

PASSIVE SOLAR BUILDING DESIGN

Using basic elements of Passive Solar Design when building a house can result in much more comfortable and energy efficient home with lower running costs. This brochure provides an introduction to some key principles, based on the local weather and wind patterns for the Shire of Mundaring.



BUILDING SHAPE AND LOCATION

On larger lots, try to locate and orient the house for good passive solar design and fit the driveway and landscaping around it. The best shape for an energy efficient house is a long rectangle on an east-west axis, maximising the living area windows facing north. This shape also reduces the amount of east and west facing walls and windows. In summer the morning sun will quickly heat up east facing rooms, and in the afternoon west facing rooms receive intense heat through the afternoon. Windows facing east and west should be minimised and shaded.

If carports or garages can be located on the east or west side of the house they can provide some protection from summer heat. When west and east facing windows and outdoor spaces can't be avoided, deciduous trees planted to the south-east and south-west of the house can provide some shade through summer. Lawns on the south side of the house can struggle where they are shaded through winter, and do better on the north side. Plastic astroturf is not recommended as it can reach very high temperatures in summer, and has environmental impacts through its manufacture and disposal.

ORIENTATION

The first step is carefully considering which rooms should face north to make the most of winter sunlight. North facing windows into living areas will give free light and heating during the colder months, while avoiding unwanted summer sun. By orienting your main living or outdoor entertaining areas to within 15% of true North (see Figure 1 below), living areas will be naturally warmer in winter and cooler in summer and save on power bills.



SEASONAL SUN ANGLES

The sun passes overhead at different angles in different seasons. In winter the sun is lower in the sky. You can naturally heat living areas in winter by letting sunlight into the northern side of the house. Avoid putting garages, carports or verandahs on the northern side of the house that block the winter sun and keep the house colder and darker.

Local architects recommend a shade cut-off angle of 65 degrees for eaves on the north side of a house, to provide the best balance between winter sunlight and summer shade. Use the 65 degree diagonal fold line and instructions at the bottom of this page to check the shade from northern eaves onto the window or door on a section drawing. Eaves and verandahs on the east, west and south will shade the walls and windows early and late on hot summer days.

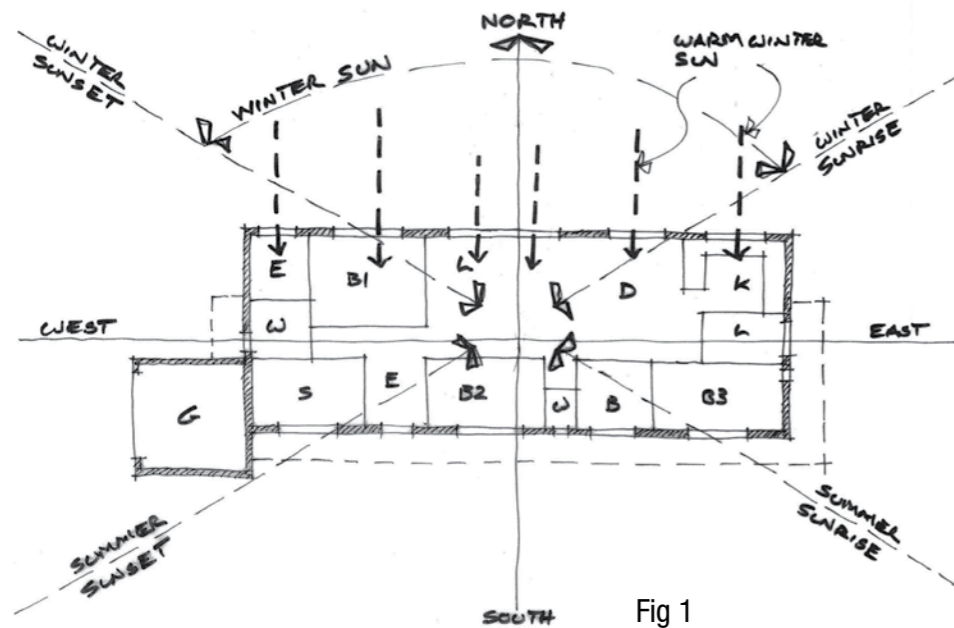


Fig 1

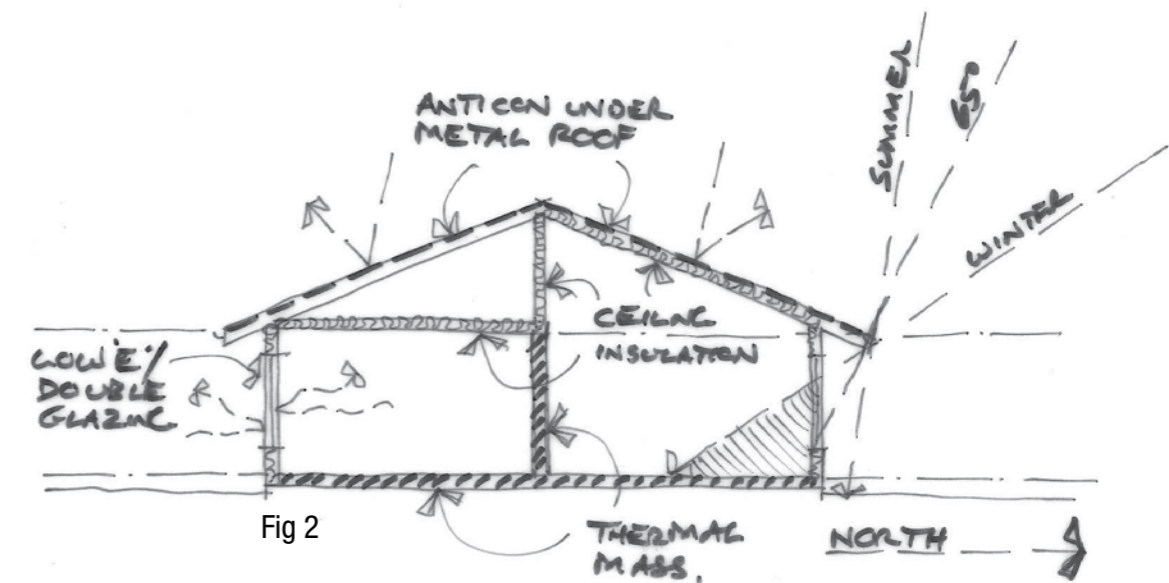


Fig 2

INSULATION

High levels of insulation is a good investment. A well-insulated house will be more comfortable throughout the year and dramatically reduce heating and cooling costs.

Under a metal roof you should use 50mm insulated foil sarking blanket, commonly known as Anticon. This stops heat transfer into the roof spaces. Anticon continued over roof ridges and under valley trays can also help keep out burning embers for houses in bushfire prone areas.

Wall and ceiling insulation bats comes in different 'R' values and the higher the R value, the better the performance (provided it's installed properly). Use thicker and higher R rated ceiling insulation. For walls and cathedral ceilings, the thickness will be limited by space – squashed insulation bats don't work well.

To check how your eaves will shade your north facing windows or doors, fold this brochure along the diagonal line. Place it over the house section / elevation drawings to check if the roof eaves align with the folded edge of the brochure (similar to Figure 2).

THERMAL MASS

Thermal mass in sustainable building design means careful use of high-density building materials (including concrete and masonry) to help moderate temperature cycles inside a building.

Internal thermal mass can smooth temperature extremes and limit heating and cooling costs. For example, a tiled concrete floor in a north facing living area will naturally warm up during a winter day. Then at night when the temperature drops, the thermal mass of the floor is gradually releasing some heat to keep the room comfortable. If correctly angled eaves provide shade from the summer sun, the slab will also stay cool and help keep the house comfortable in hot weather.

A negative effect of thermal mass can be external brick walls and tiled roofs that heat up in summer, and then radiate unwanted heat into the internal areas of the house overnight. The best approach is to build a highly insulated exterior for the building combined with good levels of internal thermal mass internally, and avoid tiled roofs.



SUSTAINABILITY TIPS

- Choose durable, low maintenance building materials
- Avoid tiled and dark coloured roofs, lighter roofs are cooler
- Solar panels will usually pay for themselves within a few years, but choose panels and suppliers with good reputations
- Water heating can be a large part of gas or electricity bills – look at a solar hot water system with a booster on a timer
- LED lights use less electricity and tend to last longer
- Ceiling fans are cheap to run
- Electric blankets can be more efficient than heating bedrooms
- Curtains with pelmet tops are much better at keeping heat in or out than blinds (except air cell honeycomb blinds)
- Check the star ratings - energy efficient appliances may be more expensive to buy but cost you less in lifetime running costs
- Plan for comfortable outdoor living areas and include herbs, edible plants or wildflower gardens in waterwise landscaping
- Don't build more than you need – you may end up compromising on quality and larger homes cost more to furnish, heat, cool, clean, maintain and insure.

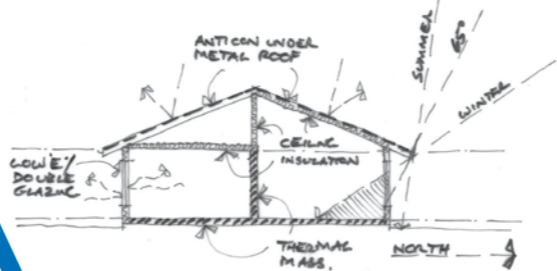


Fig 4

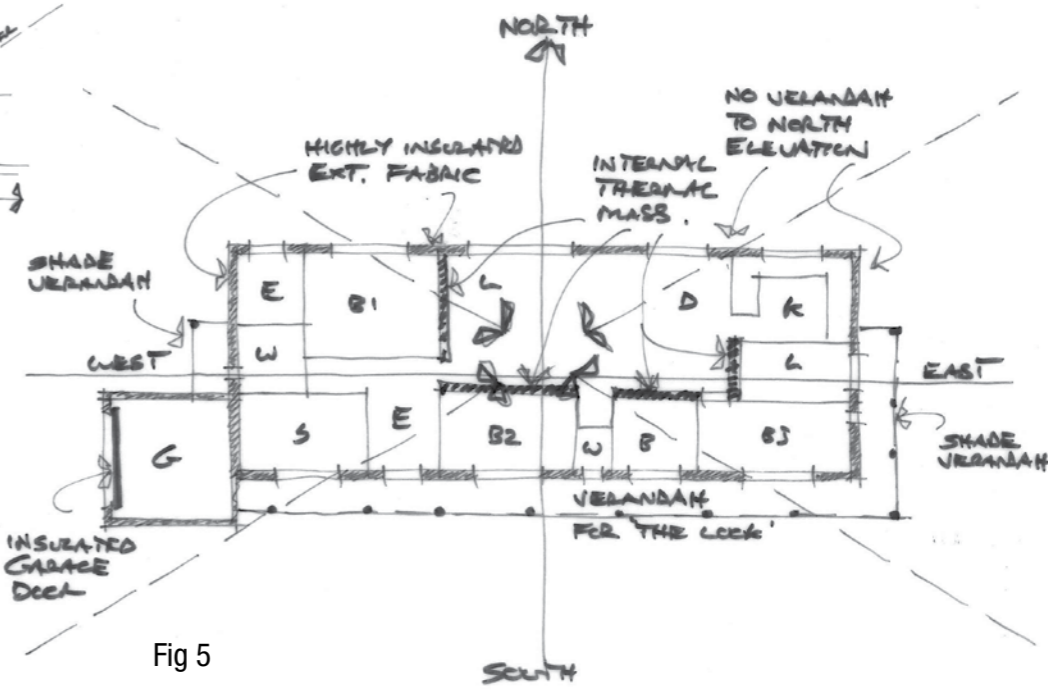


Fig 5

BALANCING ACT

Building a house often means compromising and adapting to the site. Some energy features can be retrofitted or improved after construction but others, like orienting living areas to the north, are much harder to fix. Choose a lot that will suit solar orientation if you can. If your budget doesn't allow for architectural design you might still have an architect review project home designs. They may be able to recommend simple changes to orientation, windows and eaves that will save you money on future power bills for years, as well as making your home more comfortable through the seasons.

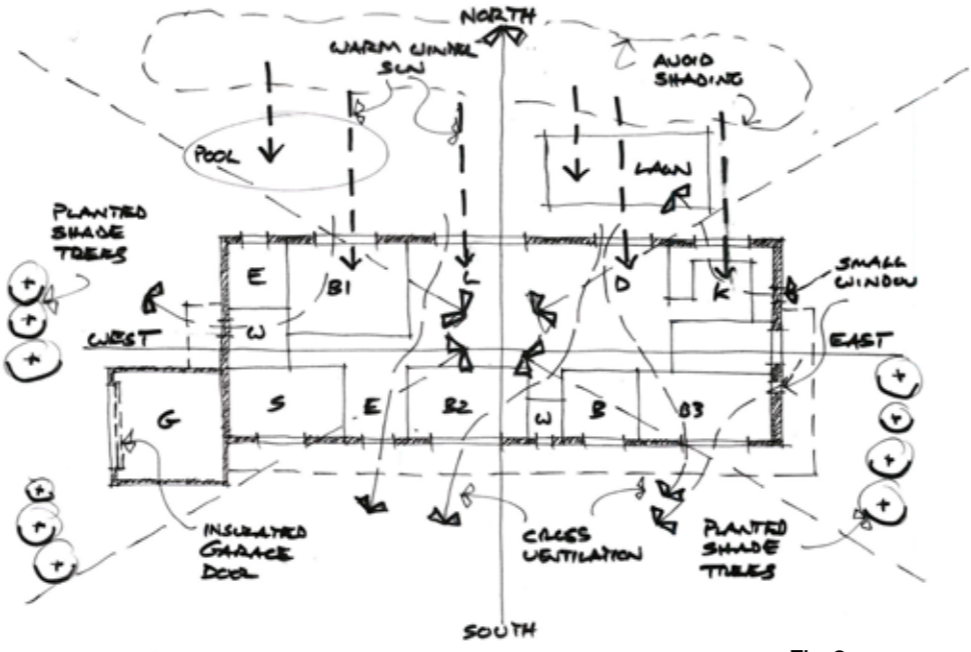


Fig 3

USE THE BREEZE

Breezes are like free air conditioning on warm evenings - open windows and create breeze pathways through the house as soon as the air outside is cooler than the air inside.

Many locations in the Shire of Mundaring will have little or no benefit from the sea breeze in summer, but can make use of cooler overnight easterlies. Open windows at night to flush out the hot stale air and cool down the interior, then close up early in the morning. At the design stage make sure your house will have windows that can open properly, and install security flyscreens so you will feel comfortable leaving windows open when you need the breeze.

Making a habit of opening and closing windows and curtains will save energy costs for artificial cooling and bring fresh air into the house.