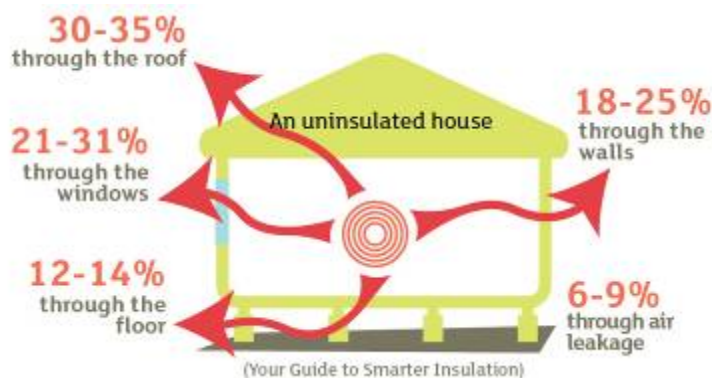


Keeping heat in: Windows

In this fact sheet:

- Double glazing
- Secondary glazing
- Curtains and pelmets
- Simple steps to prevent heat loss through your windows

Once you have insulated your ceiling and floor, windows and walls are the main sources of heat loss.



Condensation on your windows indicates heat loss and/or excessive moisture in the air. It's always best to first address the sources of the moisture (e.g. bathroom, cooking, rising damp from the ground under the floor). See Fact sheet on 'Healthy indoor air'.

Warm air holds more moisture than cold air can. The invisible moisture in the warmer room air condenses on the glass and the frame if they are cold from the outdoor air. Double glazing has an extra insulated layer to stop heat loss - as the inner glass is warmer, moisture does not condense on it. Aluminium frames are more prone to condensation than timber or PVC frames, because they're better heat conductors.

Double glazing

When thinking about double glazing there are two key considerations – what type of frame and what type of glass. For new homes, most houses use standard aluminium frames, however a range of other (but more expensive) better performing frames are available – thermally broken aluminium, wood and PVC. When it comes to glass there are a wide range of options. Some key differences in window frame and glazing are outlined in the table below.

Aluminium Frames	<ul style="list-style-type: none"> ▪ Standard, cheapest frames available ▪ Relatively low maintenance. ▪ Has poor thermal performance because the heat and cold easily transfers through the aluminium from the inside to the outside. ▪ A standard double glazed pane in aluminium frames has an R value of 0.26.
Thermally broken aluminium	<ul style="list-style-type: none"> ▪ Aluminium frames which include a “thermal break” so that heat and cold don’t pass through the frame. ▪ Widely used overseas and becoming more widely available and cheaper in New Zealand. ▪ A standard double glazed pane in a thermally broken aluminium frame has a R value of 0.31
Wooden frames	<ul style="list-style-type: none"> ▪ The standard frame in older houses. ▪ Much more expensive than aluminium, but performs much better thermally. ▪ A new wooden window frame with a standard double glazed pane of glass has an R value of 0.36. ▪ Wooden frames need to be painted and have regular maintenance.
PVC Frames	<ul style="list-style-type: none"> ▪ A new option to New Zealand but widely used overseas. ▪ More expensive than aluminium but performs similarly to wood. ▪ A PVC window frame with a standard double glazed pane of glass has an R value of 0.36. ▪ As has not been used in New Zealand long, durability in high sunshine and coastal situations is not proven.
Ventilated frames	<ul style="list-style-type: none"> ▪ Frames with built-in ventilation which stops condensation forming on the glass.
Clear double glazing glass	<ul style="list-style-type: none"> ▪ Two layers of standard glass, with an air gap in between. The thicker the air gap, the better performing the glass. ▪ A standard air gap of 12 mm is assumed in most R value calculations.

<p>Low emissivity (Low E) glass</p>	<ul style="list-style-type: none"> ▪ A higher performing glass which lets light and heat in, but is more resistant to heat escaping. ▪ If Low E glass is used instead of standard glass a large increase in performance occurs, e.g. a window with Low E double glazed glass in a standard aluminium frame has an R value of 0.31, and a window with a Low E double glazed glass in a wooden or PVC frame has an R value of 0.47.
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Retrofitting double glazing

There are a number of different options to fully double glazing your existing home. You can prioritise the windows which give you the most improvement – these tend to be south facing windows because these get very little winter sun, and are a major source of heat loss. Next consider western or eastern facing windows (particularly in bedrooms) and then finally northern windows. If you have a problem with glare or overheating in the afternoon, then western windows should be double glazed as a second priority after southern facing windows. Alternatively you can consider secondary glazing which gives you many of the benefits of double glazing without having to fully replace your windows.

When it comes to retrofitting double glazing, there are two main options – replace the whole window frame with new frames and glass, or install inserts into your existing window frames. The second option is a lot cheaper, if your window frames are still in good condition. Low E and tinted glasses are also able to be included in either retrofit option.

Secondary glazing

Another option is use of what is called secondary glazing – inserting a second pane of glass, acrylic or plastic sheets in or on to an existing window frame. It's an alternative to retrofitting new double-glazed windows, especially for old wooden houses. The most recent research indicates that glass or acrylic secondary glazing systems do perform as well as some types of double glazing, and are cheaper again than a full double glazing option. It is possible to retrofit secondary glazing with Low E glass or tints. This approach can also help reduce heat loss and noise.

Options include:

- A flexible, magnetically-attached system such as Magicseal, www.magicseal.com/content/pdfs/MagicSeal_sg_12.pdf.
- A rigid, PVC-framed magnetically-attached system such as Magnetite, www.magnetite.co.nz/.
- Rigid timber-framed secondary glazing.

At the other end of the scale are shrink wrap secondary glazing kits. These are a cheap and effective way of improving your window performance in winter – they help with condensation as well as reducing heat loss. These are attached to your window frame with double sided tape, and then shrunk to fit using a hair dryer. You can buy these from a hardware store, or online. Generally they will only last one year though, so you need to redo your windows each autumn.

Pros and cons: Secondary glazing vs double glazing

Secondary glazing

- is cheaper
- is available both as glass and acrylic inserts
- can be a better option if you are wanting to address external noise issues. Secondary glazing can be really good at blocking external noise
- can be swapped in summer for insect screens fitted to your windows in the same way - this is really popular in Europe
- can look ugly to some people, and this may be a consideration for you.
- should reduce condensation on your windows considerably.

Double glazing

- is usually not as good for noise as secondary glazing, but still makes a big difference to noise levels
- can use advanced glass (e.g. low e (emissivity) glass which has great thermal properties). Double glazing with low e glass should perform better thermally than secondary glazing
- is probably a more permanent/long term option than secondary glazing (but, again, check that warranty)
- is probably going to be valued by the market more in the long term than secondary glazing (since new houses are now required to have double glazing).
- should reduce condensation on your windows considerably.

Curtains and pelmets

With no curtains, a plain-glass, single-glazed, non-thermally-broken, aluminium-framed window has an insulation value of only R0.15.

Add even a single-layer curtain or blind and you create a still-air gap between the glass and the curtain which has an insulating effect. This can bring your R value up to R0.3. The curtain fabric itself adds very little to the R-value of the window, even for thermal drapes. (Imagine you are out camping. Would a sleeping bag made solely from the curtain material be as warm as one with a 100mm layer of insulation in it?)

Even better is a double layer thermal blind with air pockets or a thick lined curtain. These double layers create further still-air gaps and can add up to an R-value of 0.5-0.6.

Snug curtains

Curtains insulate by creating a still-air gap between the glass and the curtain. If that gap isn't adequately sealed, the cold air on the inside of the glass slides down behind the curtain and out into the room, and the warm air from the room replaces it from the top. The moisture in that warm air condenses on the glass if the glass is cold enough.

It is important to have a snug fit around the top, jambs, and sill or floor. Pelmets are useful to stop warm air being lost at the top of curtains. Velcro strips sewn on one side to the back of the curtain can also be used to make a tight fit of your curtain around the side of the window frame.

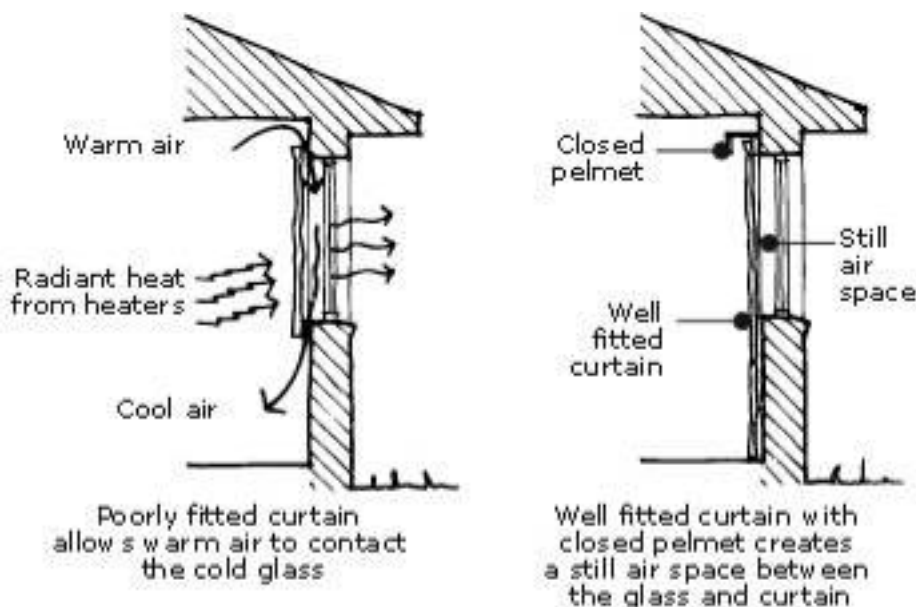


Illustration from *Your Home Technical Manual*, 3rd ed 2005 (Australian Government)

Tips: Simple steps to reduce heat loss through windows

There is a lot you can do easily and cheaply to stop draughts, keep the warm air away from the cold glass and reduce heat loss through windows.

1. **Draught-stopping.** Gaps around opening windows can lose lots of heat and most wooden joinery becomes draughty with age. Fit draught-stopping foam or V-strip, available at hardware stores.
2. **Snugging-up curtains or blinds.** The main insulating effect of curtains is in the still-air gap between the window and the curtain. If that gap isn't adequately sealed, the cold air on the inside of the glass slides down behind the curtain and out into the room. So it's important to have a snug fit around the top (where a pelmet is effective), the sides, and the sill or floor. Velcro strips sewn on one side to the back of the curtain can also be used to make a tight fit of your curtain around the side of the window frame.
3. **Make your own insulated curtains.** Thicker material is better than thinner for curtains and adding layers is also insulating. You can buy the insulating lining and sew it on the back of existing curtains.
4. **Two-layer curtains or blinds.** You can get twin-track curtain systems which attach to the underside of the reveal (frame) at the top of the windows.
5. **Close your curtains at sunset.** Simply closing your curtains while your home is still warm will retain the heat from the day.
6. **Shrink wrap insulation kits (secondary glazing).** This DIY solution is applied on the inside with double-sided tape and heat-shrunk with a hairdryer. To be effective, it needs to be 10-15 mm off the glass, so it doesn't work well on most aluminium frames. It's a cheap option that lasts only a year or two but gives effective insulation. You can buy kits online from Community Energy Action (www.cea.co.nz), from the Sustainable Living Centre, New Lynn, and they are available under brand names such as "3M Window Warmers" and "Duck" Window Insulating Kit at hardware stores. (Note: this is not the same as solar or tinting film, which is applied direct to the outside of the glass to reduce heat gain in summer.)

For more information:

- See Fact sheets on
 - Keeping heat in: Overview
 - Keeping heat in: Insulation
 - Keeping heat in: Draught proofing
 - Healthy indoor air
- For a discussion of double and secondary glazing, visit www.smarterhomes.org.nz/design/glazing/double-glazing-glass-options/#toc_3.



A window fitted with a shrink wrap insulation kit