housewarming

Guides

Windows and Doors

Low Carbon Oxford North

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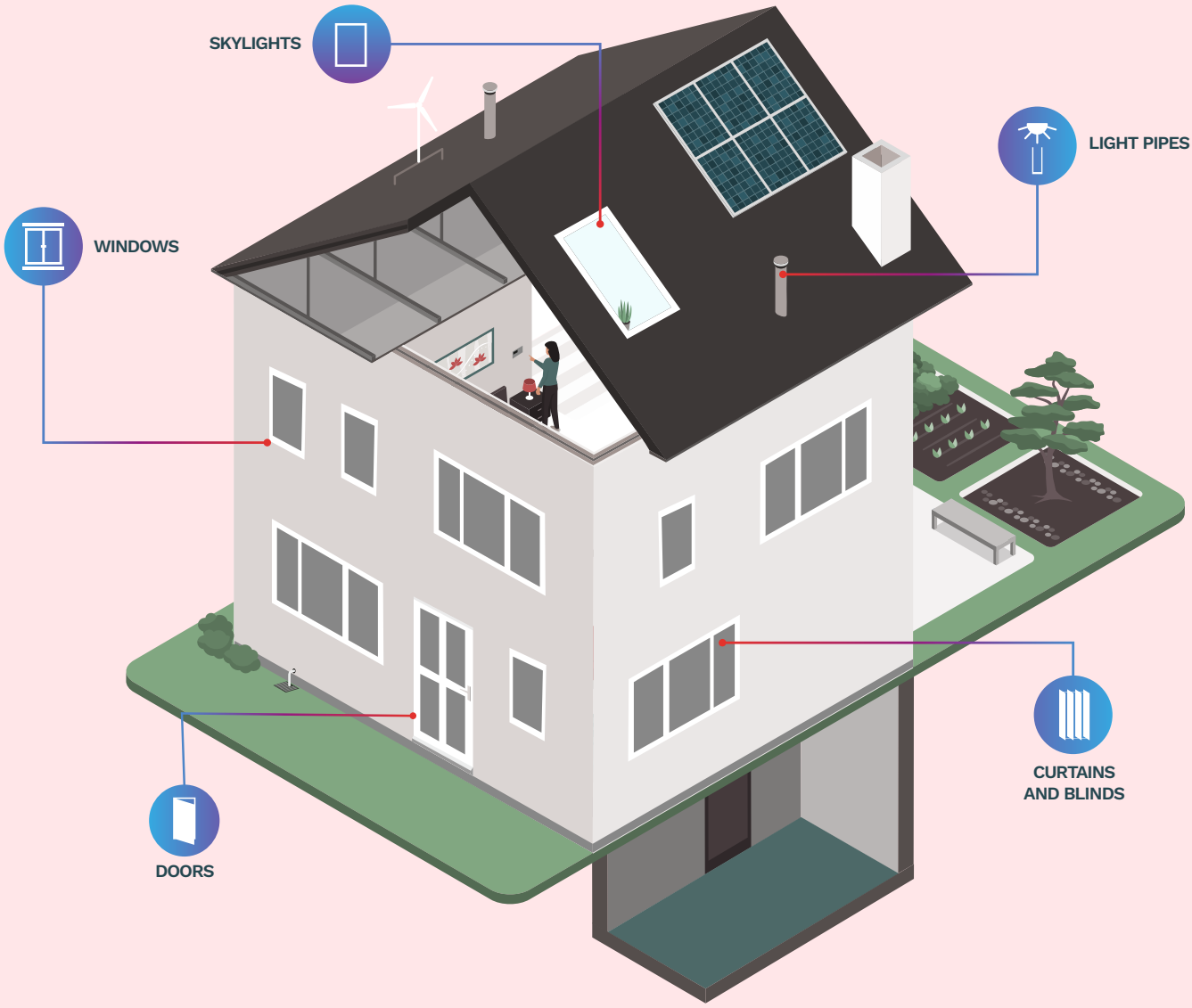

Low Carbon
Oxford North

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WELCOME TO OUR THIRD HOUSEWARMING GUIDE

Welcome to the third in the series of Housewarming guides created by Low Carbon Oxford North. The Housewarming series focuses primarily on cutting energy use by upgrading the fabric – the internal or external structures, surfaces, fixtures or fittings - of our homes. Upgrading this to better insulate our buildings means less energy will be needed to keep them warm in winter or cool in summer. Our homes will be warmer, healthier, and more comfortable to live in too.

This guide focusses on two of the most visible improvements - upgrading your windows and doors. Windows have several crucial impacts: they let light into your room which affects how often you need to switch on the lighting; they allow in sunlight which can help to heat your home, but perhaps overheat it in summer; and they are a major source of heat loss during the colder months. All these impacts can be tempered by the blinds, shutters and curtains that you install for functional or decorative purposes.

The most important decision when replacing windows and doors is to choose the lowest U-value you can afford for the whole frame and glass. In the UK, triple glazing currently has the lowest U-value and some companies will now only install this level of glazing.

If you are considering insulating your walls as well as upgrading your windows then it is important to specify both at the same time. This is because wall insulation will alter the thickness of the wall, so windowsills and ledges will need to match the new thickness.

Windows have two crucial impacts on the health of a home: light and heat.

TYPES OF GLAZING

Windows often have the lowest energy performance per square metre of your house and are responsible for about 10% to 30% of the total heat loss. Even double glazing loses around twice the heat of the same area of a typical wall.

If your house has a large area of glazing (as was common in the 1970s) or if windows are a large percentage of your external wall (for instance a 1900 terraced property) then improving the glazing will make a big difference. Perhaps the most important aspect of improved windows is that they will also have new, modern draught proofing.

- The simplest and typically oldest style of glazing is a single pane of glass in a frame, single glazing.
- This will have the poorest performance. Adding a second pane of glass reduces the heat loss considerably. There are two ways of achieving this: secondary glazing or double-glazed units.
- Triple glazing includes a third pane of glass.

SECONDARY GLAZING

Installed as a separate frame, the secondary glazing panes often sit inside the existing window frame. The new frame is fixed to the wall and windowsill and the existing frame stays in place. New glass panes are then fitted into the secondary frame. Typically, sliding panes are used so you can still gain access to the outer window. This is excellent at reducing noise as well as heat loss and can be used in listed buildings and conservation areas if you cannot gain permission to change your windows and/or frames.

Secondary glazing in a listed building:

Secondary glazing in a listed building

Secondary glazing on sash windows.

Fairly effective secondary glazing can be installed with 3mm (2mm is not as good) clear polycarbonate or acrylic plastic sheets and sticky magnetic strips. The magnetic strip comes in two parts. The dark magnetic section is attached to the acrylic sheet, as it is never visible. The white metal strip is stuck onto the window frame, as this is barely noticeable if the acrylic sheet is removed, for instance in summer. This is a cheap, safe, DIY option. You can get the plastic cut at local, large hardware outlets or online. See

www.youtube.com/watch?v=s5ACkjnbwKY&ab_channel=tubewaysales

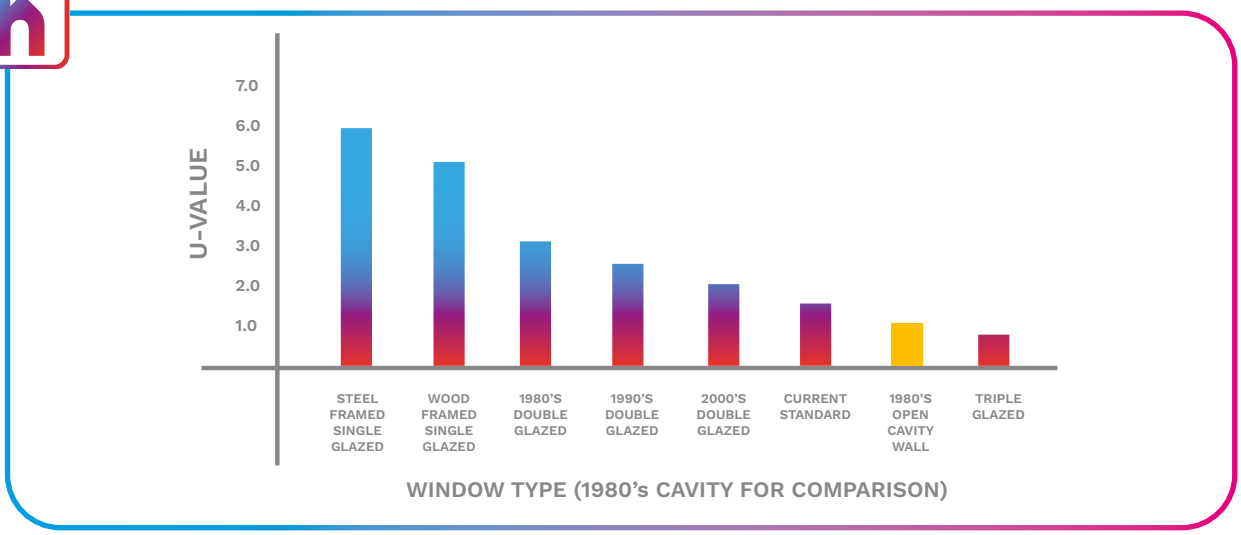
DOUBLE GLAZING

Double-glazed sealed units are two panes of glass sealed to be airtight at the edges and are often filled with a special gas mixture (a vacuum in between is being researched) to give better insulation performance. There may be coatings applied to the glass, generally to stop solar gain and overheating in summer. The key to knowing how good the windows are is to discover their whole window U-value. We discuss U-values in detail in **Housewarming Guide H2: Insulation**, the lower the U-value the better. Not all double glazing is the same and current double glazing is much better than when it first appeared. Early examples (1980s) had a U-value of ~3W/m² C whereas the best new double glazing can achieve a U-value of 1.6, a 46% reduction in heat loss, as well as better draught proofing.

TRIPLE GLAZING

Triple-glazed units add a third glass pane and the U-value for the whole window can be as low as 0.8 W/m² C. Inevitably, triple-glazed windows need thicker frames than double-glazed ones. Consider installing triple glazing if at all possible. The extra cost with new windows is not great and it will more than halve the heat loss compared to modern double glazing (see the chart below).

RELATIVE HEAT LOSS OF DIFFERENT GLAZING (WHOLE WINDOW U-VALUES W/M² C)



Notes:
1. The performance of secondary glazing depends on the primary glass and frame but is at least comparable to 1980s or 1990s double glazing. 2. 'Current Standard' is widely available now and will meet the Building Regulations.

HOW GOOD ARE MY EXISTING WINDOWS?

Before deciding whether to change or improve your windows, and especially as part of a whole house retrofit plan, balancing costs and improvements of different techniques (see Housewarming Guide H6: Whole House Plan), it is important to know what you already have.

There will be no information available to you about most single-glazed windows, other than we know the U-value will be about 5 W/m² C. With more recent installations, there may be a FENSA certificate. FENSA is a government authorised scheme that monitors building regulation compliance for replacement windows and doors.

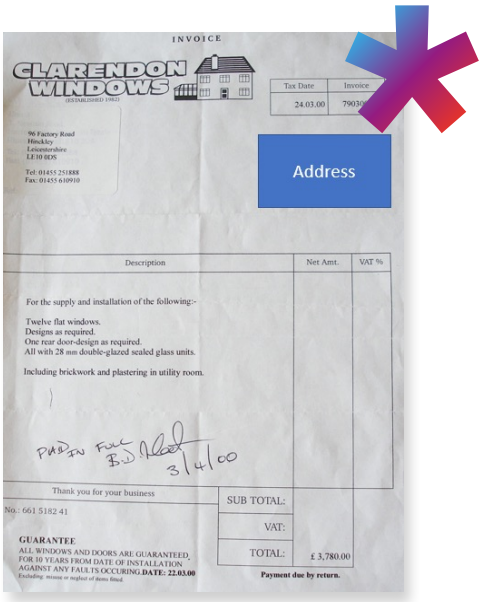
This certificate will tell you the U-value of the windows: information may be provided as an energy rating A to G. A is best and the lowest heat loss. If you cannot find this, or your windows pre-date the time when a certificate was required, you can look for an installation date or manufacturing date. Typically these details for the whole window can be found on a sticker or plate within the frame, usually where part of the window opens.

Sealed double glazing often has information printed onto the material that makes the gap the right width. Without this information there are some clues as to performance. The width of the gap between panes of glass is one clue, though this is difficult to measure. If it is about 6mm the glazing is relatively older. (Occasionally there was a restriction on what could be fitted to the frame, for example due to conservation area or listed building status.) This is likely to have a U-value of about 2.6 to 3. If the gap is about 12mm the U-value is likely to be about 2 to 2.6. A gap of 16mm suggests it is recent and probably high-performance glazing.

If you cannot find any marks and /or are uncertain of the performance, you can ask an energy surveyor to look for you as part of a house energy survey.

This names the BS EN12608 standard and date 2003. The standard is for the frame and these must have been installed between 2004 and 2016.

Here are marks in the sealed unit: BS EN1279-2 is the standard. This means they were installed between 2002 and 2018. The gap is about 16mm and likely after about 2010 so these are probably quite good, with a U-value around 2 to 2.3W/m² C.



If you can find the invoice for work done this should at least have the date.

The larger your windows the more heat they will lose so if you are contemplating an extension or some re-modelling of your house consider reducing the size of windows. In some circumstances a ‘light pipe’ may be better (see page 12).

A FENSA certificate.

TOP TIP: WHOLE WINDOW U-VALUE.
U-values are quoted for the whole installation which comprises the frame and the glass unit. It is vital to look for this figure when choosing a window or door – the lower the U-value, the better. Sometimes, the literature gives a ‘centre pane’ U-value which is solely for the glass. This is misleading and incomplete. The U-value also includes the effect of any coatings and gases between the panes of double and triple glazing.

IMPACT OF FRAME TYPE

There are many architectural styles of window including sash, side-hung or top-hung casement, bay, oriel, and picture. Whatever the style, the following guidance applies.

Older windows do not necessarily have such good performance as new designs. This is partly due to improvements in frames and partly due to the width of the air gap between panes as well as small enhancements from using different gases. It will also be due to wear and tear with old frames, especially wooden ones. Glass coatings are often mentioned in sales literature. The main benefit of these is to prevent summer overheating. However, those best at doing this may reduce the solar gain in winter, thus costing more in heating bills.

The oldest steel or aluminium framed windows (single- or double-glazed) did not always have a thermal break within the frame, so this becomes a cold bridge in the window, often identifiable in the coldest weather by condensation forming on the inside of the frame. From the 1980s insulating strips were incorporated into steel or aluminium designs, so they could have as good a performance as any frame design. If you have old frames, replacement is the only real solution.

With double glazing, as frames improved, so the air gap between the panes of glass increased to improve the insulating performance. The current commonly available industry standard is about 16mm.

Choosing your frame type might also include considering sustainability. For example, a PVCU (previously called UPVC – a type of plastic) frame is made from oil but will rarely need major maintenance. A timber frame (softwood or hardwood) may appear a more sustainable option but will probably need repainting several times through its life and has the risk of rot. Aluminium frames could most easily be recycled at end of life, but a lot of energy is used in their manufacture. So there are several issues to consider when making a choice.

Sash windows bring a particular set of problems. First, they tend to limit the width of the double-glazed pane and so a sub-optimal width has to be fitted. Secondly, as they slide they do not always create a draught-proof seal around the edges, and any seal will tend to wear more than for a hinged window. Thirdly, the weight added by the second pane in double glazing is considerable and requires extra balancing and effort to open.

Don’t forget to consider ventilation and air quality (see Housewarming Guide H4: Draughts and Ventilation). If your house is already under-ventilated or if you are also improving the airtightness of your house, make sure you choose the right sized trickle vents and a suitable number of opening windows in each room. This will allow you to control the amount of fresh air to get the right balance between air quality and reduced bills.

The key to choosing an energy efficient window is to find the U-value quoted for the whole installation which includes the frame and the glass and then compare products.

DOORS

As with all parts of building fabric, the energy performance of doors has improved over the years.

An old, thin wooden door will have much poorer performance (typically a U-value of 5 to 6 W/m² C) than a new door (U-value 1.8 W/m² C or lower). Generally, older doors will also have poorer draught proofing. On the other hand, doors are not normally a very large proportion of the whole house area and so will not be a major contributor to heat losses. If your doors have obvious maintenance needs, are clearly draughty and you are improving the house overall, they are worth replacing.

Glass doors or doors with glazed portions can be treated in the same way as windows. In other words, there will be U-value for the whole door, and older doors and frames will perform much worse than new ones.

TOP TIP: New doors require a U-value of 1.8W/m² C, or a door Energy Rating Band E. Both windows and doors now have energy ratings.

https://www.myglazing.com/be-informed/window-energy-ratings/

An older wooden door will have much poorer performance than a modern, insulated door.

SKYLIGHTS

Skylights can also be double glazed and the same science applies to the U-values.

Generally, you cannot get triple-glazed skylights nor are the best skylights as good as the best double glazing. This is partly due to the weight of higher performance frames and sealed units necessary for lower U-values. Consequently, the only control you have of heat loss is the size of the skylight. If you are modifying an existing room with a skylight, you should aim for the smallest skylight area to minimise heat loss.

Skylights do not have to be as large as windows because they let in up to five times more light per square metre than a vertical window.

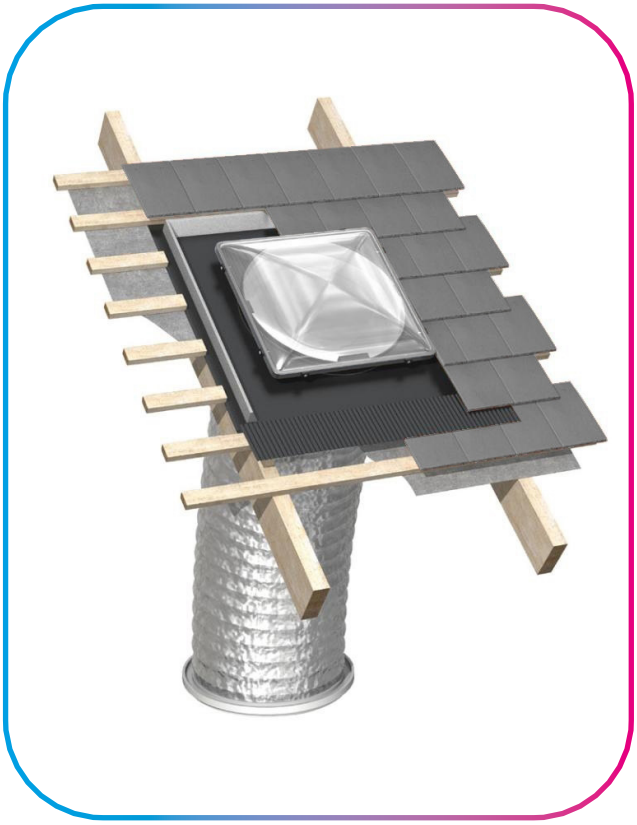
Large skylights in south-facing roofs are likely to cause overheating. The high sun in the summer 'burns' down into the room during the day whereas in winter little heat is gained and much heat lost through the glass. You can add internal blinds to reduce glare, but they don't help much with overheating. To avoid overheating a skylight is best placed in a north-facing roof and, to reduce heat loss, should be made as small as reasonable.

Skylights do not have to be as large as standard (vertical) windows as they let in more light.

LIGHT PIPES

Light pipes, or sun pipes, have emerged as a new way of bringing light into a room from above. They have a 'window' outside, typically on the roof though occasionally on a wall, and a reflective tube which ends in another 'window' in the ceiling of the room below.

These are great at bringing daylight into a room where windows are not possible or would not otherwise be useful, for example, a small bathroom or a landing. If they bring in light from a roof, they don't need to be large to deliver lots of daylight and so they can be an energy efficient way to gain daylight. As with windows, sun pipes now have U-values so you can check their performance.



Light pipes are a great way to bring light into a room.

CURTAINS AND BLINDS

A good thick curtain or blind inside a window will help save energy. It is difficult to find solid evidence for the improvement they make, but some good research shows that inside a single-glazed window a really good curtain could be almost as good as secondary glazing and could halve the rate of heat loss.

Adding a good curtain to double glazing gives a further improvement of around 20%. A ‘good’ curtain or blind is not defined but, as a guide, the thicker the better, and the closer it is to the wall the better, so it stops air moving in and out of the window space. The curtain must NOT drop past a radiator as this would direct the heat from the radiator up past the window, causing further heat loss.

Blinds can be useful at limiting the sun coming into the home during the summer if this would cause overheating.

Blinds can be useful at limiting the sun coming into the home.

SHUTTERS

Evidence shows that a well fitted wooden shutter inside the window frame can be as good as secondary glazing and can halve heat loss compared to single glazing. The shutter needs to be solid, not louvred, and should fit snugly at the edges where it meets the wall or other shutters. If your house is listed or in a conservation area then it may well be worth having old shutters refurbished so they do this and will save you energy.

However, because British windows generally open outwards it is more difficult to have external shutters, as they do in the rest of Europe where the windows open inwards.

CONSERVATORIES AND SUNROOMS

Conservatories and sunrooms have very large areas of glass and potentially extremely high heat loss. It is therefore important to try to fit the best performing double glazing and it may be appropriate to pay the extra for triple glazing. Otherwise, a heated conservatory will add considerably to your energy bills.

Heated conservatories lose a lot of heat.

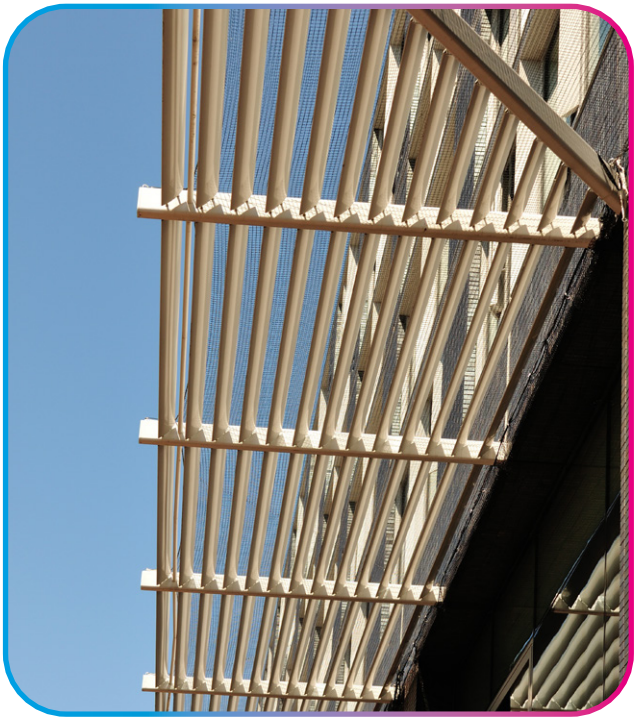
OVERHEATING AND SOLAR GAIN

Large areas of south-facing windows were once thought to be useful in terms of solar gain, enabling the sun's heat in winter to help heat the house. However, unless the house is very carefully designed, with appropriate shading overhanging the whole window, large south-facing windows risk overheating the house in summer and will always waste heat in winter.

The best place for sun shading to reduce the risk of overheating is outside, above south-facing windows. The sun is only overhead at midday in summer, so will not shine past the shade into the window. In the morning and evening the sun is at a lower angle and off to the side, so the best systems block this angled sunlight with the use of vertical slats (they look a bit like a foot-scraper) or a grill. These systems are sometimes called a 'brise soleil'.

Other alternatives are an external canopy that can be wound out or an internal Venetian blind, though internal blinds are not as effective at keeping heat out. Many companies now offer blinds between the panes of double or triple glazing. If you have the option, a small deciduous tree in front of a south-facing window provides shade in summer but lets in light and warmth in winter.

As our weather gets warmer with climate change, there will undoubtedly be a range of new options to avoid overheating coming onto the market.



External shading 'Brise Soleil' to reduce overheating of a commercial building.

REPLACEMENT AND UPGRADING PLAN

A key question is when to replace or upgrade glazing. Sometimes it will be obvious to replace old glazing but newer windows might best be left alone. Don't forget to think about ventilation in making the choice.

The chart on page 6 showed how glazing has improved significantly over the years. New double glazing is more energy efficient than old and certainly much better than single glazing. Triple glazing is best and if you can afford it we suggest you should fit it.

If you have any significant area of single glazing, then it is definitely worth evaluating upgrading these.

If you have old double glazing, it is worth considering replacing it. If your windows need significant maintenance, for example the wooden frames are rotting, or any of the panes are 'blown' (have condensation inside), or many locks are broken, then replacement may be necessary.

It is possible to replace just the panes within existing window frames. However, this is not always worth it because you are unlikely to be able to retrofit the best double-glazed units and the frames are likely to be relatively poor insulators. So you should consider the costs and benefits of replacing the whole windows with new ones.

You may not have to do the whole house in one go. It probably makes sense to replace all the windows on one façade of the house at once so they will all look the same. Otherwise, the ones to choose first could be based on one or more factors such as:

- Those most in need of maintenance, for example due to rot.
- Those in the room which suffers from most condensation on the window and frames.
- The largest windows, which will offer the greatest reduction in heat loss and therefore the greatest energy saving by replacement.
- The room that is used most and perhaps kept warmest in winter.

This old wooden window has 12mm glazing that has 'blown' (got condensation between the panes). It needs major maintenance - better to replace?

A definite candidate for replacement!

Old style, old technology, probably worth replacing even if not in need of maintenance, especially if there is condensation on the frame in winter.

Newer glazing normally has at least 2 draught strips.

INSTALLATION ISSUES

STRUCTURE

A key question to ask before having windows replaced is ‘are they part of the structure of the building?’ In many houses there will be a separate supporting lintel above the window frame, but in some the window frames perform this function. An architect or structural engineer should be able to answer this question if it is not obvious to you or an energy surveyor. If the windows are structural, structural window replacements need to be selected and the replacement work should be done with great care.

SEALING AND SNUG FIT

When the new window frame is fitted it needs to be completely sealed around the frame where it meets the wall. If it is not, rain and wind can get in.

The best window fitters will use an expanding foam tape to do this job. This is wrapped tightly around the frame just before the window is slid into the opening in the wall. Once installed, the tape slowly expands to fill any gap between frame and wall.

On the outside there should be a bead of mastic (or for some architectures, an appropriate mortar or beading) around the edge of the frame where it meets the wall. This is to prevent rainwater getting into the gap.

With a cavity wall it is also important to make sure the window and windowsill do not allow air flow from the cavity into the room. This is probably the mistake most often made in fitting replacement windows. The missing seal allows cold draughts to enter the house from the cavity, either around the edges of the frame, from under the interior windowsill or both. The solution is to have the window installed beyond the gap, further to the outside.

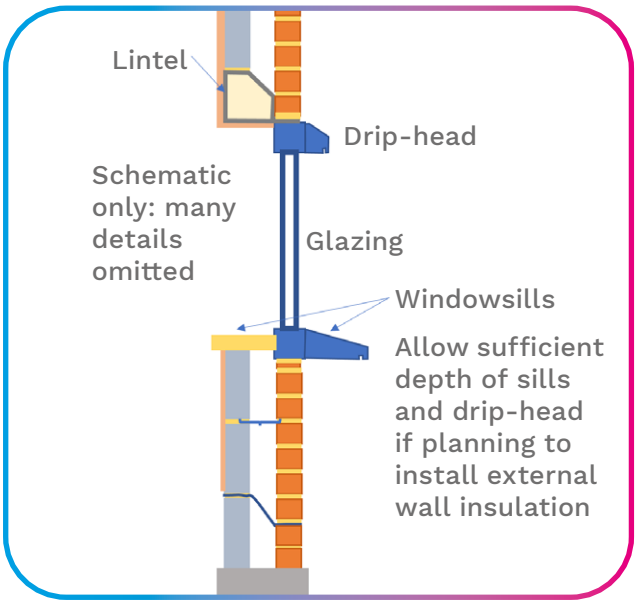
RAIN SHEDDING

Window frames have evolved over centuries to shed water so it does not enter the house or soak into the wall. There are two parts that particularly need to be chosen or made correctly to match your house.

These are:

- A drip-head along the top of the window frame: this acts like the peak of a cap and stops rainwater running down the wall and around the top of the frame onto the window.
- An outer windowsill with drip groove: this ensures that rain running off the window is shed away from the wall, and does not run back under the sill and onto the wall.

The depth of both these features is important; especially so if you are going to have external wall insulation. (See Housewarming Guide H2: Insulation.)



Rainshedding illustrated.

DECORATION

Decoration is, naturally, best done after the window is installed. This also allows for the sealing mentioned above to be inspected properly. Some window installers use plastic strips to hide the edge of the wall where it meets the frame on the inside. This is prone to draughts and is not recommended. It is better to have the gap professionally filled and finished with plaster.

TRICKLE VENTS, DRAUGHT STRIPS AND AIRTIGHTNESS

It is important to mention trickle vents in relation to windows. (We discuss ventilation and airtightness in more detail in our Housewarming Guide H4: Draughts and Ventilation.)

A typical trickle vent.

In The Building Regulations Part F on Means of Ventilation, there are now requirements for a minimum amount of ventilation per room and for the house overall. This is important to ensure good air quality. Consequently, new windows generally come with trickle vents.

There are some circumstances where you can specify them not be fitted. One main discretionary reason for not having trickle vents is if the room has other ventilation, for example air bricks or Mechanical Ventilation with Heat Recovery. This needs to be discussed and agreed with your installer and potentially the building control team at your local authority.

SUMMARY

Replacement windows and doors are perhaps the most obvious improvement to the energy efficiency of a house, but they can be costly. Where a house has large areas of single glazing replacing this with double or triple glazing will very significantly reduce energy consumption and improve comfort. Where you have existing double glazing, the benefits are less clear.

- Aim to install glazing with the lowest U-value you can afford; you are unlikely to upgrade again soon so we recommend you install triple glazing.
- You can replace windows in phases, but make sure they will be compatible with any internal or external wall insulation installations if you are planning those. Make sure you take into account any extra depth sills/ drip heads require (and the possibility of moving windows outward).
- Make sure you hold the correct consents and certification, especially in a conservation area or if you own a listed building.
- If you are also improving the airtightness of your house (see **Housewarming Guide H4: Draughts and Ventilation**) make sure you choose the right-sized trickle vents and a suitable number of opening windows in each room.

Important questions to ask include:

- How old is my double glazing and what is its U-value compared to that currently available?
- Are there any other aspects of my existing windows and doors that would be substantially improved by replacement? For example, are the draught strips up to modern standard and is there any rot in the frame?
- Does my house have a particularly large % of my external area of glass compared to others?
- Does replacing the windows have to be done to make it possible to be 'heat pump ready' and will this save overall on the cost of the whole house plan, including the heat pump?
- If I have decided to replace my windows, what would be the cost of triple glazing compared to double glazing and how would this impact on heat loss?

If you have single glazing and are in a conservation area or have a listed building:

- What is the local authority's view on fitting double, triple or secondary glazing?
- If new glazing is not going to be permitted, could you install (or refurbish) internal shutters?
- Failing all else, can you fit the best performing curtains or blinds snugly to the window reveals to get a significant benefit?

DISCLAIMER

This guidance document is written with the intention of providing a better basis for home owners to decide how to reduce the energy consumption and carbon emissions of their homes.

We have not surveyed your home and so the suggestions and discussions in this document can only be a general guide and LCON and its consultants cannot be held responsible for or accept any liability for damage, failures or disputes which result from the use of this document.

We recommend that specific decisions are made only after a suitable survey by an appropriately qualified specialist.

We recommend gaining several quotes for work from a number of suppliers and suitably qualified and experienced companies with appropriate insurance.

It is essential to follow material manufacturer's instructions and specification sheets to avoid risks of damage to structure and property and to ensure the intended performance is achieved. We recommend the use of only those products with appropriate independent certification for the intended use e.g a BBA (British Board of Agreement) certificate.

We recommend appropriate contracts are used and signed by all parties before work is undertaken and suitable legal advice should be sought.

CREDITS

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