BALANCING THE DOUBLE-EDGED SWORD OF WINDOWS

FACTSHEET 06

A house without windows is a bunker, and no one wants to live in one of those, so glazing is an essential part of any house. Windows have some wonderful benefits – they let in light, enable views, and enhance the feeling of space in a room – but they also have downsides which must be carefully managed to maintain energy efficiency.

Windows are composed of two main elements: the glazing, which is the kind of glass in the window, and the framing, which holds the glass in place. Both window elements are important for energy efficiency because both can lose heat very rapidly in a cold climate like Googong's – in extreme cases, up to 40% of heat loss from a house in winter can be through the windows!

There are other aspects to windows that also should be carefully considered, such as how many and what size they should be, which directions they should face, whether they require solar access in winter or shading in summer, and whether tinting is appropriate.

ENERGY EFFICIENCY AND WINDOWS – POSITIVES AND NEGATIVES

On the positive side, north-facing windows allow a lot of sunlight in during winter which can warm a house during the day and, if used in conjunction with thermal mass, can even help to keep it warm on cold winter nights. On the other hand, sunlight through windows in summer can rapidly overheat a well sealed and insulated house, so it is important to block sunlight from striking the glass during the summer using eaves or other external shading devices (see Shading).

On the negative side, windows are very poor insulators, so they allow a lot of heat to conduct in and out of the house. In winter, when single glazing has a similar temperature to the outside air, windows also create convection currents (see figure 1), cooling the warm air that flows past them and creating cold draughts at floor level.

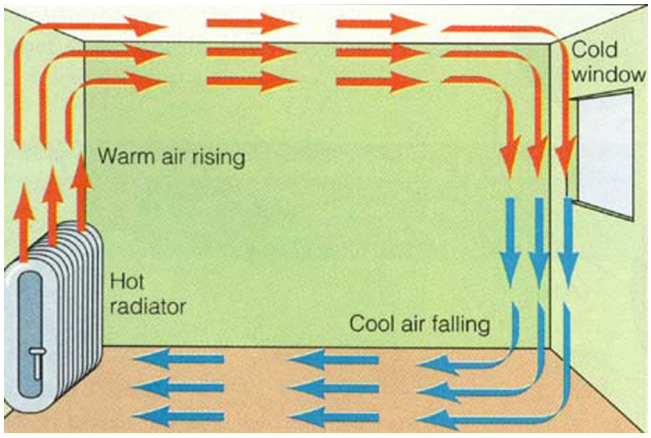

Figure 1: cold window creating convection current. source: https://www.eeb.ucla.edu/test/faculty/nezlin/PhysicalOceanography.htm

Some windows can also become leaky, especially after a significant period of use, which makes them a potential vulnerability in a well sealed house.

R-VALUES AND U-VALUES

Unlike insulation and other building products where R-values (resistance to heat flow) are used to denote insulating effectiveness, window manufacturers use U-values, the inverse of R-values (U=1/R).

*U-values tell you how quickly a window will conduct heat. Do not make the mistake of buying a window with a high U-value – **with U values, the LOWER the better.***

WERS – THE WINDOWS ENERGY RATING SCHEME

It is a requirement that all windows for sale in Australia are tested on a range of qualities: U-value (Uw on WERS, the rate at which a window conducts heat), Solar Heat Game Coefficient (SHGC, the amount of heat in sunlight that passes through a window, measured 0-1, higher means more heat), Tvw (visible light transmittance, measured 0-1, higher means more light), and AI (air infiltration, how well a window seals). Test results are published on the WERS website (http://www.wers.net/wers-home).

GOOGONG Sustainable Housing
NSW GOVERNMENT
NSW Environmental TRUST
Queanbeyan City Council

WERS also has a useful star rating system for the effectiveness of each window in terms of heating (keeping the heat in) and cooling (keeping the heat out).

THE IMPORTANCE OF FRAMING

Window framing is often forgotten, but it is a very important part of any window. In a cold climate, standard aluminium framing loses heat very rapidly during winter. The nature of the framing also contributes to how well it seals. Double and triple glazing should always be installed in conjunction with insulating framing such as thermally broken aluminium, timber or uPVC, because standard aluminium framing significantly reduces the effectiveness of the expensive glazing.

DIFFERENT KINDS OF GLAZING

Single glazing has been standard in Australian housing for as long as Australians have built houses, however it is not suitable in cold climates like Googong. Glass has minimal insulation properties, so single glazed windows are roughly the same temperature as the outside air. As a consequence, in winter single glazing creates large cold surfaces in rooms with external windows, and conduct heat out of the house rapidly, as well as creating uncomfortable convection currents. Single glazing can also cause condensation issues due to the low temperature of the glass. Single glazing typically has U-values of 5 or higher (R-values of 0.20 or lower).

Double glazing, which consists of two panes of glass either side of a gap usually filled with argon gas or a vacuum, is becoming increasingly popular in new housing and renovations in Australia. It is significantly more insulating than single glazing, and acts to keep the interior pane of glass at a temperature closer to that of the inside air, reducing conductive heat loss and the likelihood of potential condensation problems.

For maximum effect, framing of double- (and triple-) glazing should be thermally broken aluminium, timber or uPVC, and the glazing gap should be 12-16mm. Not all double glazing is equal, and there is a wide range of U-values for double glazing from 1.4-6.4 (R-values of 0.71 down to 0.16), so it is a good idea to carefully check your double glazing on WERS to make sure you are getting what you pay for: a U-value of 3.0 or lower is a reasonable expectation from double glazing.

Triple glazing is similar to double glazing except there are three panes of glass and two gaps. Like double glazing, not all triple glazing is equal: U-values range from 0.8-4.0 (R-values of1.25-0.25; an R1.25 window is incredible, but expensive! You get what you pay for in glazing). If you are going to pay a premium for triple glazing, expect a U-value of 2.0 or lower.

Secondary glazing consists of various systems used to attach a secondary window pane to an existing single glazed window, which usually involve a secondary frame or attachment via magnets. Some secondary glazing is quite effective, with U values ranging from 1.5-4.7 (R-values of 0.67-0.21).

GLAZING TREATMENTS

Low emissivity glass has a coating applied to the inside of the glazing in the factory. This helps to reflect radiant heat back into the house, improving the glazing's performance as an insulator and lowering the window's U-value. Low emissivity glass is often combined with double or triple glazing.

Tinting can be used to reduce heat gain or visible light transmittance through a window from sunlight, however it should be used with caution. External shading is often a better solution if the problem is summer heat gain. Tinting to reduce heat gain should definitely not be used on north-facing windows as that will reduce passive solar heat gain during winter. Tinting on east-, west- and south-facing windows is less problematic and can be useful in some situations.

GOOGONG Sustainable Housing
NSW GOVERNMENT
NSW Environmental TRUST
Queanbeyan City Council

WINDOW COVERINGS

It is vital to install window coverings designed for insulating to keep the heat inside, and prevent convection currents, on freezing Googong nights. There are two kinds:

1. multi-layered curtains (at least two separate layers of fabric, preferably with a layer of insulating wadding in between) with a box or blind pelmet, sealed to the architrave at the sides with velcro, and just touching the floor, so as to trap cold air next to the window, or,
2. honeycomb blinds fitted inside the window reveals and bracketed to stop air leakage.

For more detailed information: http://www.yourhome.gov.au/passive-design/glazing.