



LIVERPOOL  
CITY REGION  
COMBINED AUTHORITY

METROMAYOR  
LIVERPOOL CITY REGION

Retrofit your home.

# Retrofit your home.

**How to get a warmer,  
more comfortable and  
energy efficient home**



# Why make energy improvements to your home?

## Retrofitting can...

Retrofit helps residents have a warmer, more comfortable and better quality home.

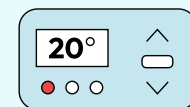
You may be unsure why retrofit is important for you. Here are some benefits which may apply to you, and may be the key reason why retrofit is right for you and your property.

It is important to take advantage of this opportunity by speaking with your local authority now while funding is available. Retrofitting your home might mean installing more than one measure over a period of time and using different funding sources.

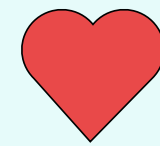
### Create a warmer home



Improved insulation in your property will help retain heat leading to a warmer living environment.



More energy efficient heating systems can result in better heating control compared to older systems.



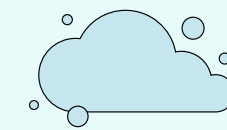
Improved thermal comfort helps with wellbeing and a range of medical conditions

### Improve the condition and resale value of your home



Recent studies show it can increase your property's resale value. Energy efficiency is a significant real estate consideration for prospective home buyers.

### Reduce the amount of energy you use

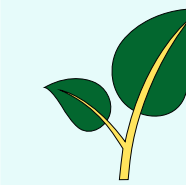


Nationwide, buildings account for a **49%** of energy consumption. Individually, most homeowners use more energy than necessary because of air leaks and poor insulation that doesn't keep the warm air inside. By retrofitting your home, you can reduce air leaks, meaning you do not need as much energy to heat your home. This in turn lowers the national consumption of energy, helping to mitigate climate change.



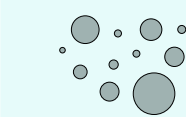
Using less energy might mean paying less on your energy bills, but this is not always the case. It is important to highlight that insulation helps keep heat inside the property. Once insulation is installed, if your heating system is used in the same way, savings will be minimal. However, if you also modify your heating to account for the new insulation, there can be energy savings for you and the environment.

### Create carbon savings for a better environment

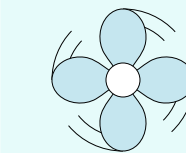


Your home may already be warm and you can afford the fuel bills for your property. A benefit of retrofit is that you will be 'doing your bit' in helping reduce carbon emissions from your home.

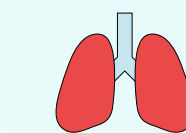
### Improve the quality of the air you breathe in your home



Thinking about indoor air quality is just as important as external air quality. Retrofit can improve the quality of the indoor air you breathe by reducing pollutants in building materials and by creating better air circulation in your home.

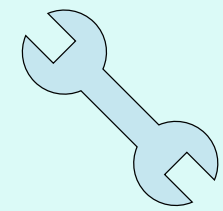


Putting proper ventilation in your home can resolve damp, mould and condensation issues.



Improved air quality can help with respiratory health conditions.

# Myth busting facts.



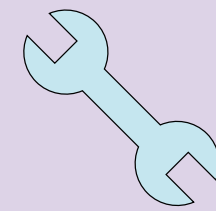
## Installer myth 1

“Why can we not install the measure like we have done before?”

The new government framework for energy efficiency measures in domestic dwellings PAS 2035 & PAS 2030 have been in force for nearly a year.

This new framework will improve the quality of domestic retrofit projects by supporting quality retrofit work and eliminating problems associated with defects, accountability and poor design performance.

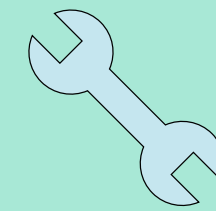
The PAS standard is a new way of working that prioritises quality and the resident.



## Installer myth 2

“We're only changing the electric heaters, this PAS is just red tape stopping us getting on with the job.”

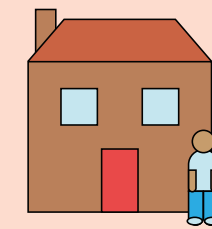
The retrofit process should be dwelling focused rather than funding focused. This is because across the UK, we need to complete a huge number of whole house retrofits to ensure we meet carbon reduction targets. PAS 2035 creates a full plan going forward for each property, rather than just securing funding and not worrying about that property until the next round of funding.



## Installer myth 3

“There is a small extension we won't bother insulating. It's not worth the time, we have limited funding and will not make any difference anyway.”

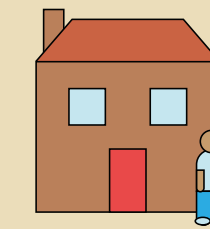
A new focus for the PAS 2035 documents is ensuring the insulation measures provide a wraparound thermal barrier, meaning no gaps in the insulation that result in cold spots which cause mould and condensation. Insulating a whole building does have its challenges; buildings have differences that will be highlighted in the retrofit assessment. It is important the design is clear and agreed with the installers.



## Resident myth 1

“They want to drill holes through my walls and trim my doors down, I am cold enough already with draughts, I don't want this insulation now!”

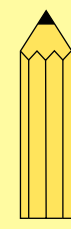
Installing energy efficient measures without ventilation will only serve to worsen the problem with condensation; potentially leading to complaints, call backs, costly remedials and worse still, health risks for residents. It is important the resident understands that ventilation is a vital part of the process. Different ventilation methods will be needed to be installed with the different types of insulation measures. Typically, mechanical ventilation systems are designed into all wet rooms, and undercuts are needed on internal doors to keep the air moving throughout the home. In the retrofit process, ventilation strategy is key to a successful retrofit.



## Resident myth 2

“Will my bills be cheaper?”

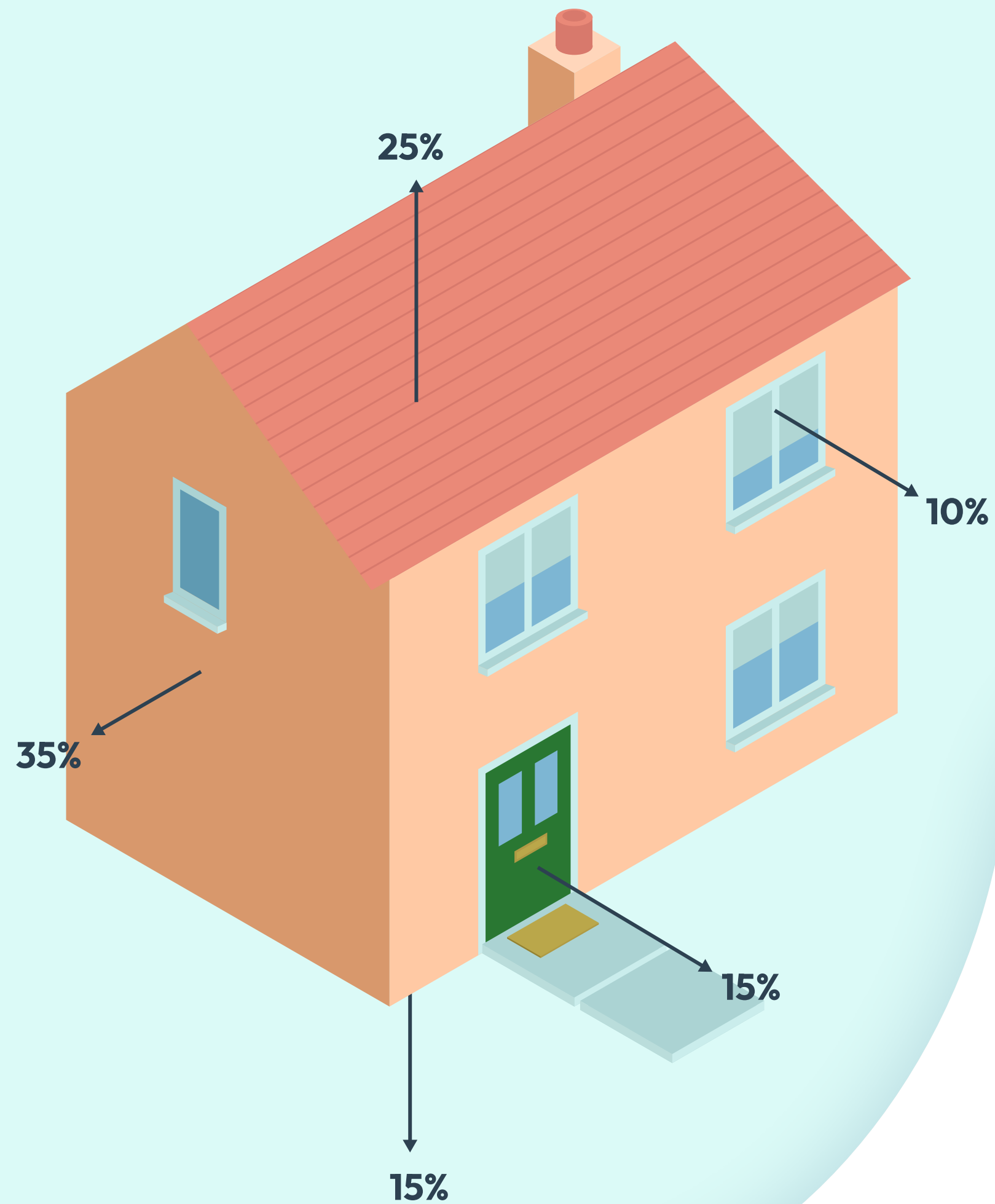
This is a legitimate concern for residents. Saving money on bills is entirely dependent on how the heating system is used. Insulation by itself will not save you any money on your energy bills. That said, insulation will keep the heat in the property, meaning you will not have to use your heating as much, and this is where the saving can come from.



## Design myth 1

“These properties are all the same so we will just work to one detail from a previous scheme.”

The retrofit assessments highlight differences in what look like similar properties. The assessment looks at a range of factors such as windows: do they open? Are trickle vents present? These small details will differ from property to property meaning the ventilation requirements will differ.



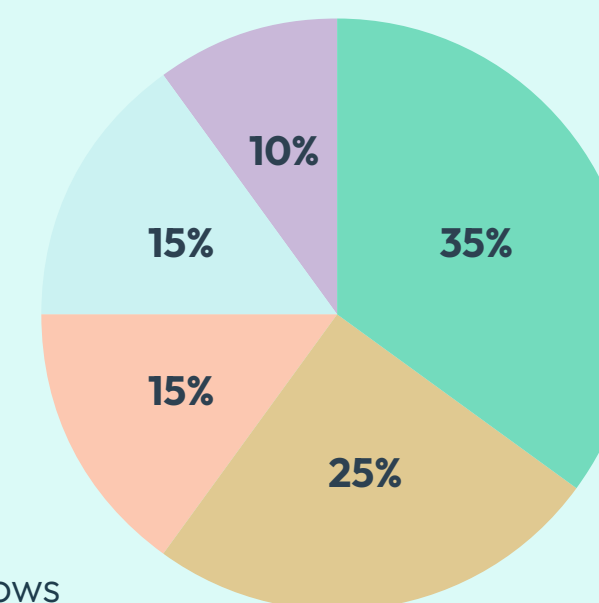
# Where heat leaks.

## Why should I retrofit my home?

Most homes do not have adequate insulation to keep residents warm and comfortable. This has an impact on energy consumption in the home, meaning more energy is needed to heat the home, or, if this cannot be afforded, homes are cold in the winter. Using more energy also has environmental impacts for us all. By reducing how much energy we need, we can be more comfortable and save the environment.

### In a typical property:

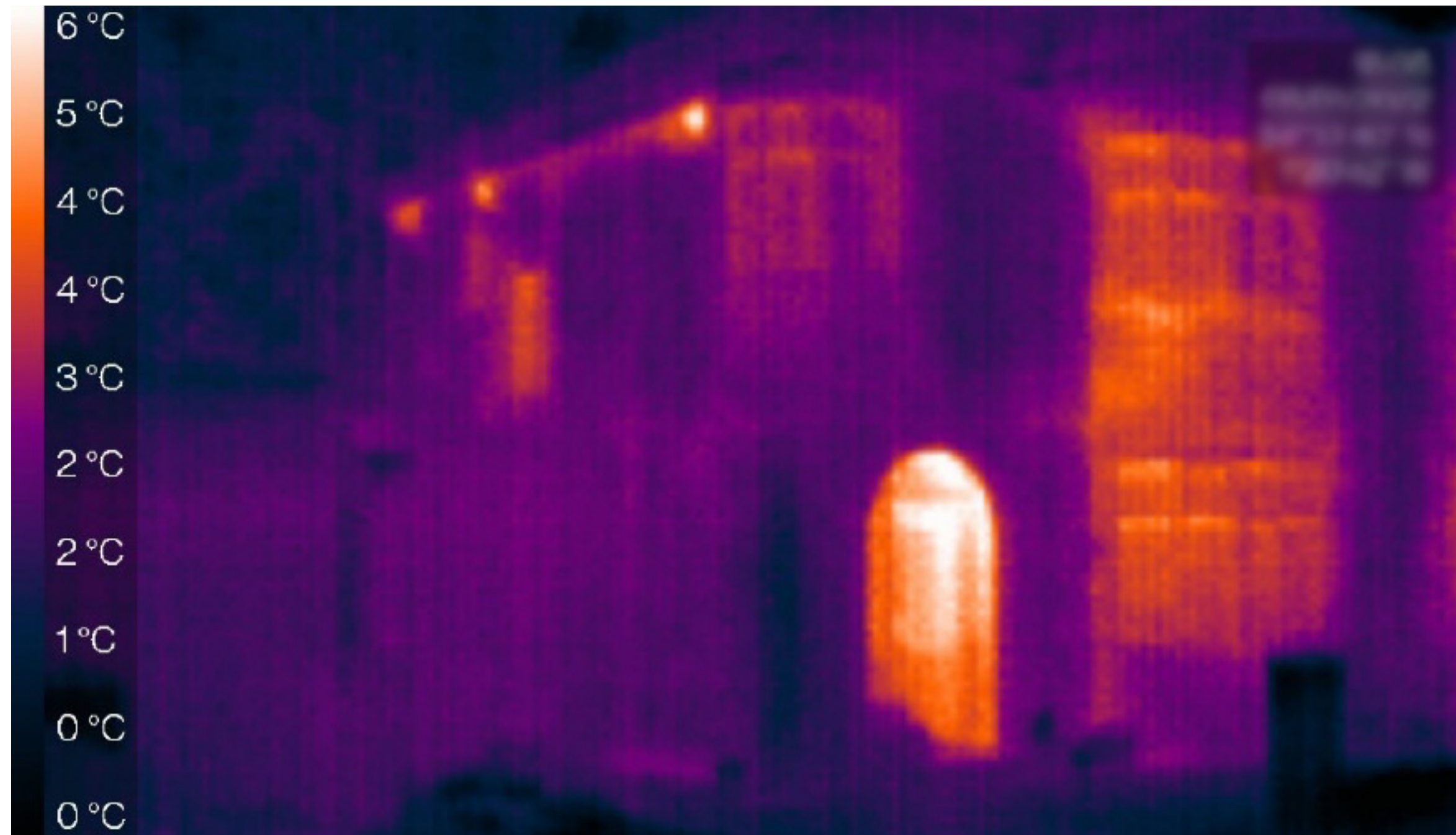
- 35% of heat is lost through uninsulated walls
- 25% of heat is lost through uninsulated roofs
- 15% of heat is lost through uninsulated floors
- 15% of heat is lost through doors and air leaks
- 10% of heat is lost through poorly performing windows



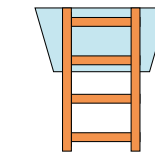
# Where heat leaks.

Below is a thermal image from a recent retrofit project before work began. The more red and orange areas show areas of leakage for this home.

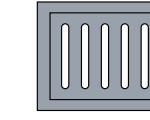
Your property can 'leak' heat. This is where heat escapes from your home, resulting in a cold home and having to run the heating for longer to compensate this. Retrofit aims to target the areas where heat leaks from houses. Multiple improvements might be needed to stop heat escaping, and retrofit programmes can put a plan in place for your home.



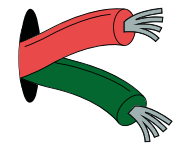
Air leaks can cause major energy loss, which in turn means you need to use more energy to heat your home. Here are some of the most common places for air leaks to occur in homes:



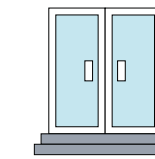
Loft Hatch



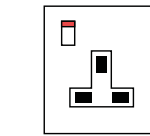
Unsealed vents



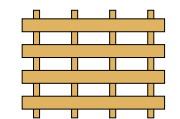
Wiring holes



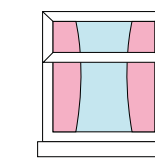
External doors



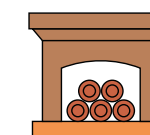
Unsealed electrical outlets



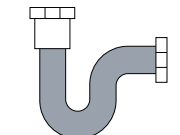
Between floor joists and behind knee walls



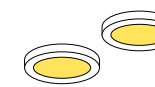
Windows



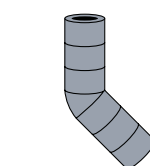
Fireplace walls



Plumbing wires



Recessed lighting



Fireplace flues

# Following a fabric first approach.

1

## All government funded projects must follow a 'fabric first' approach

Most homes do not have adequate layers of **building fabric** between the inside and outside to keep residents warm and comfortable. Retrofit aims to target the areas where heat leaks from homes. If we improve the building fabric of the home first, we can reduce the amount of heat escaping from the building, keeping the warm air in the home. This fabric first approach is the government standard for retrofit.

The best way to improve your home is to add insulation first, and provide the right ventilation to enable the home to breathe (which is very important to not have mould or condensation in the home).

2

## Build tight, ventilate right

'Building tight' is about stopping unintentional heat leaks in the home. Ventilating right is about providing intentional ventilation to allow well designed air flow through the home, reducing unwanted condensation.

Building tight is important for the entire building fabric: gaps and cracks need to be fixed at the corners and edges where materials join and holes for pipes and cables. The right approach to building tight actually makes a house feel both fresher and more comfortable.

Designing effective ventilation allows the home to replace stale air, including carbon dioxide, cooking smells, water vapour and dust with fresh air. It is important to highlight that while extract fans replace stale air, properties need a balance of fresh air, so there are different ways the right ventilation can be added into your home.

3

## What about heating?

Having insulation installed before any heating is the best way to ensure a good outcome for your home. This is because the insulation reduces the demand on your heating system, meaning it doesn't take as much energy to heat the home. Previous funding schemes have not followed this approach and fabric first is a new method to get a better outcome for residents. Your home should not have an oversized system that takes a lot of energy to use, when simple measures like insulation can be installed first.

### What is building fabric?

The 'building fabric' is the envelope of a home, or the physical parts of the building that separate the indoor environment from the outdoor. This consists of things like insulation, cladding, finishes and structure in the walls, floors and roof.

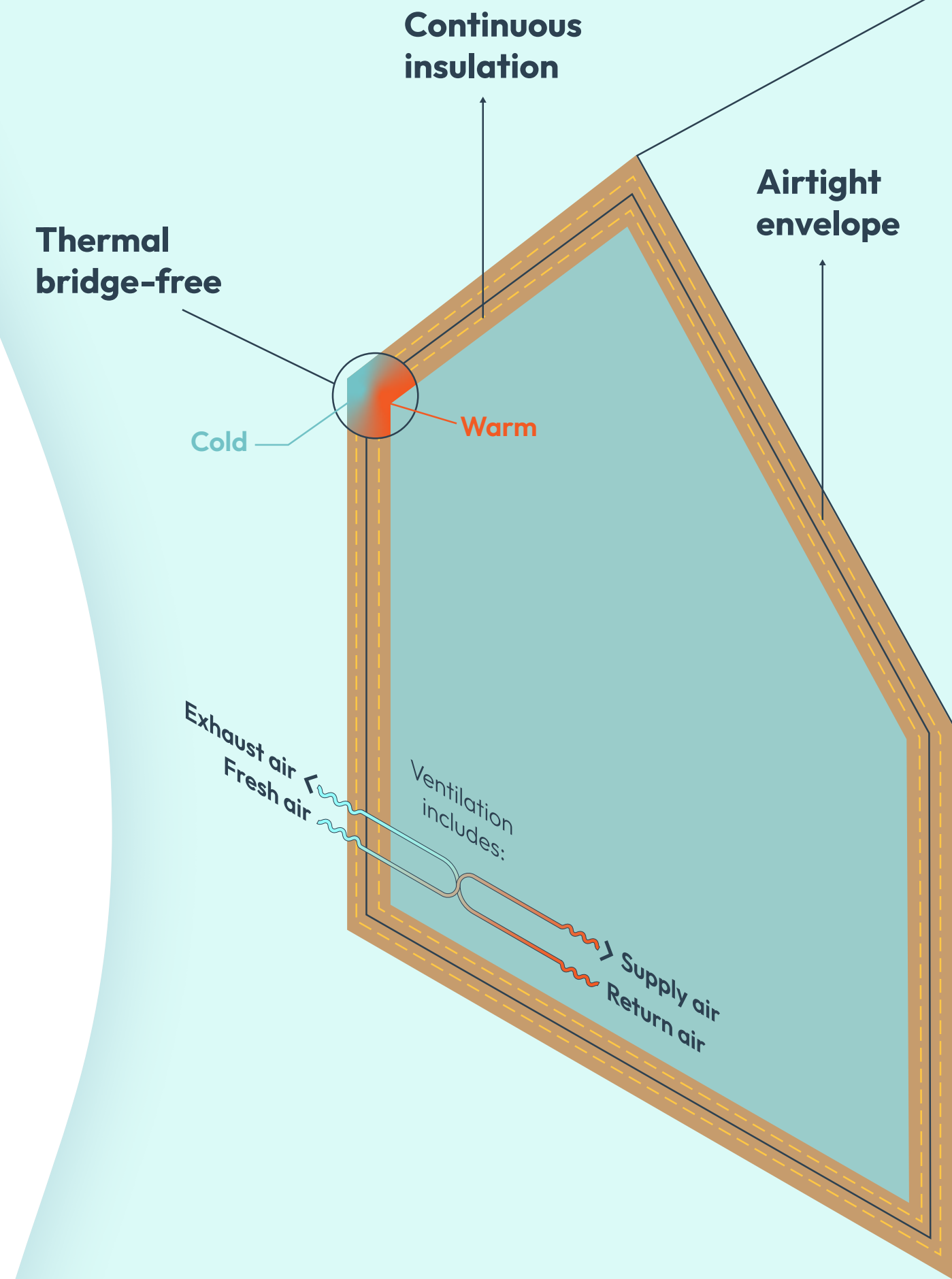
4

## Works before fabric first?

Your home needs to be without any faults before energy efficiency measures are installed. If measures are carried out without improving these faults, this could result in serious risks to the resident and the property.

The retrofit assessment that is carried out before installation will highlight any issues that may stop the retrofit. This assessment is key as each room and the exterior of the home is assessed and recorded in a condition report. Some examples of issues that might need to be addressed include:

- Poor pointing
- Cracks in brickwork or render
- Rotting timbers
- Excessive vegetation on external walls or roof



# What types of retrofit measures are there?

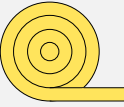
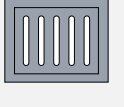
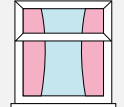
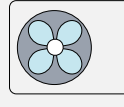

There are many retrofit measures that can improve the energy efficiency of your home. There are also many grant funding schemes that exist, all with different ways of doing things.

Part of the fabric first approach to retrofit is creating a comprehensive plan to understand all of the changes that can be carried out to improve the efficiency of your home. This means that after your home is assessed, a Retrofit Coordinator (the person overseeing the whole process) will create a Medium Term Improvement Plan.

The Medium Term Improvement Plan will recommend a range of measures that are appropriate for the home and the order in which they should be implemented. Residents do have a say in the process, and this plan has been set up to ensure residents get the best output that they agree with. It is important residents understand fabric first, and the ideal order these are installed to get the best results.

**This table covers the main measures that are applicable for retrofit - contact your local authority for applicable measures in grant funding programmes that are underway in your area.**



What is the type of measure?	Where can this be installed?	What are these called?
 <p><b>Insulation</b> There are a variety of insulation measures that can be installed and these make up the main part of the fabric first approach. Depending on the type of home and construction of the building, different types of insulation will be applicable.</p>	<p>Insulation can be applied to walls, floors and a within a roof.</p>	<p><b>Types of insulation for walls</b></p> <ul style="list-style-type: none"> <li>o External Wall Insulation (EWI)</li> <li>o Internal Wall Insulation (IWI)</li> <li>o Cavity Wall Insulation (CWI)</li> </ul> <p><b>Types of insulation for a roof</b></p> <ul style="list-style-type: none"> <li>o Loft space insulation</li> <li>o Room-in-roof insulation (RIR)</li> <li>o Flat roof insulation</li> </ul> <p><b>Types of insulation for floors</b></p> <ul style="list-style-type: none"> <li>o Solid floor insulation</li> <li>o Suspended floor insulation</li> </ul>
 <p><b>Ventilation</b> As part of the new government standard for retrofit, there are specific requirements for ventilation when retrofitting your home. These measures are put in place to protect both the resident and the building.</p>	<p>In many locations throughout the home, alongside new insulation measures.</p>	<ul style="list-style-type: none"> <li>o Mechanical fans</li> <li>o Door undercuts</li> <li>o Trickle vents</li> <li>o Cross ventilation</li> </ul>
 <p><b>Doors &amp; windows</b> Doors &amp; windows are smaller measures that can improve the thermal comfort of your home. This measure should only be done once fabric insulation measures are completed.</p>	<p>Most funding requires the dwelling to have single glazed windows to be eligible. If you already have double glazing, this is unlikely to be replaced.</p>	<ul style="list-style-type: none"> <li>o Double glazing</li> <li>o Replacement doors</li> <li>o Triple glazing</li> <li>o Draft proofing</li> </ul>
 <p><b>Low carbon heating (non-fossil fuel heating)</b> Most local authority-led schemes can install non-fossil fuel heating systems only. This means getting a new gas boiler is not an option through these schemes, because it uses natural gas (which is a fossil fuel) as the energy source to heat your home. There are low carbon heating systems that don't rely on gas. Heat pumps rely on electricity and there is now a national push to install these systems in large numbers.</p>	<p>Outside the home for a new unit, and might include garden space. New radiators also might need to be installed.</p>	<ul style="list-style-type: none"> <li>o Air Source Heat Pump (ASHP)</li> <li>o Ground Source Heat Pump (GSHP)</li> <li>o High heat retention storage heaters</li> </ul>
 <p><b>Renewable energy measures</b> There are ways to generate your own electricity at home - most commonly, this is by installing solar panels.</p>	<p>On the roof of your home.</p>	<ul style="list-style-type: none"> <li>o Solar Photovoltaics (PV)</li> </ul>

# How to retrofit your walls.

Up to 35% of the heat in your home is lost through uninsulated walls, making it a high priority when it comes to retrofitting your home. There are typically two different ways a wall has been constructed that will determine what type of fabric that can be retrofitted in your home: solid walls and cavity walls.

## Top 3 benefits of improved wall insulation

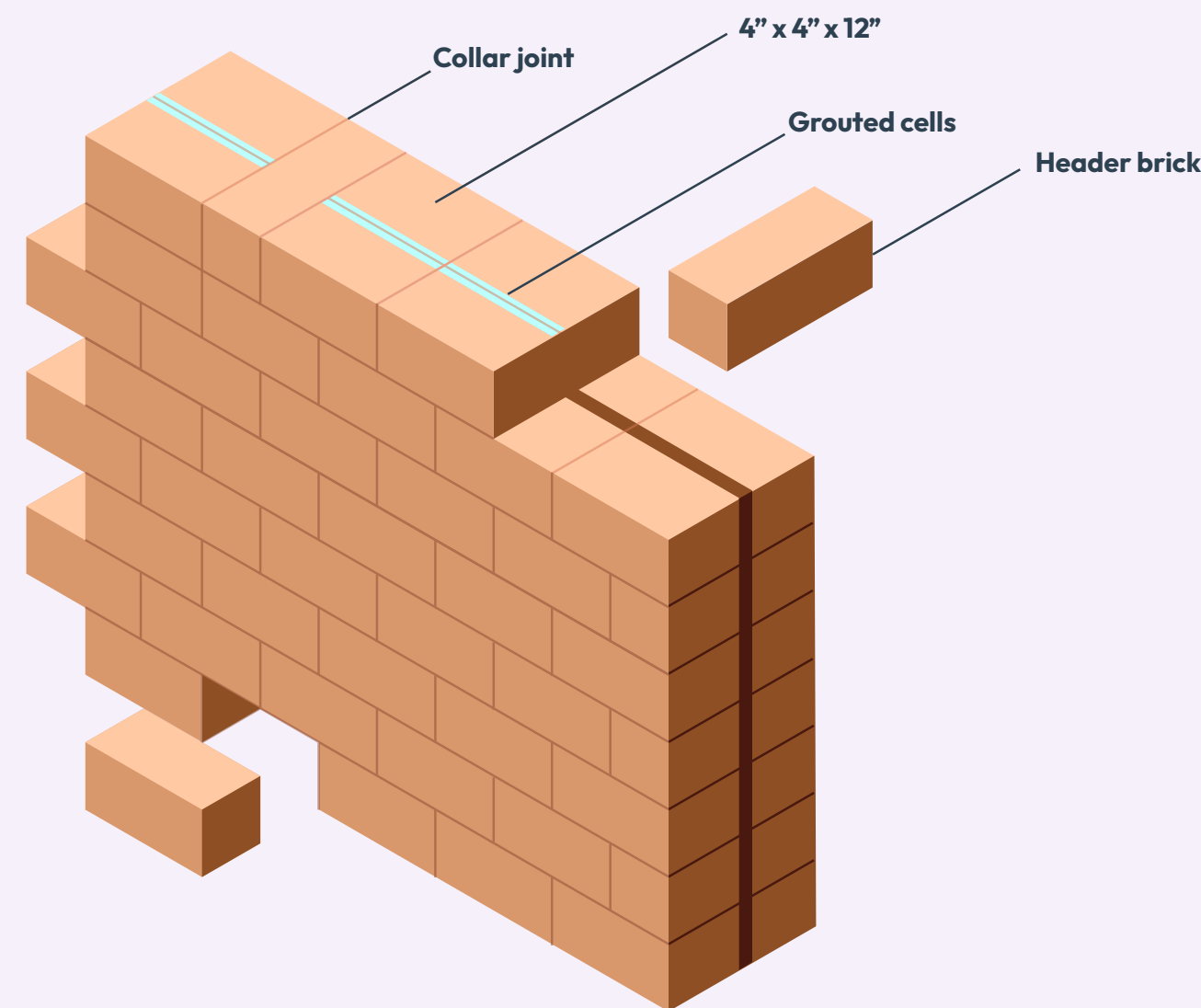
- 1 It allows your walls to retain more heat, so when your heating is off, the walls continue to heat your home, resulting in a more even temperature and reducing the possibility of dampness coming through the walls.
- 2 It makes your house more airtight, removing chilly draughts, reducing the risk of condensation and mould inside.
- 3 It also offers the added benefit of increased sound-proofing to the outside.

## What is a solid wall and do I have them?

- Common in properties built before 1930.
- Usually, two layers of bricks joined together, identifiable with common brick layers and end placed bricks through the course.
- This type of wall can be externally or internally insulated.

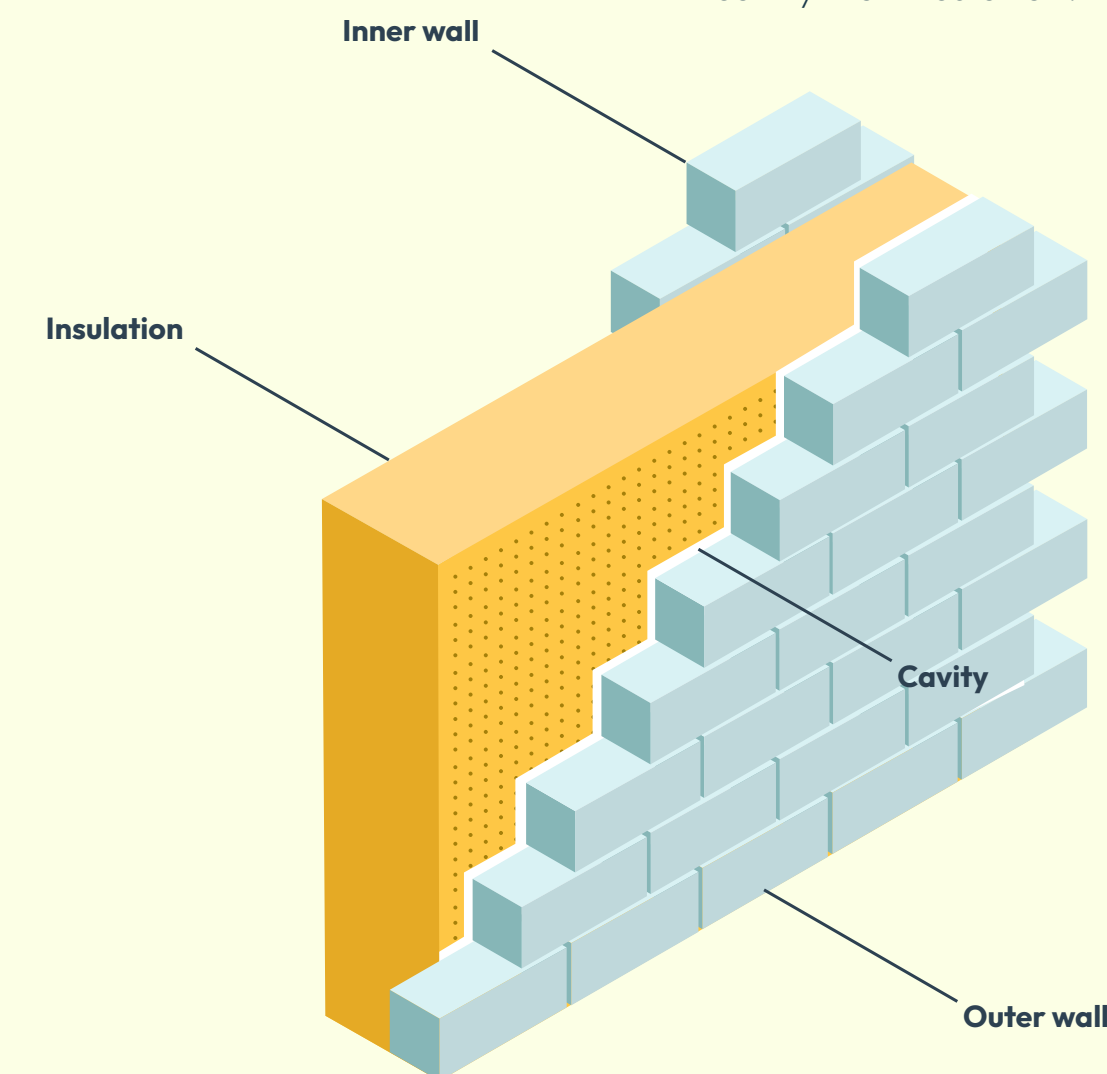
Insulation can be added to these homes in two main ways:

- 1 Internal Wall Insulation
- 2 External Wall Insulation



## What is a cavity wall and do I have them?

- Common in properties built after the 1930's.
- Usually identified by staggered brick courses.
- The cavity (empty space between the inside and outside wall) is between 50mm and 100mm.
- This type of wall is best suited to cavity wall insulation.



Most homes do not have adequate insulation to keep residents warm and comfortable.

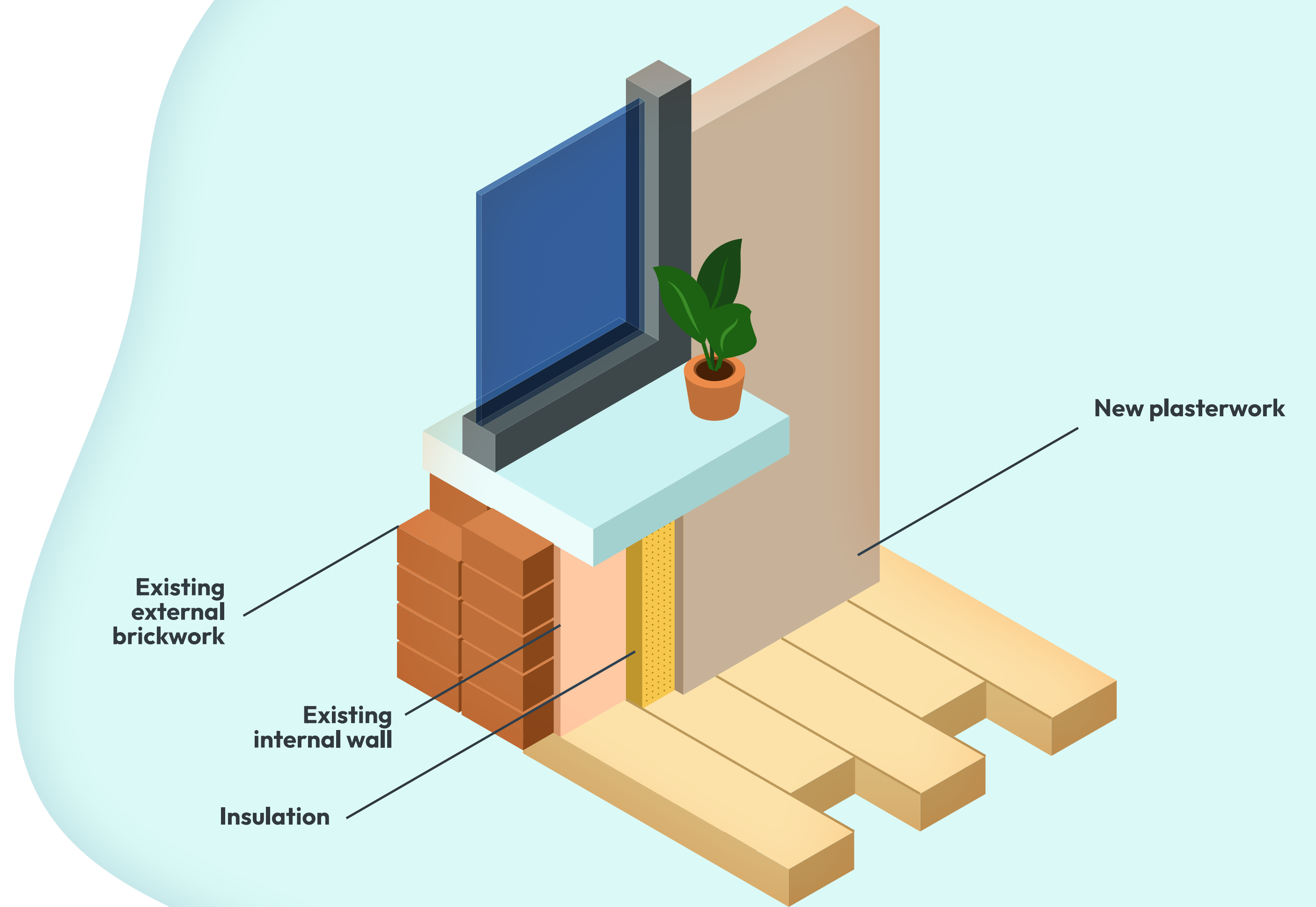
Adding insulation to solid walls and cavity walls will improve the energy efficiency of the home and can be done with local authority funding.



## How to retrofit your walls

# Internal Wall Insulation.

<b>What is Internal Wall Insulation?</b>	<b>IWI</b> is insulation is placed on the inside of your home, usually on walls that are exposed to the outside, where a lot of heat loss occurs.
<b>How is it installed?</b>	Insulation is added to an internal wall, which is then covered with another internal plaster wall – as shown in the image to the right. This means a room will need furniture to be removed to be able to add a new wall insulation and plaster layer to your home.
<b>How disruptive is it to install IWI?</b>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Is IWI right for my home?</b>	Internal Wall Insulation will not change how your property looks from the outside, so if your home is in an area of heritage or architectural beauty/importance, Internal Wall Insulation might be applicable.
<b>Do I need to consider ventilation?</b>	A ventilation assessment will be conducted in advance of the installation of wall insulation. Improved insulation means less leakage of air from the home than before. If there is an increased risk that warm, moist air trapped in the property will condense on surfaces and cause damp, an improved ventilation solution should be recommended.



## How to retrofit your walls

# External Wall Insulation.

<b>What is External Wall Insulation?</b>	<b>EWI</b> is when insulation is placed on the outside of your home on exposed walls and finished with a render. Its main advantages are that it wraps the outside of the building to thermally insulate the whole home as well as protecting the structure of the building.
<b>How is it installed?</b>	<ol style="list-style-type: none"><li>1 Insulated boards are attached to the outer surface of your home usually 100mm thick, using both an adhesive layer and mechanical fixings.</li><li>2 This insulation is then covered with a protective layer of mesh.</li><li>3 Insulation is aligned with existing features. It might be that window reveals are extended, guttering is adapted and damp-proofing is required at ground level.</li><li>4 Finally, a durable and water-resistant render is applied.</li></ol>
<b>How disruptive is it to install EWI?</b>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Is this measure right for my home?</b>	Good access to the external walls of your property is necessary to install EWI. It is less disruptive than IWI because the work takes place outside the property, but does require scaffolding and dry weather.
<b>Do I need to consider ventilation?</b>	A ventilation assessment will be conducted in advance of the installation of wall insulation. Improved insulation means less leakage of air from the home than before. If there is an increased risk that warm, moist air trapped in the property will condense on surfaces and cause damp, an improved ventilation solution should be recommended.

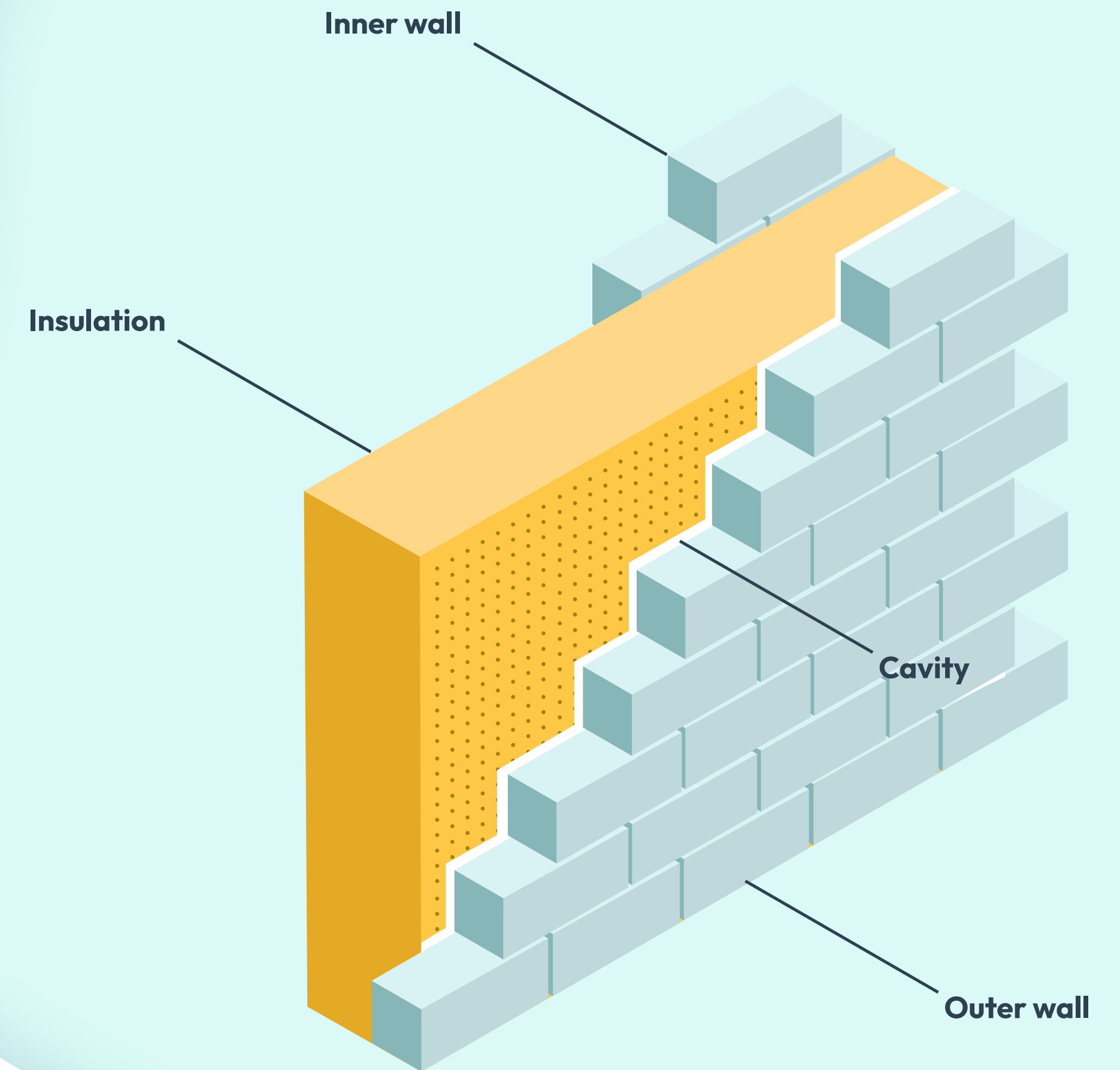


## How to retrofit your walls

# Cavity Wall Insulation.

<b>What is Cavity Wall Insulation?</b>	<b>CWI</b> works by replacing the air gap between the two parts of the wall with insulation to reduce the amount of heat lost through the wall. The three main types of insulation are mineral fibre, polystyrene balls and urea formaldehyde foam.
<b>How is it installed?</b>	Small holes are drilled through either the outer or inner leaf of the wall, at joints in the mortar between bricks. CWI is either blown or injected into the cavity.
<b>How disruptive is it to install CWI?</b>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Is this measure right for my home?</b>	Cavity Wall Insulation may be right for your home if the measure has not been done before. If the correct wall type has been identified there should be no real barriers to the work being completed. Please note in 'high exposure' areas where weather conditions can be adverse, the measure may not be appropriate.
<b>Do I need to consider ventilation?</b>	A ventilation assessment will be conducted in advance of the installation of wall insulation. Improved insulation means less leakage of air from the home than before. If there is an increased risk that warm, moist air trapped in the property will condense on surfaces and cause damp, an improved ventilation solution should be recommended.

Cavity Wall Insulation is one of the best ways to insulate and improve the energy retention of your home because it is a simple and cost effective measure that does not create much disruption.



# How to retrofit your roof.

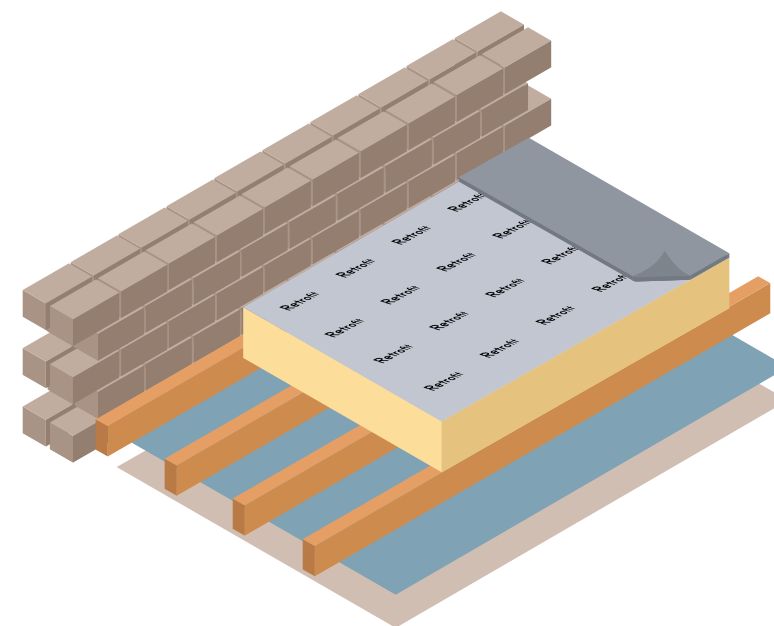
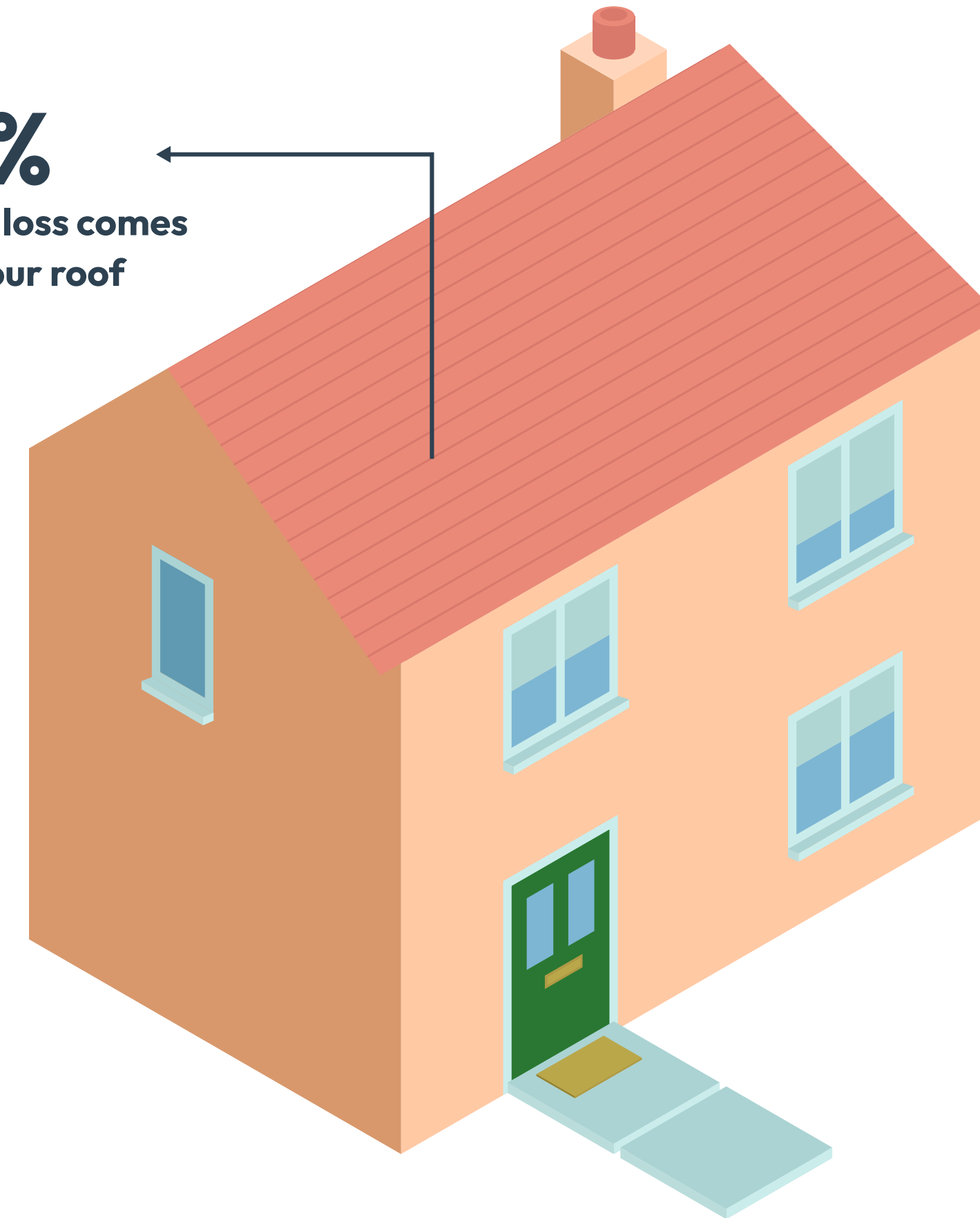
Because heat rises, it is estimated that 25% of the heat in an uninsulated home is lost through the roof. This makes the roof a high priority in retrofit measures. There are three main type of insulation for a roof and these must be insulated in different ways.

Loft space	Around an attic room (Room-in-roof - RIR)	Flat roof
Glass fibre is laid over ceilings in the loft area.	Insulation installed around the ceilings and walls of the room in the roof.	Insulation laid over or under an existing flat roof structure.
Very easy to do with good energy improvement.	Disruptive but significant improvement.	Can be laid over the roof with best effect, but under the roof with good improvement.

## Top 3 benefits of improved roof insulation

- 1 Reducing heat loss, making a warmer and cosier home.
- 2 Potential energy savings and a reduction in carbon emissions.
- 3 Reducing noise in your home.

**25%** of heat loss comes from your roof



# Loft insulation.

<p><b>What is loft space insulation?</b></p>	<p>Loft insulation is laid in the loft space of the roof, reducing the heat escaping through this space. If there is insufficient insulation currently in place, it can be worthwhile to top this up to the recommended thickness, as this will further reduce heating costs. As loft insulation keeps the heat in the lower floors of the house, it results in the loft space itself being cold. If there are water pipes in this space, they must be insulated to prevent them freezing in the cold loft.</p>
<p><b>How is it installed?</b></p>	<p>Loft insulation involves laying rolls of an insulating material in the loft space of the roof over the rafters in overlapping layers to retain the heat in the rooms below. A thickness of 270mm loft insulation is recommended as a minimum amount. The attic space will need to be completely cleared to allow the insulation to be laid. All pipework and tanks in the roof space will need to be insulated against the cold.</p>
<p><b>How disruptive is it to install loft insulation?</b></p>	<p>Loft insulation is usually a relatively low level of disruption. The work takes place in the loft space of the roof and take less than a day to install. However, the cost and disruption caused can increase if the loft is already boarded and/or is being used as a storage space.</p> <div data-bbox="436 915 776 953"> </div>
<p><b>Is this measure right for my home?</b></p>	<p>If there is a space in your home that is uninsulated, installing insulation over your rafters is one of the most cost-effective retrofit measures to install. The installation is usually simple, often taking less than one day.</p>
<p><b>Do I need to consider ventilation?</b></p>	<p>With any form of fabric measure, ventilation of the whole house needs to be assessed and considered. This is because reduced air leakage from one part of the home can mean an increased chance of warm, moist air condensing on a colder surface, potentially leading to damp. Adequate ventilation in the right places will reduce the risk of condensation.</p>



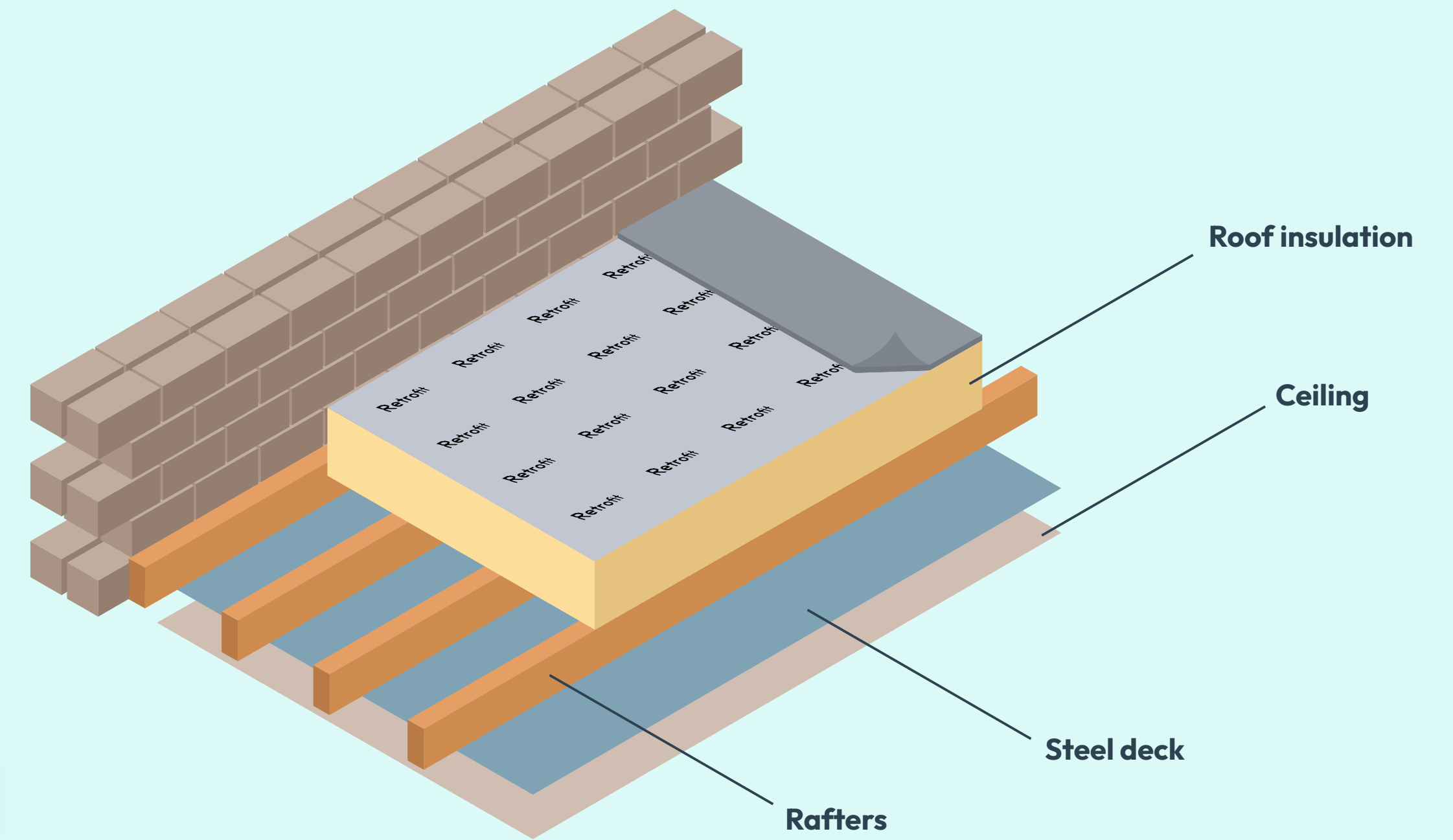
# Room-in-roof insulation.

<p><b>What is room-in-roof insulation?</b></p>	<p><b>RIR</b> is a term used for insulating a roof space if it has been converted in to an attic room, or room-in-roof. To be classed as a room in the roof, it must be accessible by a permanent staircase which you can safely walk down facing forwards. The diagram to the right highlights what areas are classed as room-in-roof. The stud walls, slope and flat ceiling are the areas considered when insulating the room in the roof. Room-in-roof insulation works by trapping heat within your home to create a blanket effect.</p>
<p><b>How is it installed?</b></p>	<p>Installing room-in-roof insulation involves insulation boarding being fitted in-between the rafters underneath the existing plasterboard walls.</p> <p>If there is already existing plasterboard walls in the room-in-roof space, they need to be stripped off and replaced once the insulation is installed.</p>
<p><b>How disruptive is it to install RIR?</b></p>	<p>As a loft conversion is usually a habitable room (e.g. a bedroom) there will be more disruption compared to loft insulation.</p> <div data-bbox="436 902 776 945"> </div>
<p><b>Is this measure right for my home?</b></p>	<p>If the loft has been converted and access to the areas listed above, then yes.</p>
<p><b>Do I need to consider ventilation?</b></p>	<p>With any form of fabric measure, ventilation for the full property needs to be assessed and considered. This is because if we improve the insulation in the roof, the surface temperatures of the other areas will become colder and increase the risk of condensation. Adequate ventilation in the right places will reduce the risk of condensation.</p>



# Flat roof insulation.

<p><b>What is flat roof insulation?</b></p>	<p>A flat roof is defined if the roof has a five-degree pitch or less. Flat roof insulation is used to enable a room to feel warmer in the winter and cooler in the summer months. Wood fibre, cellular glass and polystyrene all have good insulation properties, but foam works particularly well and is often found in modern constructions.</p> <p>Warm flat roof insulation works by ensuring the insulating layer sits above the timber rafters. Alternatively, cold flat roof insulation works by placing the insulation layer between or under the timber rafters. This leaves the roof cold and is generally regarded as an outdated method of flat roof insulation.</p>
<p><b>How is it installed?</b></p>	<p>There are two approaches to installing flat roof insulation; warm flat roofing works by placing the insulation material on top of the roof, while cold flat roofing involves placing insulation between the joists. If you're seeking a reduction in energy usage, warm flat roof insulation will work best for you. It'll also improve your property's EPC and help to reduce condensation. Cold flat roofing has a much lower installation cost and is well suited to outbuildings, which don't necessarily require all the benefits of warm flat roof insulation.</p> <p>In most cases insulation can be installed over the top of your existing felt covered flat roof. It is likely that scaffolding will need to be used, but otherwise it is minimally disruptive.</p>
<p><b>How disruptive is it to install flat roof insulation?</b></p>	<p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>
<p><b>Is this measure right for my home?</b></p>	<p>If you have a flat roof that has not already been insulated then yes.</p>
<p><b>Do I need to consider ventilation?</b></p>	<p>With any form of fabric measure, ventilation of the whole house needs to be assessed and considered. This is because reduced air leakage from one part of the home can mean an increased chance of warm, moist air condensing on a colder surface, potentially leading to damp. Adequate ventilation in the right places will reduce the risk of condensation.</p>



# How to retrofit your floors.

Homes can lose heat through the floors, especially in older houses where unwanted draughts can come through the floorboards. Installing underfloor insulation correctly can address this, but it might not be applicable for all homes. There are two main ways a floor is built:

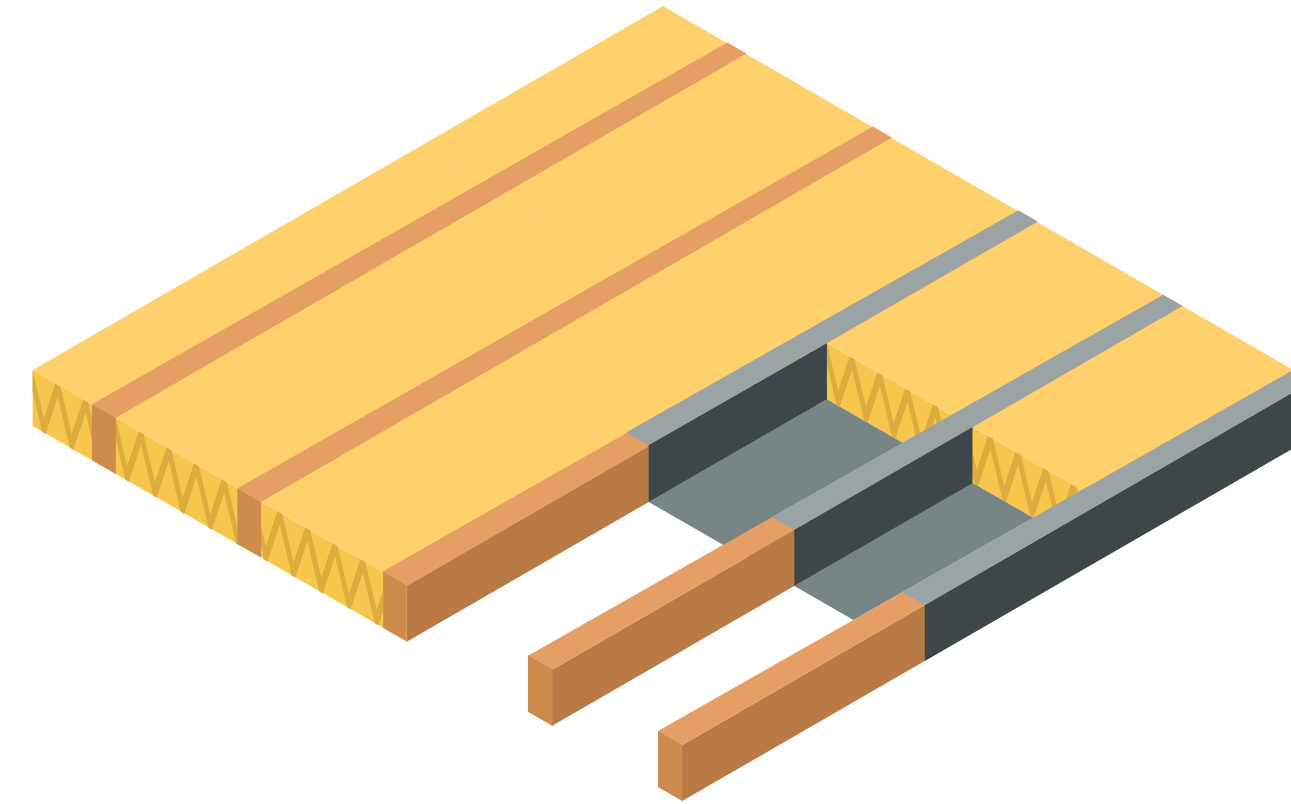
1. A **solid floor** comprises of a solid base, such as stone or concrete that is in direct contact with the earth.
2. A **suspended floor** is where the floor sits on joists that run 'suspended' over an unheated cavity. Typically, it is easier to add insulation to a suspended floor.

## What floor do I have?

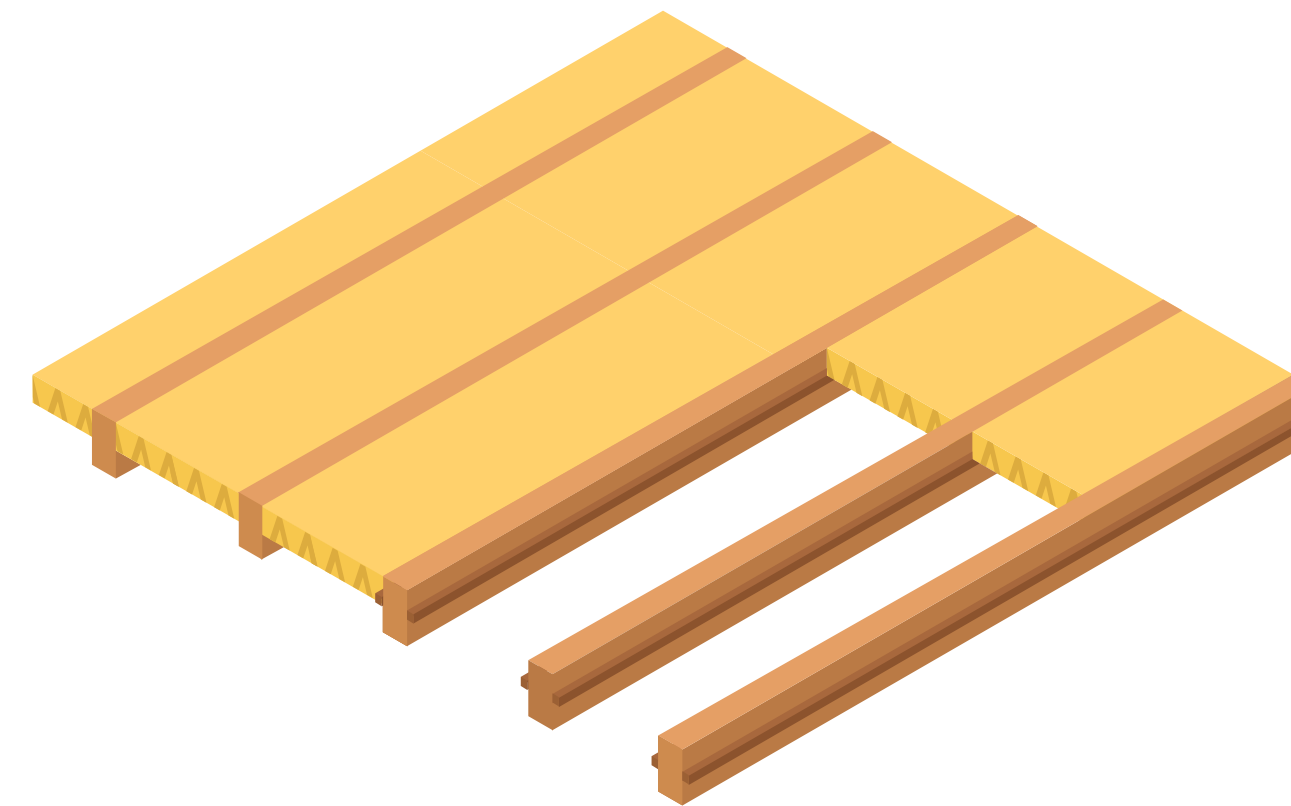
What kind of floor you have can be determined by looking for air bricks on the outside of your building. These would be close to the ground and are there to allow circulation of fresh air if you have a cavity under your floor, indicating you have a suspended floor. Solid floors sit on the ground so would not have these air bricks. Solid floors can also have their insulation improved, but the levels of disruption are considerable. Skirting boards, doors and frames would almost certainly have to be re-fitted, so it is not as easy to retrofit as suspended floors.

## Suspended floors

<p><b>What is suspended floor insulation?</b></p>	<p>In the case of a suspended floor, insulation would be placed between the joists to improve the resistance to heat travelling through your floor into the unheated air space underneath. Depending on the age of the base flooring this may be accompanied by the filling of small gaps with a flexible material to reduce air leaks.</p>
<p><b>How is it installed?</b></p>	<p>Typically, a suspended floor can be accessed underneath (via a basement), or by lifting up the floorboards and installing between the floor joists. Newer technologies involve a robot being placed in the void and spraying the insulation against the suspended floor timbers.</p>
<p><b>How disruptive is it to install?</b></p>	<p>The level of disruption involved with insulating a suspended floor can vary depending on the levels of access to the underside of the lowest heated floor.</p> <p><b>Basement</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p> <p><b>No floor coverings or carpet, no basement</b> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p> <p><b>Hardwood floors, no basement</b> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>
<p><b>Is this measure right for my home?</b></p>	<p>Given the associated cost, disruption and relatively small energy savings compared to larger measures, floor insulation should only really be considered after or alongside other larger, more impactful retrofit measures as they are installed.</p>
<p><b>Do I need to consider ventilation?</b></p>	<p>Just like all types of fabric measures, when installing floor insulation the ventilation for the full property needs to be accessed and considered. This is because if we improve the insulation in the floor and not other areas, the surface temperatures of the other areas will become colder and increase the risk of condensation.</p>



Quilted insulation supported by netting stapled to joist



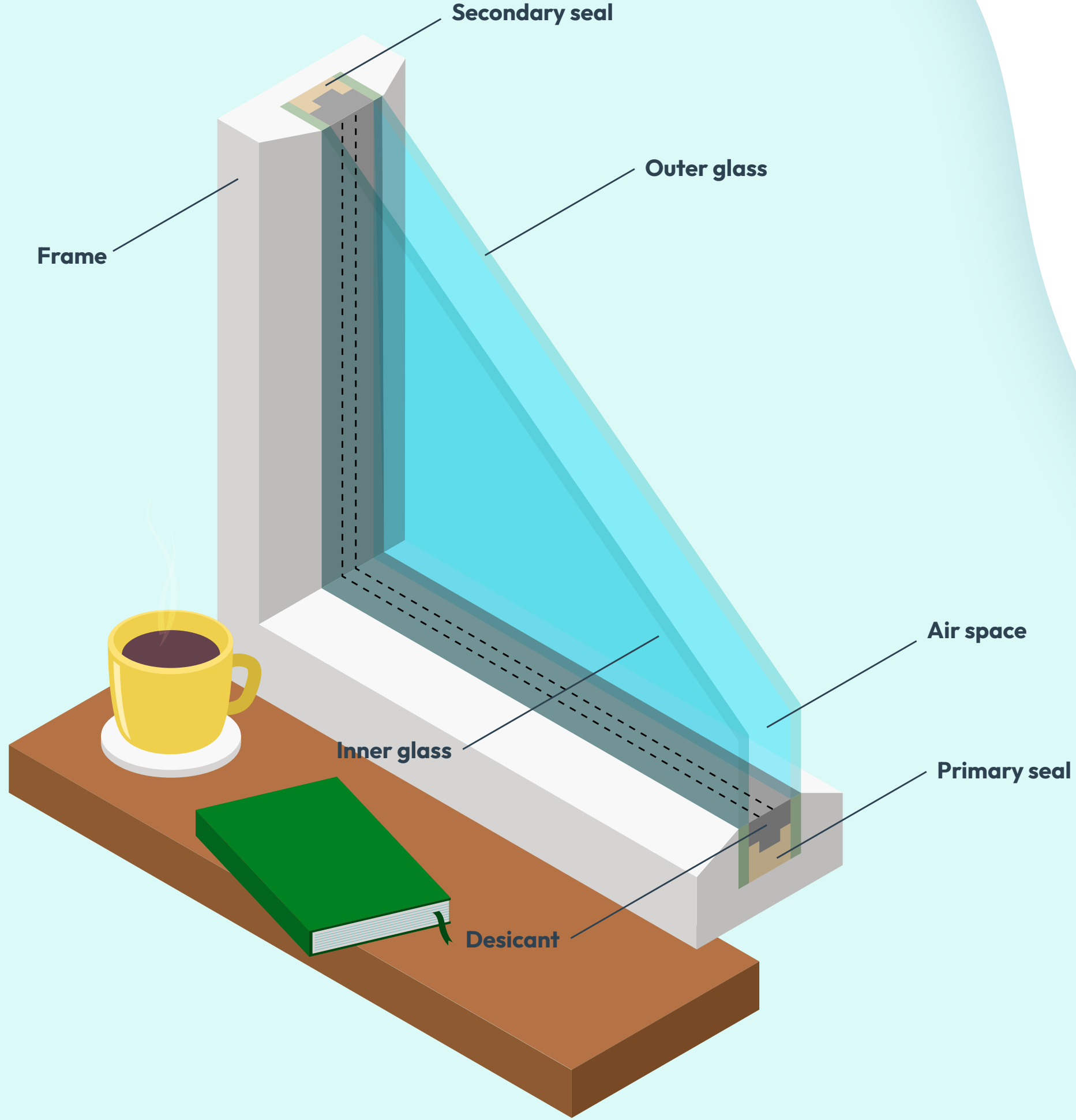
Rigid insulation supported by battens

## Top 3 benefits of improved floor insulation

- 1 Reducing heat loss. Heat rises, so insulating your house properly means you keep more heat inside the house.
- 2 It's low to no maintenance.
- 3 It future proofs your home.



# How to retrofit your windows & doors.



Windows and doors are smaller measures that can contribute to the thermal comfort of your home.

Current funding from local authorities is typically for the replacement of single glazing with double glazing.

Windows and doors are best considered for replacement after options to improve the insulation of the fabric have been explored. If wall insulation is an available measure for your home, this would be a more beneficial measure to do first. This is because a much larger area of your home will be insulated, keeping more heat in the property. Installing the windows after insulation also means that new windows can later be aligned to the new insulation, which is important in reducing air gaps and leaks.

## Windows

<p><b>What is double glazing?</b></p>	<p>Double glazing is a window that has two panes of glass. The main component of the window is the double-glazed sealed unit that has two sheets of glass separated by a spacer bar to create an air gap which is filled with an insulating gas.</p> <p>The primary benefit of double glazing is thermal insulation. It retains heat in a room whilst stopping cold air entering from outside to make the room more energy-efficient.</p> <p>Triple glazing is now available and is becoming more commonplace as costs fall.</p>
<p><b>How is it installed?</b></p>	<p>Existing windows would be removed and the opening would be cleaned. The installer would apply flashings for waterproofing and check to make sure the opening is level. The new windows are fitted, with caulk applied to seal the window.</p>
<p><b>How disruptive is it to install?</b></p>	<p>Depending on how many windows need replacing, the project should take between one and five days. It is only a short amount of time when you'll be inconvenienced compared to the benefits you'll enjoy from your new windows for many years to come.</p> <div style="display: flex; justify-content: center; gap: 5px;"> <div style="width: 20px; height: 15px; background-color: #e0f2f1;"></div> <div style="width: 20px; height: 15px; background-color: #e0f2f1;"></div> <div style="width: 20px; height: 15px; background-color: #e0f2f1;"></div> <div style="width: 20px; height: 15px; background-color: #e0f2f1;"></div> <div style="width: 20px; height: 15px; background-color: #e0f2f1;"></div> </div>
<p><b>Is this measure right for my home?</b></p>	<p>If single glazing is present and most larger insulation measures have been completed, double glazing is suitable for your home. Heritage and local planning issues could stop the replacement of windows where the property is listed or even a traditional construction.</p>
<p><b>Do I need to consider ventilation?</b></p>	<p>Double glazed windows will improve the overall insulation of your property, so a ventilation assessment for the full property needs to be considered. This is because if we improve the insulation in the windows and not other areas, the surface temperatures of the other areas will become colder and increase the risk of condensation. Windows might need to have trickle vents to allow for ventilation in your home. Your retrofit team will advise you on what is best for your home.</p>



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Measures installed in your home

## Doors

<p><b>What are replacement doors?</b></p>	<p>When old, often wooden doors swell and no longer fit the existing frame, a new replacement door can help with improving the thermal comfort of your home.</p> <p>New external doors now generally contain integrated insulation to reduce heat loss and comply with regulation.</p>
<p><b>How is it installed?</b></p>	<p>The contractor will get accurate measurements of the size of the door opening. They will then fit the door and make any amendments needed to the opening prior to fitting the hinges to the door frame. The door will also need new locks and handles.</p>
<p><b>How disruptive is it to install?</b></p>	<p>Doors should be replaced within a day with minimal disruption.</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>
<p><b>Is this measure right for my home?</b></p>	<p>If funding is available and your old door has been compromised and letting in draughts, replacement doors will be right for your home.</p> <p>Existing doors can be improved by fitting draught-proofing strips around the seals and the letterbox.</p>
<p><b>Do I need to consider ventilation?</b></p>	<p>Improved doors will have a better U-Value which improves the overall insulation of your property. A ventilation assessment for the full property needs to be accessed and considered. This is because if we improve the insulation in the doors and not other areas, the surface temperatures of the other areas will become colder and increase the risk of condensation. Internal doors should have an undercut to help aid cross-ventilation.</p>

### Top 3 benefits of improved windows and doors

- 1 Reducing heat loss, making a warmer and cosier home.
- 2 Potential energy savings and a reduction in carbon emissions.
- 3 Reducing noise in your home.



# Ventilation explained.

Ventilation is necessary in buildings to remove the 'stale' air and replace it with 'fresh' air, supporting a healthy home.

Ventilation can be designed to allow air to flow through your home. This reduces the chances of unwelcome condensation, which can lead to mould growth. Designing effective ventilation also allows fresh air to replace stale air, including carbon dioxide, cooking smells, water vapour and dust.

As part of the new government quality standard for retrofit, there are specific requirements for ventilation. These measures are put in place to protect both the resident and the building.

## Ventilation is required in government funded retrofit projects

Improved ventilation may be required if the home has issues with mould or condensation, and also when installing new systems to ensure there are no unintended consequences from the works. Properties with insufficient ventilation could lead to uninhabitable living conditions if not treated.

For more information, refer to the Ventilation Guide here:

## Examples of poor ventilation



Black mould following a pathway of a cold bridge, potentially a building defect or cold spots along the building.



Black mould around and on windows due to lack of ventilation and no treatment.

## The principles of ventilation

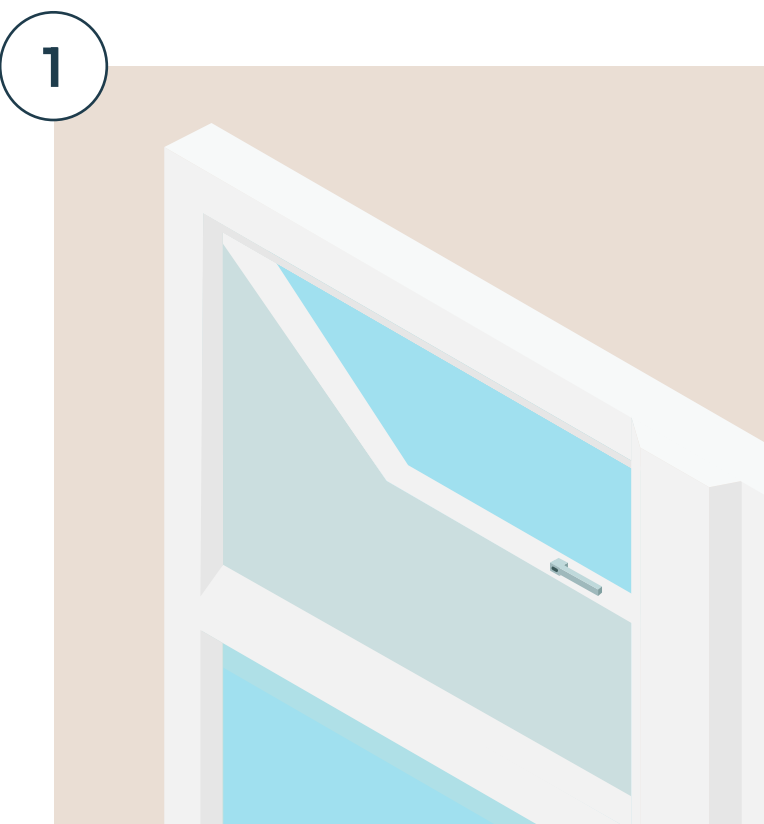
Heating and ventilation are part of the same process, and they must work together for them to be effective and in balance. Ventilation is necessary in buildings to remove the 'stale' air and replace it with 'fresh' air, supporting a healthy home.

Once your home receives more insulation, ventilation can be designed alongside this by the retrofit team carrying out works. It is important to listen to their recommendations, as the ventilation will be designed to:

- Help to moderate internal temperatures.
- Reduce the accumulation of moisture, odours and other gases.
- Create air movement in your home.

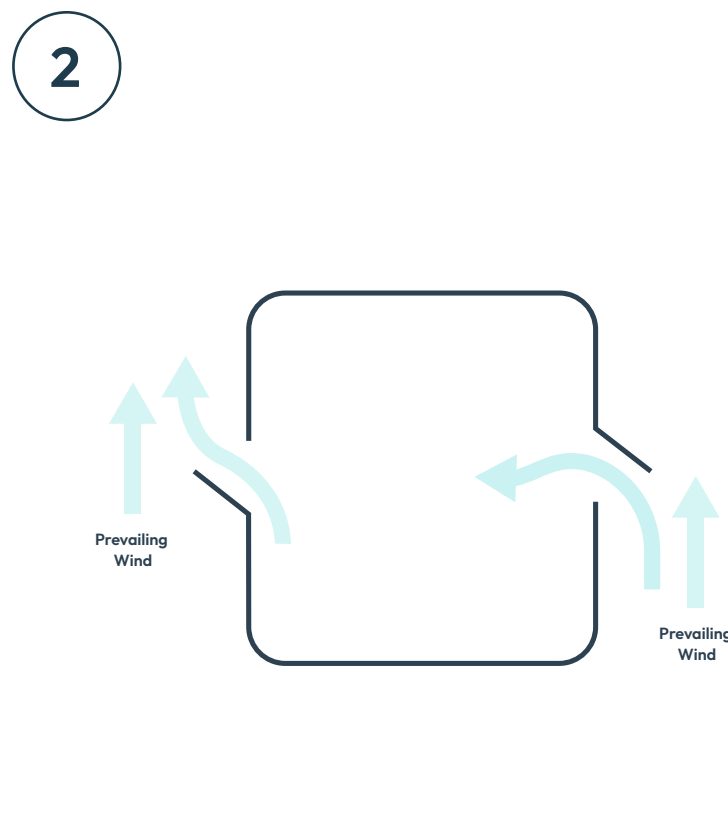
Heating and ventilation are part of the same process, and they must work together for them to be effective and in balance.

## Ventilation recommendations for your home



### Manually controlled ventilation

An example of manually controlled ventilation is opening a window.



### Cross ventilation

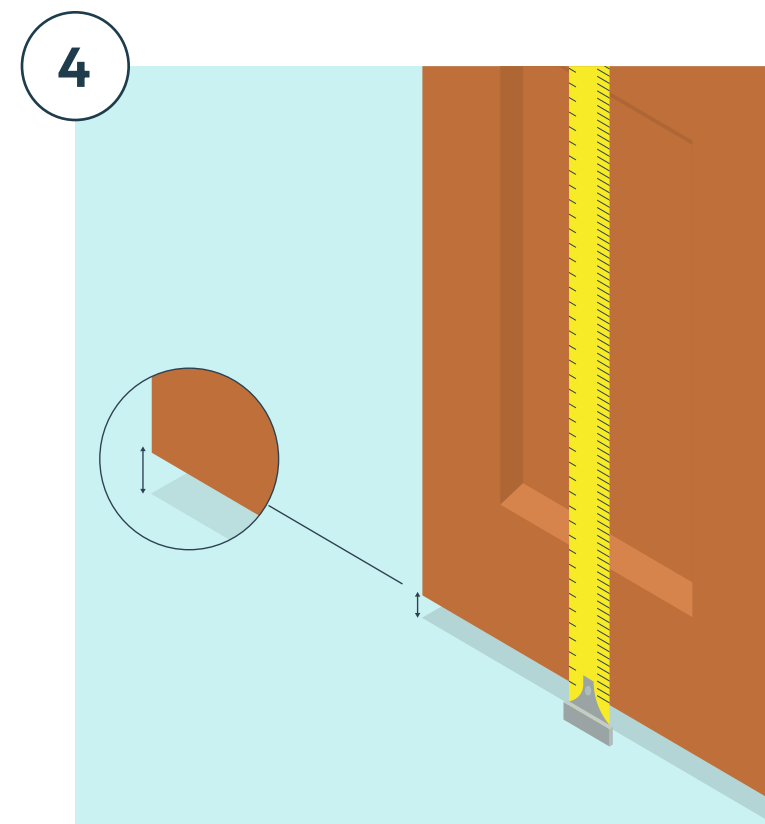
A natural method of moving air through your home. The system relies on wind to force cool exterior air into the building through an inlet (like a wall louvre, a gable, or an open window) while outlet forces warm interior air outside (through a roof vent or higher window opening).



### Trickle vents

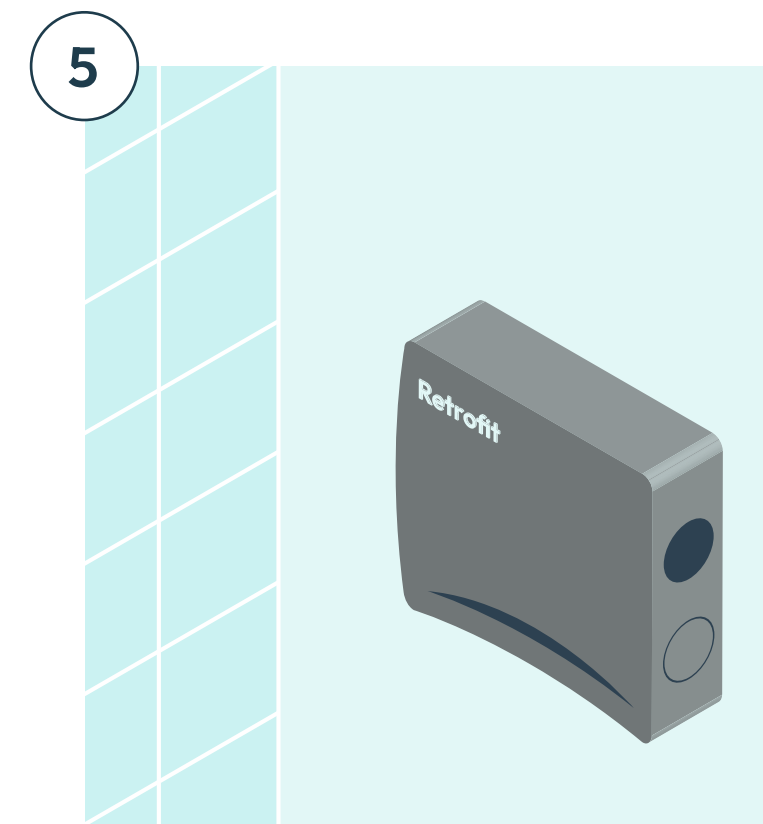
Allow air to trickle into your house at a reasonable rate so that you will not feel a cold draught.

Trickle vents can be installed in windows. It is also possible to add air bricks to walls and vented roof tiles.



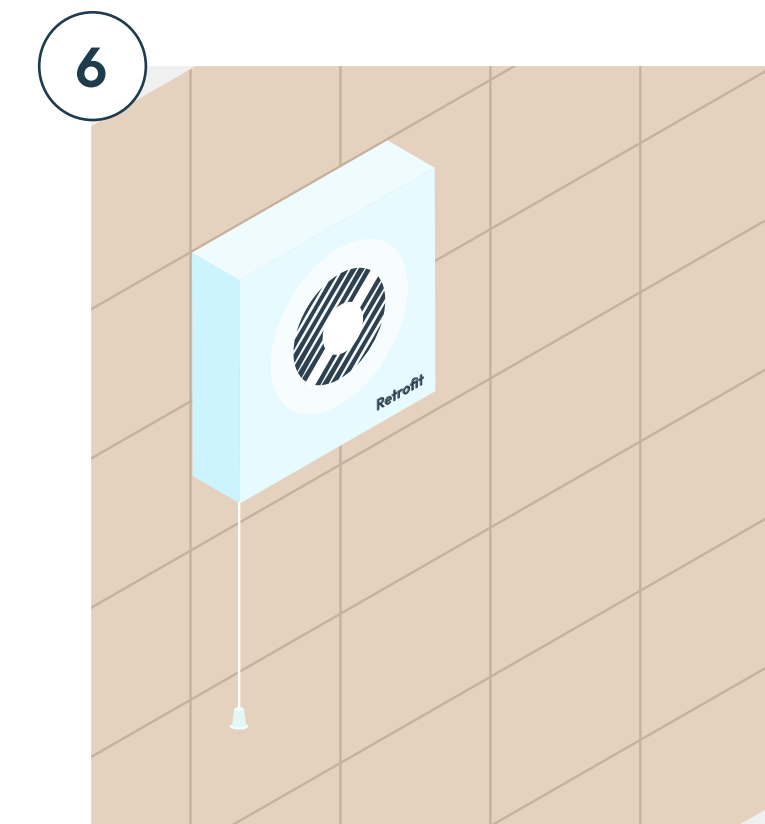
### Door undercuts

The clearance between internal doors and the floor level. This is done to allow for cross ventilation.



### Mechanical ventilation

Mechanical ventilation such as fans can be installed in windows or walls directly or in air ducts to supply air to or from the room. There are a number of different products/types that could be installed.



### Extract fans

Domestic activities such as cooking, clothes washing, showering and bathing produce a significant amount of airborne moisture. These activities take place in what are defined as wet rooms (e.g. a kitchen, bathroom or utility rooms) and it is part of PAS 2035 that in all of these environments, there is a form of controllable mechanical ventilation present.

As part of your retrofit project, the team will be aiming to ensure that you receive the maximum comfort benefits from energy efficiency products, whilst also avoiding any potential for condensation and mould. Typically, you might see the following recommendations in your home.

### Top 3 benefits of improved ventilation

- 1 Improved air quality.
- 2 Helps against risk of condensation and mould.
- 3 Effective in partnership with insulation – insulate tight ventilate right.

# How to heat your home.

Most local authority led schemes prioritise low carbon heating systems. This means getting a new gas boiler is not an option through these schemes, because it uses gas (which is a fossil fuel) as the energy source to heat a home. There are new heating systems that don't rely on gas, instead they use electricity and are called heat pumps.

## What is a heat pump?

A heat pump is a type of electric heating that extracts heat from the environment, using a process similar to a refrigerator to warm your home and hot water. A heat pump only uses electricity and does not consume any fuel so doesn't directly emit any carbon dioxide.

### Top 3 benefits of a heat pump

- 1 A carbon heating method, reducing carbon emissions vs gas.
- 2 Long life span.
- 3 Can provide cooling in summer.

## How does it work?

The heat pump uses electricity to extract heat energy from either the air, ground or water using a fluid. This fluid (or refrigerant) is used to heat water, which is then pumped through your heating system and hot water storage system. This is the basis for how a heat pump works:

- 1 The refrigerant will take in heat from the heat source (air, ground, water), then it is passed through a compressor, which will increase both its pressure and temperature.
- 2 This high temperature fluid is then used to heat another medium, which will heat the home. It will usually heat water as part of a central heating system, but can heat air for a warm air heating system.
- 3 After the excess heat in the refrigerant is transferred to the home, it travels back through a valve, returning to a lower pressure and cools further. The refrigerant is then at a low temperature and can take in heat from the heat source again.

## The two most common types of heat pump are:

- 1 Air Source Heat Pumps.
- 2 Ground Source Heat Pumps.

<p><b>What is an Air Source and Ground Source Heat pump?</b></p>	<p>An <b>Air Source Heat Pump</b> works by extracting heat energy from air.</p> <p>A <b>Ground Source Heat Pump</b> works by extracting heat energy from a series of pipes laid underground. A GSHP is usually more expensive to install than an ASHP, but can be more efficient and cheaper to run.</p>
<p><b>How is it installed?</b></p>	<p>A qualified installer will install a heat pump after assessing your home and deciding on the size you need. The actual heat pump will then be installed just outside your home, and the installers will then connect the system to central heating system and a hot water cylinder. Sometimes old radiators will need to be replaced, depending on your heating requirements.</p>
<p><b>How disruptive is it to install?</b></p>	<p><b>Air Source Heat Pumps</b> are more common and fitted to the outside of the property. They look similar to air conditioning units from the outside. These are a much lower level of disruption to install than a GSHP, however the location of ASHP is critical as noise to the home or neighbours needs to be considered.</p> <div style="display: flex; justify-content: space-around; width: 100px;"> <div style="width: 20px; height: 10px; background-color: #c8e6c9;"></div> <div style="width: 20px; height: 10px; background-color: #c8e6c9;"></div> <div style="width: 20px; height: 10px; background-color: #e0e0e0;"></div> <div style="width: 20px; height: 10px; background-color: #e0e0e0;"></div> <div style="width: 20px; height: 10px; background-color: #e0e0e0;"></div> </div> <p>If a <b>Ground Source Heat Pump</b> is installed, the resident should expect a higher level of disruption. This type of heat pump relies on underground piping to function, so a significant amount of space may be needed to install this. It can also cause significant disruption if the garden needs to be dug out to install piping.</p> <div style="display: flex; justify-content: space-around; width: 100px;"> <div style="width: 20px; height: 10px; background-color: #c8e6c9;"></div> <div style="width: 20px; height: 10px; background-color: #c8e6c9;"></div> <div style="width: 20px; height: 10px; background-color: #c8e6c9;"></div> <div style="width: 20px; height: 10px; background-color: #c8e6c9;"></div> <div style="width: 20px; height: 10px; background-color: #e0e0e0;"></div> </div>
<p><b>Is this measure right for my home?</b></p>	<p>Heat pumps are considered to be a low carbon technology because they recover renewable energy from their surroundings. However, they will rely on fossil fuels from the electricity power grid until the grid itself is decarbonised. This is anticipated to happen in the coming decades.</p> <p>It is important to understand that grid electricity is currently more expensive than gas, but heat pumps are more efficient than gas boilers. This means that a well designed system should be cost competitive or cheaper to run than a gas heated system. A heating engineer must ensure that the system is correctly designed for the home. The Government envisages that heat pumps installed in well insulated homes will be the route to an affordable low carbon future.</p> <p><b>Existing gas central heating</b> Existing central heating systems may need to be adapted when heat pumps replace gas boilers. Systems may be designed to run at lower temperatures for longer to provide the same level of heating. Pipes and radiators are sometimes increased in size to facilitate this.</p>



# Solar Photovoltaics (Solar PV).

Solar systems offer a way to generate renewable energy to a home and contribute to lowering your energy cost. Solar PV can produce electricity into your property that can be used for lighting, power, appliances and heat.

Solar PV systems are a very good addition to work with a heat pump, and this combination can make the house very energy efficient. Solar PV panels can have a diverter device that will allow it to heat water when there is low demand.

Solar systems generally go on the roof and properties which are south-facing are best, however south west and south east also perform very well.

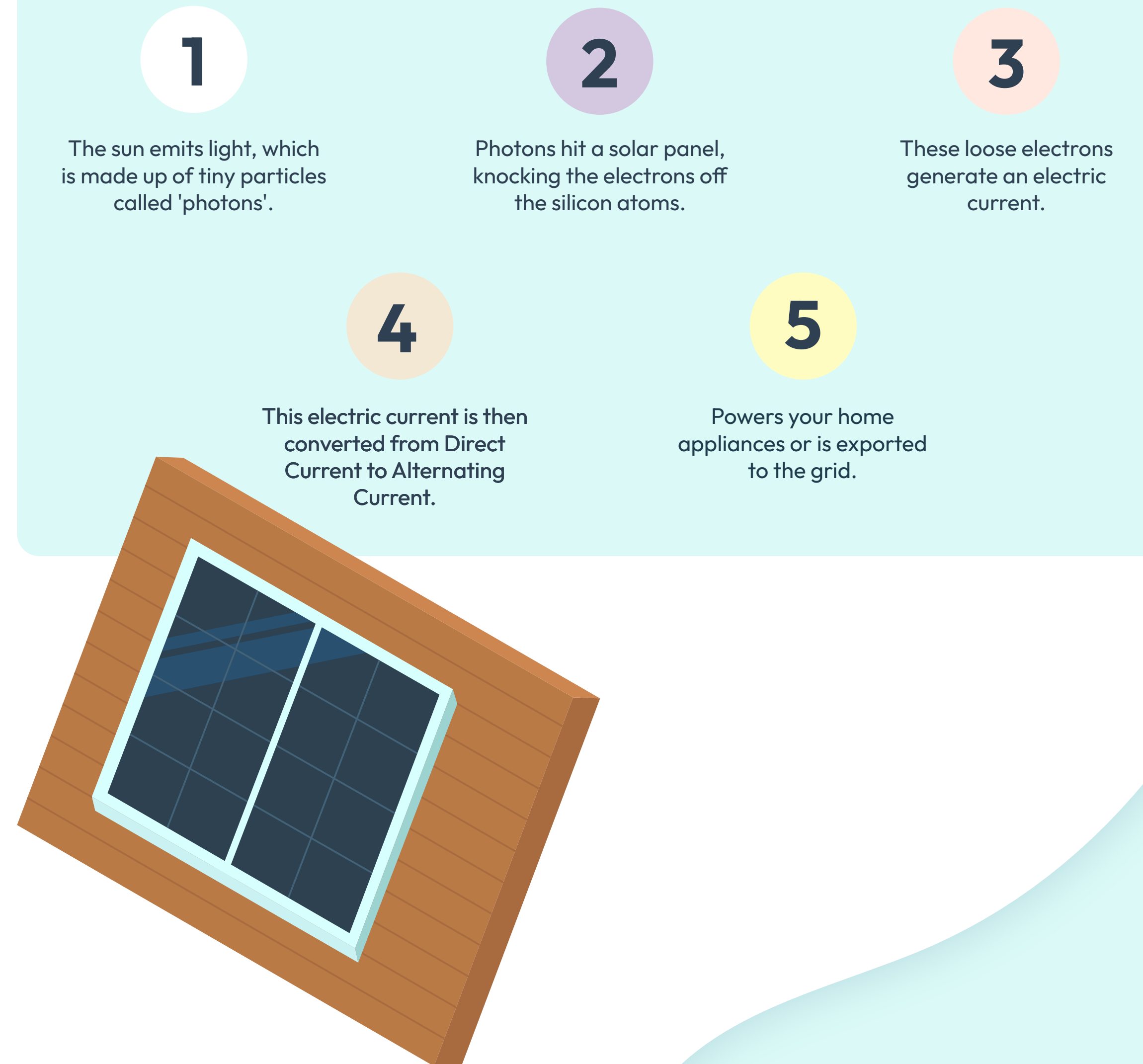
## Top 3 benefits of installing Solar PV

- 1 Lower electricity bills as the panels generate electricity.
- 2 Protection from price rises by energy companies.
- 3 Reduction in carbon emissions as the electricity is being generated in a renewable way.

## What are Solar Photovoltaics?

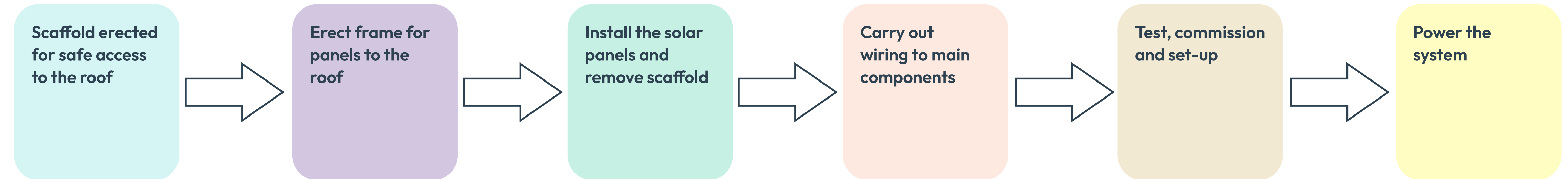
<b>What are Solar PV?</b>	Solar electricity panels, also known as photovoltaics, capture the sun's energy and convert it into electricity that you can use in your home. By installing solar panels, you can generate some of your own renewable electricity. There is a hope that renewable systems can support us to become independent of fossil fuels.
<b>How does it work?</b>	A Solar PV panel consists of many cells made from layers of semi-conducting material, most commonly silicon. When light shines on this material, a flow of electricity is created. The cells don't need direct sunlight to work and can even work on cloudy days. However, the stronger the sunshine, the more electricity generated.
<b>How is it installed?</b>	<a href="#">See diagram on the next page.</a>
<b>How disruptive is it to install Solar PV?</b>	Solar PV will be attached to the roof of the building. Access will be needed in the loft and around the electricity meter. Disruption internally is minimal. 
<b>Is this measure right for my home?</b>	Solar PV panels are worth considering if you have a mainly south-facing roof with little or no shade. Although a south-facing roof will give the best power output, south west or south east-facing roofs should also be fine, but you would get less power out of the system, and be able to save less on your electricity bill.
<b>What maintenance is required?</b>	Solar panels generally require very little maintenance to function. The only thing they need is a periodic light cleaning to make sure dirt, leaves, and other debris aren't obstructing the sun's rays. The only time you may need more extensive maintenance is during periods of heavy snowfall, or if your panels' energy output starts to decrease.

## How do solar panels work?



# Solar Photovoltaics.

## How is it installed?



**1**

### Set up scaffolding

Firstly, you have to erect scaffolding to ensure safety during the whole installation process when being on the roof.

**2**

### Install solar panel mounts

Then, the solar panel mounting system has to be set up. This will support the base of the solar panels. The whole mounting structure must be tilted and have an angle between 18 to 36 degrees to maximise sunlight exposure.

**3**

### Install the solar panels and remove scaffold

When the mounts are set up, the solar panel itself has to be installed on the mounting structure. The next step is to wire the solar panels into a solar array.

**4**

### Carry out the wiring to main electrical components

After that, the solar inverter must be connected to the system. It is typically installed near the main panel and it could be both indoors and outdoors. Inverters are more efficient if kept in a cooler place. Thereafter, solar panels may be connected to a solar battery. A solar battery can store energy for use when it is cloudy or at night. Current funding does not always cover the cost of solar batteries.

**5**

### Test, commission and set-up

The inverter is connected to the consumer unit so that energy can flow back to the grid when it is not being used in the home. A solar generation meter should also be connected to monitor the amount of electricity the solar panels produce.

**6**

### Power the system

Once connected a Solar PV system can operate without the need for much maintenance for 25 years or more.

# Retrofit your home.



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