

Passive solar design

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Passive solar design is about making the most of the sun's free natural energy to maximise comfort in your home.

Passive solar design can be incorporated into new homes, renovations or existing homes of all types. In some homes, passive solar design will maintain stable temperatures year-round without any need for supplementary heating or cooling. Others may need additional heating in winter - this supplementary heating will be far more effective in a home that uses passive solar design principles.

Position on site

The first step in designing for passive heating is orienting the house to take advantage of the sun. Ideally, this means getting plenty of sun in winter and in cooler climates, and less sun in summer and in warmer climates.

The home should ideally be positioned as far as possible from neighbouring buildings, terrain or vegetation that might block north sun. Bear in mind that, in winter, objects cast shadows two or three times their height. For maximum solar gain, site the home near the site's southern boundary to make as much use of the northern side of the site as possible.

Positioning the home may be limited by the site's orientation: a site that runs north-south should get sun throughout most of the day but a site that runs east-west is more likely to have its north sun blocked by neighbouring houses, depending on how wide the site is. Narrow north-facing sites may limit the placement of living areas along the northern face – the house design may need to make the most of both morning and afternoon sun in different rooms.

Orientation and room layout

The home should be designed with the main living areas facing north – anywhere between 20°W – 30°E of true north is fine. This means they will be warmed by the sun most of the time throughout the year, although they will need some appropriate shading to prevent summer overheating.

East-facing rooms get early morning sun and will be cooler in the late afternoon – these are ideal for kitchens, breakfast areas and bedrooms (fewer hot nights!).

West-facing rooms get low-angle, late afternoon sun which means they can easily overheat in summer. However, they do provide good winter heating so they can be suitable for living areas (but not kitchens where evening cooking creates heat) provided shading is used during summer.

South-facing rooms get little or no sun. Use these for utility areas such as the garage, laundry, bathroom, toilet, storage rooms and stairs, where people spend little time. This also provides a buffer for the living areas to the cooler south side of the house.

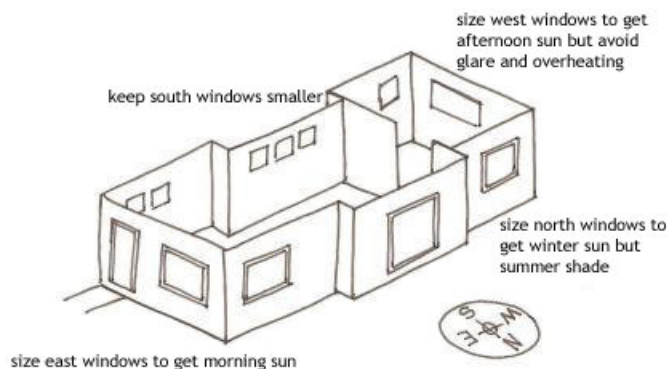


Choose a house design, or look for a new home, which faces north with living areas and lots of windows on the northern side.



Window location and size

The location and size of windows are important in passive solar design. For every square metre of glass that the sun falls on, a kilowatt of heat is generated per hour – that’s like running a heater all the time.



Source www.smarterhomes.org.nz

The majority of glazing in the house, such as windows, skylights and glass doors, should be on the northern and eastern faces to let in the sun. There should be less glazing facing west because heat from the late afternoon sun can cause glare and overheating.

South-facing windows receive daylight but minimal sun. Therefore windows on the southern side should be kept to a minimum to reduce heat loss. Aim to make them as small as possible whilst still achieving adequate daylight and ventilation.

If your client wants to capture views to the south or west, you can mitigate heat loss by using double glazing in south-facing windows or reduce glare by using tinted glass in west-facing windows.

Balancing winter warmth and summer cool

Making the most of the sun in winter needs to be balanced with not overheating in summer. Incorporate shading to make sure the home will not get too much sun in summer.

Shading should be designed to take into account the sun's path in summer and winter over the site. Sun path diagrams map the path of the sun across the sky at different times during the day throughout the year. They can help establish the position of the sun relative to a site and can be used to determine the effect of shadows cast by buildings, trees and landforms on and around the site. Sun path diagrams for New Zealand have been produced by the Victoria University of

Wellington, Centre for Building Performance (www.victoria.ac.nz/cbpr/resources/nz-sun-chart.aspx).

The sun travels higher in the sky in summer, so shading should be designed to:

- shade high-angle summer sun over north facing doors and windows
- shade low-angle summer sun over east and west facing doors and windows
- let low-angle winter sun into your home from all directions.

Eaves are a great option as well as helping with keeping rain out. The booklet *Designing Comfortable Homes* (available from the Energy Efficiency and Conservation Authority www.eeca.govt.nz) gives you information to calculate how deep your eaves need to be for winter sun and summer shade. Measurements will depend on the size, height and location of the window - as a general rule of thumb, the average window works well with a 400-500mm overhang. Think of them like the peak on your cap – shielding your eyes (and the window) from harsh overheating summer sun.

Adjustable shading provides flexibility especially where you need to deal with low-angle morning or evening sun. Options include louvres, shutters, sliding screens, awnings and removable sail shades. It is also possible to use planting with deciduous vegetation such as grapes or vines to provide protection. The leaves shade the window in summer and then when they have fallen off in winter, the sun's heat can come into the house.

Tips to maximise the sun

- Large, north-facing windows to let the sun in.
- Few and smaller south-facing windows.
- Moderately sized windows on eastern and western sides of the house.
- Keep windows clean.
- Prune trees to make sure they don't obstruct the sun in winter.
- Plant deciduous trees for summer shade, especially in places with cold winter temperatures.
- Take care that curtains aren't blocking sun during the day.

For more information:

- See Fact sheets on
 - Thermal mass
 - Keeping heat in: Insulation
 - Keeping heat in: Windows
 - Keeping cool
- The Smarter Homes website has more information at www.smarterhomes.org.nz/design/passive-heating/ and www.smarterhomes.org.nz/design/passive-cooling/
- Level also has a section on passive design: www.level.org.nz/passive-design/
- The Australian Government site, Your Home, has a section on passive design in its technical manual: www.yourhome.gov.au/technical/fs41.html