

# WINDOWS

## How do they affect your heating bills?

House design very much affects the heating system performance and efficiency. Windows are the most significant factor affecting the heating system. As heating designers and suppliers we are keen to assist in the process by producing this technical sheet explaining the effects in more detail

### Window heat gains and heat losses explained

To keep a house warm in winter a heating system has to supply the same amount of heat as is lost through the external surface of the house. It is the design of the house that determines heat loss, and therefore is a major factor in the energy used for heating and resultant energy bills. As heating system designers and suppliers we are keen to assist in the design process by producing this technical sheet explaining the effects in more detail, with the aim of helping our customer's to understand, and possibly reduce, their energy bills.



Windows are a very important part of any house for many reasons, including the solar gain which contributes significant amounts of heat to keep a house warm .

However they are also the single biggest cause of heat loss in a modern house and more heat loss means more heating is needed to keep a house warm.

The modern trend for large areas of glass will not necessarily result in low heating bills as window specifications and orientation will have a big say in how much heat the window gains relative to its heat loss.

### In Summary

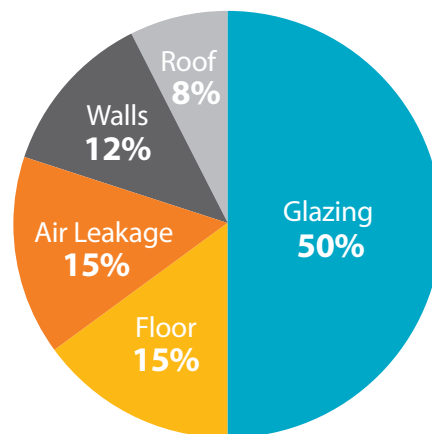
1. Windows are the biggest single source of heat loss in a standard new house.
2. Standard double glazed (DG) windows lose heat at 7 times the rate of a standard insulated wall
3. Even high spec double glazing loses heat faster than an uninsulated weatherboard wall
4. In the winter it is dark for 2/3 of the day during which time a window only loses heat
5. Complex house shapes result in parts of a house shading windows on other parts, greatly reducing passive solar gain.

## Where is heat lost in a new house?

The Building Research Association of New Zealand (BRANZ) estimate that 50% of the heat lost from a new house is through the glazing even though almost all new houses are double glazed and glazing is only around 40% of wall area.

This is to be expected when you consider that standard double glazing loses heat at seven times the rate of a standard insulated wall.

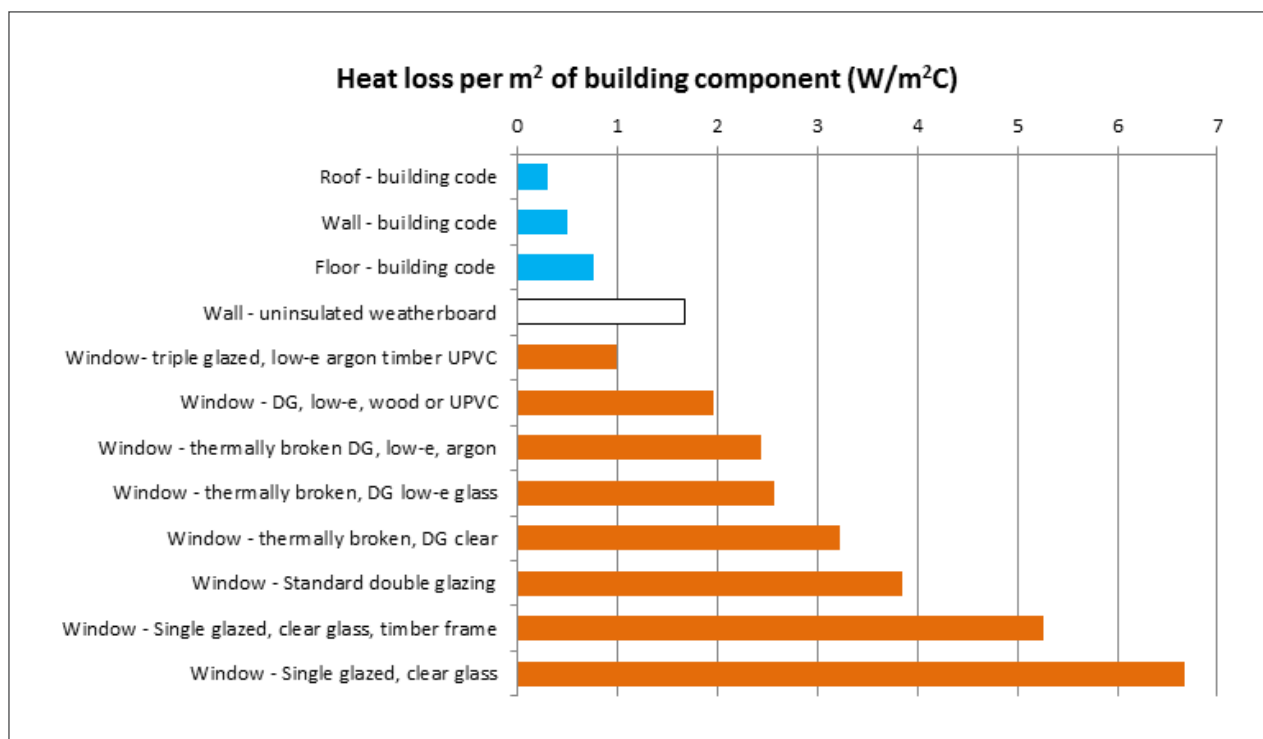
Greater heat loss results in more heat being needed to keep a house warm, and consequently bigger energy bills for heating



Sources of heat loss in a new house.  
(From Build magazine, issue 117, BRANZ April 2010)

## Why are windows the main source of heat loss in a new home?

The graph below shows types of window or wall, floor, roof, and indicates heat loss per square meter ( $m^2$ ) – the longer the line the greater the heat loss.



DG = double glazing; all window frames aluminium unless otherwise stated.

## Curtains

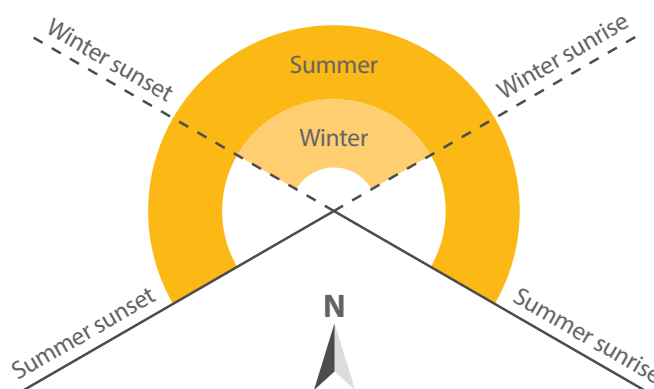
Curtains will reduce heat loss through a window. How much is highly dependent on how well they prevent air circulating around the window. (Consumer March 2015). BRANZ used to estimate that curtains would increase the R value of a window by 0.05 but haven't published figures in recent years.

## Passive solar gain

Windows provide many important functions in a building including being a main source of heating due to solar gain. Many new houses use floor to ceiling glass, sometimes along whole walls and around most of a room, and it is widely believed this will result in a reduction in heating bills.

Solar gain occurs when sunlight comes through a window and is turned into heat when it falls on a surface inside the building. However the amount of solar gain varies hugely according to:

1. **Hours of the day the sun is up** – which is around 9 hours out of 24 in the winter. To heat a building entirely by solar gain means the sun has to provide enough heat to both heat the building during daylight hours and store enough in the fabric of the house to continue heating it over the long cold winter nights during which time the outside temperature is continually falling until dawn the next day.
2. **The angle of sun on the window** – which is actually better in the winter as it is lower in the sky and generally windows are vertical. However as air temperatures are lower in the winter more heat is needed by a building to maintain a comfortable temperature. (Even small amounts of solar gain in the summer can lead to over-heating as the outside air temperature is already at comfortable levels.)



Wellington sunlight info	Sun rise	Sunset	Day length	Night length	Sun up direction	Sun down direction	Maximum height above horizon
<b>Mid-winter day</b>	07:47	16:58	9 hrs	15 hrs	59°	301°	72.2°
<b>Mid-summer day</b>	05:44	20:53	15 hrs	9 hrs	123°	237°	25.3°

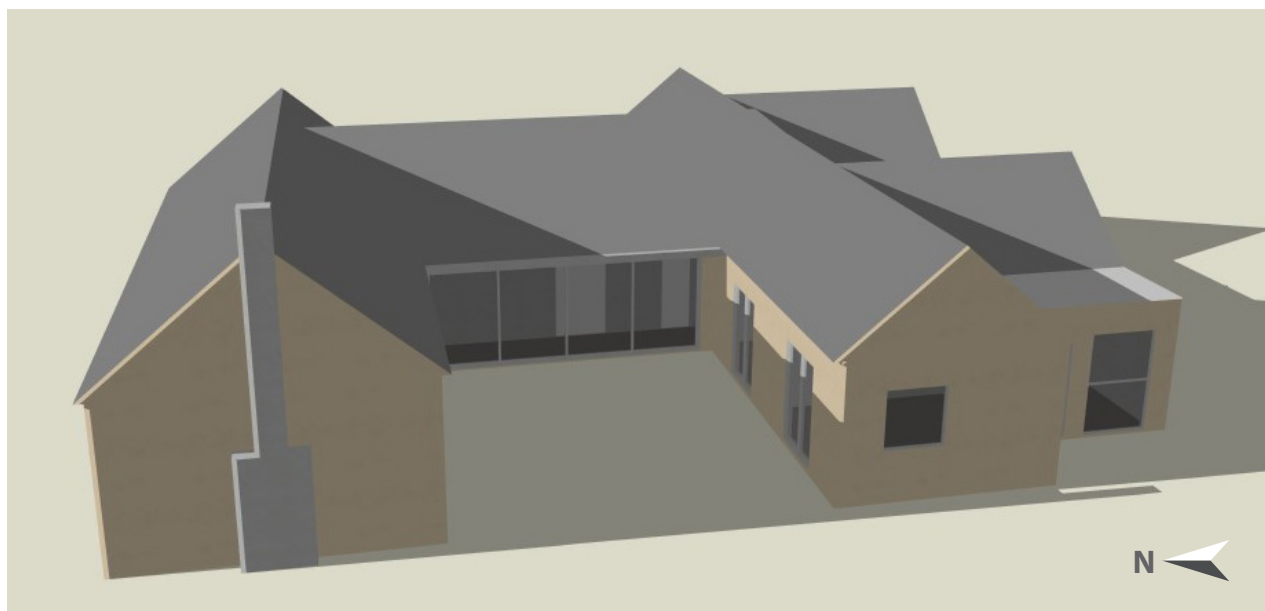
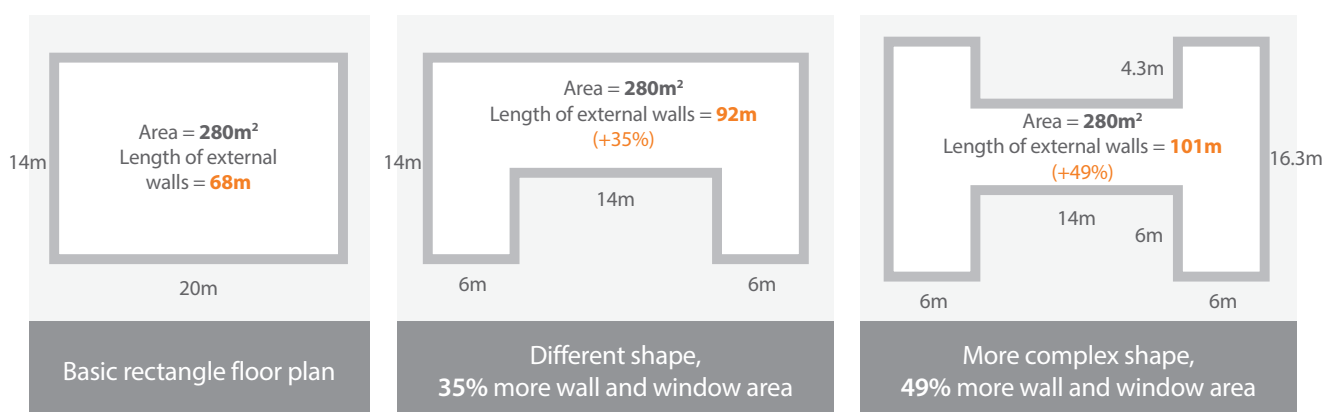
3. **Direction windows face** – North is best; East or West facing will only get half the sunlight available in a given day; and in the winter South facing windows will get no solar gain, they only lose heat.
4. **Shading from other parts of the same building**, including eaves that shade the top of windows even in the winter when the sun is low in the sky. Anything other than a simple rectangular floor plan will have structures that shade other parts of the building.
5. **Shading from other buildings and trees etc.** – in the winter the sun is much lower in the sky meaning nearby buildings, trees and fences will cast a much longer shadow.

## Building shape impact on solar gain and heat loss

Many architecturally designed buildings are more complex in shape, often having a couple of wings around a courtyard area, or the current trend which is to have separate living and sleeping areas connected by an enclosed corridor, often with glass walls.

This means 50% or more wall and window area compared to a more compact plan resulting in much more heat loss for a given floor area.

But there probably won't be 50% more solar gain as complex house shapes often result in one part of a house shading windows in another part, especially in the winter when the sun is low in the sky and shadows are much longer.



In the winter months the northerly part of this house design shades other parts behind it through most of the day as the sun is so low in the sky.

There is a lot more to passive solar design than just using lots of glass. More windows doesn't necessarily equal more solar gain, but it always means more heat loss.