WINDOWS AND CURTAINS

ECO-DESIGN ADVISOR SERIES NO.2

THE WEAK LINK

Windows are the weak link in keeping houses warm. In a typical uninsulated house, a third of heat is lost through windows. (The roof accounts for another third and the final third vanishes through the floor, the walls and gaps under doors and in floorboards.) Single-glazed windows let out heat 10 times more readily than insulated walls, and even standard double-glazed windows are inferior to uninsulated walls.

We can't do without windows, of course: our rooms would become prison cells. Windows admit light and connect us to the outside world. If correctly proportioned and placed, however, they can let in welcome winter sun. And if also double glazed and properly curtained, they will hold in much of that free heat, reducing your power bills in the process.

If you have single-glazed windows, there are three choices available to you:

- Cheapest of all is a window insulator kit manufactured by 3M. Thermally, it is unexpectedly efficient, though aesthetically it may not be to everyone's taste (the film does not reflect exactly like glass).
- Secondary glazing can be half the price of removing single-glazed windows and installing double-glazed windows. However, the seals must be absolutely right or condensation can occur. Opening such windows can be awkward because you have in a sense two windows.
- Installing double-glazed windows is not cheap, but the benefits are undeniable. (They are also compulsory in new houses.) They hold in warm air and deflect cold air very well, ensuring energy used in the house is not wasted. Performance can vary according to the type of glass, whether the vacuum between the panes is filled with air or gas and the type of window framing, as the chart below shows. Single glazing is included for a comparison of performance. The R-value in the chart is a measure of thermal effectiveness: the bigger the number, the greater the effectiveness.

Comparison of Types of glazing

	Single glazing	**Standard double glazing**	**Double glazing with Low E glass**	**Double glazing with Low E glass plus Argon**
Aluminium frames	R 0.15	R 0.26	R 0.31	R 0.32
Thermally broken aluminium frames*	R 0.17	R 0.31	R 0.39	R 0.41
Timber/uPVC	R 0.19	R 0.36	R 0.47	R 0.50

* Stops transfer of heat and cold via window frames

Note: Figures from NZS 4218:2009. Figures for double glazing based on 10mm space between panes

Note how the performance improves with better window frames and glazing (though the use of argon gas adds only a very slight enhancement). To put into perspective the performance of even the best glazing, a wall without insulation has a rating of between R 0.35 and R 0.60, and an insulated wall has a rating of R 1.9.

For the technically minded, Low E coatings let the sun's heat through the glass but act like a mirror to prevent it from leaving. All double-glazed windows have a gap between the panes of between 8 millimetres and 12 millimetres. In standard double-glazed windows, the gap contains air. For extra money, the air can be replaced with argon gas, which is a better insulator than air. There are questions, however, about how long argon gas stays in the unit.

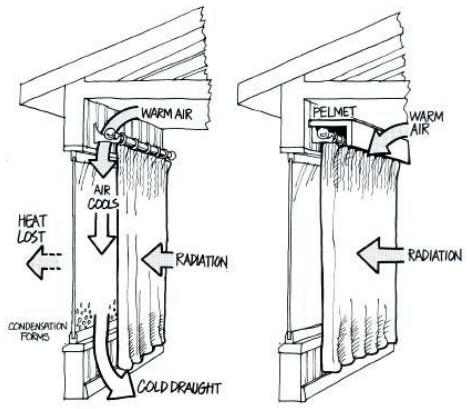
Building from scratch

Your options are much wider if you are building rather than trying to improve an existing home. Definitely choose the best-performing windows your budget will allow. But also think carefully about where you place windows and select a size that fits the aspect. Keep south-facing windows to a minimum (and make them as small as possible.) And don't forget humble-looking but vitally important eaves. If well designed, they will admit winter light but block out the worst of the summer sun. (Deep eaves also protect windows, doors and cladding from rain.)

Drawing the curtains on heat loss

No matter what type of windows you choose, curtains can enormously improve their resistance to heat loss. Windows, as we have noted, have the lowest insulation properties of any part of a house. (A square metre of uncovered window can lose four or five times as much heat as a square metre of uninsulated wall.)

The key to effective curtains is snugness of fit, followed by layers of material. Below are three basic rules to good curtain design. But first some simple science: Glass is a very poor insulator. On a cold winter's night, with curtains or blinds closed, the air behind the curtain or blind loses heat through the glass. This colder air is heavier and sinks. Warmer air gets drawn in from the top to replace it. (See left diagram.) This cools and also sinks, creating a cycle in which warmer air at the top of the room is pulled down behind the curtains and drops out as cold air below the window, pumping heat outside. The insulating effect of curtains and blinds is achieved mainly by the layer of still air it traps against the window. If that layer isn't adequately sealed, the convection cycle can resume, taking your precious heat with it.



Heat loss with and without pelmets

Rule one: Close off the top

Pelmets are an excellent way to seal off the top of this heat exchange, but the sides of the pelmet must fit snugly to the wall. Other options are: fit curtain brackets that are flush with the wall; fit a strip of hardboard between the wall and the curtain track to seal off the gap (paint a colour that matches the track and you won't notice it); or fit curtain tracks that attach to the underside of the window frame.

Rule two: Close off the bottom

Make sure the bottom edge of the curtain rests on the floor or sill, and that blinds seal against the sill. Consider using roman or pleated insulating blinds if it is impractical to take the curtain all the way to the floor or sill.

Rule three: Two-layer minimum

Use a minimum of two layers of fabric to provide adequate insulation. The thicker the material is, the better. The curtain fabric itself adds very little to the insulation value of the window – it's the layers of still air trapped in and between materials that provide the insulation, so the key is layers of material that will trap still air.

Thermal versus standard fabrics

The term "thermal drape" usually refers to a single-layer fabric with a rubberised backing. It gives a slight improvement in thermal performance, but is nowhere near as effective as a standard curtain material with a separate lining. Remember, it's the layers of still air that provide the insulation. Also on the market are "insulating curtains" containing a thick light layer between the curtain fabric and lining. They improve insulation (and help deaden sound), but only if there are no leaks round the outside. Heat, like sound, is sneaky and can get through the smallest gaps

Blinds

Two-layer roman blinds (decorative fabric on the front, with a separate lining behind) can be as effective as double-layer curtains, provided they are snug all round. Velcro dots at the bottom corners can help hold the blind snug. Another good option is multi-walled pleated blinds, which trap layers of still air within them. These are generally made of moisture-tolerant fabrics and are a good option for wet areas such as bathrooms and kitchens.

Venetians and slatted blinds are great for screening out sun and providing privacy, but ineffective at keeping heat in because there are too many gaps. If you're serious about reducing heat loss in winter, avoid them.

Mould and mildew

If mould and mildew appear on curtains, there's too much moisture in the house. This is a separate topic. See eco-design adviser series no. 3. You can get curtain fabrics and linings that have anti-microbial properties to reduce the likelihood of mould growing – talk to your curtain consultant

More information

For further information, contact the council's eco-design advisor on 570 6666 – a source of free, independent advice on how to include sustainable features in your building or renovation project