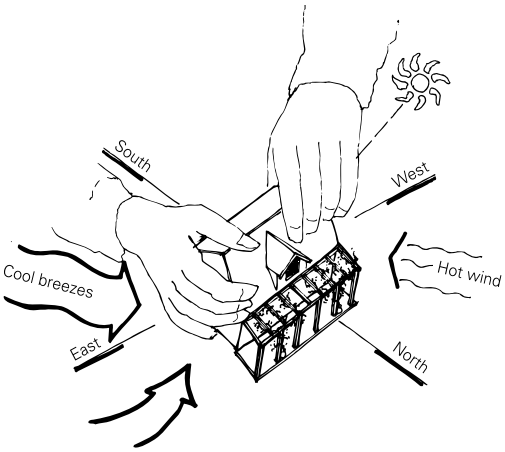
Orientation

Good orientation increases the energy efficiency of a home, making it more comfortable to live in and cheaper to run.

This fact sheet should be read in conjunction with the Passive Solar Heating and Passive Cooling fact sheets.



Principles of good orientation

With good orientation the need for auxiliary heating and cooling is reduced, resulting in lower energy bills and reduced greenhouse emissions.

Choose a site or home with good orientation for your climatic and regional conditions. Build or renovate to maximise the site's potential and to achieve the best possible orientation for living areas.

In hot humid climates and hot dry climates with no winter heating requirements, orientation should aim to exclude sun year round and maximise exposure to cooling breezes.

In all other climates a combination of passive solar heating and passive cooling is required. The optimum degree of solar access and the need to capture cooling breezes will vary with climate.

Where ideal orientation is not possible, as is often the case in higher density urban areas, an energy efficient home can still be achieved with careful attention to design. [See: Passive Solar Heating; Passive Cooling]

Deciding the best orientation

Prioritise your heating and cooling needs. Are you in a climate that requires mainly passive heating, passive cooling, or a combination of both?

If unsure, compare your summer and winter energy bills, consult an architect or designer, or refer to local meteorological records. The website for the Australian Bureau of Meteorology is http://www.bom.gov.au. [See: Passive Design Introduction]

Research of your local climate may include:

> Temperature ranges- both seasonal and diurnal.

> Humidity ranges.

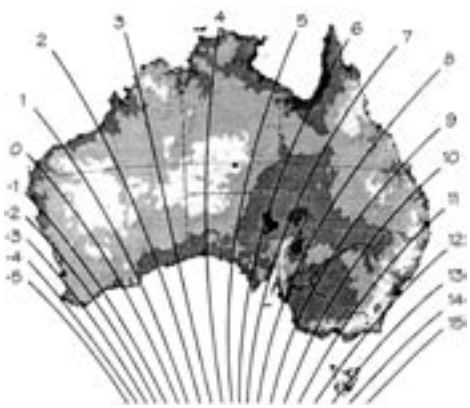
> Direction of cooling breezes, hot winds, cold winds, wet winds.

> Seasonal characteristics.

> Impact of local geographic features on climatic conditions. [See: Choosing a Site]

Observe the impact of adjacent buildings and existing landscape on your site.

Establish true or 'solar' north for your region. This is useful in all climates whether encouraging or excluding solar access. Maps and street directories can give this information. Alternatively, use a compass to establish magnetic north and then establish true or solar north by adding or subtracting the "magnetic variation" for your area using the table below.



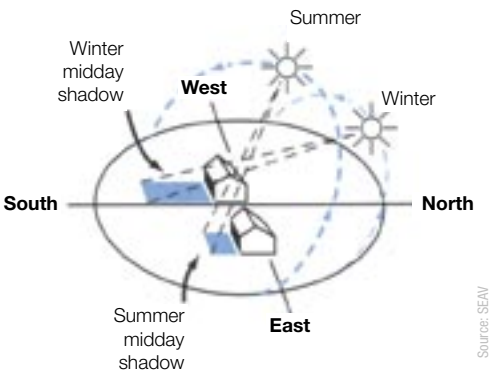
True north as degrees west of magnetic north

Courtesy Dr Holga Willrath - Solar Logic

Note that solar north deviates significantly from magnetic north throughout Australia and should be taken into account when orienting a home. All references to north in this guide are to solar north not magnetic north.

Your local council can assist you at the planning stage. Check the planning controls governing your site, for example building setbacks from boundaries and height limits, as they may affect how you build on your site.

ORIENTATION FOR PASSIVE HEATING



Source: SEAV

Orientation for passive heating is about using the sun as a source of free home heating. Put simply, it involves letting winter sun in and keeping unwanted summer sun out. This can be done with relative ease on northern elevations by using shading devices to exclude high angle summer sun and admit low angle winter sun. [See: Shading]

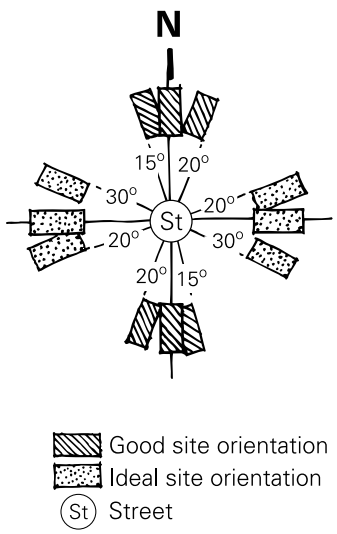
'Solar access' is the term used to describe the amount of useful sunshine reaching the living spaces of a home. The desired amount of solar access varies with climate.

Various techniques are available for measuring solar access when designing a new home or renovating, to ensure good solar access without compromising that of neighbours. These techniques include computer programs, charts and formulas. Refer to the additional key references listed at the end for further information.

Your site

You can achieve good passive solar performance at minimal cost if your site has the right characteristics. Where possible, choose a site that can accommodate north-facing daytime living areas and outdoor spaces. [See: Choosing a Site]

Permanent solar access is more likely to be achieved on a north-south block. However, on narrow blocks, careful design is required to ensure sufficient north facing glass is included adequate passive solar heating.

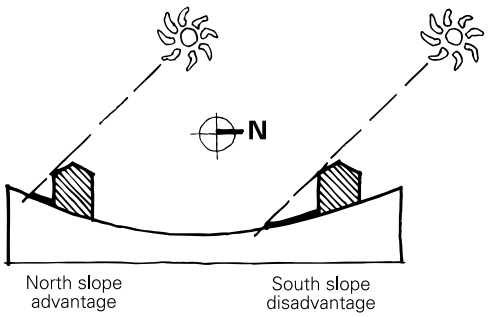


Sites running N-S are ideal because they receive good access to northern sun with minimum potential for overshadowing by neighbouring houses. In summer neighbouring houses provide protection from low east and west sun.

N-S sites on the north side of the street allow north facing living areas and gardens to be located at the rear of the house for privacy.

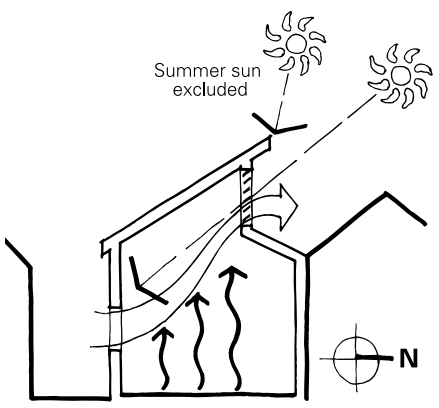
N-S sites on the south side of the street should be wide enough to accommodate an entry at the front as well as private north facing living areas. Set the house back to accommodate a north facing garden.

Sites running E-W should be wide enough to accommodate north facing outdoor space. Overshadowing by neighbouring houses is more likely to occur on these sites.



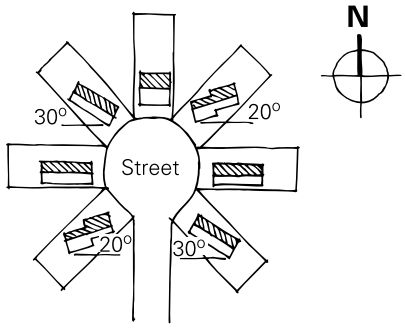
A north facing slope increases the potential for access to northern sun and is ideal for higher housing densities. A south facing slope increases the potential for overshadowing.

Views to the north are an advantage, as north is the best direction to locate windows and living areas. If the view is to the south avoid large areas of glass in order to minimise winter heat loss. West or east facing glass areas will cause overheating in summer if not properly shaded.



High level openable windows capture winter sun and create cooling currents in summer

On sites with poor orientation or limited solar access due to other constraints, an energy efficient home is still achievable through careful design. A larger budget may be required. Use of advanced glazing systems and shading can achieve net winter solar gains from windows facing almost any direction while limiting summer heat gain to a manageable level. [See: Passive Solar Heating; Glazing; Shading]



Day time living areas shown shaded

Your home

The ideal orientation for living areas is within the range 15ºW-20ºE of true or 'solar' north. (20ºW-30ºE of true north is considered acceptable).

This allows standard eaves overhangs to admit winter sun to heat the building and exclude summer sun, with no effort from the occupants and no additional cost. [See: Passive Solar Heating; Shading]

Poor orientation can exclude winter sun, and cause overheating in summer by allowing low angle east or west sun to strike glass surfaces.

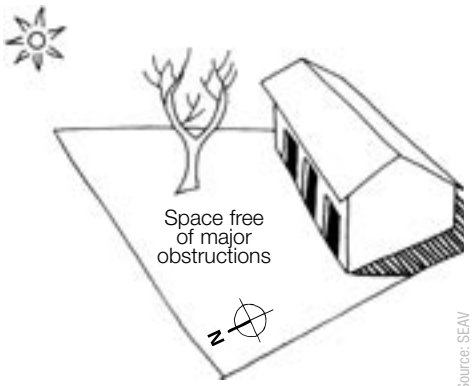
Choosing a house or unit

Look for a home which has good orientation or can be easily adapted for better orientation.

Look for living spaces with good access to winter sun. North facing living areas and balconies or outdoor spaces are ideal.

Look for a suitable area of glass on north facing walls with access to winter sun. As a general guide this should be 10-25 percent of the floor area of the room.

Check that west facing glazing is not excessive in area and is properly shaded to prevent overheating. West facing walls receive the strongest sun at the hottest part of the day.



Source: SEAV

Check that there is no significant detrimental over-shadowing by adjacent buildings and trees.

Ensure that there is year round solar access for clothes drying and solar collectors.

Choosing a project home

[See: Modifying a Project Home]

Select a design that allows living areas to face north on your site. Most project home companies will mirror or flip a design to suit your needs at no extra cost.

Check and adjust north eave overhangs for passive performance. [See: Shading]

Turn north facing verandahs into pergolas by replacing roofing material such as tiles or metal with slats or louvres, particularly over window areas.

Shade east and west facing glass by adding shade structures. Relocating verandahs and deep covered balconies to the east or west can improve shading on those elevations. [See: Shading]

Reducing the amount of south, east and especially west facing glazing, or relocating some to north facing walls often adds no cost but significantly improves performance.

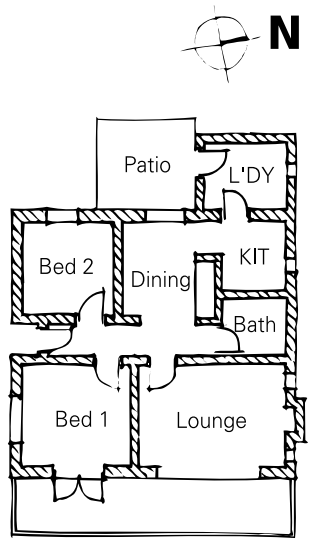
Smaller windows on south, east and west facing walls can aid cross ventilation.

Designing a new home or renovating

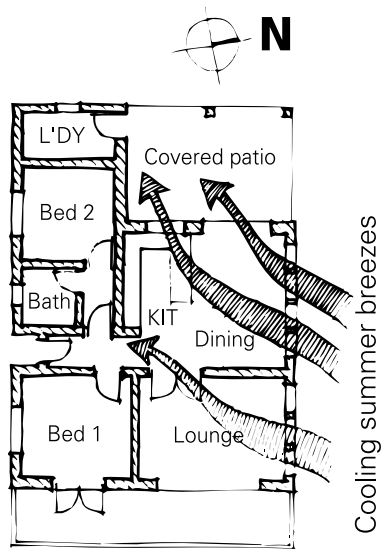
There are things you can do to maximise what your site has to offer when you build or renovate.

If renovating, check the existing floor plan. Do the living areas face the right way to take advantage of winter sun and cooling summer breezes?

It's easy to change the orientation of a house when renovating: swap room uses from one side of the house to another. Doing this enables the house to work better without necessarily becoming bigger. This saves building costs and long term running and maintenance costs.



Original floorplan



New floor plan

The diagrams above show how the layout of a house in a warm temperate climate was changed to let winter sun in and let summer breezes flow through.

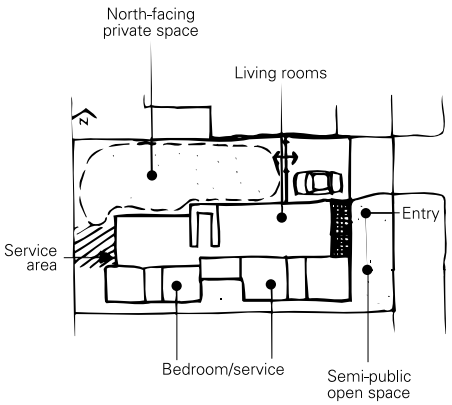
Maximise the amount of daytime living space that faces north, whether designing a new home or configuring renovations.

Provide passive solar shading to east, west and north facing elevations, particularly glass areas. Correctly designed eaves are generally all that is required to shade the northern elevations of single storey houses. [See: Shading]

Place a suitable amount of glazing in north facing walls with solar access. The glazing area should be between 10 to 25 percent of the floor area of the room, depending on climate and mass. [See: Passive Solar Heating]

Glazing on other facades should ideally be less to prevent unwanted heat loss and gain. South facing glass facilitates winter heat loss, while east and particularly west facing glass encourages summer heat gain if not properly shaded. Smaller, well shaded windows are desirable for cross ventilation.

Avoid west facing bedrooms where possible. East facing bedrooms are acceptable as they capture morning sun but remain cool on summer evenings.



Source: AMCORD

Locate utility areas such as laundries, bathrooms, garages and sheds to the south, west and east to protect living areas from summer sun and winter winds.

Maximise the distance between the house and any building development to the north. Avoid placing obstructions such as carports or sheds to the north.

Building on the south boundary (if permitted by your local council) can be useful to increase the amount of north facing outdoor space. Avoid compromising the solar access of neighbours by overshadowing.

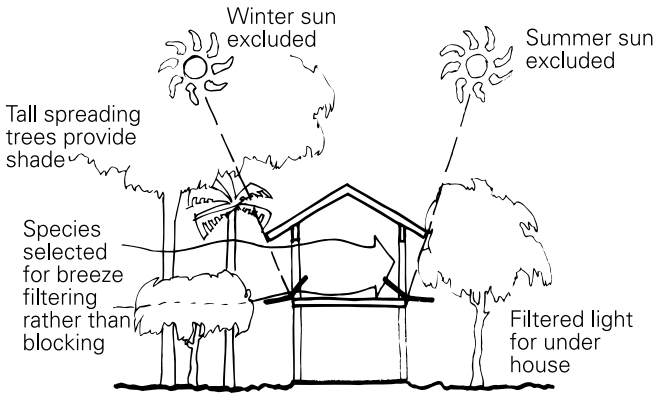
Plant shade trees in the appropriate locations. Landscaping can also be used to block or filter harsh winds. [See: Sustainable Landscape and Shading]

Prune vegetation that blocks winter sun.

Orientation for passive cooling

Good orientation for passive cooling excludes unwanted sun and hot winds and ensures access to cooling breezes. A degree of passive cooling is necessary for most Australian climates.

In hot humid climates and hot dry climates with warm winters, direct and reflected sunlight should be excluded at all times of the year. In all other climates a degree of controlled solar access is beneficial.



Your site

Look for a site with good access to cooling breezes. Ensure that landscape and adjacent buildings do not block beneficial breezes. [See: Choosing a Site]

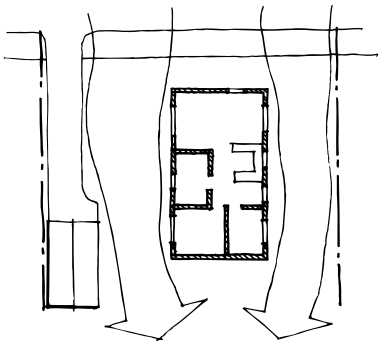
Look for a suitably shaded site. Land with a south facing slope will provide increased shade.

South is a good direction for views, as south facing windows require no shading from direct sun, or minimal shading above the tropic of Capricorn.

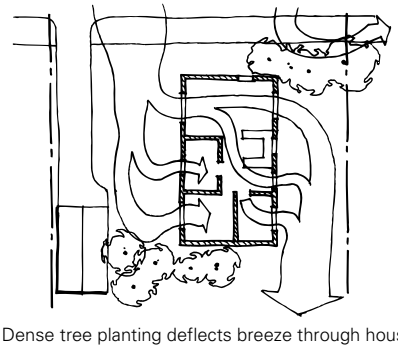
Solar access is beneficial for solar collectors, clothes drying and vegetable gardens in all climates.

On sites with poor orientation or no access to cooling breezes an energy efficient home is still possible with good design. Use high level windows and vents to create convection currents for cooling in the absence of breezes.

Landscape and building form can be designed to deflect and control the flow of breezes or to block unwanted sun. [See: Passive Cooling; Shading; Sustainable Landscape]



Prevailing breeze flows past house



Dense tree planting deflects breeze through house

Your home

Choose or design a home with maximum exposure to cooling breezes and limited or no exposure to direct sun (depending on climate). Use careful design to improve performance in the case of poorly oriented sites or existing homes. [See: Passive Cooling]

Security and noise can be an issue in many locations. Use security screens over openings to allow effective ventilation without compromising safety. In high noise areas early evening is a good time to ventilate the house. By night time the house has cooled and openings can be closed for a better sleep.

Choosing a house or unit

Look for a home that has good orientation or can be easily adapted for better orientation.

Look for a home that is well shaded and facilitates the flow of cooling breezes through it. [See: Passive Cooling]

Narrow, elongated buildings facilitate passive cooling. Ideally the long elevation should open up to cooling breezes.

Avoid large, exposed areas of west facing wall if possible as they receive the strongest radiation at the hottest part of the day.

Open plan internal layouts facilitate ventilation. Homes of one-room depth are ideal.

Windows should be openable and located on more than one side of a room to improve ventilation.

Outdoor living areas such as courtyards, verandahs and balconies should be suitably shaded.

Choosing a project home

Select a design that can be positioned on your site to capture cooling breezes, particularly to living areas. Avoid large areas of west facing windows.

Most project home companies will mirror or flip a design to suit your needs at no extra cost.

Moving windows or doors from one elevation to another to capture cooling breezes often adds no cost but makes significant improvements to performance.

Avoid windows with fixed glass. Ask for windows with a significant openable area for ventilation.

Ensure that all openings are suitably shaded. Use landscape as an effective means of providing additional shade. [See: Shading]

Ask for eaves to be included if the design has omitted them.

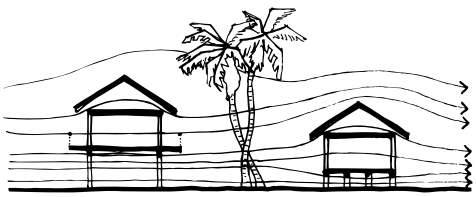
Designing a new home or renovating

There are things you can do to maximise what your site has to offer when you build or renovate.

If renovating, check the existing floor plan. Is the house configured to capture cooling breezes and let them flow through? It's easy to change the orientation of a house and the location of door and window openings when renovating.

Doing this enables the house to work better without necessarily becoming bigger. This saves building costs and long term running and maintenance costs.

Provide an appropriate level of shade and locate openings in the direction of cooling breezes. Shade the entire building in hot humid climates and hot dry climates with warm winters. [See: Passive Cooling]



Design narrow, elongated building forms for best performance, with the long elevations opening up to cooling breezes. Elevating the house so that air can circulate beneath it will also assist performance.

Use landscape and building form to deflect cooling breezes into the interior and to exclude undesirable hot winds. Make use of shade or windbreaks provided by adjacent buildings or existing landscape.

Design extensions to open to cooling breezes, particularly if they are living areas.

Avoid large areas of exposed west facing wall.

East and west facing openings receive the strongest sun and are the most difficult to shade. Keep their size to a minimum if this does not compromise cooling by ventilation. Alternatively, ensure they are well shaded.

Ensure adequate north eaves overhangs, plus south eaves overhangs above the Tropic of Capricorn. [See: Shading]

Design open plan interiors to facilitate ventilation. Homes of one-room depth with openings either side are ideal.

Design and position openings to control air flow. Use clerestory windows, roof ventilators, and vents in ridges, eaves and ceilings to create convection currents to cool the house in the absence of breezes. [See: Passive Cooling]

Install windows that can be opened for maximum ventilation. When renovating, replace fixed windows with systems like casement windows or louvres.

Add additional small windows to rooms with only one window to improve ventilation.

Use vents above or in internal doors to facilitate cross ventilation.

Ensure outdoor living areas are shaded. Covered balconies and verandahs can be useful additions, providing shaded outdoor living space. Use landscape to provide additional shade.

ADDITIONAL KEY REFERENCES

- *BDP Environmental Design Guide*, RAIA
- *Energy Efficient Housing Manual*, Energy Victoria
- *AMCORD*, Commonwealth Department of Housing & Regional Development
- *Warm House, Cool House*, Hollo, N
- *Sunshine & Shade in Australasia*, Phillips, R.O
- *Site Planning in Australia*, King, Rudder Prasad, Ballinger 1996
- *Energy Efficient Australian Housing*, Ballinger *et al* 1992
- *Energy Efficient Building Design Resource Book*, Brisbane Institute of TAFE

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