



Cool Homes

Smart design for the tropics

How cool are you?

Use this checklist to help you create your own cool home. Does your design incorporate the following features?

Orientation and shading

- ☐ House orientated with the long axis running east to west to minimise the wall area exposed to morning and afternoon sun.
- ☐ A cool open plan living area to the north, away from the summer sun.
- ☐ Generous eaves (minimum 800mm) to shade walls and windows.
- ☐ Verandas, external shading devices, trees and shrubs to shade walls and windows, particularly on east and west.
- ☐ Any windows exposed to the sun tinted to keep out the heat.

Ventilation

- ☐ An open plan design with minimal hallways and fewer internal walls for good cross ventilation.
- ☐ Natural air-flow encouraged by use of large, wide opening windows and doors.
- ☐ A minimum of two openings in each room for cross ventilation.
- ☐ Windows and doors placed to capture prevailing south-easterly and north-easterly winds.
- ☐ Roof cavity ventilated with roof and eave vents to reduce heat build-up.

Building materials and colours

- ☐ Lightweight building structures used as they cool quickly at night.
- ☐ If using concrete block walls ensure these are well shaded to keep them cool.
- ☐ Light colours selected for roof and walls to reflect the heat.
- ☐ Low emissions paints and cabinetry chosen as they are healthier for your family with little or no added cost.

Insulation

- ☐ Roof system with reflective foil and bulk insulation to keep your roof cool.
- ☐ Lightweight walls insulated with reflective foil and bulk insulation to keep out the heat.

Outdoor rooms

- ☐ Functional outdoor living areas created that are weather proof, well ventilated and centrally located.
- ☐ Courtyard spaces between pavilions incorporated to create useable outdoor areas and provide access for breezes to enter the home.
- ☐ Outdoor spaces linked to internal living areas with large bi-fold or sliding doors to bring the outdoors in.

Energy savers

- ☐ 100% energy efficient lighting selected.
- ☐ Energy efficient appliances selected to save on running costs.
- ☐ Energy efficient pool pump and filtration system selected to reduce your pool running costs.
- ☐ Large ceiling fans selected to reduce the need for air-conditioning.
- ☐ Solar power and solar hot water selected to access free energy from the sun.

In the garden

- ☐ Garden plan developed to compliment your home design.
- ☐ Vegetation incorporated into design to shade your roof and walls and direct breezes into rooms.
- ☐ Native plants planned in the garden to reduce the need for watering and to attract native fauna.
- ☐ Veggie garden incorporated into plan to provide the family with nutritious fresh food.
- ☐ Rainwater tank included to provide water for the garden and to fill the pool.

Reach for the stars

- ☐ Talk to your designer or builder about how you can increase the energy star rating of your home by incorporating the above features.



Contents

How cool are you?	2
Why build a cool home?	4
Orientation and shading	8
Ventilation	12
Building materials and colours	15
Insulation	17
Outdoor rooms	19
Energy savers	20
In the garden	24
Reach for the stars	28
Appendix: Additional resources for a sustainable home	29

NOTE

In this guide the term 'designer' refers to the architect or building designer.

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Why build a cool home?

A cool home keeps out the heat and invites in the breeze, so you can live comfortably for less

Are you building, buying or renovating a home?

Getting the design right is essential in our tropical climate. If your home is not designed for the climate you run the risk of having a hot home that is expensive to keep cool, particularly over the long hot summer.

Your home is likely to be the biggest investment you will ever make. This is why it is important that you think about how you can increase the value of your home, save money on running costs and most importantly have a home that is comfortable to live in.

A cool home can achieve all this without costing much more than a standard home. You can also feel good knowing that you have reduced the demand on resources and reduced your environmental footprint.

This guide has been prepared to help you work with your architect/designer and your builder to incorporate tropical design features into your home, from the contemporary block home to the popular 'Queenslander' and anything in-between. Whether you are building a new home or renovating your existing home, the information in this guide can help you create your own cool home.



Far North Queensland climate

The Cairns region has a wet season which runs from December to April and a dry season from May to November. Cairns experiences prevailing north and north-easterly breezes during the hot summer wet season and the prevailing south and south-easterly trade winds all year around.

During the summer months the region experiences temperatures between 23-31° and high humidity. This can create uncomfortable living conditions and make it difficult to keep cool in the home. It is therefore extremely important to design homes that keep out the heat and maximise opportunities for cooling breezes.



Hot summer wet season

Sun Rises in south-east and sets in south-west, higher angle

Breezes North to north-east, south to south-east, some easterlies

Warm winter dry season

Sun Rises in north-east and sets in north-west, lower angle

Breezes South to south-east, some easterlies

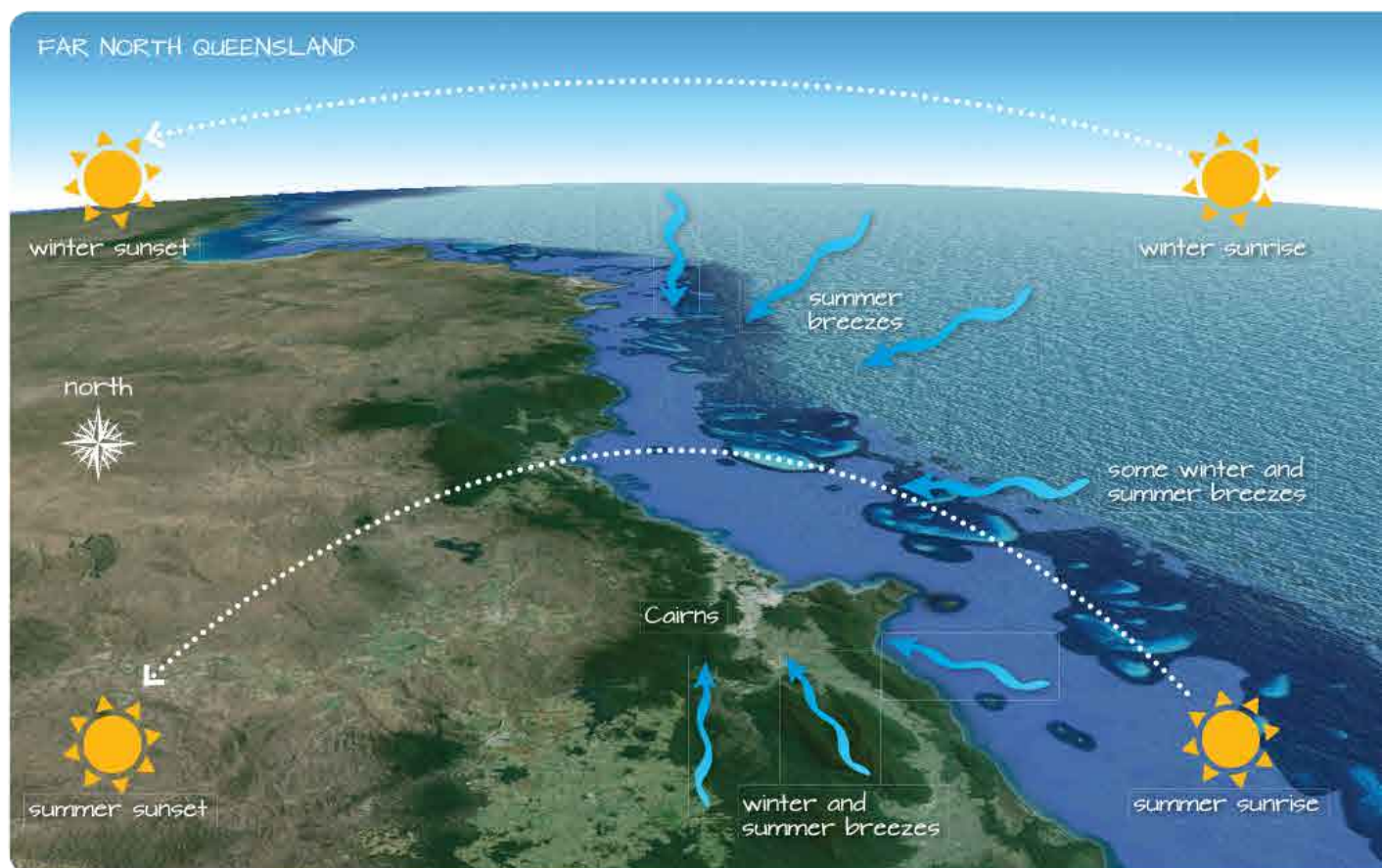


Figure 1: Local sun and wind conditions. Image: Google Earth†

The information in this guide applies to the coastal areas of Far North Queensland.

† Image Landsat, Data SIO, NOAA, U.S. Navy, NGA, GEBCO; Data LDEO-Columbia, NSF, NOAA



A cool home can look like any other home, except for the power bill

Tropical Green Building Network

Designing the cool home – passive design

By designing your home with an awareness of the local sun, wind and temperature conditions you can maintain comfort and reduce or eliminate the need for air-conditioning. This is known as passive design.

Orientation, building shape, shading, ventilation and material selection are key components of passive design. The following sections will provide you with some great tips on how to design your cool home using these features.

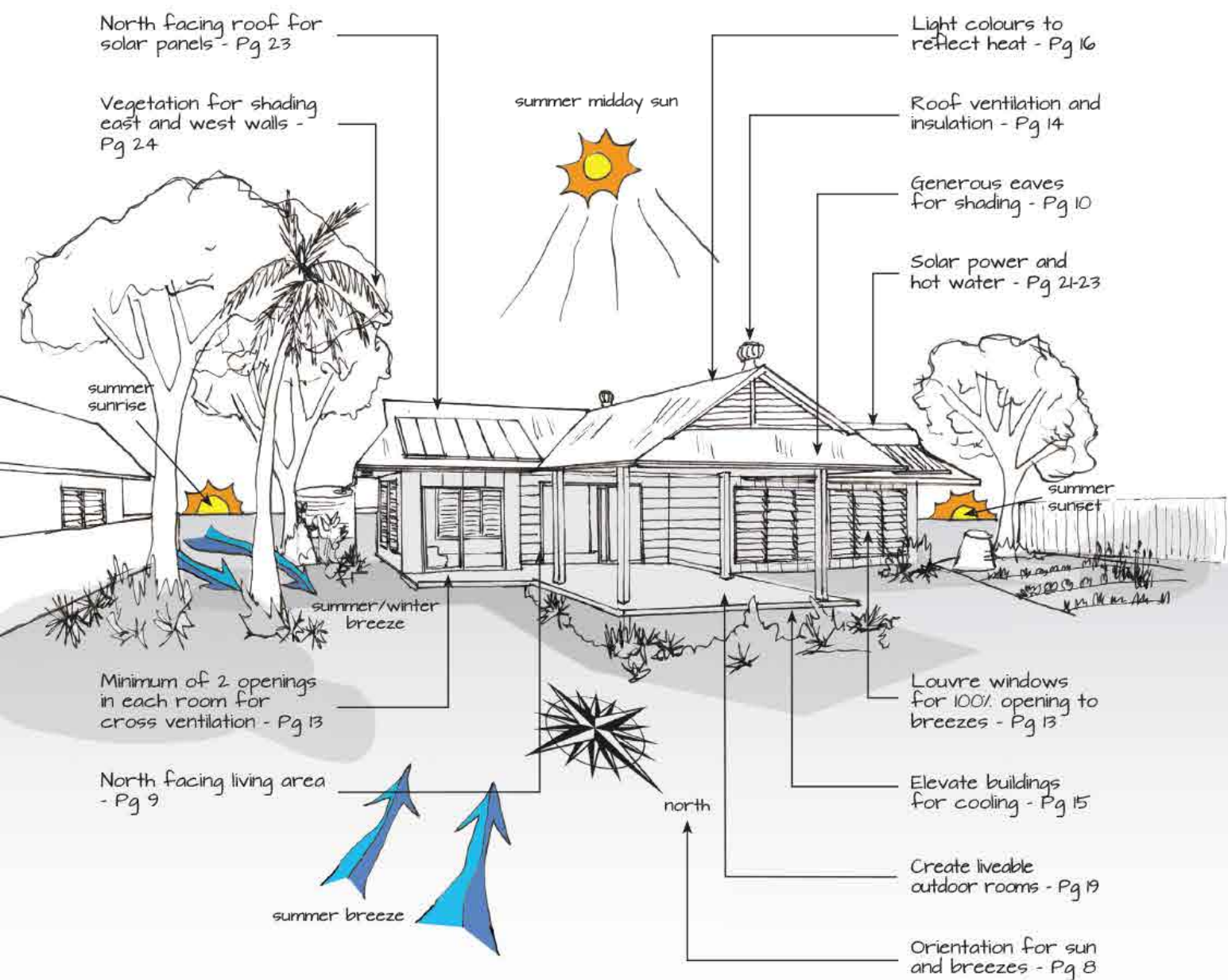


Figure 2: Designing your cool home





Chris Vandyke Designs, Photo: Sean Reason



Choosing a designer or builder

- Having your house designed by a suitably skilled architect or building designer will ensure that your biggest investment is designed for the tropics.
- Check the credentials of your architect or building designer to see if they specialise in sustainable design and ask if they have any additional qualifications in this area.
- Choose a green builder who specialises in sustainable building. Many are accredited Housing Industry Association (HIA) GreenSmart Professionals or are part of the Master Builders' Green Living program.
- Ask your builder or designer if they can work with you to incorporate some of the suggestions in this guide to create a cooler, more comfortable home.

For architecture, building design and building associations' websites refer to the Appendix on page 29.



Orientation and shading



Cool idea

Good orientation and shading are essential to keep out the summer heat. Orientate living areas to the north and shade your home with verandas or minimum 800mm eaves.

Designing your home for the best solar orientation and providing shading is essential to keep out the heat. By applying the principles below you can create a cool and comfortable home.

Orientation

If possible, choose a block of land that allows you to design a home with the shorter walls facing east and west (long axis east to west) to minimise heat gain from morning and afternoon sun. It is best if your block allows you to design a home that has cool living areas to the north, away from the summer sun.

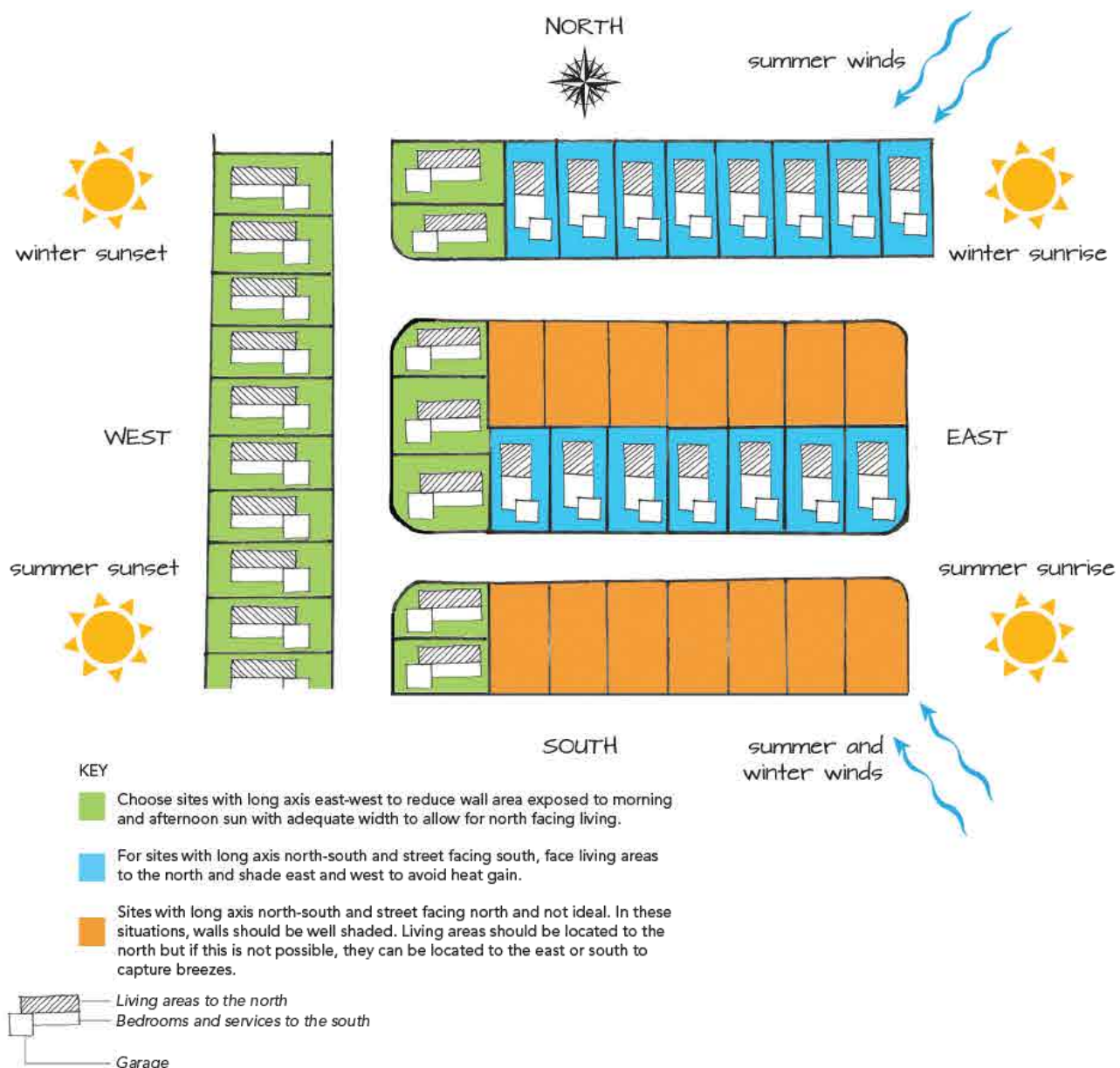


Figure 3: Select land that provides the opportunity to incorporate a north facing living area



The diagram below shows the ideal orientation of your home to keep out the summer sun and let in the breezes.

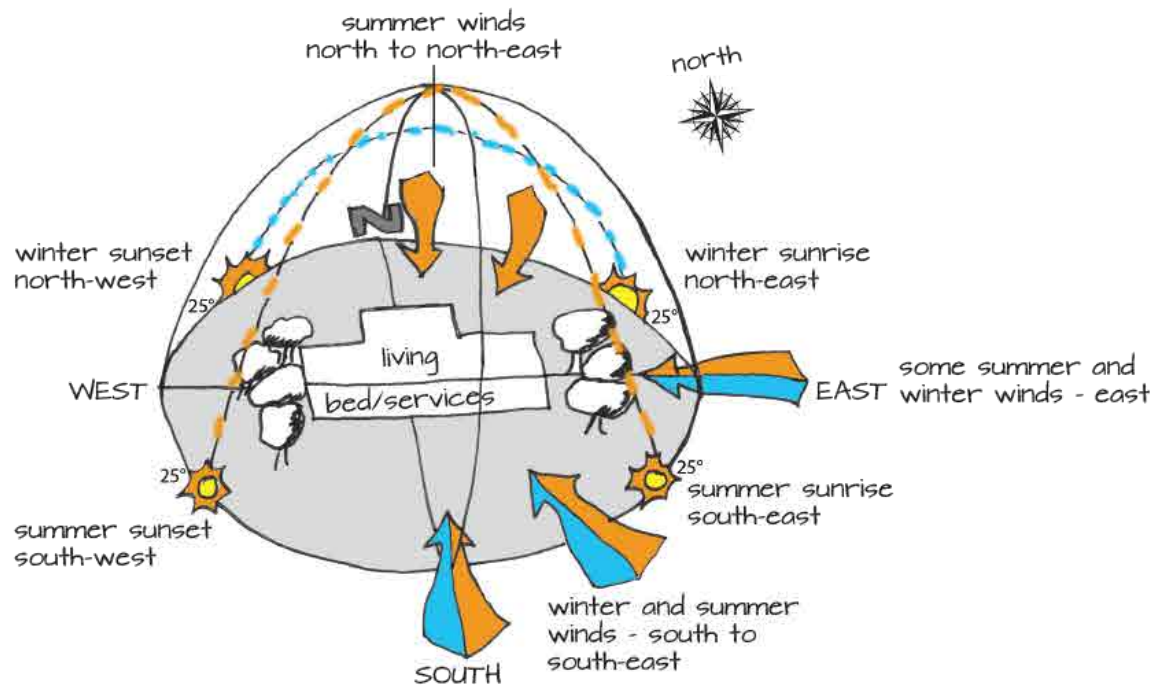


Figure 4: Local site climatic features and recommended house orientation for the Cairns region

Ideally living areas should be located to the north and bedrooms and services to the south. Garages and storage areas can be located adjacent to, or adjoining east or west walls (ideally south-west) to shield the main house from the sun.

It may not always be possible to design for the ideal orientation. In these situations it is important to ensure that you provide adequate shading and opportunities for ventilation to keep your home cool.





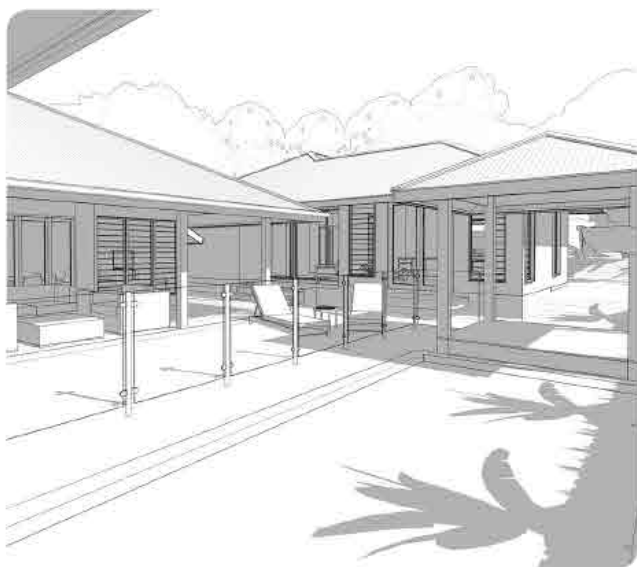
Cool idea

Tint any windows exposed to the sun. Ensure that you choose an effective tint that keeps out the heat but is not so dark that you have to use artificial lighting in the daytime.

Shading

Shading keeps your home cool by preventing materials from heating up and heat entering through glass windows and doors. You can shade your home using generous eaves, verandas, vegetation and external shading devices.

- Make sure your eaves are at least 800mm wide which will help ensure they shade walls and windows from hot sun in the middle of the day. Ensure eaves are not located too far above windows so they can keep out the sun.
- Large verandas provide deep shade for cooler living areas.
- Your home can also be shaded using vegetation, screens, shade sails or other external shading devices to keep out the heat. This is particularly important on the east and west sides of the house which will get low morning and afternoon sun.
- If building with concrete block it is essential that walls be well shaded. If not they can act as a heat sink and emit heat into the home well into the night. See Figure 8, page 15.
- Planting shady trees around your home will reduce heating of external surfaces, especially concrete, and avoid the heat entering your home.



Chris Vandyke Designs



Awnings and generous eaves can shade walls, Belinda Allwood



Buying off the plan

If buying off the plan, choose a design that incorporates passive design principles or talk to your builder about altering standard designs to create a cool home. Changes can be as simple as thinking about where rooms or windows are positioned or increasing eaves. Many improvements can be made without incurring additional construction cost.

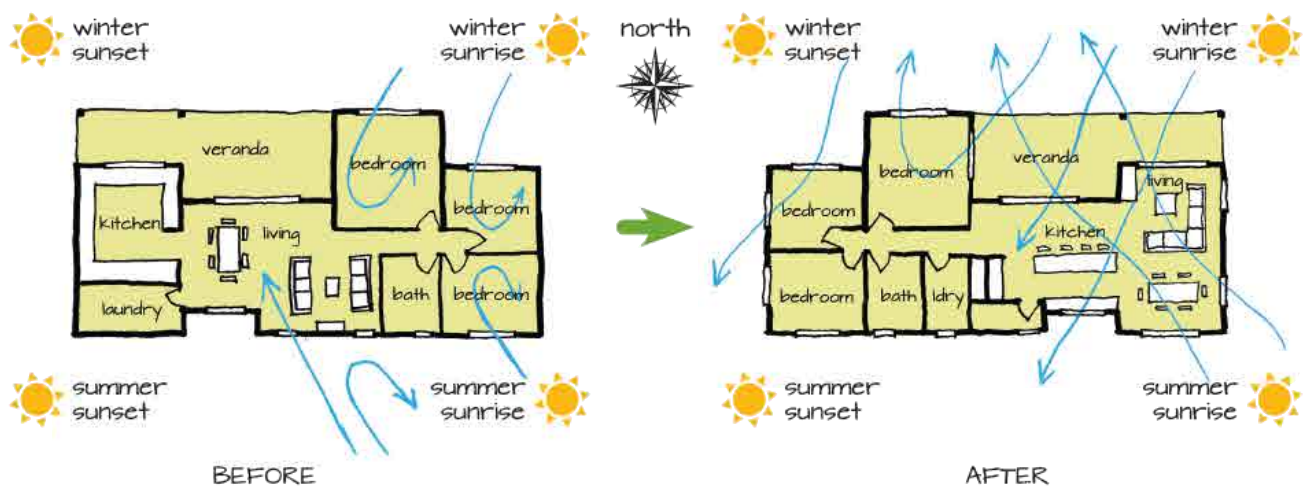


Figure 5: Improvement of orientation through minor changes and mirroring the house plan

The liveability of this home has been dramatically improved by mirroring the standard floor plan to allow for correct orientation for sun and breezes. Other improvements include removing internal walls in the living area, adding a few windows and moving the laundry out of the breeze paths. These minor changes will make this home cool and comfortable reducing the need for artificial cooling.



Ask your designer or builder to:

- Orientate your home on your block of land with the shorter walls facing east and west and living areas facing north.
- Locate bedrooms and services to the south as these rooms are used less often during the day.
- Increase your eaves to a minimum of 800mm.
- Shade east and west walls with external shading devices, verandas or vegetation.
- Tint any windows exposed to the sun.



Ventilation



Cool idea

If buying off the plan choose an open plan design and check that windows are located on the windward side of the building. Make sure breezes are not blocked by garages, bathrooms or laundries.

Inviting air movement into your home is essential to staying cool and reducing the effects of high humidity, particularly during summer. Maximising the benefits of ventilation involves designing for prevailing winds, locating windows in breeze paths, utilising cross ventilation, using roof ventilation to draw in cool air and release hot air. It is also important to ensure the shape of the building allows for good internal ventilation to keep your home cool.

What shape should my home be?

To capture breezes and stay cool, it is best to design a narrow or pavilion style home. This maximises the opportunity to install windows and doors to bring in cool air and open indoor areas on to outdoor spaces. Courtyard spaces are excellent as they can direct breezes into internal areas. It is important to ensure that breezes are not blocked by internal walls or hallways. If possible choose high or raked ceilings to improve natural cooling.



Pavilion style homes have more windows to let in the breeze, Total Project Group Architects

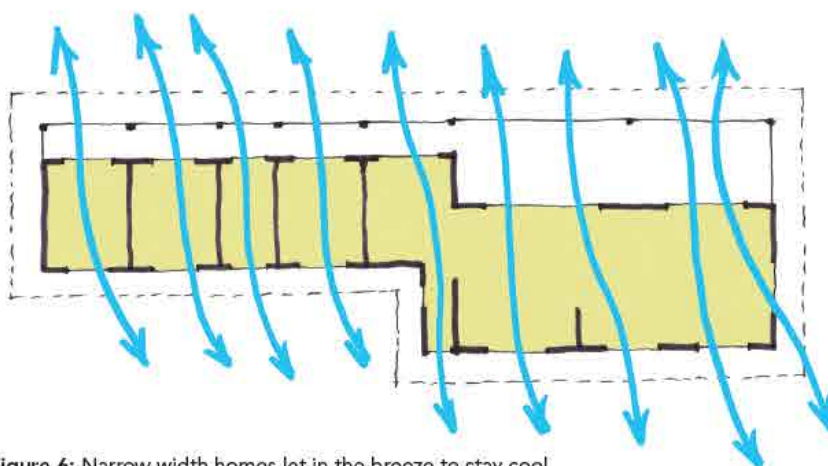


Figure 6: Narrow width homes let in the breeze to stay cool



Narrow homes work well in the tropics, Sunbird House, Studio Mango



Cross ventilation

- Maximise cross ventilation opportunities by designing an open plan home. Minimise internal obstacles to breezes such as hallways and internal walls.
- Locate service rooms and garages out of breeze paths.
- Allow enough room on site for breezes to enter windows and doors (i.e. Don't locate your home against a boundary fence to the south-east).
- Where possible, elevate your home to allow breezes to flow underneath it.
- Windows and doors can be kept open at night to bring in cool air and release heat that has built up during the day.



Cool idea

Choose windows and doors that allow maximum opening to let in more breeze. Louvres, casement windows and bi-fold doors are good options.



Louvres can promote ventilation and allow breeze through 100% of the opening, Chris Vandyke Designs

Windows and doors

- Maximise the number of windows on the windward sides of your building particularly to the south and south-east (winter and summer breezes) and north and north-east (summer breezes).
- Include a minimum of two openings in each room to allow for cross ventilation.
- Select window and door types that let in more breeze. Louvres allow 100% of the breeze through the opening. Other good options include casement windows, bi-fold doors and windows and large stacker sliding doors.
- Link outdoor spaces to internal living areas with large bi-fold or sliding doors to bring the outdoors in.
- Heavy curtains and blinds can block breeze paths so choose venetian blinds or timber or aluminium louvres as an alternative.
- Install insect screens so the breeze can enter without the bugs.



Create openable walls to let in the breeze, Cairns Road Residence, People Oriented Design





Clerestory windows, CA Architects



Ridge roof ventilator, R.V. Roof Ventilator



Pop up roof ventilation, Total Project Group Architects

Roof ventilation

- Ventilate the roof cavity with roof and eave vents to reduce heat build-up and cool your home. See Figure 7.
- Eave vents work best when located in shady areas (e.g. north side of building or shaded by vegetation) as the air that is entering your roof will be cooler.
- Use clerestory windows with high ceilings to release heat from inside the home.
- A good roof ventilation system helps to reduce moisture and mould.

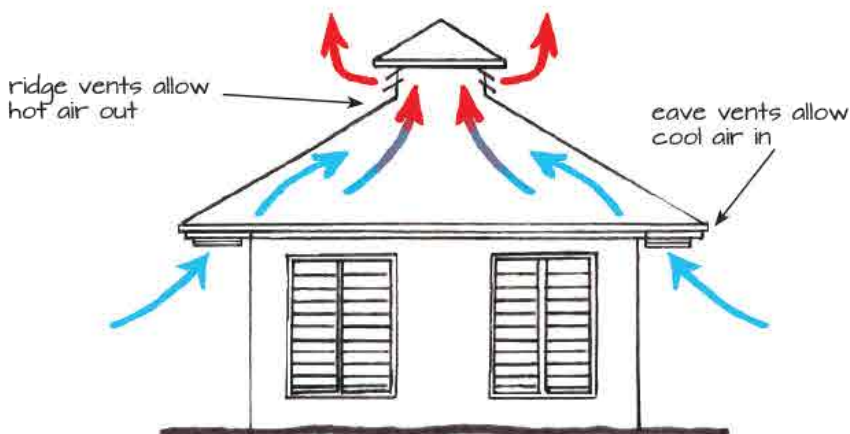


Figure 7: Eave vents used in combination with ridge vents work well to cool the roof space



Ask your designer or builder to:

- Promote cross ventilation by designing a narrow or pavilion style home.
- Create an open plan design with fewer hallways and internal walls for good ventilation.
- Incorporate courtyard spaces to create access for breezes.
- Maximise wide opening windows to the south-east and north-east to capture breezes.
- Provide a minimum of two openings in each room.
- Link outdoor spaces to internal living areas with large bi-fold or sliding doors to bring the outdoors in.
- Incorporate eave and ridge vents to cool down your roof.



Lightweight or heavyweight

Lightweight structures

Lightweight structures work well in the tropical climate as they don't store heat and can cool down faster during the night. These buildings can also be elevated so that breezes can be directed through the home and under the floor. They are also well suited to sloped blocks.

- Lightweight timber framed walls can cost the same as heavyweight block walls for a house of the same internal floor area. Timber framed walls are typically 90mm thick compared to a block wall at 200mm. This reduction to the external footprint reduces the overall square metres without reducing the internal floor area and hence offsets any additional cost.
- Lightweight houses are engineered to have the same cyclone rating as block houses.
- Select well-insulated lightweight materials for those parts of the exterior that cannot be shaded.

Heavyweight structures

Heavyweight structures typically sit on the ground and have a slab-on-ground construction. Heavyweight materials can store heat if exposed to the sun. These structures can work well if they are well shaded by eaves, verandas and vegetation.

- Non-shaded heavyweight walls can heat up during the day and radiate the stored heat into the house at night so shading is essential.
- Shaded heavyweight walls can cool down overnight if windows are opened and can keep your home cooler the next morning.



Cool idea

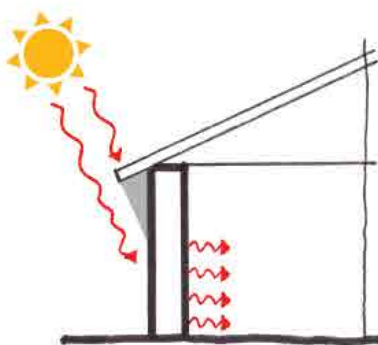
Lightweight structures can be elevated to catch the breeze and allow airflow through the home and under the floor, like the typical 'Queenslander'.



Tony Lawson Building Design



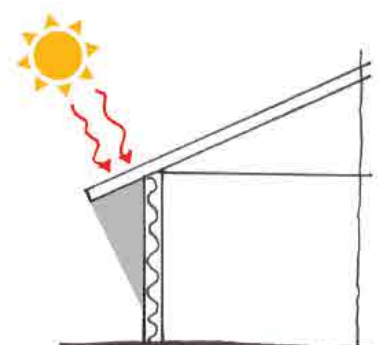
Treehouse, MMP Architects



Block wall - inadequate shading
Heat is absorbed during the day and is transferred into the home in the afternoon and evening making home hotter.



Block wall - well shaded
Wide eaves shade block walls and prevent heat build-up.



Timber walls with insulation
Insulated lightweight walls keep out the heat.

Figure 8: Provide adequate shading, particularly to heavyweight walls, to keep out the heat





Cool idea

Light colours
reflect heat
better than dark

colours. Research shows that in Northern Australia, a light roof has about 30% less heat gain than a dark roof.

Source: Suehrcke et al., 2008



Light coloured roofs and walls can help keep your home cool by reflecting heat, Own Home Design

Light colours

Using light colours on the roof and walls of your home will help to reduce heat build-up, making your home more comfortable to live in. Used in conjunction with insulation, this simple design feature can make a huge difference to the temperature of your home.

Consider using heat reflective coatings to reflect additional heat. These can also be used on block walls. Choosing a light coloured finish for your driveway and paved areas will also help reduce heat build-up around your home.

If you live in a hill-slopes area there may be Council conditions on the roof colour you can choose so that your home blends into the forest. In this case it is best to choose the lightest colour allowed and ensure you vent and insulate your roof space.

Healthy materials

- Choose paints and finishes with low or no volatile organic compounds (VOCs) – they are safer for workers to install, healthier for your family and add little to the cost. Normal paints can off-gas for up to 7 years and may aggravate conditions such as asthma or other respiratory issues.
- Select E0 materials (no emissions) for your kitchen and cabinetry. Ask your local suppliers for more information as many are offering this option for kitchens at the same price.
- Consider green insulation products which are safer for installers, have fewer chemicals and are available at the same price.
- For termite protection, investigate a physical barrier rather than a chemical termite treatment which has the same effect but without the chemicals.
- Ensure that roofs and walls are breathable to prevent mould or mildew.
- Why not investigate products made from recycled materials such as insulation products, recycled plasterboard or 'wood' products made from recycled plastics?



Ask your designer or builder to:

- Consider lightweight insulated walls that cool quickly. With current cyclone regulations, these homes are just as sturdy as concrete block, look great and are available at the same cost. If using block construction shading is essential.
- Choose light coloured walls and roofs.
- Consider choosing healthy paints and materials which are healthier for your family and are often available for the same cost.



Insulation

Insulation is an essential part of a cool home. While there are many material choices for insulation, they typically fall into two main categories:

- bulk insulation (e.g. batts); and
- reflective insulation (e.g. reflective foil).

Insulation effectiveness is spoken of in terms of its R-value which is a value which indicates how well the insulation will resist heat. The higher the R-value the better the performance of the insulation. When choosing an insulation product make sure you compare the 'product R-value' rather than the 'system R-value' to gauge the true effectiveness of the product. The 'system R-value' includes the air space and other materials.

Insulation can be installed in the roof and/or walls of your home and will increase the comfort of your home while greatly reducing air-conditioning costs.

Roof insulation

- Bulk insulation includes glass fibre, polyester and wool insulation. These products resist heat transfer through their bulk and the air trapped within the material.
- Reflective insulation installed directly under metal roof sheeting is highly effective. It can prevent up to 95% of radiant heat entering your roof space and also provides a very important condensation barrier.²
- A combination of bulk and reflective insulation is most effective.
 - For naturally ventilated homes use reflective foil and bulk insulation directly under the roof.
 - If the home will be air-conditioned then the reflective foil should be placed under roof sheeting and bulk insulation on the ceiling (see Figure 9). The bulk insulation provides a barrier to keep the room cool – like an esky.

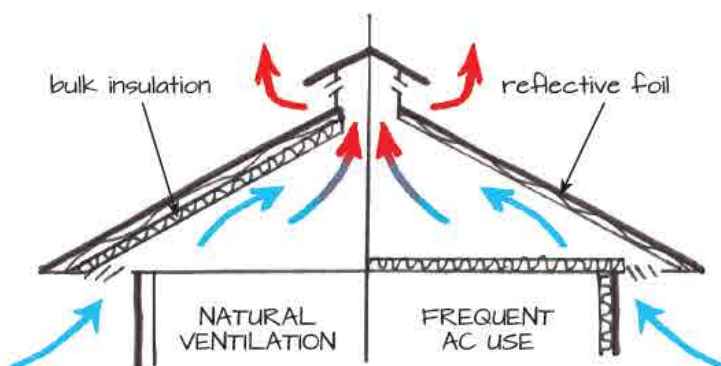


Figure 9: Consider location of reflective and bulk insulation for natural or artificially cooled homes



Cool idea

Insulation can make your home up to seven degrees cooler in summer and can reduce the energy used to cool your home by as much as a third.¹

1. Ausgrid - Keep your Cool Guide, www.ausgrid.com.au
2. <http://www.yourhome.gov.au/passive-design/insulation>





Cool idea

Insulate pergolas, garage and carport roofs with reflective foil and/or bulk insulation to make these spaces more comfortable to use.



Bulk insulation in lightweight wall

- Bulk insulation in the roof should ideally have a product R-value of 3.5 for maximum effectiveness. Check with your builder as higher R-value batts are often the same price as lower.
- Insulation should be used in combination with ridge and eave vents for maximum benefit.

Wall insulation

- Insulate walls with reflective foil and bulk insulation to prevent heat gain, particularly walls to the east (including south-east) and west (including south-west).
- Choose wall insulation with a product R-value of at least R2.5.
- Consider breathable reflective insulation to prevent condensation and mould.
- Bulk insulation also provides an acoustic barrier to keep out the noise.



Ask your designer or builder to:

- Provide a roof system with reflective foil and bulk insulation to save you hundreds of dollars a year in cooling costs.
- Compare the cost of using a higher R-value batt (e.g. R3.5 rather than R2.5) for your roof. You might be surprised to find that the cost is often the same but makes a big difference to the temperature of your home.
- Consider including insulation in the garage roof to reduce the amount of heat transferred from the garage into your home.
- Use reflective foil and bulk insulation in lightweight walls to keep out both heat and noise.
- Consider a sustainable insulation product – these are usually the same price but are safer for workers to install, contain recycled glass or plastic and reduce the amount of chemicals in your home.



Outdoor rooms

In the tropics well-designed outdoor living areas are often the most popular 'room' in the house.

An outdoor area should have an insulated roof and be open to prevailing breezes to stay cool. Shading in outdoor areas should be planned to provide protection from the sun and rain and can include verandas, awnings, pergolas and sails. Vegetation in outdoor areas provides shading and breeze filtering and can enhance the view.

- Create functional outdoor living areas that are weatherproof, well ventilated and easily accessible from the rest of the house. Install fans, screens and power outlets to make the most of these spaces.
- Include generous eaves to protect outdoor living areas from rain and make them liveable year round.
- Increase the indoor-outdoor connection of your home by opening on to verandas, courtyards and tropical gardens with large windows and doors.
- Courtyard spaces between pavilions create useable outdoor spaces and provide access for breezes to enter the home.
- Large shade trees can cool outdoor areas and filter breezes.



Cool idea

Design outdoor living areas and courtyard spaces connected to internal living areas with access to cooling breezes from the north and north-east and/or south-east.



Well-designed outdoor living areas are the most popular room in the house. Treehouse, MMP Architects



The Queenslander veranda



Ask your designer or builder to:

- Provide a functional shaded outdoor living area (insulation, screens, fans, power points) with access to cooling breezes to the north and north-east and/or south-east.
- Incorporate courtyard spaces to create access for breezes.
- Link outdoor spaces to internal living areas with large bi-fold or sliding doors to bring the outdoors in.





Cool idea

Halogen downlights generate a lot of waste heat in your living areas and roof space and cost more to run. By avoiding these you can keep your home cooler.



An energy efficient fit out of your home may increase building costs, but the additional investment will deliver immediate savings on your electricity bill, saving you money in the long run, and reduce your carbon footprint. Consider the following energy savers in your cool home.

Lighting and appliances

Energy efficient lighting now comes in a wide variety of globe styles and colours and is very cost effective. Installing energy efficient lighting such as compact fluorescent (CFL) and light emitting diode (LED) can save you a lot compared to older lights such as halogen downlights. The table below compares different types of downlights with similar light output.

Comparison of bulb purchase and running costs:

Lighting type	Cost of bulb	Annual electricity use	Annual running cost	Rated bulb life*	10 year total cost
Halogen 50W	\$1-\$3	73 kWh	\$22	2,000 hrs	\$245
CFL 13W	\$10-\$14	18 kWh	\$6	8,000 hrs	\$82
LED 9W	\$15-\$30	13 kWh	\$4	50,000 hrs	\$65

Calculations for 240V GU10 bulb assume running time of 4hrs /day and electricity cost of 30.8¢/kWh

*Actual bulb life may be less than rated bulb life

Select energy efficient appliances. A good place to start comparing the energy efficiency of appliances is the national Equipment Energy Efficiency website www.energyrating.gov.au.

Natural ways to save energy

- Maximise natural daylighting by incorporating open plan design, increasing the number of windows, adding tube style skylights internally and specifying light coloured internal and external surfaces.
- Avoid significant costs from operating a clothes dryer all year by installing a well-positioned outdoor clothesline which catches sun and breezes or an undercover line to dry clothes during the wet season.
- Design your fridge space to allow for airflow around the fridge to make it more efficient. Fridges can use over 20% of the energy in your home.

Energy efficient pool pump

Swimming pools can be one of the largest users of power in the home. When designing and building your pool consider the following:

- Install an energy efficient pool pump and filtration system to save up to 80% on your pool running costs.³
- Choose the most appropriate electricity tariff for your pool pump.

For more information on pool design see the *In the garden* section on page 24.

3. www.ecosplash.com.au



Air-conditioning

Air-conditioning typically accounts for around 40% of household electricity use in Queensland.⁴ A single air-conditioning unit can cost around \$400 per quarter to run.⁵ Incorporating tropical design features into your home will reduce your reliance on air-conditioning and help you stay cool throughout the hot humid summer. You may not even need to install air-conditioning at all, avoiding significant purchasing and running costs.

- Design for good cross ventilation and install fans in every room to reduce the need for air-conditioning. By installing 1400mm fans (instead of 900mm or 1200mm) you can achieve better air movement.
- If you decide to install air-conditioning, invest in a model with the highest star rating you can afford to save money on running costs. Solar-boosted air-conditioners are also available.



Cool idea

Through good house design and installation of large ceiling fans you may be able to eliminate the need for air-conditioning. This can avoid significant purchase and running costs.

Hot water systems

Water heating is one of the largest energy users in the home. Choosing the right hot water system when building your home can provide you with big cost savings year after year.

- Solar hot water systems are a great option for our sunny tropical climate, providing free hot water using the sun's energy. These are typically more expensive to purchase but with little to no running costs they will soon prove to be the cheapest option.

Comparison of hot water system purchase and running costs:

Type of Hot Water System	Average cost of installed system	Indicative average yearly running cost	Indicative 10 year total cost
Electric boosted solar	\$5,100*	\$200	\$7,100
Electric heat-pump	\$3,900*	\$370	\$7,600
Electric element	\$1,600	\$790	\$9,500
7-star instant gas (using bottled LPG)	\$1,900	\$1,130	\$13,200

Running costs calculated using the Rheem Hot Water Running Cost Calculator www.rheem.com.au/RunningCostCalculator assuming an average daily load of 200L and 19 tap turns. Electricity costs based on super economy off-peak tariff of 15.8c/kWh. Gas costs based on 45kg cylinder cost of \$137. Installed system costs based on average of range of costs for systems suitable for a 4 person household. This information is indicative only. Discuss with your installer the installation and on-going running costs of a system to suit your needs prior to purchase.



Heat pump hot water system, NQ Solar

4. Ergon Energy 'Energy Advisers'

5. Based on a unit with 2.4kW input running for 6 hours per day and electricity cost of 30.8c/kWh





Cool idea

Consider installing a split-system solar hot water system.

These have a slim-line solar collector on the roof and a storage tank on the ground. They do not need any additional roof supports and are less visible than a tank-on-roof system. The solar collector is best located on a north facing roof in full sun.

- Electric heat pump hot water systems operate like an air-conditioner in reverse. They draw heat from the air to heat water and use much less electricity than traditional electric element hot water systems. Heat pumps are easy to install and provide a good option for homes in shady locations where solar is not feasible. They make a noise similar to an air-conditioning unit so should be located away from windows. For maximum cost effectiveness, connect your heat pump to the night time off-peak tariff.
- Instantaneous gas hot water systems are cheaper to install than solar or heat pump systems and are very efficient. However, they can often be more costly to run in Far North Queensland as they require the ongoing purchase of bottled gas.



Solar hot water system, CA Architects

Wind power

Home-scale silent wind turbines are now available. These can provide a great alternative to solar panels if you have consistent wind.



Solar power

Installing solar power will help to reduce your electricity bills particularly if you use electricity during the day. Domestic solar power systems are typically connected to the electricity grid so you draw upon extra power when required and send any surplus solar power back to the grid.

- Panels should ideally be located facing north in full sun. Other orientations can still deliver good power generation.
- A two kilowatt solar power system can save you over \$1,000 a year on your electricity bill.⁶



Solar power system, Kenick Constructions



Cool idea

To finance your solar power or energy efficient hot water system, consider additional funding via 'green / low interest' loans or renovation loans. Then use the savings made on your electricity bill to help service the loan.



Ask your designer or builder to:

- Select 100% energy efficient lighting.
- Design your home to let in lots of natural light.
- Incorporate a well-positioned clothes line to save using the dryer.
- Select an energy efficient pool pumping and filtration system.
- Include fans (1400mm) in all habitable rooms including the kitchen to reduce the need for air-conditioning.
- Consider energy efficient air-conditioners to save you money in the long term.
- Select a solar or heat pump hot water system.
- Include as large a solar power system as you can afford with a larger inverter so you can add more panels later.

6. Savings based on offsetting 9kWh of grid power / day at a cost of 30.8¢/kWh





Cool idea

A carefully landscaped garden will make a big difference to keep the heat out of your home. It also creates a beautiful place to live and can help feed the family.

Develop a concept garden plan to complement your home design. A well designed garden can shade your home and filter breezes into outdoor areas. It also helps create a great place to spend time with the family. Native planting can bring in wildlife and increase biodiversity. You can also use your backyard to grow fresh fruit and vegetables.

Landscaping for the cool home

- Strategically planted vegetation can filter breezes or direct them in to your home. Make sure that you do not plant dense vegetation that can block breezes.
- Large shade trees can protect your home in summer by shading roofs and walls. Consider planting trees to the east, west and south sides of your home to shade walls.
- In the absence of large shade trees, trellises can provide an immediate and long term shading solution and a place to grow your favourite climbers and creepers.

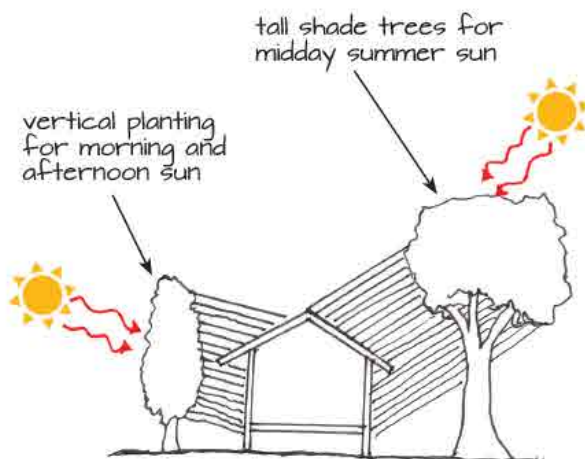


Figure 10: Tall shady trees and vertical plantings keep out the heat

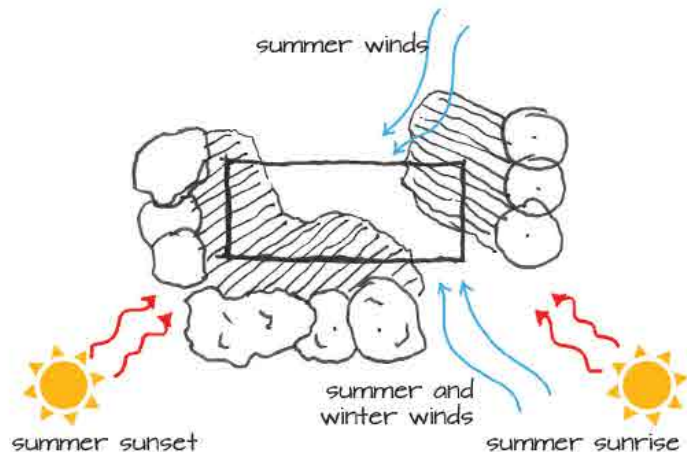


Figure 11: Breezes can be directed into the home by strategically placed planting



- Avoid large trees to the north if you are planning on installing solar panels as any shading, even on one panel, can potentially compromise the output of the whole system.
- Using softer surfaces such as grass, pebbles and garden beds will encourage on site water retention, reduce heat build-up and create a great tropical environment.
- Mulch garden beds to reduce the need for watering.



- Planting native vegetation will reduce demand for water and bring in the native wildlife. Native flowering plants can feed adult butterflies and attract birds. Try planting host plants to encourage butterflies including *Aristolochia tagala* for the Cairns Birdwing or *Melicope elleryana* and *Melicope rubra* for the Ulysses butterfly.⁷
- Plan for a veggie garden to provide the family with nutritious fresh food. This should be carefully located to receive good sun and shelter from wind, while being close to the kitchen. See Figure 12.
- Ensure you leave a gap between garden vegetation and your house to allow inspection for termites.



Vegetation can shade your home, CA Architects

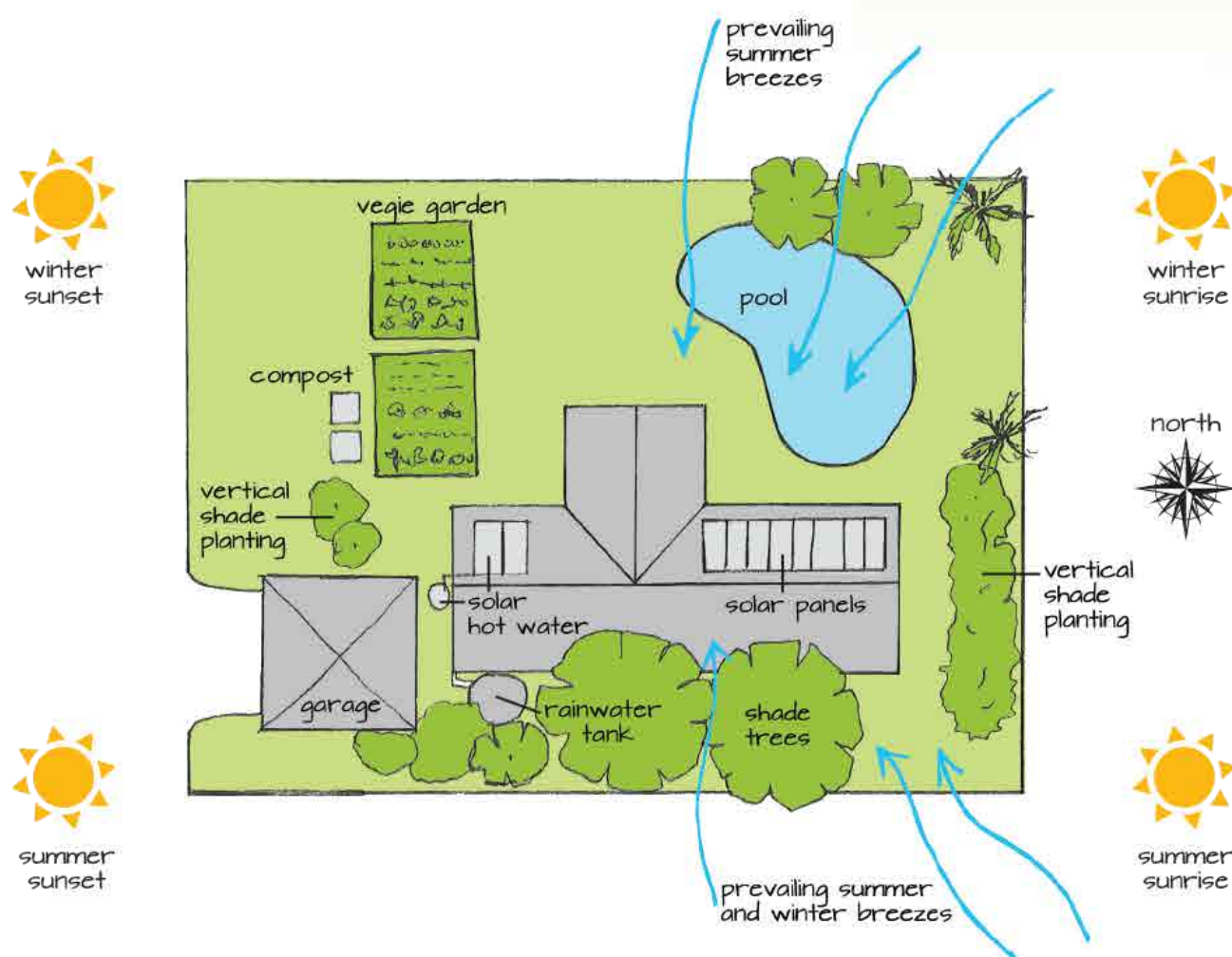


Figure 12: Create a concept plan of your home and garden design to take advantage of cooling breezes and keep out the heat

7. Yuruga Native Plant Nursery, www.yuruga.com.au

Rainwater tanks

- Install a rainwater tank to water the garden or fill the pool.
- Consider raising your tank or putting it on a hill to use gravity rather than a pump to circulate water.
- Rainwater tanks can be plumbed into the house for use in the laundry and for toilet flushing.



Incorporate a rainwater tank and a well located vegetable garden, Kenick Constructions

Swimming pools

Good pool design can save lots of money on operating costs by reducing electricity, water and chemical use.

- Installing an energy efficient pool pump, or retrofitting a pump controller, to give variable speed pumping can save 60-70% on your pool pump running costs.⁸ This will also make your pump quieter.
- Choose the most appropriate electricity tariff for your pool pump. Off-peak tariffs are generally considered the best option due to reduced electricity costs. However, if you have a recently installed solar power system without a feed-in tariff you may benefit most from using the solar power generated during the day to run your pump.
- Shade your pool to reduce water evaporation and reduce the sun's impact on pool chemicals.

8. Based on 1kW pump connected to economy tariff of 23.1¢/kWh, www.coolmob.org/content/how-save-money-your-swimming-pool-electricity-costs



- Use a pool cover when the pool is not in use to reduce evaporation of water and chemicals while also keeping your pool clean.
- Consider a chemical free naturally filtered pool. This can reduce operating costs by 80% while providing a healthy and natural swimming environment.⁹ These cost more to install but the savings in electricity and chemicals can pay off the investment within a few years. This type of filtration can also be retrofitted to existing pools. Talk to your local supplier about your options.
- Careful positioning of your pool can also help to cool your home. See Figure 12.



Chris Vandyke Designs,
Photo: Sean Reason



Investigate natural or low chemical pool options, Chris Vandyke Designs



Ask your designer or builder to:

- Ensure your home and block plan allows enough room for planting shade trees or installing trellises to the south, east and west.
- Plan room for a veggie garden that can feed the family, and vegetated areas around the home to reduce heat build-up.
- Include a rainwater tank to water the garden or top up the pool.
- Locate your swimming pool so that it helps to cool your home.
- Investigate the option of a naturally filtered pool.

9. www.ecosplash.com.au



Reach for the stars

All new homes in Queensland need to pass minimum energy efficiency requirements as part of the building approval process. The design must be assessed against the provisions in the National Construction Code (NCC) or show compliance by achieving a minimum star rating using an approved energy rating tool.

Ask your designer or builder about the star rating of your home design. The current minimum required star rating is six stars, with ten stars being the maximum. This is a good indicator of the future performance and comfort of your home. By including the features shown in this guide you can greatly improve the energy efficiency of your home above the minimum requirements and increase your star rating. A higher star rating may also increase the future value of your home.

Some simple and cost effective tips for increasing your star rating include choosing light coloured walls, increasing fan sizes to 1400mm, increasing eaves, tinting windows, insulating roof and walls and ventilating the roof space.



Energy efficient home using recycled materials, Driscoll Carvey Building Design and Interiors and Maxa Constructions



Case Study: Tropical Green Building Network – Sustainable Display Home National HIA GreenSmart Home of the Year



TGBN Sustainable Display Home 2012, Kenick Constructions,
Designer: Green at Heart

In a recent project in Cairns, the energy rating of a new project home was increased from 6 stars to 9.5 stars by only spending an additional \$6000. Changes included using lightweight construction, incorporating reflective foil and higher R-value insulation to the whole home, highly ventilating the roof space, using 1400mm fans throughout, tinting windows, and using light colours.

With the addition of energy efficient lighting, solar hot water and solar power this home has no ongoing power bills and is cool and comfortable to live in.



Appendix: Additional resources for a sustainable home



Visit the sites below for more information on sustainable design in the tropics.

Architecture, building design and building associations

Building Designers' Association of Qld
www.bdaq.com.au

Australian Institute of Architects
www.architecture.com.au

Board of Architects Queensland
www.boaq.qld.gov.au

Housing Industry Association
www.hia.com.au

Master Builders Association
www.masterbuilders.com.au

Queensland Building and Construction Commission
www.qbcc.qld.gov.au

Cairns Style Design Guide

The Cairns Style Design Guide describes in words, pictures and diagrams the tropical style that is the desired design direction for Cairns.
<http://www.cairns.qld.gov.au/building-planning-and-infrastructure/strategic-land-use-planning/cairns-style-design-guide>

Cool Mob

Sustainable living for the tropics
www.coolmob.org

Environmental design guide

www.environmentaldesignguide.com.au

GreenBuild directory

Tropical eco building and living resource
www.greenbuild.com.au

Tropical Green Building Network

Network of architects, designers and suppliers for green building in the Far North Queensland region. Great resource of information on green building in the tropics.
www.tgbn.org.au

Retrofitting an existing home

Find out how to retrofit your home to make it more sustainable.

Retrofitting for sustainability – A guide for Far North Queensland (Author: Green at Heart), download at: www.cafnec.org.au

Your Home

Sustainable house design principles
www.yourhome.gov.au

In the garden

Permaculture Cairns
www.permaculturecairns.org.au

Commercial and multi-residential

Sustainable Tropical Building Design: Guidelines for commercial buildings
www.cairns.qld.gov.au/buildings

Further guidance on providing sustainable outcomes for multiple dwellings can be found in Council's planning scheme.
www.cairns.qld.gov.au/building-planning-and-infrastructure/planning-schemes



Charles Street Residences, Studio Mango,
Photo: Robert Gesink





Want to find out more about saving energy and water, reducing waste, improving backyard biodiversity and active travel? Read on for some great tips. To download our fact sheets, have your sustainability questions answered and for the chance to win some great prizes for your home, visit Council's *Green Thumb* website.



Lighting	Find out about energy efficient lighting options at www.yourpowerqld.com.au
Air-conditioning	Compare the running costs of most makes and models at www.energyrating.gov.au
Hot water	Compare different types of hot water systems and associated running costs at www.yourpowerqld.com.au
Appliances	Search and compare the energy efficiency of appliances at www.energyrating.gov.au



Water efficient appliance and fixtures	Search and compare the water efficiency of appliances and fixtures at www.waterrating.gov.au
Rainwater tanks	Connect your washing machine and second toilet to rainwater. Contact Council for more information.
Water saving showers	A 3-star rated shower can save up to 20,000L of water per person per year compared with less water efficient models. ¹⁰



Kitchen Bins	If incorporating bin space into the design of the kitchen, ensure space is allocated for a kitchen recycle bin too.
Wheelie Bins	Include space for your wheelie bins in any landscaping design.
Green Waste	Include space green waste storage / compost bins in any landscaping design



Native gardens	Selecting predominantly local native species for your garden will reduce maintenance and water use, help to prevent the spread of environmental weeds and promote backyard biodiversity.
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Bicycle storage	Incorporating a bicycle storage area into the design of your home will help to make riding more convenient.
Commuting	Local infrastructure like pathways and bus stops can make alternative travel options more convenient.
Fuel efficient vehicles	Search and compare the fuel efficiency of vehicles at www.greenvehicleguide.gov.au

10. Save water, www.savewater.com.au/how-to-save-water/in-the-home/bathroom



