023-consultation/the-future-homes-and-buildings-standards-2023-consultation**

10. **https://www.ofgem.gov.uk/sites/default/files/docs/2015/10/eco2_measures_table_-_oct_2015-_v2_3_-_final.pdf**

GLOSSARY OF LINKS

Introduction

Hackney's Climate Action Plan:
hackney.gov.uk/rebuilding-a-greener-hackney

Purpose of this document

Residential Retrofit Guidance webpage:
hackney.gov.uk/retrofitting-existing-buildings

How does the Supplementary Planning Document (SPD) fit with other planning policy

The NPPF on the Gov.uk website
bit.ly/NppF

The London Plan on the Mayor of London's website:
london.gov.uk/programmes-strategies/planning/london-plan

The Hackney Local Plan on the Councils website:
hackney.gov.uk/lp33

The Council's Pre-application service:
hackney.gov.uk/pre-application

The Council's PPA service:
hackney.gov.uk/ppa

Planning and building control application page on Planning Portal:
planningportal.co.uk/applications

Information on how to submit a planning application on the Council's website:
hackney.gov.uk/submit-planning-application

The Council's Building Control service:
hackney.gov.uk/building-control

Information on Building Control approval on the Gov.uk:
gov.uk/building-regulations-approval/when-you-dont-need-approval

A whole building approach to retrofit

SBTA's Guidance Wheel:
stbauk.org/guidance-wheel/

Climate Emergency Retrofit Guide, LETI:
leti.uk/retrofit

National Retrofit Hub:
nationalretrofithub.org.uk/

Retrofit measures

Information on permitted development rights on Planning Portal:
planningportal.co.uk/permission/responsibilities/planning-permission/permitted-development-rights

Insulation

Floor insulation: suspended timber floors

Insulating floors in historic building:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/upgrading-thermal-elements-installing-insulation/insulating-floors-in-historic-buildings/

Floor insulation: solid ground floors

Insulating solid fround floors:
historicengland.org.uk/images-books/publications/eehb-insulating-solid-ground-floors/

External wall insulation (EWI)

Insulating walls in historic buildings:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/upgrading-thermal-elements-installing-insulation/insulating-walls-in-historic-buildings/

Understanding best practice in deploying external solid-wall insulation and internal wall insulation in the UK – GOV.UK:
gov.uk/government/publications/understanding-best-practice-in-deploying-external-solid-wall-insulation-and-internal-wall-insulation-in-the-uk

Advice on insulating your solid walls – Energy Saving Trust:
energysavingtrust.org.uk/advice/solid-wall-insulation/

Cavity wall insulation

Insulating walls in historic buildings:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/upgrading-thermal-elements-installing-insulation/insulating-walls-in-historic-buildings/

Cavity wall insulation in existing dwellings: A guide for specifiers and advisors CE252:
buildingcentre.co.uk/media/_file/pdf/22220_pdf27.pdf

Cavity wall insulation (CWI): consumer guide to issues arising from installations – GOV.UK:
gov.uk/government/publications/cavity-wall-insulation-cwi-consumer-guide-to-issues-arising-from-installations

Internal wall insulation (IWI)

Insulating walls in historic buildings:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/upgrading-thermal-elements-installing-insulation/insulating-walls-in-historic-buildings/

Retrofit internal wall insulation:
Best practice – GOV.UK:
gov.uk/government/publications/retrofit-internal-wall-insulation-best-practice

Roof insulation between rafters

Energy efficiency and historic buildings:
Insulating pitched roofs at rafter level:
historicengland.org.uk/images-books/publications/eehb-insulating-pitched-roofs-rafter-level-warm-roofs/heag070-insulating-pitched-roof-rafter-warm-roofs

Retrofit room in roof insulation:
Guide to best practice:
assets.publishing.service.gov.uk/media/61d727d18fa8f50594b59305/retrofit-room-in-roof-insulation-best-practice.pdf

Technical guidance and advice on warm and cold roofs:
cncbuildingcontrol.gov.uk/wp-content/uploads/2019/07/CNCD-053-Warm-Roofs-Easy-Guide.pdf

Roof insulation between joists

Technical guidance and advice on warm and cold roofs:
cncbuildingcontrol.gov.uk/wp-content/uploads/2019/07/CNCD-053-Warm-Roofs-Easy-Guide.pdf

External roof insulation

Technical guidance and advice on warm and cold roofs:
cncbuildingcontrol.gov.uk/wp-content/uploads/2019/07/CNCD-053-Warm-Roofs-Easy-Guide.pdf

Windows and doors

Draught proofing

Draught-Proofing | Historic England:
historicengland.org.uk/advice/your-home/energy-efficiency/making-changes-to-save-energy/draught-proofing/

Energy efficiency and historic buildings:
Draught-proofing windows and doors:
historicengland.org.uk/images-books/publications/eehb-draught-proofing-windows-doors/heag084-draughtproofing/

Retrofitting and improving the energy efficiency of your home:
rics.org/consumer-guides/retrofitting-improving-energy-efficiency-home

Guidance for improving indoor air quality in existing homes:
beama.org.uk/resourceLibrary/guidance-for-improving-indoor-air-quality-in-existing-homes.html

Secondary glazing

Modifying historic windows as part of retrofitting energy saving measures:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/modifying-windows-and-doors-in-historic-buildings/modifying-historic-windows-as-part-of-retrofitting-energy-saving-measures/#Section3Text

Glazing replacement within original frame

Modifying historic windows as part of retrofitting energy saving measures:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/modifying-windows-and-doors-in-historic-buildings/modifying-historic-windows-as-part-of-retrofitting-energy-saving-measures/#Section3Text

Window replacement (double, triple and vacuum glazing)

Modifying historic windows as part of retrofitting energy saving measures:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/modifying-windows-and-doors-in-historic-buildings/modifying-historic-windows-as-part-of-retrofitting-energy-saving-measures/#Section3Text

Door replacement

Historic England – I want to alter a door:
historicengland.org.uk/advice/your-home/improvement/door/

S.P.A.B – Doors:
spab.org.uk/advice/doors

Air permeability and ventilation

Airtightness

Air and Vapour Control Layers (AVCLs) in buildings of traditional construction.
A literature review to understand appropriate use | Historic England:
historicengland.org.uk/research/results/reports/44-2024?search=44%2F2024&searchType=research+report

Natural ventilation

CIBSE top tips 1: Ventilation in buildings (2015):
cibse.org/knowledge-research/knowledge-resources/engineering-guidance/top-tips/cibse-top-tips-1-ventilation-in-buildings-2015

Overheating in historic buildings:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/upgrading-thermal-elements-installing-insulation/overheating-historic-buldings/

How to retrofit houses to reduce overheating:
ribaj.com/intelligence/retrofit-your-building-to-reduce-overheating

Mechanical ventilation

CIBSE top tips 1: Ventilation in buildings (2015):
cibse.org/knowledge-research/knowledge-resources/engineering-guidance/top-tips/cibse-top-tips-1-ventilation-in-buildings-2015

Overheating in historic buildings:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/upgrading-thermal-elements-installing-insulation/overheating-historic-buldings/

Mechanical ventilation with heat recovery

Passivhous Learning Hub – The case for MVHR:
passivhaus.uk/the-case-for-mvhr/

Passivhous Learning Hub – MVHR for single dwellings:
passivhaus.uk/good-practice-guide-to-mvhr-for-single-dwellings/

Overheating and shading

External shading: shutters

Overheating in retrofit and existing homes:
kb.goodhomes.org.uk/wp-content/uploads/2022/03/202112-GHA-Retrofit-Existing-GUIDANCE-LAUNCH-VERSION.pdf

British Red Crosss and Shade the UK – Overheating adaptation guide for homes:
static1.squarespace.com/static/5f479ec7e8691c46c4ef7417/t/66e2fac1e6d4bf18dc3abaa5/1726151371011/Overheating_Adaptation_Guide_For_Homes_STUK_BRC.pdf

How to retrofit houses to reduce overheating:
ribaj.com/intelligence/retrofit-your-building-to-reduce-overheating

External shading: awnings and roller blinds

Overheating in retrofit and existing homes:
kb.goodhomes.org.uk/wp-content/uploads/2022/03/202112-GHA-Retrofit-Existing-GUIDANCE-LAUNCH-VERSION.pdf

British Red Crosss and Shade the UK – Overheating adaptation guide for homes:
static1.squarespace.com/static/5f479ec7e8691c46c4ef7417/t/66e2fac1e6d4bf18dc3abaa5/1726151371011/Overheating_Adaptation_Guide_For_Homes_STUK_BRC.pdf

How to retrofit houses to reduce overheating:
ribaj.com/intelligence/retrofit-your-building-to-reduce-overheating

External shading: planting

The Ignition Project, nature-based solutions to the climate emergency – The benefits to business and society:
ukgbc.org/wp-content/uploads/2020/08/Nature-based-solutions-to-the-climate-emergency.pdf

First steps in air quality for built environment practitioners:
tdag.org.uk/first-steps-in-urban-heat.html

British Red Cross and Shade the UK – Overheating adaptation guide for homes How to retrofit houses to reduce overheating:
static1.squarespace.com/static/5f479ec7e8691c46c4ef7417/t/66e2fac1e6d4bf18dc3abaa5/1726151371011/Overheating_Adaptation_Guide_For_Homes_STUK_BRC.pdf

External shading: window film (fixed)

British Red Crosss and Shade the UK – Overheating adaptation guide for homes:
static1.squarespace.com/static/5f479ec7e8691c46c4ef7417/t/66e2fac1e6d4bf18dc3abaa5/1726151371011/Overheating_Adaptation_Guide_For_Homes_STUK_BRC.pdf

How to retrofit houses to reduce overheating:
ribaj.com/intelligence/retrofit-your-building-to-reduce-overheating

External shading: overhangs and fins

British Red Crosss and Shade the UK – Overheating adaptation guide for homes:
static1.squarespace.com/static/5f479ec7e8691c46c4ef7417/t/66e2fac1e6d4bf18dc3abaa5/1726151371011/Overheating_Adaptation_Guide_For_Homes_STUK_BRC.pdf

How to retrofit houses to reduce overheating:
ribaj.com/intelligence/retrofit-your-building-to-reduce-overheating

Internal shading: shutters and blinds

British Red Crosss and Shade the UK – Overheating adaptation guide for homes:
static1.squarespace.com/static/5f479ec7e8691c46c4ef7417/t/66e2fac1e6d4bf18dc3abaa5/1726151371011/Overheating_Adaptation_Guide_For_Homes_STUK_BRC.pdf

How to retrofit houses to reduce overheating:
ribaj.com/intelligence/retrofit-your-building-to-reduce-overheating

Chimneys

Repair of disused existing chimneys

Open fires, chimneys and flues | Historic England:
historicengland.org.uk/advice/your-home/improvement/open-fires-chimneys-and-flues/

How to draught-proof your chimney - Energy Saving Trust:
energysavingtrust.org.uk/how-draught-proof-your-chimney/?cats%5B%5D=1780

Chimney draft excluder

How to draught-proof your chimney – Energy Saving Trust:
energysavingtrust.org.uk/how-draught-proof-your-chimney/?cats%5B%5D=1780

Decarbonisation measures

Heating system upgrade

Retrofitting and improving the energy efficiency of your home:
rics.org/consumer-guides/retrofitting-improving-energy-efficiency-home

New electric boiler

Mayor of London – Energy assessment guidance:
london.gov.uk/sites/default/files/gla_energy_assessment_guidance_june_2022_0.pdf

Electric radiators (direct electric)

NHBC – Transition of electric heating:
nhbc.co.uk/insights-and-media/foundation/publications/future-homes-avoiding-unintended-consequences/transition-to-electric-heating

Air source heat pump (ASHP)

UKPN – Low carbon technology:
ukpowernetworks.co.uk/low-carbon-technology-domestic

Historic England – Heat Pump installation:
historicengland.org.uk/advice/technical-advice/building-services-engineering/installing-heat-pumps-in-historic-buildings/

Planning Permission: Air source heat pump - Planning Portal:
planningportal.co.uk/permission/common-projects/heat-pumps/planning-permission-air-source-heat-pump

The Microgeneration Certification Scheme – Heat pumps – Planning portal:
planningportal.co.uk/permission/common-projects/heat-pumps/the-microgeneration-certification-scheme

Ground source heat pump (GSHP)

UKPN – Low carbon technology:
ukpowernetworks.co.uk/low-carbon-technology-domestic

Historic England – Heat pump installation:
historicengland.org.uk/advice/technical-advice/building-services-engineering/installing-heat-pumps-in-historic-buildings/

Energy Saving Trust – Ground source heat pump:
bit.ly/426KYhG

Planning Portal – Ground source heat pump:
planningportal.co.uk/permission/common-projects/heat-pumps/planning-permission-ground-source-or-water-source-heat-pump

Planning Portal – Ground source heat pump:
planningportal.co.uk/permission/common-projects/heat-pumps-non-domestic/planning-permission-ground-source-heat-pumps

The Microgeneration Certification Scheme - Heat pumps – Planning Portal:
planningportal.co.uk/permission/common-projects/heat-pumps/the-microgeneration-certification-scheme

Electricity

Replacement of existing lighting bulbs and tubes

Energy Saving Trust – Home appliances:
energysavingtrust.org.uk/advice/home-appliances/

Replacement of existing gas appliances with electric alternatives

Energy Saving Trust – Home appliances:
energysavingtrust.org.uk/advice/home-appliances/

Electricity generation

Photovoltaic (PV) panels

Historic England – Low and zero carbon technologies:
historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/low-and-zero-carbon-technologies/#SectionPhotovoltaicsText

Historic England – Installing solar panels:
historicengland.org.uk/advice/technical-advice/building-services-engineering/installing-photovoltaics/

Energy Saving Trust – Home appliances:
energysavingtrust.org.uk/advice/home-appliances/

Micro wind turbine

Planning portal – Wind turbines – Building regulations:
planningportal.co.uk/permission/common-projects/wind-turbines/building-regulations

Planning Portal – Planning permission: Building-mounted wind turbines:
planningportal.co.uk/permission/common-projects/wind-turbines/planning-permission-building-mounted-wind-turbines

Biodiversity measures

Green roof

Gro – Documents and membership information:
greenrooforganisation.org/downloads/

Appendices

APPENDIX 01 – CONTENTS OF A RETROFIT PLAN

Where retrofit is proposed, it is recommended the following details should be included in the Retrofit Plan, the table below outlines the key information for a Retrofit Plan:

- details of the building's current performance (energy, air quality, ventilation, comfort and experience of residents, moisture/damp, EPC rating, how spaces are used), systems and construction condition, including the identification of issues and locations where it is suboptimal,
- options which have been assessed; and
- how consideration has been given to this issue having regard to the impact upon the historic environment.

WHAT SHOULD BE INCLUDED IN A RETROFIT PLAN?	
Potential chapter within Retrofit Plan	**Content**
1. Key building information, condition, constraints, risks, and opportunities;	**Building fabric –** understanding the construction of your key elements which form the external envelope namely the roof, the walls, the floors as well as the construction date of your building will generally give you a good idea of the type of build ups you are likely to encounter.
	Understanding the condition of your building – the assumptions made based on visual observations and historical data should be confirmed by a condition survey being carried out by a suitable professional such as a RICS chartered surveyor who will also highlight visible defects and suggest remedial works.
	Understanding the building physics – it is critical to understand the existing moisture and air movement within your building to avoid unforeseen consequences and ensure that the retrofit work will not compromise the integrity of your building. It is recommended that a thermal survey be carried out with suitable equipment, such as a thermal camera to highlight weaknesses in the existing envelope.
	Understanding the significance of your building – where your site is located within a conservation area or if your building is listed, it is critical to seek professional advice and prepare an appraisal of significance so sensitive elements are identified.
	Building fabric – understanding the construction of your key elements which form the external envelope namely the roof, the walls, the floors as well as the construction date of your building will generally give you a good idea of the type of build ups you are likely to encounter.

WHAT SHOULD BE INCLUDED IN A RETROFIT PLAN?	
Potential chapter within Retrofit Plan	**Content**
2. Main works proposed along with related strategies and details;	**Interaction of measures** Careful considerations should be given to the interactions of the proposed measures to maximise energy, health and comfort improvement benefit, limit unwanted consequences and avoid unnecessary, costly or abortive work. It is recommended that you seek the advice of a suitable professional with the relevant expertise to establish your own retrofit plan depending on your existing building and identify the key measures based on the targeted outcomes.
	Fabric improvement measures Improving the fabric performance will contribute to reduce the energy demand of an existing building – this is possible through implementing the following measures: • **Installation of insulation** • **The repair and replacement of windows and doors** • **Air permeability and ventilation improvements** • **Mitigating overheating and shading** • **The repair and blocking up of chimneys**
	Decarbonising measures Decarbonisation of the energy use will reduce the carbon emissions of the existing building – this is possible by the switching the way the building is powered, heated and provided with hot water as described in the following measures: • **Decarbonisation of heat and water** • **Adopting electric utilities**
	Biodiversity measures Green roofs can provide insulation and reduced water runoff rates but also improve local biodiversity: • **Green roofs**
	Embodied carbon measures When choosing what materials to use in a retrofit project you should also consider the embodied carbon of the materials you have chosen to use and whether your project can feed into the circular economy: • **Consider embodies carbon** • **Consider circular economy**

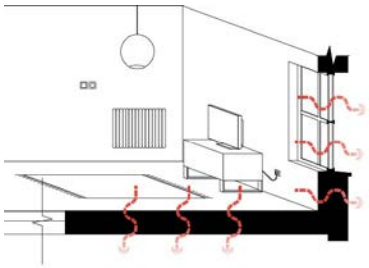
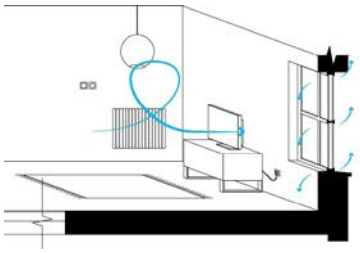
WHAT SHOULD BE INCLUDED IN A RETROFIT PLAN?	
Potential chapter within Retrofit Plan	**Content**
3. The sequence of work	Once you have established a clear picture of your existing building by preparing the relevant surveys, identifying the suitable measures, and considering costs and funding, sequencing the works is key so measures are installed complementary without compromising the sought performance. It is recommended that you seek the advice of a suitable professional with the relevant expertise to establish your own retrofit plan depending on your existing building and identify the key trigger points based on the lifespan of existing and proposed measures. See **Appendix 05** for more information. Note that a retrofit assessor might be able to prepare a plan for a post-war building with limited heritage features, however it would be necessary to seek specific expertise for the retrofit of a listed building so adequate considerations to its significance are made.
4. A plan for monitoring and reporting energy consumption	It is recommended to set a number of targets based on assumptions which can then be verified once the proposed measures have been installed. There are a number of certifications available which come with pre-set targets for each stage of the retrofit, more information can be seen in **Appendix 03.**

Table 1 – Summary of Retrofit Plan content.

APPENDIX 02 – HOW TO MEASURE YOUR RETROFIT IMPACT

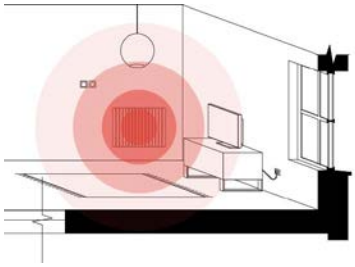
The fundamental objectives of retrofit are to improve the owners and users' experience of the building as well as delivering public benefits through reducing its carbon footprint. Whilst both goals are tightly intertwined, their outcomes are different and therefore their impact must be quantified through appropriate metrics.

A good retrofit plan as described in **paragraphs 3.13–3.15** would detail what metrics have been selected to monitor the outcomes of the installed measure.

ASSESSING FABRIC IMPROVEMENT	
Heat loss 	The fabric improvement delivered through retrofit can be assessed by looking at the changes between the pre and post retrofit building levels of heat losses and air permeability between the inside and the outside of the building. The heat loss is measured through a metric called U-value which is expressed in W/m2.K, it measures the heat (Watt) going through a specific material (m2) for a set temperature difference (K). **Rule of thumb:** The lower the u-value, the less heat is transferred through, the more insulating the material is.
Air permeability 	The air permeability is measured through a metric called air permeability which is expressed in m3/m2.hr at 50Pa, it measures the amount of air leaking from the inside to the outside (m3) of the building (m2) every hour (hr) for a set air pressure of (50 Pa). **Rule of thumb:** The lower the air permeability, the less air is leaking through the building envelope, the more air-tight the building is.
Caution	Reducing the heat losses and air permeability change the building physics balance, to avoid unintended consequences (eg. build up of moisture, overheating, poor indoor air quality) it is essential to implement an appropriate ventilation strategy so the indoor air is replaced effectively, keeping both end occupiers comfortable and building sound.
Best practice 	**Best Practice:** Existing guidance on recommended u-value and air permeability is available – LETI (Low Energy Transformation Initiative) have published recommendations for unconstrained and constrained buildings reflecting the need to balance out fabric performance with existing constraints such as heritage, site orientation, access and architectural limitations.

ASSESSING ENERGY REDUCTIONS

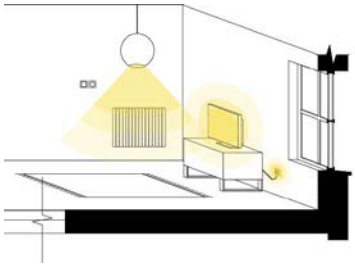
Space heating demand



The space heating demand is expressed in kWh/m2.yr, it measures the amount of energy (kWh) required to heat up the building (m2) each year – this metric is an excellent proxy to verify the heat losses and air permeability levels have been optimised.

Rule of thumb: The lower the space heating demand, the less energy is required to heat up the building, the more energy efficient the building is.

Energy use intensity

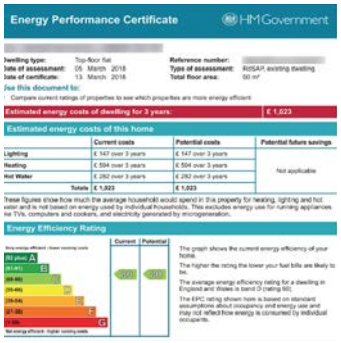


The energy use intensity is also expressed in kWh/m2.yr, it measures the amount of energy (kWh) required to power the building (m2) each year. The EUI represents the overall energy use of the building including the regulated (anything wired in) and unregulated (anything plugged in) energy loads – this metric should be estimated through energy calculations (prepared by an energy consultant) pre-retrofit and verified through regular metre readings post-retrofit.

Rule of thumb: The lower the energy use intensity, the less energy is required to run the building, the more energy efficient the building is.

ASSESSING CARBON EMISSIONS REDUCTIONS

Energy performance certificate


Energy Performance Certificate

HM Government

This calculation is typically prepared by a qualified energy consultant who will use the relevant national carbon factors.

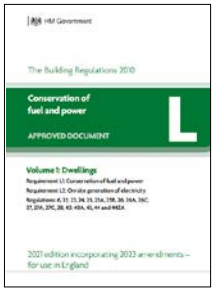
Energy Performance Certificate which gives a brief overview of a building's alleged energy performance and may also suggest a number of measures to improve the current rating. EPC are rating energy performance from G (poor) to A (efficient).

However, it is worth noting that EPC are being increasingly criticised for their lack of accuracy by the construction industry – as those assessments seek to balance assumed costs against energy saving impacts with flawed baseline assumption and no consideration for heritage significance.

This methodology is based on Approved Document Part L and is a compliance tool rather than a prediction tool – this means that unlike energy metrics, it doesn't reflect the actual carbon emissions generated by the building.

APPENDIX 03 – CERTIFICATIONS

Depending on the extent of the retrofit measures being implemented, the works can be intrusive. To secure the best outcomes and de-risk the material, time and financial investments, there are a number of certifications currently available. As retrofit becomes more mainstream in the next few years, it is anticipated that a number of new certifications will emerge.

CERTIFICATION AND COMPLIANCE	
Approved Document Part L 2021 	The approved document contains limited thermal performance targets for both existing, renovated and new elements. Compliance with the Building Regulations must be achieved where applicable - refer to Building Controls for further information: **gov.uk/government/publications/conservation-of-fuel-and-power-approved-document-l** Note the current building regulations are subject to be replaced with Future Homes and Future Building Standards[9].
PAS 2035 	The PAS 2035 is a standard which regulates the process of implementing retrofit measures. It focuses on quality insurance but does not set any energy targets to meet. This standard is required for any works carried out through government back funding. An accredited professional will be required to issue the certification. **retrofitacademy.org/knowledge/pas-2035/**
AECB CarbonLite Level c 	The AECB Carbonlite Level 01 and Level 02 is a retrofit methodology developed by the Association of Environmentally Conscious Building. It takes a step by step approach which focuses on repairing and upgrading the building envelope just enough so a renewable heating alternative (such as a Heat pump) can be installed at no additional running cost than a gas boiler. Once the heat pump has reached its end of life (15yrs) then the second phase focuses on reducing the energy use through further fabric improvement. An accredited professional will be required to issue the certification. **aecb.net/aecb-carbonlite-retrofit/**

CERTIFICATION & COMPLIANCE	
EnerPHit 	EnerPHit is the equivalent of PassivHaus certification for existing buildings. The methodology focuses on analysing the building physics through predictive energy modelling to deliver optimum level of comfort and minimum energy input. It includes a robust quality insurance procedure and sets a number of absolute metrics targets such as the delivered space heating demand not exceeding 25 kWh/m2.yr. The final performance is guaranteed through a multi staged certification process. An accredited professional will be required to issue the certification. **passivhaustrust.org.uk/competitions_and_campaigns/passivhaus-retrofit/**
UK Net Zero Carbon Building Standard 	The UKNZC Building Standard is technical in-use standard which sets time sensitive and building specific operational and embodied carbon targets. Those targets are applicable both to both new and retrofit developments and are aligning with the UK Carbon Budget and commitments to become Net Zero Carbon by 2050. Certification is achieved through post occupation reporting and must be renewed yearly. **nzcbuildings.co.uk/**

APPENDIX 04 – GLOSSARY

Air source heat pump (ASHP):
An energy efficient heating or cooling system that transfers heat to or from the air, typically to generate hot water and space heating or cooling.

Airtightness:
A measure of the permeability of a building - i.e. how much external air enters or leaves the building in an uncontrolled fashion. Also called infiltration. This is measured either in m3/m2.h – i.e. what volume of air escapes per hour for every m2 of the external envelope, or in Air Changes per Hour (ACH) i.e. what proportion of the volume of air in the building escapes every hour.

Building fabric:
The structural materials that the building is made of such as the walls, floors, ceilings, roof, windows and doors.

Carbon factor:
The factor that is applied to electricity that is consumed by buildings, to understand carbon emissions associated with the electricity use. The carbon factor of the UK grid changes throughout the day and the seasons depending on how much renewable energy is being generated.

Coefficient of performance:
As for Seasonal Coefficient of Performance, but relating to a particular instant or condition, rather than over the course of a year. For example, a heat pump could be rated as delivering a COP of 3.5 when the external temperature is 20°C. However, over the course of a year, the SCOP will be less.

Cold roof:
A pitched roof construction where the insulation layer is at joist level above the ceiling of the top floor. Thus, the roof space itself is not heated.

Cooling hierarchy:
A hierarchy of different cooling measures, with the aim of reducing potential overheating using passive measures before reliance on air conditioning systems.

Decarbonisation:
Decarbonisation refers to the process of decreasing carbon emissions resulting from human activity. This is primarily achieved by switching energy generation away from sources which rely on burning of fossil fuels but it can also be expanded to include any process that releases carbon into the atmosphere.

Deep retrofit:
A retrofit which has included work to the vast majority of the building fabric as well as changes to the building's heat source and ventilation systems. This type of retrofit would typically occur at the same time as major renovations or extension and could be expected to realise around a 70 % reduction in energy demand.

Energy use intensity (EUI):
The amount of energy (in kWh/m2/year) that needs to be delivered to a building to provide for all its requirements – both regulated and unregulated energy. The EUI is not the sum of space heating and hot water demand. The actual energy used by the building for these purposes will be reduced by the coefficient of performance of the heat pump (consumption).

Embodied emissions – (Also called Embodied carbon or Embodied energy):
The carbon emissions of an asset are the total GHG emissions and removals associated with materials and construction processes throughout the whole life cycle of an asset (Modules A1-A5, B1-B5, C1-C4). This includes emissions associated with the extraction and processing of materials and the energy and water consumption used by the factory in producing products and constructing the building. It also includes the 'in-use' stage (maintenance, replacement, and emissions Climate Emergency Retrofit Guide Annex K 201 associated with refrigerant leakage) and 'end of life' stage (demolition, disassembly, and disposal of any parts of product or building) and any transportation relating to the above.

Fabric first:
The concept of focussing on the building fabric before trying to reduce emissions using more efficient heat sources, or using renewable energy systems. The building fabric includes walls, floors, roofs, windows, doors and the ventilation system.

Fossil fuel:
A natural fuel such as petroleum, coal or gas, formed in the geological past from the remains of living organisms. The burning of fossil fuels by humans is the largest source of emissions of carbon dioxide, which is one of the greenhouse gases that allows radiative forcing and contributes to global warming.

Fuel poverty:
Households who need to spend more than 10 % of their income on heating their home (note: exact definitions vary across the UK nations).

Heat pump:
Heat pumps transfer heat from a lower temperature source to one of a higher temperature. This is the opposite of the natural flow of heat. Heat pumps can be used to provide space heating, cooling and hot water. A refrigerant fluid is run through the lower temperature source (ambient air, ground, water, etc.). The fluid 'absorbs' heat and boils, even at temperatures below 0°C (although the coefficient of performance (COP) decreases with lower temperature). The resulting gas is then compressed, which further increases its temperature. The gas is passed into heat exchanger coils, where it condenses, releasing its latent heat. The process then repeats. (Adapted from **designingbuildings.co.uk/wiki/Heat_pump**).

Indoor air quality:
The quality of air inside a home. This could be affected by: CO2 levels, Volatile Organic Compounds (VOCs), particulates, odour, humidity, combustion products/fumes.

Mechanical ventilation with heat recovery (MVHR):
MVHR, heat recovery ventilation (HRV) or ventilation heat recovery (VHR) uses a heat exchanger to recover heat from extract air that would otherwise be rejected to the outside and uses this heat to pre-heat the 'fresh' supply air. (**designingbuildings.co.uk/wiki/Thermal_bridging_in_buildings**) As a result, MVHR is more energy efficient than natural ventilation, whilst also providing air quality and acoustics benefits.

Interstitial condensation:
Interstitial condensation occurs when moist air permeates through the different layers of the building fabric and condensation forms due to the temperature difference - the water contained in the moist air becomes liquid at the contact of a colder surface, trapped within the building fabric

If not remediated, the dampness will lead to mould growth and decay, compromising both the health of the occupiers as well as the structural integrity of the building,

The risk of interstitial condensation is mitigated through careful specification of materials as well as effective ventilation strategy put in place

Operational emissions (Also called Operational carbon or energy):
The carbon dioxide and equivalent global warming potential (GWP) of other gases associated with the in-use operation of the 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 (i.e. both regulated and unregulated energy uses).

Performance gap:
This term refers to the discrepancy between energy predictions at design stage, compared to in-use energy consumption of buildings.

Permeability:
See airtightness.

Retrofit:
The retrospective upgrading of a building to enable it to respond to the imperative of climate change.

Retrofit Plan:
A coherent plan which sets out the proposed retrofit measures for a particular house. In creating the plan, the effect and interaction of the measures will have been considered to ensure that there is no adverse effect on the building fabric or the internal living environment. The plan could be staged over several years (see also whole house approach and Step-by-step).

Seasonal coefficient of performance (SCOP):
The ratio of input to output energy that a heat pump is able to deliver, on average, across the course of a year. For example, a SCOP of 2 means that, on average, a heat pump will deliver 2kWh of heat energy for every 1kWh of electrical energy it draws from the grid.

Space heating demand (SHD):
The amount of energy per m2, over the course of an average year, which is needed to maintain a comfortable internal temperature. This is directly related to the thermal performance of the building and is therefore a good proxy for fabric efficiency.

Step-by-step:
The concept of planning a retrofit in a series of stages – perhaps over several years. This approach goes alongside the whole house approach to ensure that the final result is a dwelling which has been retrofitted to its full potential without adverse impact on the building fabric or the internal living environment.

Thermal bridge:
A discontinuity in the insulation layer which results in additional heat loss. If the bridge is particularly bad, then condensation could occur internally.

Urban Heat Island Effect:
When urban areas experience much higher temperatures than surrounding rural areas. This is primarily caused by darker surfaces like roads and buildings in the city which absorb heat from the sun and air pollution which can trap heat.

U-value:
The rate of transfer of heat through a structure (which can be a single material or a composite), divided by the difference in temperature across that structure. The units of measurement are $W/m^2.K$. A lower U-value indicates a structure which conducts less heat.

Warm roof:
A pitched roof construction where the insulation layer is in line with the roof rafters, just below the outer layer of tiles/slates. Thus the roof space is heated and can be occupied.

Whole house approach:
The concept of treating the whole house as a system when planning a retrofit and thus ensuring that any action taken does not preclude another action at a later date. It also means that actions which may affect other aspects of the dwelling's performance are properly considered to ensure that they do not result in any unintended consequences.

APPENDIX 05 – MEASURES AND SERVICES LIFESPAN

CERTIFICATION & COMPLIANCE	
Draught Proofing	10 years
Condensing gas boilers, Heating controls	12 years
ASHP(air source heat pump)	15 years
Replacement of glazing, secondary glazing	20 years
GSHP (ground source heat pump)	20 years
Flat Roof Insulation	20 years
Solar Photovoltaic Panels (PVs) and Solar Thermal Hot Water Panels	25 years
Insulated Doors	30 years
External or Internal Wall Insulation	35 years
New connection to district heating	40 years
Cavity Wall Insulation	42 years
Loft Insulation	42 years
Floor Insulation	42 years

Table: OFGEM Relative Service lifetimes of a range of fabric, service improvements and renewable energy systems[10].

APPENDIX 06 – INSULATION MATERIALS

The following table outlines the different materials that can be used for insulation, along with the reason for them to be used and any technical aspects to be considered as part of installation.

MATERIALS	REASONS FOR USE	TECHNICAL CONSIDERATIONS
Natural materials – e.g. wood fibre insulation, cork, sheep's wool, hemp	These products provide good insulation performance and also are of a relatively lower embodied carbon than many other insulation types. The wood and plant based products store carbon during their growing period which is then held within the product for as long as it is in active use. At the end of life, natural materials can be composted. These materials can also provide more breathability and may be more compatible with older building methods accordingly than some more manufactured options. As these materials tend to be easily malleable, there is more tolerance when installing as compared to some harder panel-based options, which makes it easier to achieve the desired overall performance – less gaps between pieces.	To provide the equivalent u-value as compared to some more manufactured insulations, it may be necessary to allow greater thicknesses when specifying natural insulation products. That means that some natural insulation materials may not be suitable where there is constrained space. Some natural materials can be susceptible to moth or water damage if not appropriately protected against in the design and construction. It is worth considering what if any treatments are added to insulations and whether this affects their contribution to internal air quality at all adversely or end of life disposal.
Recycled materials – e.g. recycled cellulose (paper), recycled fabrics (options including denim and polyester fabrics are available), recycled PET plastic insulation	These can be lower embodied carbon than many insulation types as materials are derived from waste streams rather than from virgin resources. These can be malleable as with the Natural materials.	The downsides are that some of the plastic based products may contribute to microplastic pollution and may not be possible to recycle again at end of life. These can require thicker quantities as with natural materials to achieve the desired thermal performance. These materials may be considered combustible.

MATERIALS	REASONS FOR USE	TECHNICAL CONSIDERATIONS
Mineral wool – made from spun stone fibres	This insulation is similar in providing malleable insulation. It is resistant to fire and water-repelling.	Mineral wool is often higher carbon impact as compared to natural or recycled materials, although there are mineral wools that incorporate recycled content available. There can be health considerations for those who are installing the wool.
Plastic sheets and insulation boards		Rigid insulation boards are harder These also tend to have a higher embodied carbon impact as compared to many other insulation types. They may also be highly combustible.
Spray foam	This has been used where existing buildings have cavity spaces uninsulated or in roofs.	It is now generally not considered advisable to use spray foam and in some applications in roofs is considered a fire risk and is being removed.
High performance thin insulation – e.g. aerogel, ultra thin XPS foams, graphene based insulants	Where there is very limited space available, or where addressing moments of thermal bridging, these can be useful options.	While the u-value performance of these products is impressive, it is important to consider in practice how they will perform when installed. It can be difficult to create a fully sealed continuous insulation line with hard insulation products as compared to more malleable thicker products, and so construction quality can lead to varying actual performance outcomes. These products can be more expensive compared to other insulation types. They also tend to be a higher embodied carbon impact as compared to many other insulation types. They may also be highly combustible.

If you would like to find out what this document says please tick the appropriate box, put your name, address and phone number at the bottom of this page and return it to the address below.

☐ এই কাগজে কি লেখা আছে সে সম্পর্কে যদি আপনি জানতে চান তাহলে অনুগ্রহ করে উপযুক্ত বাক্সে টিক্ দিন, এই পাতার নীচে আপনার নাম, ঠিকানা ও ফোন নম্বর লিখুন এবং এটি নীচের ঠিকানায় ফেরত পাঠান। (Bengali)

☐ 如果你想知道这份文件写的是什么，请在方框内打钩，在本页下面写下你的名字、地址和电话号码并寄到下面的地址。(Chinese)

☐ Si vous désirez connaître le contenu de ce document, veuillez cocher la case appropriée et indiquer votre nom, adresse et numéro de téléphone au bas de cette page et la renvoyer à l'adresse indiquée ci-dessous. (French)

☐ Ger hun dixwazin bizanibin ku ev dokument çi dibêje, ji kerema xwe qutika minasib işaret bikin, nav. navnîşan û hejmara telefona xwe li jêrê rûpel binivîsin û wê ji navnîşana jêrin re bişînin. (Kurdish)

☐ Jeśli chcesz dowiedzieć się, jaka jest treść tego dokumentu, zaznacz odpowiednie pole, wpisz swoje nazwisko, adres i nr telefonu w dolnej części niniejszej strony i przeslij na poniższy adres. (Polish)

☐ Haddii aad jeclaan lahayd in aad ogaato waxa dokumeentigani sheegayo fadlan calaamadi godka ku haboon, ku qor magacaaga, cinwaanka iyo telefoon lambarkaaga boggan dhankiisa hoose ka dibna ku celi cinwaanka hoose. (Somali)

☐ Si desea saber de lo que trata este documento. marque la casilla correspondiente, escriba su nombre, dirección y numero de teléfono al final de esta página y envíela a la siguiente dirección. (Spanish)

☐ Bu dökümanda ne anlatıldığını öğrenmek istiyorsanız, lütfen uygun kutuyu işaretleyerek, adınızı, adresinizi ve telefon numaranızı bu sayfanın alt kısmına yazıp, aşağıdaki adrese gönderin. (Turkish)

☐ (Urdu) – اگر آپ یہ جاننا چاہتے ہیں کہ دستاویز میں کیا لکھا ہے تو براہ کرم مناسب باکس میں صحیح کا نشان لگائیے اور اپنا نام، پتہ اور فون نمبر اس صفحہ کے نیچے لکھئے اور اسے نیچے دیئے گئے پتہ پر واپس بھیجئے۔

☐ Nếu bạn muốn biết tài liệu này nói gì hãy đánh dấu vào hộp thích hợp. điền tên, địa chỉ và số điện thoại của bạn vào cuối trang này và gửi lại theo địa chỉ dưới đây. (Vietnamese)

☐ (Yiddish) אויב ווילט איר וויסן וואָס דער דאָקומענט זאגט, ביטע טיק די פאסיגע קעסטל, שרייב דיין נאָמען, אַדרעס און טעלעפאָן נומער און שיק עס צוריק צו די אַדרעס אונטן.

If you would like this document in any of the following formats or in another language not listed above, please complete and send the form to the address below. ☐ **In large print** ☐ **In Braille** ☐ **On disk** ☐ **On audio tape**

☐ **In another language, please state:** _____

Name: _____

Address: _____

Telephone: _____

Return to: Please send this form to Freepost, Strategic Planning, Hackney Service Centre, 1 Hillman Street, London E8 1DY