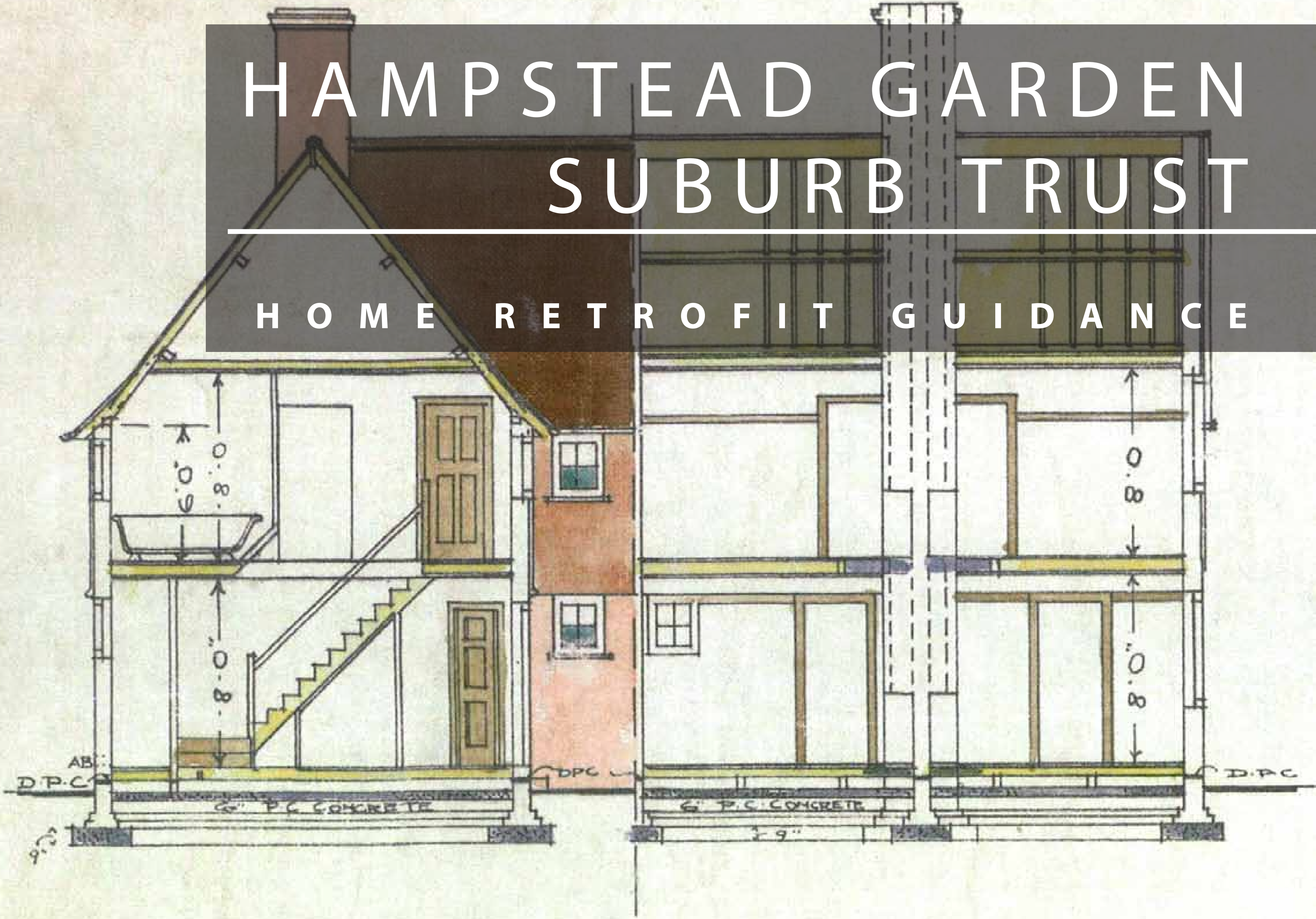
HAMPSTEAD GARDEN SUBURB TRUST

HOME RETROFIT GUIDANCE



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Foreword

In its day, Hampstead Garden Suburb was an exemplary illustration of how to build to respect the environment.

Raymond Unwin designed homes that maximised the comfort of residents, optimised the use of energy and respected the natural topography. Unwin was keen to incorporate as much environmental thinking into his new development as possible. Houses were orientated to make the most of the sun, room layouts maximised ventilation, gardens encouraged nature, trees offered shade and urban cooling, small fireplaces made the best use of fuel and efficient house plans made the most of limited space and budgets.

Architects are having to rediscover this thinking today.

In the last several years, environmental concerns have played a dramatically increased role in our public understanding. Most of us recognise that our energy usage needs to be reduced.

The Trust has produced this supplementary guidance on retrofit and energy efficiency to allow you to better understand your home's energy consumption. It should be read alongside the Trust Design Guidance (2010) and subsequent supporting notes found on our website.

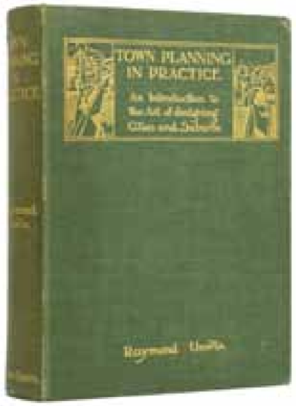
Architectural conservation and energy conservation are not conflicting aims. Well-considered retrofit works can improve energy efficiency with minimal impact on the Suburb's character and historic value. Much can be done simply and inexpensively to improve the performance of your home and save energy. You don't have to do it all. Small steps will make a difference.

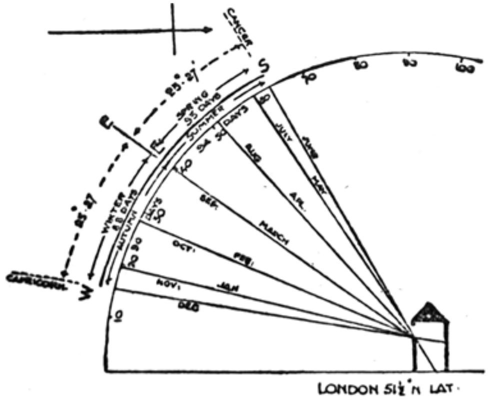
Because Hampstead Garden Suburb is internationally recognised as one of the finest examples of twentieth century domestic architecture and town planning, we all have a duty to look after it. The present Hampstead Garden Suburb Trust has acted as custodian for the continued character and amenity of the Suburb since its establishment by residents in 1968. Changes to properties have always been controlled for the benefit of all residents. Any changes made now must be done with a consciousness of this history.

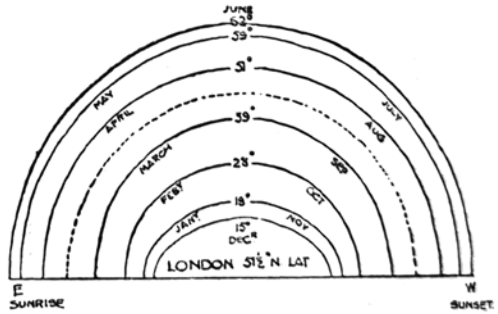
This guide cannot provide a bespoke retrofitting strategy for any particular house. Each property will be different, and you should take the advice of a suitably qualified independent professional when considering extensive retrofit measures.

Simon Henderson
Chief Executive
Hampstead Garden Suburb Trust

Right: *The original Suburb architects intended to reduce energy use and increase comfort by arranging rooms to take advantage of natural light throughout the day. The diagram on the right sets out the height of the sun in the sky throughout the year and how this penetrates the south-facing rooms of a house. (Illustration by M. B. Cotsworth, via Unwin, Town Planning in Practice, 1909, pictured, inset.)*







Right: Inglenook in cottage, Temple Fortune Lane. A simple living room, heated by a single fire, in which meals were eaten at the table. It was designed to be a multipurpose space for family life.

Section 1: Retrofit in general

Section
1

Retrofit in general

1.1 What is retrofit?

Retrofit, or **retrofitting**, refers to any work to an existing building that improves its thermal efficiency and comfort.

Sometimes, retrofitting also introduces a renewable energy source, meaning that the building can rely less on fossil fuels.

Retrofit can be pursued on its own and alongside general refurbishment or alteration work.

Retrofit has many advantages. By using less energy to heat your house, or by changing to renewable energy, it can lower your carbon footprint and energy bills.

It can also improve your personal thermal comfort, and allow you to have greater control over the temperature and ventilation of your house. But it is important to understand that buildings in the Suburb require special care when retrofitting is being considered, in order to protect their character.

Right: The residents of this Suburb home relied on fireplaces for heat, before upgrading to the radiator.

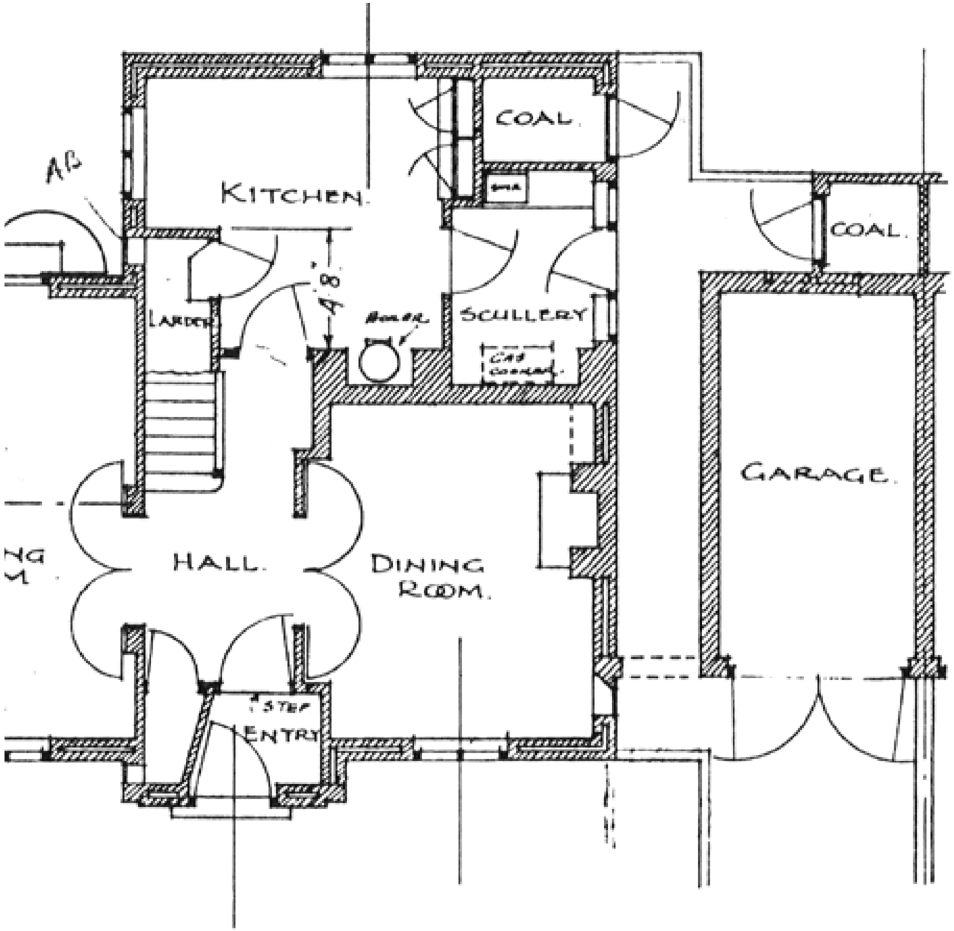
1.2 Buildings in the Suburb

Suburb homes are not always as energy efficient as we might wish them to be. The Suburb housing stock is generally of traditional construction and built for systems of heating that were common between 1907 and 1939.

In other words, they were designed to suit a different historical context - one where coal and gas were the conventional domestic fuels, and when less was known about their impact on the environment.

Far right: 1930s drawing of a pair of houses on Brim Hill (Soutar).

Section 1



Despite their historical origin in the early twentieth century, Suburb houses are durable and adaptable to the present day. There are many ways in which the **energy performance** of a historic house can be improved once its traditional built fabric is understood. Technological advances mean that there is an increasing variety of ways to save and produce energy that are compatible with a house's function, while preserving historical significance and character.

Left: Many Suburb houses were designed with external coal stores.

This is an extract from a plan of a house in Cotman Close showing the coal store as accessed from a side door.

The coal was used in the house fireplace to heat the rooms.

There is a gas cooker in the scullery and a gas boiler for hot water in the kitchen.

1.3 Understanding how your house performs

Many retrofit measures can be undertaken on their own without specialist help. Even the smallest steps will help you make a difference to your carbon footprint, energy bills, and the comfort of your home. The individual measures are detailed in Section 2 and are broadly ordered in terms of complexity.

For more extensive retrofit measures, it is worth considering how individual components of retrofit interact within the house, using a **whole house approach**.

The whole house approach refers to viewing a house as having interdependent parts. Upgrading one part of a house could have a knock-on effect on other aspects of the house, such as its ventilation and heating strategies.

For instance, enhancing **insulation** or upgrading your windows will decrease your heating demand and affect the design of the heating system.

Thus, if you are considering both insulation and a heating system upgrade, such as an air source heat pump, it is beneficial to tackle insulation first.

Looking at all the parts of the house will allow you to prevent issues with performance further down the line.

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Open windows provide natural ventilation, which reduces damp and improves air quality. In the original Suburb houses, coal fires and gas lighting encouraged residents to open windows more than we are used to today. Fresh air was an essential ingredient of Suburb life.

The whole house approach does not mean that every aspect of a house must be upgraded for retrofit to be worthwhile. Rather, it means thinking of your house as a series of interdependent parts, and working out which measures should be carried out in a particular order to allow these measures to function well.

1.4 Ventilation and airtightness

Ventilation describes how a building provides fresh air by deliberate, controlled means - as opposed to draughts. Ventilation can be natural (such as through a window or vent) or mechanical (such as an electric fan).

For further detail, see the section '**Ventilating your home**' on pgs. 24-25.

Ventilation is important in retrofit to maintain the integrity of the existing building's fabric (through the avoidance of damp), as well as good air quality within the house.

An adequately retrofitted home with lots of new insulation will subscribe to the maxim 'build tight, ventilate right'.

Ventilation should not be confused with **airtightness**. Airtightness describes how well draughts have been removed from a building, which occur through unintended gaps in the building fabric. Airtightness can be improved through measures such as **draught-proofing**.

For further detail, see section 2.6, '**Draught-proofing**'.

1.5 Planning retrofit

Retrofit might be carried out as a standalone measure, but it can also be integrated into general building and repair work - whether this is carrying out a rear extension, overhauling a roof, or fixing a boiler.

Like any work relating to building fabric, retrofit can be disruptive - but **planning** will help you prepare and reduce costs.

Section
1

Extensive refurbishment underway at a large Suburb house. When undertaking works of this scale, a thorough retrofit schedule can be built into the design.

You should seek the advice of a professional experienced with traditional buildings and retrofitting before considering more complex retrofit steps. Advice should not be sought from any party with a vested interest in a particular product or installation without also taking independent advice.

If you are planning a refurbishment with an architect or designer, it is a good idea to raise sustainability issues with them early on in the design process, so they can address retrofit steps as well as the other work.

1.6 Retrofit example

On the next page is a drawing of a hypothetical Suburb house with its various retrofit measures labelled. It gives an indication of the range of retrofit measures that can be considered for a given property.

Houses in the Suburb come in a wide variety of styles, forms and structures, so each retrofit project will be different.

For specific information on the individual measures, see Section 2.

1 Internal wall insulation

2 Cavity wall insulation

3 Gas boiler optimisation

4 Roof insulation

5 Underfloor insulation

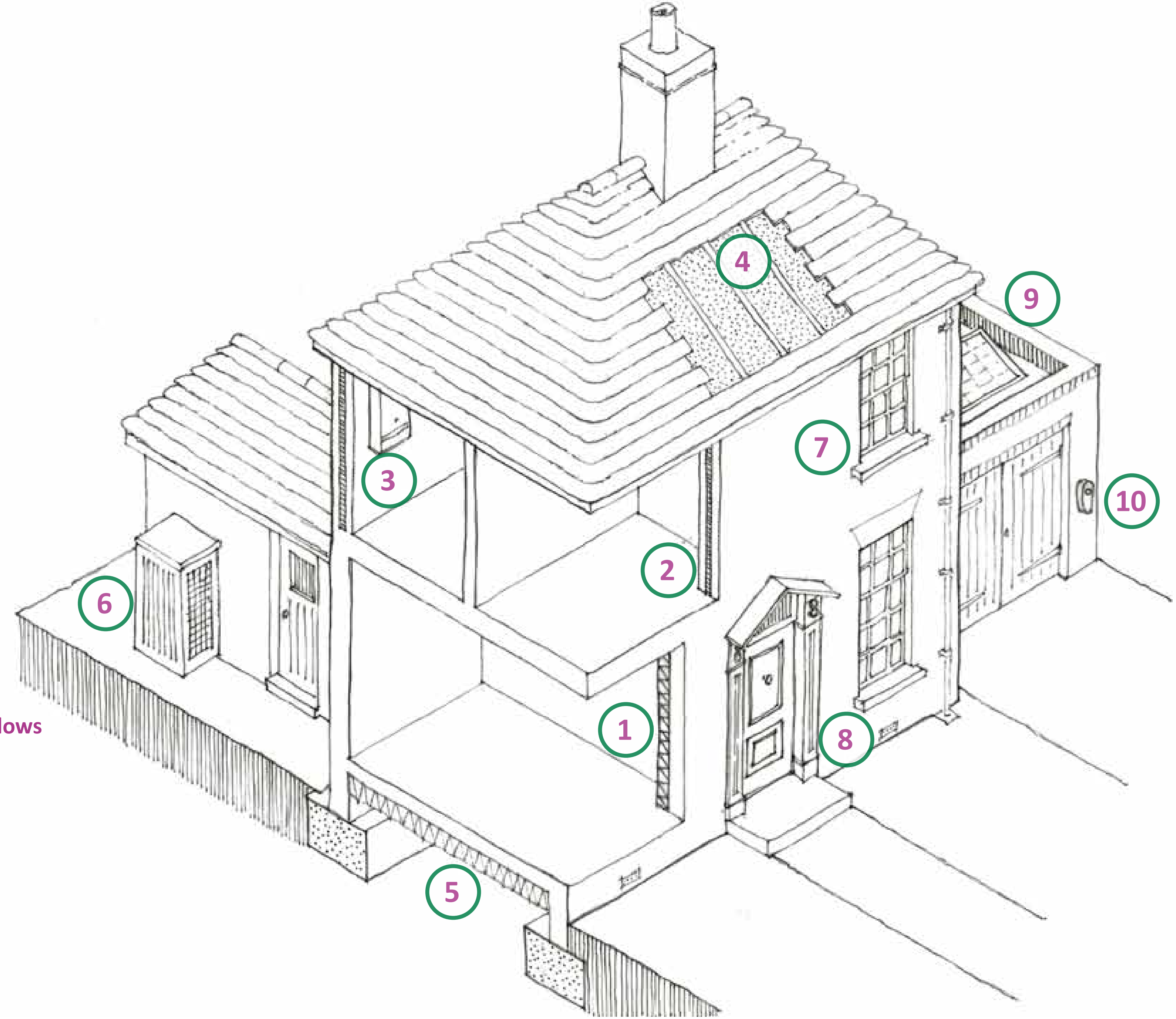
6 Air source heat pump (ASHP)

7 New double-glazed windows

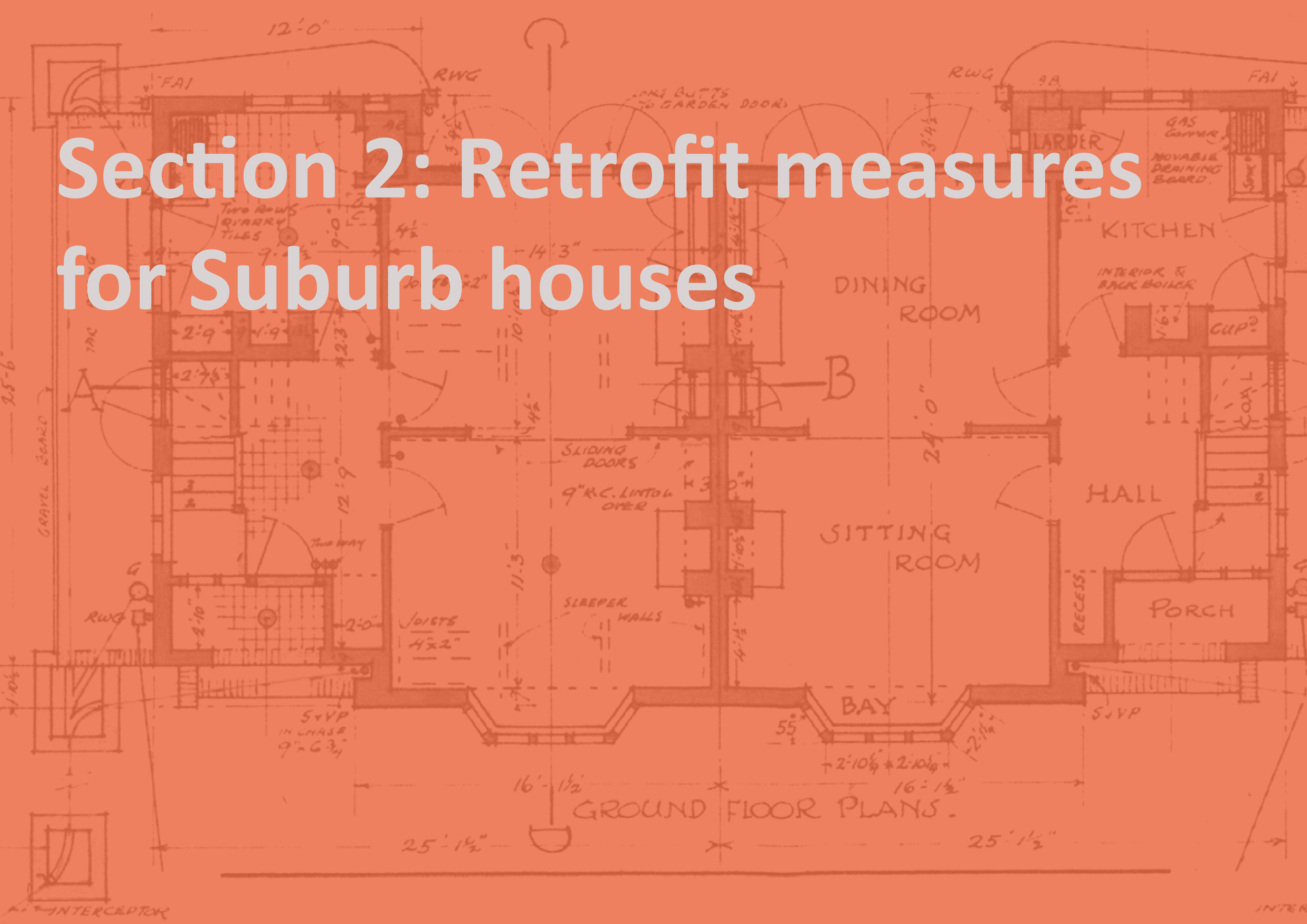
8 Draught seals to doors and windows

9 Solar panels

10 E V charger



Section 2: Retrofit measures for Suburb houses



Section 2

Retrofit measures for Suburb houses

This section outlines a range of measures that might be selected individually or together while planning a retrofit project on a Suburb house. It is broadly ordered in a scale of complexity, from simple to more extensive measures.

Trust Consent for alterations is noted where it is required.

2.1 Internal lighting

On average, lighting constitutes around 10% of a property's energy bills. Swapping to LED bulbs from older incandescent lightbulbs can reduce lighting energy usage by 95%, and swapping from modern compact fluorescent lightbulbs can reduce usage by 40%. LEDs have the added advantage of lasting longer than older lightbulbs.

Left: Modern LED bulb (left) versus older incandescent bulb (right).

Right: Boiler showing flow temperature at 60°C.

2.2 Water consumption

Using less water helps to prevent shortages and can save on bills. Water aerators can be fitted to taps to reduce water flow, which in turn maintains water pressure and prevents wastage. Similarly, flow reducers can be installed in showers to manage water flow effectively, saving energy and water without compromising on pressure. If washing machines and dishwashers are being replaced, it is worth noting that modern units generally have higher water efficiency ratings than older models.

2.3 Boiler flow temperature

Flow temperature refers to the temperature that a boiler heats the water up to before sending it over to the radiators, allowing the house itself to reach comfortable room temperature. Reducing flow temperature will enable a boiler to run more efficiently and last longer.

The flow temperature of a boiler should generally be set at a maximum of 60°C, provided the house still feels comfortable on the coldest days. The size of radiators can also be increased, which allows a lower flow temperature while providing the same amount of heat. You can set the flow temperature lower than this to test or monitor the existing level of thermal comfort.

2.4 Heating controls

You can control a house's heating system so that the house is heated only when needed. Thermostats that are either programmable or 'smart' allow for increased levels of control. Additionally, **thermostatic radiator valves** (or TRVs) can be installed on radiators, which allow rooms to be controlled and heated individually.

A **weather compensation** kit is an add-on device that can be installed on a compatible boiler. This adjusts heating output based on the outdoor temperature, altering the flow temperature as the weather changes. It can lead to significant savings.

> Every time you repair, upgrade or alter your home, you should consider if there are any retrofit measures that you could also do to make your home more efficient.

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2.5 Household appliances

Understanding the energy efficiency and energy consumption of household appliances (such as by consulting user manuals) will help you decide how to run them efficiently. For example, fridges should be set at 3°C and freezers at -18°C for optimum energy usage.

2.6 Draught-proofing

Up to 20% of heat lost in houses is due to draughts, and so eliminating them can lead to lower energy bills. You can see where to prioritise **draught-proofing** by using an infrared camera to view different parts of your home.

Heat can be lost through the edges of windows and doors. Adequately sealing these edges using brushes or 'compression seals' will reduce their heat loss. Heavy curtains on windows and certain doors can help to reduce draughts, while sealing insulated loft hatches with draught strips can prevent down draughts from the loft (if the loft is not a habitable space).

If a chimney is not in use, a 'chimney balloon' can prevent draughts and reduce heat loss. This is usually a plastic product that is inflated within the chimney to prevent cold air entering and warm air escaping. Chimneys should be swept before installation to avoid the build-up of soot on the balloon over time. A fireplace draught stopper can also be placed in the fireplace when not in use, to seal the fireplace opening.

Gaps can develop between individual floorboards and underneath skirting boards as a building settles, and as wood ages and changes shape over time. Filling these gaps with a suitable sealant, caulk or flexible filler can prevent draughts. Airtightness tape can be used if skirting boards are being removed.

Above: Diagram showing an expanded chimney balloon inserted into the flue. Unlike a draught excluder sheet or 'blanket', a chimney balloon is concealed out of sight.

Far left: Underfloor air brick (vent) at the base of a house.

Below: Draught excluder tape on windows (left) and filler between floorboards (right).

Infrared cameras

You can use an infrared camera to get a sense of how much heat is being lost through each surface in your home. It may help you make decisions about where to insulate.

The HGS Residents Association offers a loan scheme for the cameras.

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As with curtains, placing heavy rugs and carpets on floors can reduce draughts. Be careful not to block underfloor vents as they are necessary to prevent damp forming in floor voids.

2.7 Window replacement

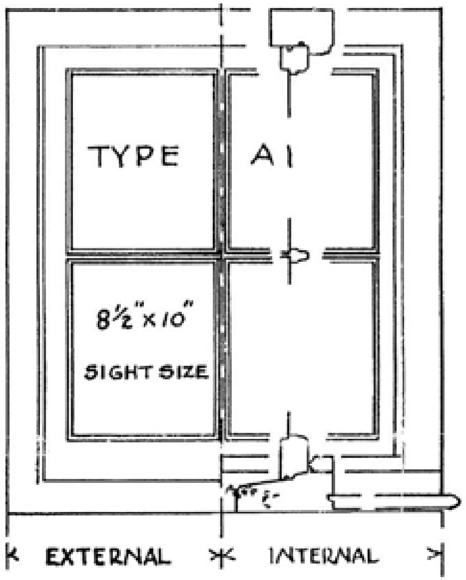
Replacing windows and glazed doors with double-glazed units significantly enhances comfort and energy efficiency. The Trust regularly approves double-glazed units, as both timber and steel windows can usually accommodate them without detriment to their character. It is important that replacement windows match the original single-glazed windows in profile exactly.

Typically, the glazing units approved by the Trust are made up of a maximum depth of 16mm (4mm glass, 8mm spacer bar, 4mm glass). However, what is acceptable may vary depending on the building or windows in question.

For replacement windows, it is important to submit full details of existing and proposed windows to the Trust as part of a formal application. This includes photos of the existing windows, elevation drawings and sections of the proposed windows, and a physical sample (delivered to the Trust office or viewed on site) if the Trust is unfamiliar with the manufacturer. The Trust can provide a list of timber and steel window suppliers on request.

The Trust will be unable to approve double-glazed 'leaded light' windows with applied lead 'cames' on front or prominent elevations of houses. This is because due to their construction, authentic leaded lights cannot be faithfully replicated with double-glazing. It may be possible to have double-glazed leaded lights on side and rear elevations, subject to the correct detail.

Double-glazed uPVC windows will not be acceptable on any Suburb houses as they cannot match the profiles of timber or steel, and have a harmful impact on the character of historic buildings. Similarly, modern aluminium windows cannot match the appearance of steel windows and will not be approved.



Left: Original architect's window drawing showing both elevation and section.

Right: Viewing a sample window, designed to match the original, on site.

2.8 Repairing windows

Upgrading existing windows through repair has the benefit of being less expensive than replacement. It also saves **carbon emissions** through the reduction of the **embodied energy** associated with producing new windows. Ensuring your windows are in a good state of repair through regular maintenance will help them perform with maximum efficiency.

Any work of maintenance or repair that does not alter the external appearance of the existing windows does not require Trust Consent, although you should inform the Trust of your intentions to repair and supply a method statement if the work is extensive.

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2

2.9 Secondary glazing

For traditional buildings, **secondary glazing** is often an alternative measure when upgrading windows. It is a panel of glazing that sits behind an existing window.

Secondary glazing comes in many models, and some have very fine frames and are barely noticeable.

It can significantly reduce heat loss as well as acting as a sound barrier to noise. It is cheaper than wholesale window replacement and does not require Trust Consent.

Left: Discreet secondary glazing behind a leaded light window.

2.10 Loft insulation

Where your loft is not a habitable room, loft spaces allow for the installation of insulation between the ceiling joists. Most homes in the UK have some level of loft insulation, but today an insulation thickness of 270mm is recommended.

It is important that any new insulation does not block existing ventilation pathways, particularly around the eaves. Maintaining these pathways helps to remove moisture and prevent condensation that could otherwise damage the building structure. Additional roof vents may be required but will need to be a type approved by the Trust, to minimise their visual impact.

Applying adhesive foam insulation to the underside of the roof is not recommended. It is not easy to remove, makes the re-use of roof tiles impossible, and may block airways.

2.11 Roof insulation

Where roof spaces are habitable rooms or are being converted, roofs can be insulated internally at rafter level. Such insulation is usually a rigid insulation board installed between rafters. Sufficient roof insulation

Right: Installing quilt insulation above the ceiling in a non-converted loft.

Far right: Rigid insulation board installed between the rafters.

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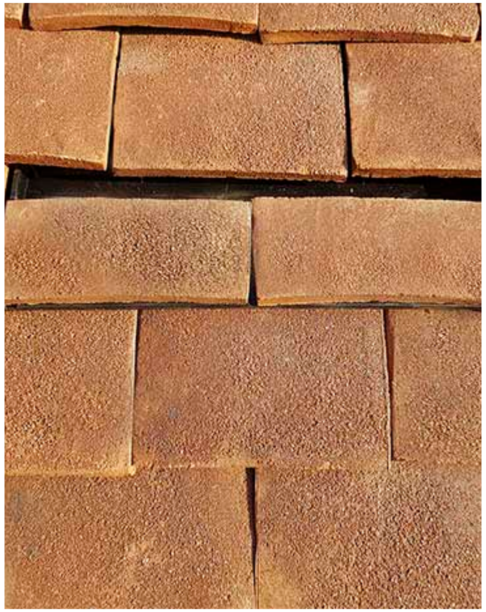
between rafters is necessary when converting your loft space to avoid both heat loss and heat gain. Roof spaces can be unbearably hot in summer.

In insulating, it is important to ensure that there are ventilation pathways above the insulation layer (below the roofline), to remove the build-up of any moisture. Eaves, soffit, ridge or tile vents will be required, and these will need to be a type approved by the Trust, to minimise their visual impact.

Adding insulation on top of the rafters would require the removal of the roof tiles.



Left: Subtle roof tile vents, work to ventilate the roof space. These appear as subtle shadows in the roof plane.

Right: Installation of rigid insulation within a suspended timber floor. The insulation sits between the floor joists and the floorboards are nailed into the joists after installation.

This is sometimes suggested when roof coverings are being replaced. However, this would result in the raising of the roof level, which impacts on its appearance, particularly at the eaves, chimneys, dormers and so on. As a result this type of roof insulation is unlikely to be acceptable.

2.12 Ground floor insulation

Heat loss from ground level floors can considerably impact on the thermal performance of a house. Insulating under ground floors can improve thermal comfort. Doing so is disruptive, requiring the removal of all furniture to lift up the

floor and insulate underneath. Solid floors can be dug out to increase the depth for insulation to be inserted below.

If insulating a solid or suspended timber floor, it is important to first check for damp. If damp is found, it should be addressed before work starts in order to prevent the build-up of moisture, which can damage floors.

To this end, it is important to ensure there is sufficient under-floor ventilation, via unobstructed air bricks and air paths. You should check with the Trust which air bricks are acceptable for the character of the house.

External wall insulation is very unlikely to be approved on Suburb homes due to the harmful impact it would have on architectural details and the appearance of the house.

2.13 Internal wall insulation

Internal wall insulation is an option for traditional buildings with both solid walls and cavity walls.

Applying insulation to the inside of the external walls can offer energy savings and improved comfort.

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It is another example of an energy-saving measure that can be undertaken as part of other major work to extend or remodel your home.

Professional assessment is crucial to identify any risks, such as damp, and to ensure proper ventilation is maintained after installation. Attention must also be paid to the choice of insulation material and installation technique to preserve the building's structural integrity.

Left: Framework in place prior to the fixing of internal wall insulation.

Right: An example of a home built with cavity walls. It is important to survey the home before planning retrofit measures to understand its construction.

Far right, top: Injecting insulation can damage external brickwork if not carried out carefully.

Far right, bottom: Diagram showing insulation within a brick cavity wall.

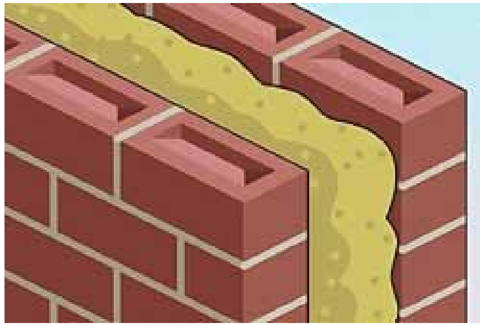
2.14 Cavity wall insulation

Cavity wall insulation might be chosen as a retrofit strategy for houses with cavity walls. Suburb houses were constructed with solid or cavity external walls, and sometimes a mix of both.

This type of insulation, which involves the insertion of polystyrene beads, expandable foam or wool into the cavity, can be done without harm to the appearance of a building. It requires small holes to be

drilled externally into the walls (brickwork or roughcast/render) for the injection, and these can be rectified if carefully drilled.

In the first instance, cavity wall insulation requires a professional assessment to determine the suitability of the building structure, including the components and width of the wall cavities, and any potential for damp issues to emerge.



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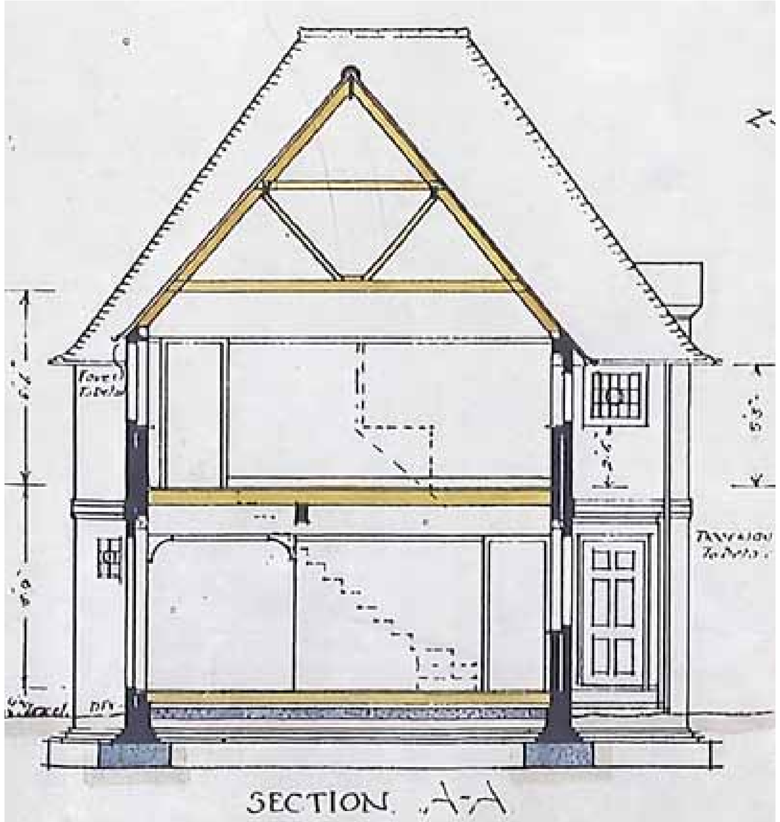
Breathability and insulation

In traditional construction, buildings are generally '**breathable**' - meaning that they allow the passage of moisture through the building envelope.

New insulation, whether on internal walls, or within lofts and floors, can interfere with this **breathability**, and cause moisture to become trapped in the building fabric, causing **interstitial condensation**. Interstitial condensation can lead to damp and poor air quality, and potentially the damage of a building's structure.

To avoid this, an adequate system of ventilation is required. (See Section '**Ventilation methods**' on pgs. 24-25 for further detail.)

In addition, choosing breathable insulation (insulation that allows air and moisture to move through it) will reduce moisture risk.



Above: Section drawing of a 1920s house showing cavity walls (Soutar).

The wall must be dry and the cavity free of debris before installation, to avoid moisture retention and the degradation of building materials. Any work should be carried out by a member of the Installation Assurance Authority (IAA).

The Trust does not control cavity wall insulation in Suburb homes, unless damage is required to external masonry, in which case a method statement should be supplied.

Residents should be aware that such insulation is an irreversible measure to a building's fabric, and so cannot be undone if a problem emerges later on.

Cavity walls were not originally designed to contain insulation and insulating injections are not a traditional building practice.

Listed Building Consent (LBC) for internal works

Installing floor and internal wall insulation can be harmful to the special interest of a listed building, particularly where interior finishes and fittings are affected. If your building is listed, you will need to apply for Listed Building Consent (LBC) from Barnet Council for alterations affecting both the interior and exterior of your home. You should contact Barnet for further information.

Section 3: Heating your home

Section
3

Heating your home

This section deals with the decisions you can make about heating your home in the future. It also considers solar panels and the ventilation strategies you might use in your home. Trust Consent is noted where required.

3.1 Gas boilers

It is likely that gas boilers will be phased out of homes over time but many homes will remain dependent on them for years.

If a new boiler is being installed, a heat loss calculation should be undertaken on the house to ensure the new boiler is correctly sized. This will allow it to run smoothly, which improves its efficiency. It is a good idea to install a boiler that is **weather compensation** compatible (see above Section 2.4 '**Heating controls**').

You should think about any external flues, as their appearance will need to be checked with the Trust before they are installed. Try to position boilers where the flues will be least visible.

If an existing gas boiler is being retained, the focus should be on reducing its heating demand by optimising it, maintaining it regularly and simultaneously improving the thermal performance of the building fabric generally.

3.2 Electric boilers, infrared panels and underfloor heating

Electric boilers are available for domestic use. But given the cost of electricity compared to gas, it is only advisable to use them if a house's heating demand is significantly reduced. Space heating by infrared panels on walls or ceilings is an efficient alternative. These work by heating people rather than buildings, and are required to run for less time to provide thermal comfort compared to a boiler. However, a strategy for hot water would still be required in addition to infrared panels.

Above: AC unit housed in a timber enclosure.

Right: ASHP before a timber enclosure is added.

Left: Infrared panels installed on a ceiling.

Underfloor heating can be effective when coupled with an air source **heat pump** (ASHP), given that a lower **flow temperature** is required for such a system.

3.3 Air source heat pumps (ASHPs)

Air source **heat pumps** use natural heat from the air to provide hot water and to heat internal space, on an 'air-to-water' basis, delivering harnessed heat into a wet heating system such as radiators or underfloor heating. ASHPs run off electricity rather than gas.

If you plan to install an ASHP, there will need to be sufficient space to locate the unit in the garden in an inconspicuous location.

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Residents need to be aware of the exact size required before making an application, as units can be surprisingly large. A louvred timber surround to conceal the unit may be required. A hot water cylinder will be needed inside the house. It is important to understand the space required for plant inside the house before committing to a heat pump. (In addition to the water cylinder, there will be an expansion vessel and maybe a buffer.)

An application will need to be submitted to the Trust with all details and plans showing the location and size of the proposed ASHP.

3.4 Ground source heat pumps (GSHPs)

Ground source **heat pumps** (GSHPs) use natural heat from the ground to provide hot water and to heat internal space. They typically require a small amount of electricity to run. Ground source heat pumps are generally more efficient than air source heat pumps, as the ground stays at a more constant temperature than the air throughout the year. But the former are more expensive to install as they require extensive groundwork.

Far left: ASHPs, like this one before screening, can be surprisingly large.

Left: Plant for retrofit measures, such as ASHPs and underfloor heating, can be extensive.

Right: Ground loop for a GSHP.

GSHPs require pipework (what is known as a 'ground loop') to be placed underground, either in a long trench or in one or more vertical boreholes. Once buried, this pipework can be covered with soil and planting.

As with ASHPs, a hot water cylinder will be required inside the house. The size of both types of excavation will depend on the garden of the property in question, but given the area required, GSHPs will only be viable in large gardens in the Suburb.

An application will need to be submitted to the Trust with all details of the installation and plans showing the site.

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Air conditioning (AC)

Air conditioning (AC) is a type of air source heat pump that provides heating and cooling to a house.

Unlike the ASHPs mentioned above (which work on an 'air-to-water' basis), AC systems pump warm or cool air into your home on an 'air-to-air' basis.

Air conditioning, like other heat pumps, requires an external unit. This will require Trust Consent. This should normally be screened by a timber enclosure so that it does not appear unsightly from neighbouring properties. You will need to size the air conditioning unit to the heating or cooling demands of your house.

In recent years the Trust has experienced an increased demand for air conditioning units. In sensible locations and screened appropriately, these are likely to be acceptable, subject to a full application with plans and details.

It should be noted that air conditioning requires a significant amount of energy to run.

3.5 Solar panels

Solar installations, whether photovoltaic panels (which provide electricity) or solar thermal (which provide additional hot water), are often installed on pitched roof slopes.

However, given the very special nature of the Suburb's appearance, these will not be acceptable on pitched roof slopes.

This is because they are highly visible and, if installed, would be very damaging to the appearance and character of an individual property, and by extension the Suburb as a whole. The original tiled roofs of the Suburb are an integral part of its character and appeal.

Solar installations, where they are not visible (such as on crown roofs or flat roofs in particular locations, screened by a parapet or ridge) may be acceptable.

The roof may need additional structural support to take the additional weight of the panels and ballast. In rare cases it may be acceptable to install solar panels in a garden, if discreetly located. The Trust will ask for plans of the roofs or sites in question, with fully dimensioned details of the solar equipment, as part of a formal application.

Top right: Solar panels installed on a flat garage roof, hidden by the parapet.

Right: The Suburb roofscape is a large part of the Suburb's character.

Section
3

Ventilating your home

Section 1 noted the importance of adequate room ventilation as part of retrofit. Ventilation is critical to retrofit work, particularly for extensive insulation upgrades. Adequate ventilation can be achieved by natural or mechanical means, or a combination of both. Ventilation methods will have to be tailored to the individual needs of each house.

Natural ventilation

Natural ventilation happens when air is allowed to circulate in and out of the building, through openings like doors, windows, air bricks in walls and tile vents in roofs.

Natural ventilation is commonly paired with local extractor fans.

Mechanical ventilation

Mechanical ventilation uses fans to assist in supplying and removing air from the building. This type of ventilation is divided into two main categories: **mechanical extract ventilation (MEV)** and **mechanical ventilation with heat recovery (MVHR)**.

MEV

An **MEV** system extracts air from individual 'wet' rooms (such as bathrooms, kitchens and utility rooms). The extraction can be continuous or intermittent.

Moist air is extracted through local extractor fans (such as a bathroom fan) and discharged to the outside of the building, through individual external vents.

Alternatively, MEV systems can be centralised, where moist air is extracted through fans to a single extractor fan (usually positioned in a loft or cupboard). The air is then discharged to the outside through a single, larger external vent.

MEV systems are generally coupled with natural ventilation.

Above: Interstitial condensation can cause damp and mould within houses.

Below, left: MVHR heat exchanging plant within a loft.

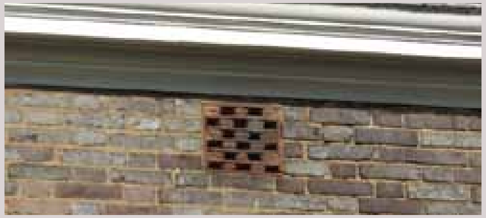
MVHR

Where a house has been made highly airtight, an **MVHR** system might be adopted.

This system extracts air from the wet rooms of a building and supplies them to the 'dry' rooms (such as living rooms and bedrooms).

Moist air is extracted from the wet rooms through extractor fans and passed through a centralised heat exchanger (usually positioned in a loft or cupboard). The heat exchanger removes heat from air that is subsequently vented to the outside. This heat is then used to warm fresh air that is supplied into the other rooms of the building.

Section
3



MVHR requires an external intake vent as well as an extract vent. The system has to be carefully designed in order to be balanced.

Unlike MEV, MVHR is not combined with natural ventilation.

It is important to think about ventilation strategies (whether natural or mechanical) in your retrofit, to maintain the integrity of the existing building fabric, as well as good air quality.

You should consider the external manifestation of the ventilation strategy you opt for. External vents or flues will need to be agreed with the Trust in advance of installation to minimise their visual impact.

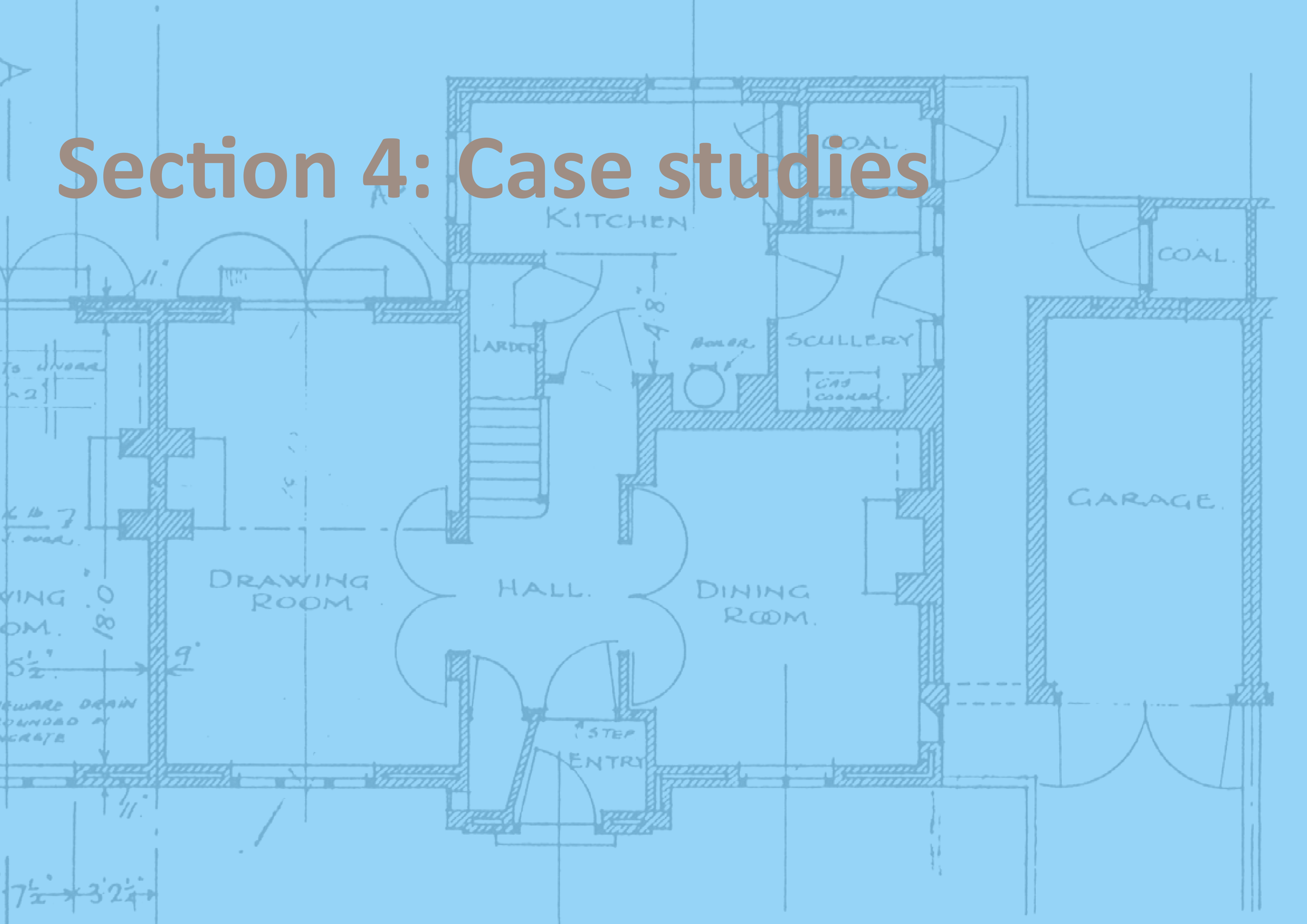
Above: Traditional tile vent to naturally ventilate the house.

Right: In this book illustration from 1928, the kitchen of a Suburb house is praised for its layout. The through ventilation and good daylight provided by the bay were essential to the function of the room. Kitchens were placed on the north sides of houses to keep them cool in summer.

A KITCHEN-SCULLERY WITH RANGE IN RECESS — *J. C. S. Soutar, Architect*

Washing-up needs are admirably met by the twin sinks with ampl draining boards that occupy the tiled bay. Note the excellent lighting

Section 4: Case studies



Section
4

Case studies

This section looks at three retrofit case studies from houses in the Suburb that cover many of the measures above. The combined measures of all the properties include internal insulation, window replacement, an air source heat pump and solar panels.

All three properties have been successful in improving their energy efficiency, in turn reducing both their bills and their carbon footprint.

The interviews for all three case studies were conducted in 2023.

Case study 1 – Window replacement and internal insulation

> *'Working with our architect we decided to install whole house insulation, double glazing and a new heating system.'*

After moving into this detached house, the owners tasked their architect with making their home as energy efficient as possible.

This included insulating the walls, floors and roof, replacing the windows, and upgrading the house's heating system.

Left: Window sills are slightly deeper as a result of the internal insulation. See section 2.13: Internal insulation.

The works were undertaken alongside a wider remodelling of the house, meaning there was little additional disruption for the homeowners as all the interior finishes of the house were being replaced.

The financial investment was substantial. The overall cost of the retrofit works was £140,000 (60% was spent on the windows, 25% on internal wall insulation, 7% on floor insulation, and 8% on other measures).

However, the house is warm in the winter, cool in the summer and has lower energy bills and carbon emissions – which is what the owners were aiming for. While the owners decided to focus on lowering their bills and improving comfort by reducing their heating bills, they may choose to install a heat pump in the future, as part of a phased approach.

Lessons learned

- Working with a professional helps to navigate the best strategy for a property
- Scheduling works alongside wider home improvements helps to minimise disruption
- Allow time for snagging once the building work has settled in

Right: Some well-detailed replacement windows at the house.

Section 4

Case study 2 – Air source heat pump

'Make sure you have an agreed maintenance contract in place up front and get to know an installer in your local area.'

The owners of this terraced house decided to install an air source heat pump (ASHP) at the property to stop their reliance on gas.

The ASHP was installed in their relatively small rear garden with a surrounding timber screen. It works well, keeping the house at a comfortable temperature.

At the time of interview, the system cost around £10,000 after the Boiler Upgrade Scheme subsidy was made use of (£5,000 at the time).

The ASHP is about £1,000 cheaper to run each year than a gas boiler.

The owners had to negotiate issues with their seller and the manufacturer, working through various design options. They believed these issues could have been mitigated by going to a local installer directly.

The owners did not receive a tutorial for the heat pump's operation. They felt that having a maintenance plan and a demonstration of the controls system after the installation would have helped them gain confidence in its long-term maintenance. This would include understanding how the manufacturer's online app worked, so that any troubleshooting could be done remotely.

Right: The ASHP was enclosed with a timber enclosure to improve its visual appearance.

Far right: The internal plant associated with the ASHP.

Lessons learned

- Ensure you have a maintenance contract agreed up front
- Visit a previous installation to understand exactly what is being installed
- Make sure the installer shows you how to operate the controls after the installation

Section
4

Case study 3 – Solar panels

‘The crown roof helps to conceal the solar panel system. After we demonstrated this with our architect’s drawings, getting permission was straightforward.’

The owners of this semi-detached house decided to install photovoltaic (PV) panels on the top of their crown roof, concealed by the ridge. They had been inspired both by their work running a solar installation business, and the desire to teach their children about climate change. They submitted architectural drawings showing the proposed panels to the Trust and Barnet Council, and received permission within a few months.

While permission for the solar system was granted in 2020, the actual installation took place in 2022. This was due to roof repairs being undertaken prior to the works.

The system took two days to install, with scaffolding set up beforehand. The homeowners are happy with the running of the solar PV system.

At the time of writing, 75% of energy generated was used on site. It is low maintenance, contributing to the charging of the family’s electric car, and more broadly their reduction in carbon emissions.

Right: Solar panels are hidden within the crown of the roof.

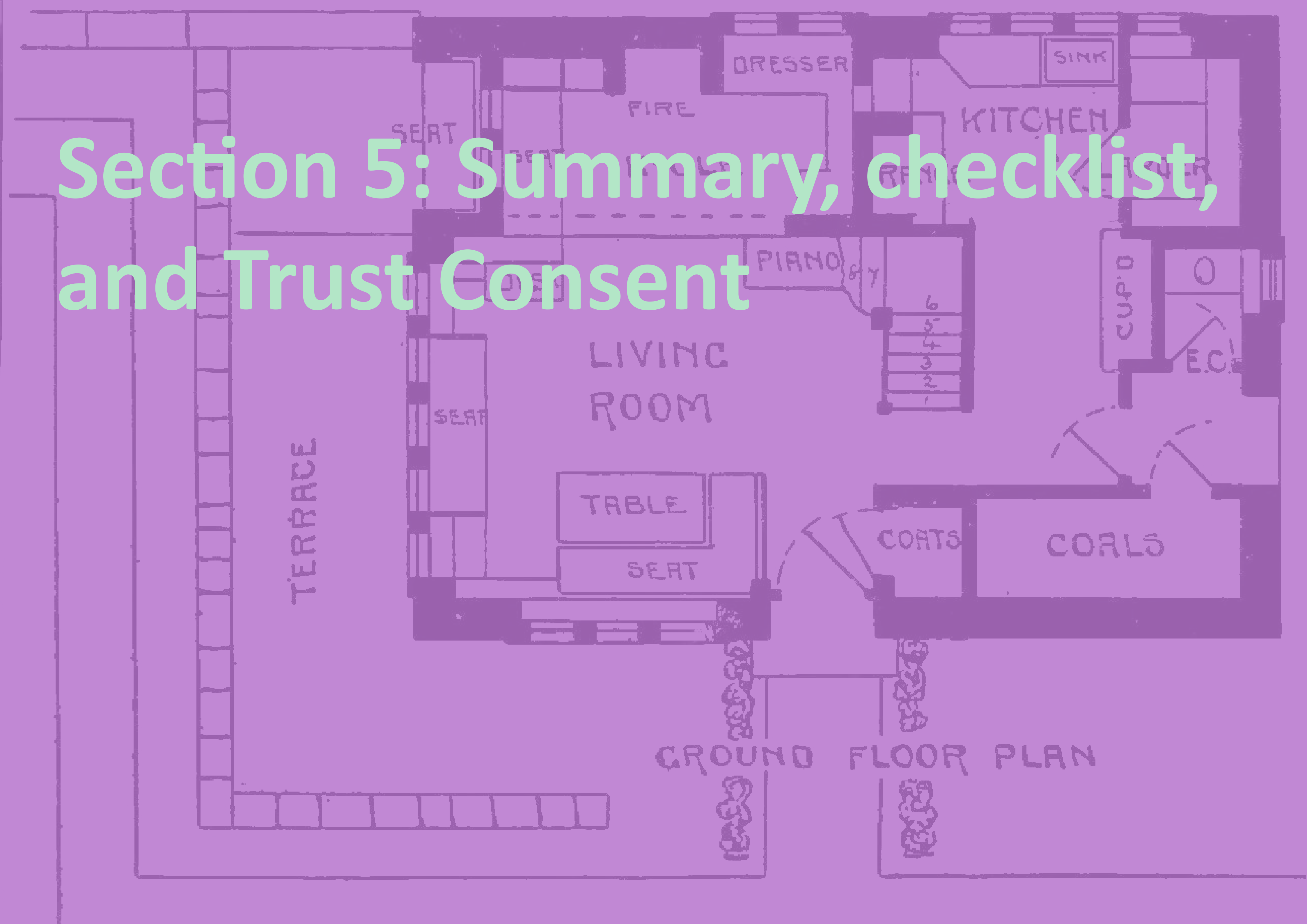
In the future the owners plan to install a battery to use more solar power generated on site, and to take advantage of flexible tariffs in the energy market.

Right: Installing the solar panels.

Lessons learned

- Install a battery that connects to the solar panel system if possible
- Check the condition and structure of the roof before installing solar panels
- Coupling solar panels with a ‘solar diverter’ can help to reduce hot water use (though a hot water tank will be needed)

Section 5: Summary, checklist, and Trust Consent



Section 5

Summary

This guidance has covered a variety of aspects relating to retrofit. It outlines specific measures with regards to retrofit alterations and heating and ventilation strategies.

The guidance stresses that some measures can be adopted individually, to suit your budget and prioritise the particular requirements of your home. It also highlights the importance of the whole house approach for more extensive work, perhaps in conjunction with a qualified professional.

Lastly, the three case studies taken from the Suburb give an indication as to the range of retrofit measures residents can undertake. Retrofit, done sensitively and carefully, can improve a Suburb house's energy efficiency while still maintaining the overall established character of Hampstead Garden Suburb.

Retrofit checklist

How to plan your work

1. Look through Sections 2 and 3 and identify the retrofit measures that you would like to undertake.

2. Ask the Trust for pre-application advice on the retrofit work you would like to carry out (if Trust Consent is required).

3. Formulate a plan, with expert advice if necessary, including potential phasing of works.

4. Seek approval from the Trust (if Trust Consent is required).

5. Engage installers/designers to obtain quotes and costs.

6. Carry out the work.

7. Seek Final Consent from the Trust (if Trust Consent is required).

Leaseholders may require consent for internal retrofit alterations.

Please contact the Trust architectural team for questions about Trust Consent.

What needs Trust Consent?

Trust Consent is not required for

Internal lighting upgrades

Adjustments to water consumption, boiler flow temperature, heating controls and household appliances

Draught-proofing

Authentic like-for-like repair of existing windows

Internal secondary glazing

Internal wall insulation

Electric boilers, infrared panels and underfloor heating

Trust Consent is required for

Window replacement

Air source heat pumps (ASHPs)

Ground source heat pumps (GSHPs)

Air conditioning (AC)

Solar panels

Insulation (of lofts, roofs and cavity walls)

Boiler flues

Natural or mechanical ventilation systems

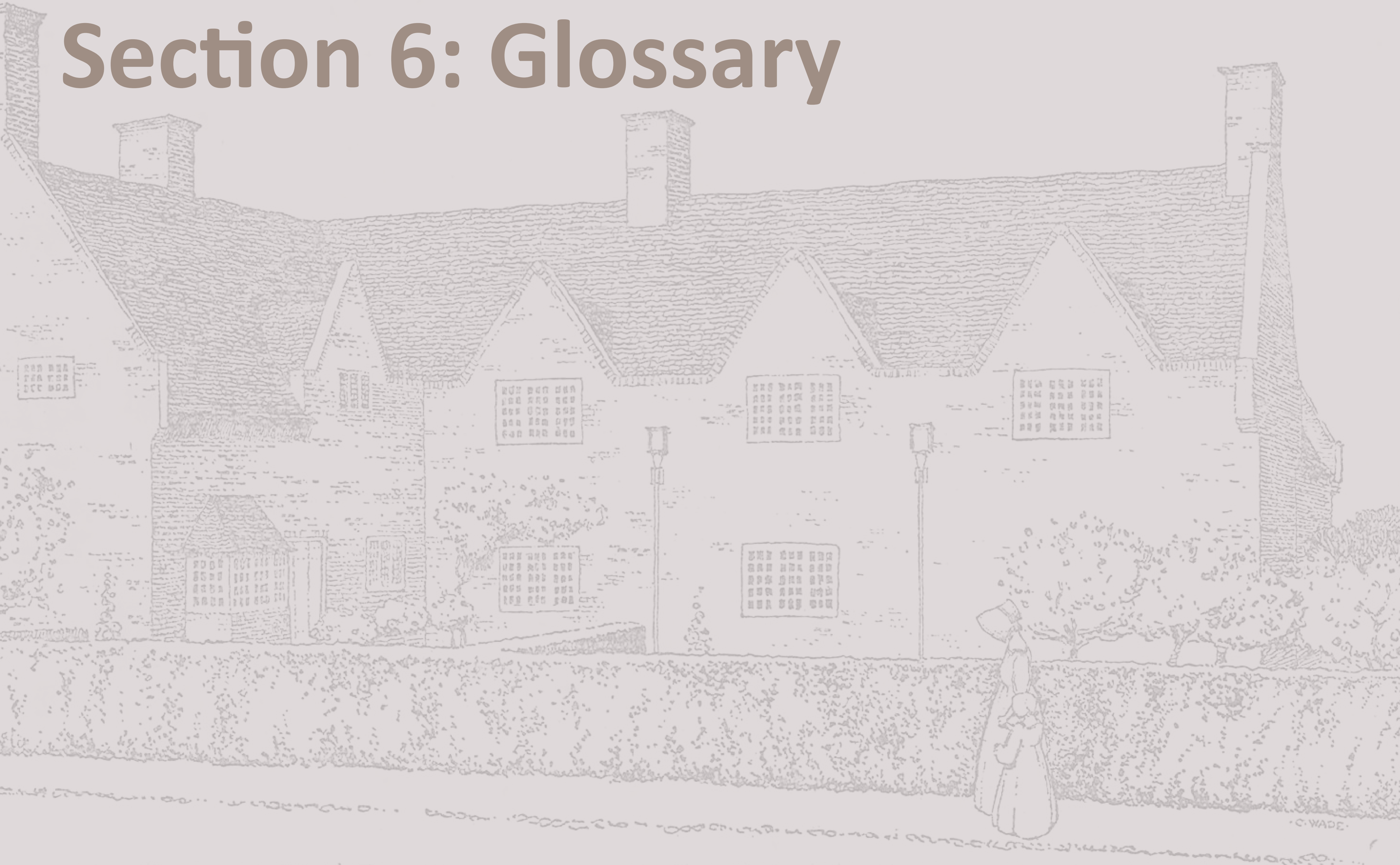
Barnet Council permissions

Hampstead Garden Suburb falls under an 'Article 4' direction by Barnet Council, removing permitted development rights for almost all building work. You may need to apply for planning permission to perform certain upgrades, such as window replacement.

If your building is listed you may also require Listed Building Consent (LBC), for both internal and external work.

You should contact Barnet for further information on both points.

Section 6: Glossary



Section 6

Glossary

Air conditioning - A type of air source heat pump that provides heating or cooling to a house.

Airtightness - How well a building prevents uncontrolled air leakage through the building fabric.

Breathability - Building materials that are 'breathable' allow the passage of moisture through the building envelope.

Carbon emissions - The release of carbon dioxide (CO2) into the atmosphere as a result of human activities. In the context of sustainable building, it specifically denotes the amount of carbon dioxide associated with the construction, operation, and demolition of buildings.

Cavity wall insulation - An insulation strategy that insulates the space (or cavity) within a cavity wall, typically using foam or plastic beads.

Draught-proofing - The process of sealing gaps and openings in a building to prevent the infiltration of uncontrolled air, reducing heat loss and improving energy efficiency.

Embodied energy – A calculation of all the energy used to produce a particular material, product or building, considered as if that energy were 'embodied' in those entities themselves.

Energy performance - The efficiency with which a building uses energy, often related to heating, insulation, and overall energy consumption.

Flow temperature - The temperature at which water flows through a heating system, a crucial factor in boiler efficiency.

Heat pump - A device that extracts heat from the air or ground, and transfers it to a building for heating purposes.

Insulation – A material used within building fabric to reduce heat transfer and improve thermal performance.

Internal wall insulation - Affixing insulation to the inner surfaces of external walls for energy efficiency in buildings with solid walls.

Interstitial condensation - Condensation that emerges when warm moist air moves into colder exterior walls and roofs. The moisture in the air condenses within the building fabric. This condensation can lead to damp and poor air quality, which in turn can degrade the structure of a building.

Mechanical extract ventilation (MEV) - A mechanical ventilation system that extracts air from individual rooms, and is usually coupled with natural ventilation.

Mechanical ventilation with heat recovery (MVHR) - A mechanical ventilation system that extracts and supplies air, recovering heat from exhaust air to minimize heat loss in airtight homes.

Natural ventilation - The process of allowing air to circulate within a space through thermal, or wind effects, utilising doors, windows, or intentional openings without relying on mechanically driven equipment.

Planning - The strategic sequencing of retrofit measures to ensure optimal functionality and interaction.

Retrofit / retrofitting - The process of making improvements or modifications to an existing building to enhance its energy efficiency, comfort and safety.

Secondary glazing - Interior glazing that sits behind an existing window to reduce heat loss and noise.

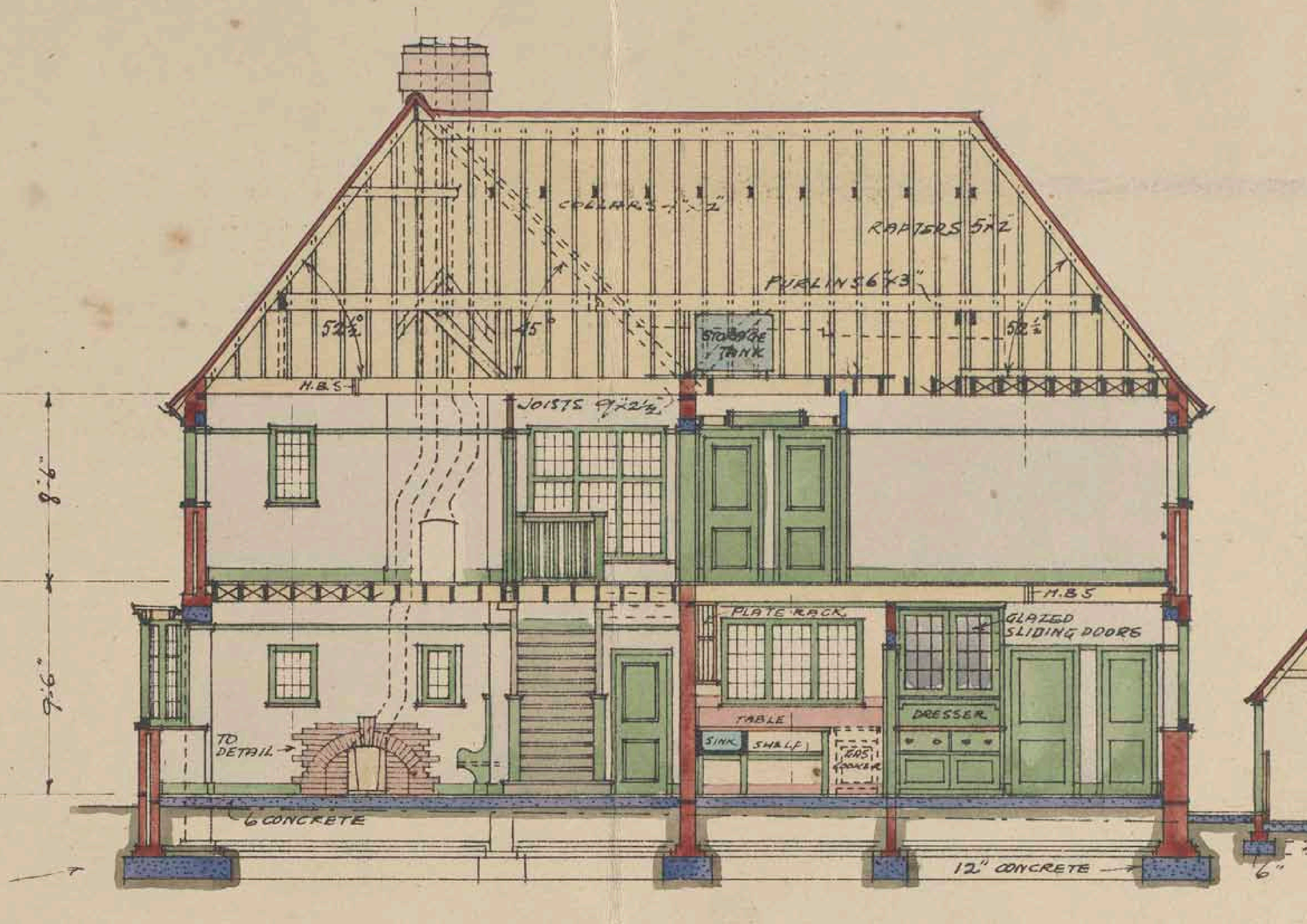
Solar panels – A technology for on-site energy generation. Panels can be photovoltaic/PV (which provides electricity) or solar thermal (which provides additional hot water).

Thermostatic radiator valves – Valves that can be added to existing radiators to allow them to be controlled individually.

Ventilation - The supply of fresh air into the dwelling by controlled means, and for the purpose of maintaining good indoor air quality.

Weather compensation - Controls that can adjust a boiler's flow temperature (based on heat demand and outdoor temperature) to improve its efficiency.

Whole house approach - A comprehensive approach to retrofitting that considers the entire house as a dynamic system, focusing on energy efficiency improvements in various aspects of the building.



COLLARS 4"x2"
RAFTERS 5"x2"
PURLINS 6"x3"
52½°
45°
52½°
STORAGE TANK
H.B.S
JOISTS 9"x2½"
8'-9"
7'-6"
H.B.S
PLATE RACK
GLAZED SLIDING DOORS
TABLE
DRESSER
SINK
SHELF
GAS COOKER
TO DETAIL
6 CONCRETE
12" CONCRETE
6"

Further reading

Historic England
Adapting Historic Buildings for Energy and Carbon Efficiency – HEAN 18
(Historic England, 2024)

Historic Environment Scotland
Guide to Energy Retrofit of Traditional Buildings
(Historic Environment Scotland, 2023)

Oxley, Richard
Survey and Repair of Traditional Buildings: A Sustainable Approach
(Donhead, Dorset, 2003)

Suhr, Marianne and Hunt, Roger
Old House Eco Handbook: A Practical Guide to Retrofitting for Energy Efficiency and Sustainability, Second Edition
(Society for the Protection of Ancient Buildings, London, 2019)

Resources

London Borough of Barnet
https://www.barnet.gov.uk/

Hampstead Garden Suburb Residents Association
https://hgsra.uk/

Historic England:
Energy Efficiency and Retrofit in Historic Buildings
https://historicengland.org.uk/advice/technical-advice/retrofit-and-energy-efficiency-in-historic-buildings/

Society for the Protection of Ancient Buildings (SPAB)
https://www.spab.org.uk/

Sustainable Traditional Buildings Alliance (STBA)
https://stbauk.org/

Home Retrofit Guidance

Produced in collaboration with
Cook & Cardenas
a retrofit consultancy with experience upgrading historic buildings.

www.cookcardenas.co.uk

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