



Better Build Toolkit

HOME RENOVATION GUIDE

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Background

The “Better Build Toolkit” is a series of four Guides designed to inform a range of development in Indigo: residential build, home renovation, commercial development or subdivision. The Guides focus on improved building efficiency by providing information on climate sensitive design and construction elements. The Guides also encourage a healthy living environment by providing information on wise choices in products and materials.

The concept for the toolkit was identified as a priority action within Indigo Shire Council’s *Environment Strategy* (2009). Each Guide is intended to encourage innovation and excellence above existing industry standards when developing within our communities. People spend a large proportion of time indoors for reasons of work, life, and play. Accordingly, the focus is on how enhanced comfort levels and reduced running costs can be achieved through better building choices, while caring for the health and wellbeing of the occupants and the environment.

There are a number of trends making improved design and development more attractive. These include:

- increases in energy and water prices
- a growing desire to reduce our environmental footprint
- incentives such as grants, rebates and renewable energy targets
- products such as water tanks, photovoltaic (PV) cells, solar hot water and double glazing being more readily available and affordable

Disclaimer: Many of the elements discussed within this document have been simplified in an attempt to provide a basic introduction to concepts and reduce the volume of information. This information guide was derived from a variety of sources and while every effort has been made to produce a useful and accurate document Indigo Shire Council and its employees do not guarantee that the publication is error free and without flaw and wholly appropriate for your particular purposes. Indigo Shire Council therefore disclaims all liability for any error, loss or consequences which may arise from your relying on any information contained in this material. In addition, the authors have no control over the contents of websites listed and thorough research is recommended before undertaking any building construction. Sustainable design, construction methods and sustainable technologies are rapidly evolving fields; regular review of current best practices is encouraged. You should verify critical information and application of design elements, products and technologies with the relevant authorities and field professionals to ensure suitability.

Introduction

There are a number of reasons why people embark on a home renovation. The motivation may be to improve comfort and efficiency, replace a faulty appliance or retrofit new technology, revamp a tired appearance, or increase the value of the property. The work may happen in small instalments or as one grand overhaul. Regardless of the reason and the scale, a renovation can provide an excellent opportunity to improve the living environment and reduce running costs while meeting the on-going needs of the home's occupants.

Planning and researching options is essential to achieve the best outcomes for your renovation project. It is important to review your home's existing strengths and weaknesses to identify priorities. Consider first how to best use the current structure before planning to extend. Thoughtful reworking of the existing layout may better meet household requirements without the need for an extension. Low cost alterations may improve efficiency avoiding large scale intervention. Conversely, additional money spent during renovation may deliver long-term benefits including increased resale value, improved comfort and reduced energy bills.

Indigo Council is strongly committed to protecting and enhancing the rich historical fabric of the Shire. The many heritage homes within the region offer character appeal and reflect our place in history. The renovation of a character home presents a real opportunity to address energy and comfort deficiencies and introduce new technology into the home. This can be achieved without compromising heritage values.



This Guide offers basic information to help complete a project that rewards the occupant with improved health and comfort while being sympathetic to the environment. Part A initially presents a set of pre-design suggestions to highlight key areas of consideration when planning to renovate. This section then provides an introduction to a range of topics including; good design elements, energy efficiency and capture, material selection, water use and reuse, landscaping and outdoor areas, a room by room overview, and build styles used in construction.

Part B offers a quick checklist for the reader to use when evaluating their proposed renovation. It may be used to assist in identifying areas for improvement. Further links and resources are included for readers wishing to source more detailed information. When considering any building works it is advisable to seek professional advice to ensure your plans meet relevant compliance and building code requirements, and that design elements are correctly applied.

Good Building Principles

Regardless of development type or scale, there are a number of environmental design principles to consider when building or renovating:

- Reduce the consumption of resources, particularly non-renewable resources through energy efficient design, incorporating renewable energy, using passive solar heating/cooling techniques, natural ventilation and natural lighting.
- Design for durability, adaptability and resale.
- Avoid potential health hazards by minimising the use of hazardous chemicals, avoiding chemically treated materials and being cautious of electromagnetic radiation.
- Maximise the health, safety and comfort of building users.
- Design to minimise waste and maximise water efficiency.
- Minimise the environmental pollution of air, water and soil.

Glossary

Diurnal Temperature Variation	A meteorological term that relates to the variation between the highs and lows in daily temperature.
Double Glazing	A glazing unit in either a window or door formed by using two panes of glass with a 12-20mm space separation. The space may be filled with air or gas. Double glazing improves window energy efficiency.
Embodied Energy	Consumption of energy during manufacture and transport of a product.
Embodied Water	Water used during manufacture of a product.
Feed in Tariff	Rate paid to producers for feeding renewable energy back into the grid supply.
Geothermal Heating & Cooling	A ground source heat pump and the relatively stable geothermal conditions near the Earth's surface are used for the purposes of heating and cooling.
Glazing	Glassed surfaces such as windows, skylights, and glass panes within doors.
Green Energy	Energy generated from renewable sources.
Grey Water	Wastewater generated from household activities such as bathing, dishwashing and laundry, but excluding the toilet.
Hydronic Boiler	Fluid/water based system used to generate heat which is typically circulated throughout the home through radiators or coils. The system is connected to a variety of fuel sources and can be combined with domestic hot water supply.
IEAC	Indigo Environment Advisory Committee. Section 86 Committee of Management.
LED	Light Emitting Diode. Within this document LEDs relate to the use of this energy efficient technology available in lighting and appliances.
Off Gassing	The release of trapped gasses at normal atmospheric conditions. Referred to in this document when talking about Volatile Organic Compounds and the slow release of organic chemicals into the surrounding environment.
Passive Design	Climate sensitive design that reduces the need for mechanical heating or cooling.
Potable Water	High quality drinking water.
PV	Photovoltaic. Referring to the technology used in solar panels for generating electricity.
RBV	Reverse Brick Veneer. Brick construction method where the brick skin is on the inside of the building to add thermal mass. An external cladding is fitted to the outside of the building and insulation added to the void in between the two skins to protect the brick layer from the external elements. This build style can provide improved use of the bricks' thermal mass properties to reduce heating and cooling requirements when compared to standard brick veneer construction.
Standby	Also referred to as "Phantom Load". Electricity consumed by appliances while they are switched off or operating in standby mode and not performing any useful function.
Sustainability	In ecological terms it is the ability for biosystems to remain diverse and prolific. For humans it the ability to maintain wellbeing which is generally reflected in the considered and responsible use of the world around us and its natural resources.
SV	Sustainability Victoria. Victorian Government agency.
Task Lighting	Lighting which is focused on a specific area to make the completion of visual tasks easier.
Thermal Mass	Ability of a material to store heat.
VOC	Volatile organic compounds are slowly released at room temperature from the material they are found in. VOCs are numerous and varied and many can be harmful to humans and the environment.
WELS	Water Efficiency Labelling and Standard. Water rating labelling for appliances and products.
Zoning	Referred to in the Guide as the closing off of unoccupied sections of the house to reduce heating and cooling needs.

PART A – Build Elements

“Renovate for comfort and efficiency”

Where to Begin	
1	<p>Plan in advance.</p> <p>Successful outcomes usually stem from well researched ideas and sound planning. In addition, good planning reduces the risk of frustrating and expensive modifications during building.</p> <p><i>Clever ideas at the design stage can improve outcomes and pay huge dividends later on.</i></p>
2	<p>Home energy assessment.</p> <p>It is important to understand the strengths and weakness of your existing home to identify opportunities to improve comfort and efficiency.</p> <p><i>Small changes can make a big difference and they don't need to cost the earth.</i></p>
3	<p>Do your homework.</p> <p>Find out what products and materials are available, learn from the experience of others and speak to professionals for advice and inspiration.</p> <p><i>Acquaint yourself with the approval and construction process so you have realistic expectations of outcomes and time frames.</i></p>
4	<p>Write a wish list.</p> <p>Prioritise each item so you can justify its importance against your budget.</p>
5	<p>Prepare a budget.</p> <p>Understand your expense streams and take a long term view of costs.</p> <p><i>Without good planning many renovations run over budget. Older homes can also reveal some unexpected "challenges" when renovating, e.g. termite damage, rising damp, dry rot. Make an allocation for unexpected expenses. Factor long term savings and improved resale value into your decision making process.</i></p>
6	<p>Investigate rebates, incentive schemes and green mortgages.</p> <p>Help offset the purchase of alternative energy technology, and investigate mortgages that offer lower interest rates for energy efficient renovations.</p>
7	<p>Design for the future.</p> <p>Homes are being built to increasingly high standards and energy prices continue to rise. Look to improve energy efficiency. Think clever design, not necessarily bigger.</p> <p><i>A renovation is an opportunity to future proof your home against increased building performance expectations and reduce running costs.</i></p>
8	<p>Find the right expertise.</p> <p>Depending on the type of renovation, take advantage of expert knowledge to ensure you get it right the first time.</p>

Passive Design

Enhance comfort and reduce energy consumption by using passive design in your renovation.

Passive design is an integrated approach where elements of a building work with the local climate and seasonal weather patterns to maintain comfort. Features such as orientation, window systems, window placement and shading, thermal mass, airflow, insulation and draught proofing are applied to reduce the need for additional heating and cooling.

Passive design can be applied across all build styles to strengthen a building's end performance. Within a renovation these elements may be applied on a smaller, more targeted scale, or more extensively on larger projects like adding an extension. Typically passive design can be implemented at a similar cost to standard construction, yet the benefits of improved building performance and comfort levels may be obtained.

Orientation & Layout

Good orientation increases the energy efficiency of a home. The north side of a house is warmer in winter and the best place for rooms that are used frequently such as living areas. While it may not be reasonable to pick up the home and rotate the existing floor plan, use a renovation to improve layout and functionality with respect to passive design and the family's needs.

Which rooms go where?

- Orientate the living and family areas towards the north to receive high amounts of winter sunshine for passive heating and natural light (see Figure 1).
- Carports and garages work well on the western side of the house where they can also help protect the home from the sun. Avoid placing garages or additional structures where they will shadow northern windows.
- Bathrooms, laundries and drying rooms do well on the western side of the home where the warm sun can keep the room dry. Locate wet areas together to reduce the need for long plumbing runs and to minimise delays in hot water supply.
- Bedrooms are best located towards the cooler southern section of the house as it is easier to moderate temperatures with bed clothing and blankets. Avoid placing bedrooms along western aspects.
- Group rooms with similar uses together to enable zoned heating and cooling. Use doors or partitions to close off areas.

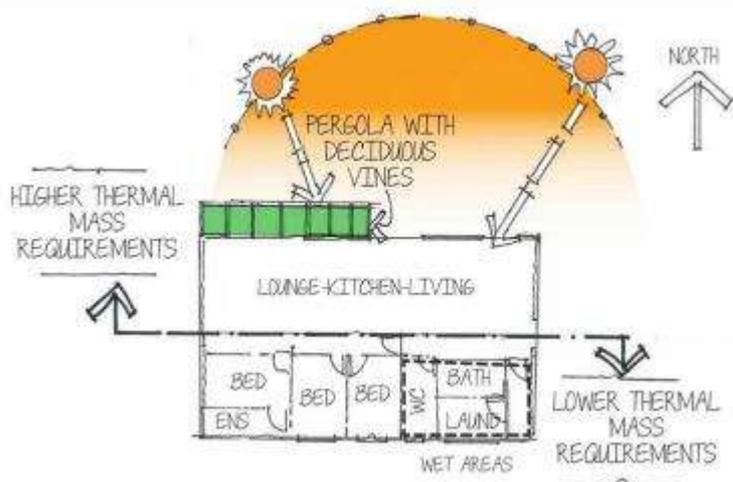


Figure 1: Consider the layout and positioning of rooms to support solar passive design. The living areas of this home have good solar orientation. The bedrooms could be protected from the hot afternoon sun by building a garage or moving the wet areas to the western side of the house.

Windows Systems

The windows of a home are a major source of heat loss and gain. Installing, upgrading or replacing windows can provide a great opportunity to enhance the appearance and efficiency of your home. Refer to Table 1 for a general guide to window placement.

Table 1: Basic guide to window placement for passive solar heating.

North	Maximise north facing windows to support passive design, especially in living areas. In summer use flexible shading such as deciduous trees/creepers, adjustable awnings etc, to protect these windows from heat gain.
East	Minimise windows where possible, provide deep overhangs, external blinds or pergolas.
West	Eliminate windows where possible. Provide the ability for complete shading with deep pergolas and/or other external shading options.
South	Minimise large windows and provide some weather protection, while allowing for ventilation and air flow during summer.

(Source: DCCEE, 2010)

Window and door systems (window glazing and frame material) are available in a variety of arrangements. When shopping for new window systems, double glazing is a wise investment for comfort and efficiency. Double glazing products, such as the doors pictured in Figure 2, can help reduce heat loss during winter. Double glazing has the additional benefits of reducing noise and improving security. If you cannot replace windows consider thrifty secondary glazing products to reduce heat gain or loss. Explore solar films, acrylic panels, or transparent heat shrinking membranes that perform like a double glazing product.

During winter heat can also be lost through window frame material. Frame configurations will have differing resistance to heat flow and differing maintenance requirements. For example, wood frames may be better insulators compared to aluminium frames; however wood requires more maintenance and can move or swell with changes in climate.

The following list outlines the most effective to least effective frame insulators:

- wood, composite wood-polymer, or composite wood-aluminium
- PVC
- aluminium with a thermal break (gap)
- plain aluminium

Source; CSIRO, 2009

It is also wise to avoid dark coloured frames as they can absorb heat during summer.

Glazing and frame options should be carefully considered before purchasing a window system. The Windows Energy Rating Scheme (WERS) rates a window's energy performance out of 5 stars. Purchase windows with a high star rating for improved energy performance.

Unprotected glass can also significantly contribute to heat transfer. Various forms of window shading and protection should be incorporated to restrict unwanted summer heat gain and winter heat loss. To reduce heat loss in winter install heavy lined drapes, tight fitting blinds and pelmets. Table 2 illustrates how double glazing in conjunction with heavy drapes and pelmets offers greater resistance to winter heat loss when compared to an unprotected single glazed window.



Figures 2. Double glazed windows and French doors being installed.

Table 2: The effects of window treatments on winter heat loss

Percentage of <u>WINTER HEAT LOSS</u> for window treatments	
Unprotected single glazing	100%
Vertical or venetian blinds	100%
Unlined drapes or Holland blinds, no pelmets	92%
Heavy, lined drapes, no pelmets	87%
Unlined drapes or Holland blinds with pelmets	79%
Double glazing*	67%
Heavy, lined drapes with pelmets	63%
Double glazing with low-E coating*	57%
Double glazing, heavy drapes and pelmets*	46%

* Some double glazing window systems may perform substantially better than this.
(Source: Sustainable energy info fact sheet, Window Protection.)

For summer cooling, locate windows and doors to encourage breezes to pass through the home. Choose windows that have a wide opening to encourage air flow. For instance, casement windows offer the greatest opening to promote movement of air.

In addition, restrict summer heat gain by protecting and shading windows. Large windows with northern aspects are integral to passive heating but must be sheltered from the sun in summer. Install shading devices including eaves, a pergola, blinds, awnings or plant deciduous trees. Table 3 offers useful information to assess the impact of window treatments and protection.

Table 3: Comparison of heat gain in summer through different window treatments

Percentage of <u>SUMMER HEAT GAIN</u> for window treatments and protection	
Unshaded single glazing	100%
Double glazing	90%
Vertical blinds/ open weave drapes	76%
Internal venetian blinds*	55-85%
Internal drapes or Holland blinds	55-65%
Tinted glass#	40-65%
Solar control or reflective films#	20-65%
Trees full shade	20-60%
1 metre eaves over north wall+	30%
Roller shutters	30%
External awning	25-30%
2 metre pergola over north wall with deciduous plants or shade cloth	20%
Outside metal blind or miniature louvres parallel and close to the window	15-20%

* Effectiveness is reduced as colour darkens

Solar films, tinted glass and reflective glass have varying effectiveness. They all significantly reduce levels of light all year round

+Further analysis may be required to determine suitable eave overhang with respect to wall height, window position and location

(Source: Sustainable Energy of Victoria, Sustainable energy info fact sheet, Window Protection)

Thermal Mass Passive Heating & Cooling

Thermal mass is the ability of a material to absorb heat. High levels of thermal mass are used in passive design to store and later re-release heat, thus achieving a more even climate within the home. Thermal mass in the form of concrete or tiled flooring is often installed in living areas with good solar access. Alternatively, thermal mass can be added by constructing internal walls from building materials such as bricks or concrete blocks.

Thermal mass is used in passive cooling to capture heat entering the building during the day. Cooling night breezes are then used to remove the stored heat from the home. Throughout summer thermal mass should be protected from direct sunlight and provided access to cross ventilation for night purging.

Over winter thermal mass should be exposed to heat from lower angled sunlight or additional heating appliances. The thermal mass will absorb this heat and release it overnight when it is needed.

Figure 3 illustrates how thermal mass can be used in flooring to store and later release heat. A renovation may provide an opportunity to add thermal mass for passive solar heating and cooling purposes. Target existing living areas, or new living areas when planning an extension. Thermal mass should be used in conjunction with good design, insulation and draught proofing.

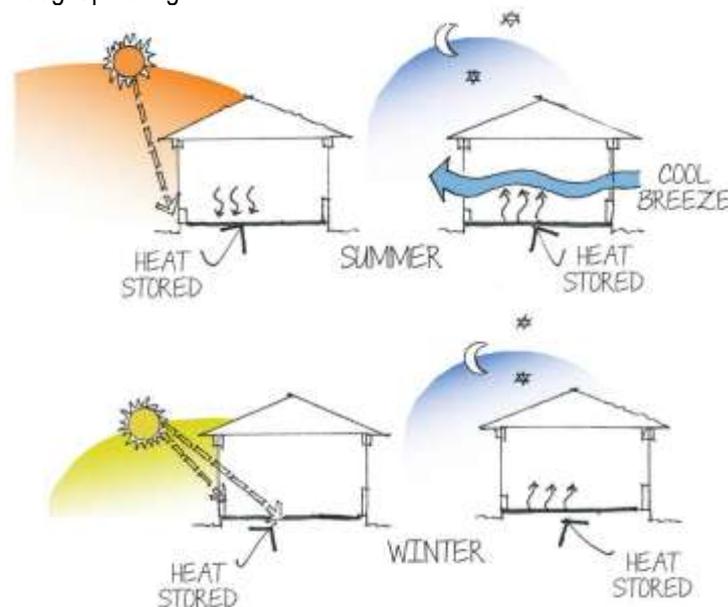


Figure 3: Seasonal use of thermal mass. The higher position of the summer sun and the use of eaves restrict heat penetration. In winter, the lower path of the sun across the sky allows for solar penetration and promotes heat storage in the high thermal mass flooring, which is later released over night. (Source: DCCEE, 2010)



Figure 4: Wall insulation can save up to 20% on heating and cooling costs

Insulation & Draught Proofing

Insulation is one of the easiest and most cost effective ways to guard against unwanted heat transmission. It offers a good return on investment by reducing heating and cooling needs. A renovation may provide an opportunity to install new or upgrade existing insulation. Often the greatest Accessing rooflines and wall cavities (see Figure 4) may be easier during alterations while these voids are exposed.

Wooden flooring can be insulated by installing batts between the joists and securing them with reflective insulation film (shiny side down) fixed to the underside of the joists. Insulating the edges of concrete slabs can also help reduce heat loss.

Insulation effectiveness is measured using an R-rating. The higher the R-rating the greater the resistance to heat flow. Use the highest R-rating insulation product available for your budget. . Follow product instructions when fitting insulation to maximise the benefits of the material being used.

Draught proofing strengthens insulation efforts by further restricting the transfer of heat. A smoke plume from an incense stick may serve as a simple indicator of air movement to help identify a draught source. When looking for air leaks target areas such as doors, windows, light fittings, fireplaces, exhaust fans, heating and cooling vents and cracks between wooden flooring (refer to Figure 5). Consider closing off vents, installing insulation, using sealing strips or fillers and draught stoppers to restrict the flow of air and the resulting heat loss or gain.

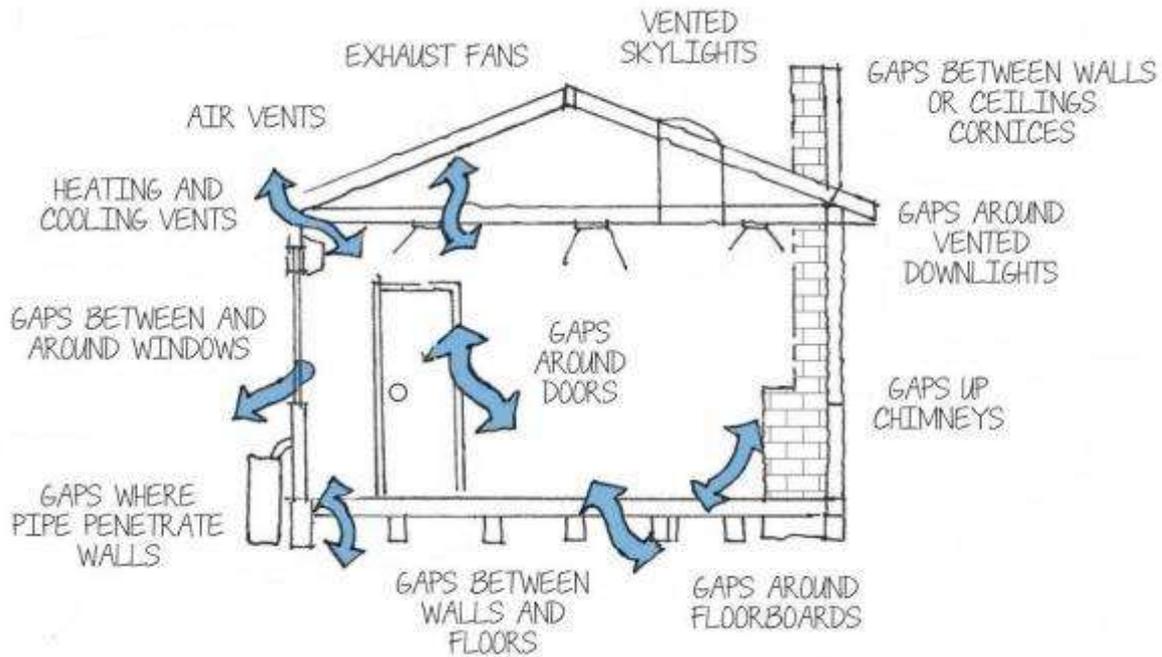


Figure 5: Typical sources of air leakage (Source: DCCEE, 2010)

Passive design tips when renovating

1. Design extensions or rearrange floor plans to include passive design. You may not be in a position to physically reorientate the existing property but you can reconsider the layout of any renovated or additional rooms.
2. Include thermal mass (dense heavy materials such as concrete, tiles, or masonry products) when designing extensions for passive solar heating and cooling.
3. Design to capture prevailing breezes for natural ventilation and cooling.
4. Improve window performance. Use advanced glazing solutions in new windows and doors, e.g. double glazing. If the budget allows look at replacing inefficient windows, otherwise upgrade with thrifty secondary glazing products.
5. Install window treatments and furnishings, such as pelmets and heavy curtains to reduce heat gain and loss.
6. Upgrade or add quality insulation. Access to roofs, wall cavities, and under flooring is often easier during a renovation.
7. Draught proof your home. Target typical sources of air leakage such as doors, fireplaces, light fittings, floorboards, windows and air vents.
8. Add doors and walls to “zone” or reduce areas requiring additional heating or cooling.

Energy Efficiency & Capture

Minimise the use of energy and non-renewable resources.

Rising energy prices and increasing energy consumption place a strain on many household budgets. A renovation allows for the purchase and installation of energy efficient appliances and renewable energy equipment. Suitable product selection can help reduce power usage and supply some of the electricity needs for the home.

Hot Water

The hot water system is typically one of the biggest users of energy in the home. When purchasing or replacing a hot water system install an advanced, energy efficient option. A variety of technologies are available with some more suitable than others depending on local conditions, booster and general energy supply and the hot water requirements of the household.

Hot water tips

1. Choose a system that is size appropriate for your lifestyle and family.
2. Check if you need frost protection.
3. Insulate hot water pipes and joins to reduce heat loss.
4. Install the system as close as possible to the intended area of use. Group wet areas to minimise pipe runs.
5. Consider timers on hot water systems to restrict heater operation to common periods of use.
6. Check if rebates are available to help meet the cost of purchasing a new system.

Solar Hot water.

Solar hot water heaters use the sun's radiant energy to heat water. Generally, solar heaters have a gas or electric booster connected to supply hot water when weather conditions are unfavourable to meet demand. Some models may be boosted with a wood heater. Roof mounted solar hot water panels should be orientated in a north facing direction, at a suitable angle to the sun and away from any shading or shadowing.

There are two main types of solar hot water panels – flat panel collectors and evacuated tube collectors.

Flat panel collectors are glass fronted cabinets that contain pipes which heat up in the sun. These pipes may contain water, though more commonly a heat exchange fluid is used.

Evacuated tube collectors are narrow insulated glass tubes with a vacuum and a system for heat exchange.

Evacuated tube collectors may perform better than flat panel systems on days with minimal sun. They also have some advantages on frosty nights and during the cooler months of the year. Evacuated tubes can withstand lower temperatures without the need for anti-freeze fluids or frost prevention measures. They weigh less than flat panel systems but can cost significantly more.

Heat Pumps

Hot water heat pumps are efficient electric systems that transfer heat from the outside air to a storage tank where water is heated. They do not require direct sunlight and units are not roof mounted. A small amount of noise may be associated with the operation of the system, so be mindful of the installation location to ensure noise is not a concern to occupants or neighbours. Heat pumps work most efficiently in warm, humid climates but cooler climate systems are also available.

Instant Gas Hot Water.

Instant gas hot water units heat water on demand. They do not store water and hence do not use energy to heat water that is unused. Instant hot water units are best used in conjunction with low flow shower heads and taps to slow water consumption and allow for heating to occur as required.

Mechanical Heating & Cooling

On average 38% of Australian home energy consumption is for the purpose of space heating and cooling (DCCEE, 2010). Use a renovation as an opportunity to improve year round comfort through good passive design, upgrading insulation and draught proofing to minimise or avoid the need for artificial heating and cooling. If considering the installation of a mechanical heating or cooling system seek the highest possible energy star rating. Ensure the system is size appropriate with programmable thermostat controls (if applicable) to allow management of use.

If additional heating is required consider the following options in preference to standard electric heating systems:

- high efficiency wood stoves
- gas heaters
- energy efficient reverse cycle air conditioners
- hydronic boilers

Additional options that may be suitable depending on your location and budget include solar heating and cooling and geothermal heating and cooling.

Mechanical cooling systems can be energy or water intensive. As a result, consider using portable or ceiling fans (as pictured in Figure 6) before switching on an air conditioning unit. Many fans have a summer/winter switch to allow the blades to spin in the opposite direction and assist with heat distribution during winter.

If you are considering the installation of an energy efficient reverse cycle air conditioner, ensure the outdoor unit is located in a position where it has good air flow and is not exposed to extremes of weather. Once again it should be suitably sized as bigger is not necessarily better, and the area that requires cooling should be reduced or zoned to improve outcomes and operating costs.



Figure 6: Install ceiling fans with a summer/winter switch to offer air movement and cooling.

Tips to reduce additional heating and cooling needs:

1. Choose a light coloured roof to minimise heat loading.
2. Paint roof surfaces with a reflective solar paint to reduce heat absorption.
3. Install roof vents or whirly birds to allow hot air to disperse during summer.
4. Seal gaps and cracks to draught proof, restricting heat loss or gain depending on the season.
5. Install quality glazing or thermally improve windows with solar films or temporary double glazing solutions. Also use forms of window protection and furnishing on glazed areas.
6. Fit high levels of insulation to the ceiling, walls and floors.
7. Use ceiling fans as an alternative to air conditioning.
8. Zone or close off the main living quarters to reduce the area requiring heating or cooling.
9. Match the size of any heating or cooling unit to the needs of the living areas.

Appliances

Energy rating labels make it easier to identify and evaluate the energy efficiency of products. This information allows buyers greater ability to compare models. Subsequently an informed decision can be made on new appliances to be installed as part of a renovation.

The energy label has two main features:

- A star rating out of 6 that compares like sized appliances. Aim for **four** or more stars.
- A yearly consumption figure that estimates typical energy use in a home.



Figures 7-9: Front loading washing machine. The unit has energy and water efficiency labelling to help compare like sized models to assist buyers to make an energy efficient purchasing decision.

The washing machine pictured above has two rating labels to consider; energy and water consumption. The buyer considered both rating labels along with the household washing needs and the overall capacity of the machine.

Tips when considering new appliances;

1. Study energy ratings and annual consumption data to select the most efficient model available for your budget.
2. Purchase size appropriate appliances. Bigger is not always better - you may spend more money running the appliance and not receive any usable benefit.
3. Consider the placement and housing of fridges and freezers. Protect the fridge from heat sources such as sunlight, cooking appliances, and hot external walls, which can put an extra load on the unit. Also allow suitable area around the unit for air to circulate.
4. Consider all efficiency rating material available for an appliance. This may include energy, gas and water. Water Efficiency Labelling and Standard (WELS) rating will let you compare the water flow and water consumption rates of various products. The more stars on the label the more water efficient the appliance.

In order to get the greatest efficiency out of electrical appliances consider the inclusion of standby eliminators that allow an appliance to be turned off fully when not in use. Many appliances still consume power when they are not active or are operating in standby mode. This standby power or phantom load consumption can contribute up to 10% of a typical home's electricity use. Appliances that may use a standby function include those with remote controls, LED lights or digital clock displays. Often it can be inconvenient or difficult to access the power supply for appliances and a renovation may provide an opportunity to introduce conveniently located power outlets or technology to allow for greater control of otherwise difficult to reach switches.

Lighting

Natural sunlight is the cleanest and cheapest way to meet daytime lighting requirements. Well designed windows, skylights or light tubes may allow considerable light into the home.

A renovation may involve simply replacing existing light globes for more energy efficient alternatives, wiring of new fittings, or installation of roof glazing such as day lights, skylights or light tubes.

When planning for the installation of any new window, daylight or skylight, ensure the glazing will not add an unexpected heat load to the room. Roof glazing should be installed only where necessary and be kept as small as possible to minimise heat transfer. Where possible, place skylights south facing and avoid north and west facing installations. Winter heat loss through high level glazing is greater than low level windows of the same size. If possible fit roof glazing with ceiling diffusers to reduce winter heat loss (as illustrated in Figure 10).

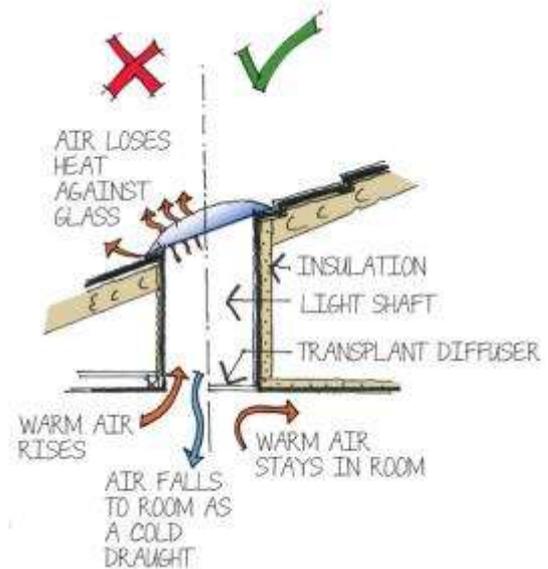


Figure 10: Skylight diffuser (Source: SEAV, 2002)

A common housing design trend is the excessive use of down lights to illuminate entire rooms. Standard halogen down lights are typically very inefficient, e.g. the average 12v 50w halogen down light converts 90% of the energy used into heat and only 10% into light. In contrast, currently available LED (light emitting diode) down lights use around 10% of the energy a standard halogen globe uses, yet provide up to 85% of the light output and lasting 20-50 times longer (Toda, 2011).

Tips when considering your artificial lighting requirements:

1. Consider energy efficient technologies when planning for additional household lighting. The availability and quality of compact fluorescent lights and LEDs has improved dramatically over recent years making them an obvious choice for new lighting needs or when retrofitting existing globes. (Check product guidelines when installing on a dimmer switch or within enclosed fixtures.)
2. A lower voltage globe does not indicate an energy efficient product. Consider low wattage, rather than low voltage globes to receive the greatest savings during operation.
3. Fluorescent lights use about 70-80% less energy and last longer compared to incandescent lights. They can be an economical choice for lighting larger areas.
4. To reduce energy consumption, install zone or task lighting for specific purposes such as reading.
5. Avoid general use of halogen down lights. These may be suitable for direct task lighting, but not cost effective when used to illuminate an entire room. If down lights are required, install energy efficient options and ensure they are fitted correctly with respect to insulation.
6. Motion sensor lights are preferable to leaving lights on for long periods of time.
7. Solar powered garden lighting can be used to illuminate or decorate driveways, paths and gardens. They are available in a variety of styles and sizes and are simple to install.
8. Dimmer switches can improve the efficiency of lighting, however, should not be used in place of energy efficient lighting. The cost saving resulting from dimming are not proportional to the amount of light reduced. For example, dimming a light by half will save about a quarter of the running costs.

Energy Capture

Capturing the raw solar energy that strikes a house can meet much of a home's hot water and electricity needs. This can be achieved by installing advanced solar hot water technology and/or a solar photovoltaic (PV) array. These technologies can be easily retrofitted to a home, providing you have suitable roof orientation and adequate space. Additional energy requirements to meet demand can be bolstered through grid electricity, gas supply or an alternate fuel or power source.

In basic terms, electricity being generated by a grid connected PV system is sent to an inverter where it is first used by the home. Any excess power is fed into the grid, where it may be eligible for a feed-in tariff (see Figure 11). Conversely, household demand above the PV output, or required overnight when the cells are not active, may be purchased directly from the grid supply.

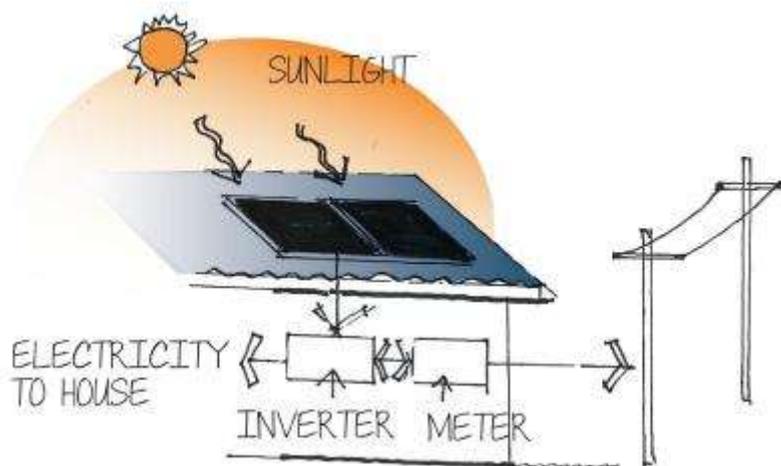


Figure 11: Grid connected Solar PV array. Electricity generated is first used by the household with any access supply able to be feed back to the grid.

Questions to consider when exploring the installation of advanced hot water and solar electricity (PV):

- Is the roof surface correctly pitched and orientated to maximise solar access? A northern orientation with a roof pitch of approximately 20-30 degrees is desirable. You can use frames (usually at an additional cost) to improve positioning.
- Do I have enough surface area to fit a system?
- Will shade from surrounding buildings or vegetation interfere with energy production?
- Are there any rebates, incentive programs or feed in tariffs that may help reduce my initial outlay and payback periods for products?
- Have I considered a number of quotes, inspected labour and product warranties, and spoken with energy providers to determine what changes will happen to my existing electricity account if I install a grid connected PV array?

Material Use & Selection

Consider product life span, environmental impact and potential health hazards when selecting materials.

All materials have an economic, environmental and social cost associated with them. Owners will be faced with a number of complex decisions and need to consider many factors that at times may conflict.

Material characteristics that will need to be considered include:

- cost and skill availability to work the material
- source of the material, environmental, health and toxicity issues
- thermal and insulation performance of the material
- maintenance, durability and life cycle of the material
- adaptability of a product
- embodied energy (energy use to produce a product, bring it to market, and dispose of it when no longer in use)
- climate and design intention versus material suitability

All materials have an embodied energy cost to manufacture and transport the product. Using materials with high embodied energy may be justified if they offer long term benefits or assist in reducing energy consumption during occupation. For example, concrete has high embodied energy but is a common flooring material for passive design as it adds considerable thermal mass to a building to reduce heating and cooling needs. It is however, possible to source more environmentally friendly forms of concrete compared to the standard product. These alternatives have recycled material such as aggregates and fly ash within the mix which lower the products environmental impacts.

In general, consider low energy embodied materials and look for locally sourced recycled products. It is also advisable to avoid using materials and products that have been treated with hazardous chemicals or which release high levels of toxic gases such as volatile organic compounds (VOCs) which can be harmful to your health. For example, regular paints release low level toxic fumes that can irritate breathing or induce headaches in sensitive individuals. Products such as paints and varnishes, adhesives, particle board, treated timbers and carpets may all have some level of “off gassing” and should be carefully investigated to reduce exposure to toxic substances. Given the trade-offs involved with materials selection, adequate research is important to inform your decision.

When renovating an older property beware of the potential dangers posed by lead based paints and asbestos, which may have been used during the initial construction. If removal and disposal is necessary make sure it is done responsibly. Demolition, removal and disposal of asbestos material require specialist attention. Asbestos is classified as a hazardous material and there are strict EPA guidelines on how it should be packaged, transported and disposed of.

Up to 40% of all waste reaching landfills is derived from building sites. Consequently waste management should be considered for even minor renovation projects. The mantra of reduce, reuse and recycle may also have the additional benefit of savings to your hip pocket. Reduce the amount of materials required for your project. Only purchase what you need. Reuse existing materials where possible or source options from salvage yards. Recycle excess or obsolete materials.

Water Use & Reuse

Minimise the consumption of water and integrate water capture and reuse.

Australia is the driest inhabited continent on Earth, yet one of the highest per capita water users in the world. In addition, considerable energy is used in the treatment of mains water, which is often used for purposes that do not require high quality water.

The existing home, carport or shed may present considerable surface area to collect water for tank storage. By installing a water tank during a renovation, you can create a supply for a number of household and garden activities such as laundry, toilet flushing and garden irrigation.

When making a decision on what type of water tank to install, consider:

- maximising storage capacity for your budget and available space
- location to household and gardening needs, positioning of downpipes
- expected service life of the tank
- aesthetics
- the need for support devices such as a pump, back flow valve, leaf or “first flush” diverter, or extra downpipes

A renovation may also provide an opportunity to upgrade fittings and appliances, as well as reconfigure and even insulate if necessary, the current plumbing work. Retrofit water saving devices such as low flow shower heads, tap aerators and dual flush toilets. Purchase new or replace worn-out appliances, such as washing machines, with more water efficient options. Consult the WELS water rating scheme to compare models and choose the highest rating product available for your budget. Avoid large baths as they require considerable amounts of water to fill. Some homes may have long hot water runs and as a result, waste large amounts of cold water waiting for the hot water to arrive. If applicable, explore water saving devices that bypass the need to purge cold water from the line first. Additional water saving measures may be achieved by assessing the viability of grey water reuse. Rebates for water efficient products may also be available. Request further information from your water provider or the relevant state or federal agency.



Figures 12 & 13: Dual flush toilet cisterns can be installed as a new unit or retrofitted separately to the existing toilet assembly. Low flow shower head.

Did you know?

- A water-efficient washing machine may use only one-third the water of an inefficient model.
- An old-style single-flush toilet could use up to 12 litres of water per flush, while a standard dual flush toilet uses just a quarter of this on a half-flush.
- A standard showerhead may use up to 25 litres of water per minute whereas a water-efficient showerhead might use as little as 7 litres per minute, less than a third. (WELS, 2011)

Landscaping & Outdoor areas

Landscape to support passive design and add beauty and amenity to the property while applying water conservation measures.

Undertaking a major landscaping project or conducting general garden maintenance can provide an opportunity to enhance your home living conditions. Trees, shrubs and ground covers can be planted for a range of purposes including; to shade, to act as a wind break, to channel cooling breezes, to reduce glare, to minimise run off and to add appeal to the garden. When planning a makeover of your outdoor areas select low water, drought tolerant plants and local native species while being mindful of bushfire defence. Resource material on the selection of indigenous plants for your area can be obtained from Indigo Shire, Landcare and the Department of Sustainability and Environment (DSE). If additional watering is required install a ground drip irrigation system attached to a rain water tank and timer and mulch garden beds to reduce both run off and evaporation.

Creating an appealing outdoor room can add to the size and flexibility of a home. A BBQ or decked area invites a healthy outdoor lifestyle and expands the usable dimensions of your block. When considering an outdoor area look to support the concept of solar passive design.

When designing your outdoor space consider provisions for:

- a clothes line (see Figure 14)
- a bin system for general waste, recycled waste, composting bins and worm farms
- a vegetable patch to supplement or supply food for the home



Figure 14: Position clothes line in a sunny open space

Swimming Pools & Spas

Besides the upfront costs of purchasing and installing a swimming pool or spa, associated operating costs can account for a large percentage of home energy consumption. Pool and spa pumps and water heating have the potential for high energy use and may be responsible for up to 30% of the household electricity bill (CSIRO, 2009). In addition, the use of chemicals to sanitise, clean and balance the water adds cost and brings hazardous substances onto the property. Before embarking on the installation of a pool or spa consider local community amenities, projected patterns of use, and the anticipated impact on home valuation.

Tips for the improving the efficiency of a pool or spa include:

1. Explore options to reduce the need for chemicals and the use of a pump to treat water. Options may include saltwater pools to reduce the amount of chlorine required, installing a natural pool where plants are used to treat the water, or portable solar powered water purifiers that use ionisation to help maintain water quality. These floating ionising devices can dramatically lower the amount of chlorine needed in the pool and subsequently reduce the duration of pump operation.
2. Follow the manufacturer's instructions for filter pump use to maintain pool hygiene. Reduce costly overuse. Clean and regularly maintain the filter system
3. If water heating is necessary for your pool or spa preference should be given to solar, electric heat pump, or gas heating options. If the spa has a standby heater, switch it off when the spa is not in use. In addition protect and insulate the spa from extreme conditions.
4. Use a pool cover to reduce evaporation and heating requirements.

Room by Room

Common design efficiency and material decisions can be identified when considering renovations on a room by room basis.

Home Office/Study

Having a designated home office is becoming more and more desirable as increasing numbers of people work from home. Many renovations will consider the inclusion of a study/home office (and potential spare bedroom) to meet the needs of working adults or students. When planning an area for this use, consider:

- Expected pattern of daily use?
- Is there enough natural light?
- Is the area comfortable and healthy?
- Are electronic connections easily accessible?
- Are appliances and office equipment energy efficient?

Garage or Shed

Think about the common activities to be conducted in your garage. If it is simply to store tools, equipment or a motor vehicle then you may not need to utilise additional efficiency measures. If it is going to be used for recreational pursuits, the space may require heating and cooling. If this is the case, consider installing insulation to reduce demand and energy use. As most of the heat loss occurs through the roof this would be a good place to start, followed by the walls if the budget allows. Addressing other needs, power outlets, water connections and lighting may provide an opportunity to improve efficiency and increase usability.

Common Living Area

It makes sense to use a renovation to improve comfort and efficiency in the most commonly used areas of your home. Look to include passive design features and improve insulation to reduce the need for additional heating and cooling. Make provisions to allow the area to be closed off from the rest of the house for times when additional heating and cooling is unavoidable.

Consider the following to improve the energy performance of this area:

- Maximise comfort through good design, the application of passive design elements and insulation.
- Use light colours schemes and maximise natural light.
- Install energy efficient globes, and where applicable use task lighting to meet artificial lighting needs.
- Avoid the excessive use of down lights to illuminate entire rooms.
- Improve glazed areas and apply window treatments, covering and protection to reduce heat transfer.
- Research the energy efficiency of appliances and entertainment equipment and choose low energy options.

Kitchen

Kitchens are often included within the main living area and can be a common focus for a renovation. Common upgrades may include replacement of existing bench tops and cabinet doors, or purchase of new appliances such as refrigerators, dishwashers and those used for cooking. Larger works may involve the total replacement or relocation of the entire kitchen area. Depending on the scale of work being undertaken there will be a number of material selections, and energy and water efficiency decisions to be made along the way.

When considering a kitchen renovation look at:

- Purchasing size appropriate and energy and water efficient appliances and devices.

- Evaluating the working layout, bench space and storage options.
- Including an easy to use waste sorting bin system to separate general rubbish, recycled material and composting or green waste.
- Using task lighting.
- Ensuring separation of cooking and refrigeration appliances.
- Selecting healthy (low VOC) interior products when choosing paints, finishes, flooring and cabinetry.

Wet Areas

Wet areas like bathrooms are also a frequent renovation target. Work may provide access to otherwise difficult to reach plumbing and allow upgrading of insulation. It may also provide the opportunity to check for leaks in existing plumbing and the fitting of water saving appliances and devices.

Look to improve efficiency by:

- Installing a dual flush cistern and consider connecting the toilet to a rainwater supply.
- Fitting water efficient shower heads and tap aerators.
- Selecting water and energy efficient washing machines and appliances.
- Installing an advanced hot water system.
- Adding insulation to ceilings, walls and floors, and around hot water pipes (lagging).
- Allowing for windows to provide natural lighting and that can be opened for ventilation.
- Draught proofing exhaust fans.
- Selecting low VOC interior products when choosing paints, finishes, flooring and cabinetry.



Figure 15: Many water efficiency gains are possible in a bathroom renovation.

Outdoor Areas

Look to create an outdoor area as an extension of the existing home. This will give a feeling of increased space and encourage healthy outdoor activities. An outdoor dining area can be designed to complement passive design and flow from the main living area. Pergolas can use deciduous planting to provide shade in summer while allowing sun during winter. Gardening areas offer the pursuit of hobbies and provide services for the household.

When designing the outdoors space consider:

- Including an outdoor living room for entertaining. This can be planned to support passive design.
- Landscaping using drought tolerant plant species.
- Mulching garden beds to reduce watering needs.
- Including usable spaces for a washing line, vegetable patch, composting area and waste systems.



Figure 16: Home grown vegetables offer many benefits; financial, health, flavour, freshness and low embodied energy.

Summary of Opportunities

Action	Cost	Benefit
<p>Adapt existing floor plan to work with solar passive design.</p> <p><i>Many elements to consider, e.g. orientation, use of thermal mass, window location, window treatment & protection.</i></p>	Varied.	Improved use of existing floor plans may enhance occupant comfort & reduce heating & cooling requirements.
<p>Upgrade or install quality insulation.</p> <p><i>Roof, wall & floors, as well as lagging hot water pipes to reduce heat loss. Also, consider solar roof paints to reflect sunlight.</i></p>	Low to medium.	Reduce household operating cost & improve comfort levels.
<p>Identify & seal draughts.</p>	Low.	Reduce winter heat loss & summer heat gain while enhancing insulation effectiveness.
<p>Upgrade windows.</p> <p><i>Install double glazing or fit secondary glazing solutions.</i></p>	Medium (secondary glazing products) to high (total window replacement).	Reduce household running costs & improve comfort levels.
<p>Install window protection.</p> <p><i>E.g. eaves, awnings, solar films, curtains, pelmets.</i></p>	Medium.	Improve comfort & reduce running costs.
<p>Retrofit water saving devices.</p> <p><i>E.g. tap aerators, low flow shower heads, dual flush toilets.</i></p>	Low. Check for rebates.	Reduce water consumption & reliance on high quality potable water.
<p>Install a renewable energy.</p> <p><i>E.g. PV or wind turbine (if suitable).</i></p>	High. Check for rebates and incentive schemes.	Reduce reliance on grid electricity.
<p>Install energy efficient, size appropriate hot water.</p> <p><i>Advanced hot water systems, e.g. solar hot water and heat pump systems.</i></p>	High. Check for rebates.	Reduce household running costs.
<p>Upgrade to energy efficient lighting.</p>	Low.	Reduce energy consumption & household running costs.
<p>Purchase energy & water efficient appliances.</p> <p><i>When buying new or replacing obsolete models.</i></p>	Varied.	Reduce household running costs & reduce potable water consumption.
<p>Install water tanks.</p>	Medium. Check for rebates.	Reduce reliance on high quality potable water.
<p>Landscape for the local climate.</p> <p><i>Choose drought tolerant native species.</i></p>	Low.	Lower water & fertiliser requirements. Higher probability of plant establishment.

Build styles

Choose a renovation build style that is sympathetic to the local climate and complements the existing dwelling.

Build styles are many and varied. Bricks are a commonly used material that can be applied as a single skinned veneer, double brick or reverse veneer (bricks on the inside) construction. Other build styles may include timber, metal or polystyrene cladding, concrete bricks, stone, mud brick, straw bale, timbercrete, rammed or poured earth.

A renovation may allow for the introduction of a new build style or an improved application of the existing build style. This is particularly relevant when modifying the existing structure or adding additional rooms. All materials and build styles will have their advantages and disadvantages. Materials have differing properties that can greatly influence the manner in which the house stores and transfers heat. These properties may impact design options and insulation requirements. It is important to assess the design, thermal mass and insulation properties of a material to choose a build style suitable for your location.

Materials with high thermal mass will allow the home to heat and cool gradually. Combining high thermal mass with passive design, quality insulation and good ventilation can lessening extreme and rapid changes in temperature making the home more comfortable to live in.

Some effective ways of applying thermal mass and insulation through a build style include:

- Reverse brick veneer (RBV). Bricks are the inner shell of the house and are separated from an outer external cladding (such as corrugated iron) by a layer of quality insulation in the wall cavity.
- Double brick veneer, also called full brick, where the home has an external and internal shell of bricks separated by insulation in the wall cavity.

Other less conventional building techniques such as straw bales, rammed earth, and mud brick may have a lower embodied energy and environmental impact than traditional brick buildings while offering considerable thermal mass or insulation advantages. In general, materials may need to be considered and applied differently depending on location and climatic conditions. When the opportunity arises, select a build style and materials that works with the existing dwelling and the local climate to reduce costs and improve comfort.

For further information on individual build styles and their performance summaries refer to Section B of the *Better Build Toolkit – New Home Guide*.



PART B – Checklist

Checklist

The following checklist is a basic tool to prompt discussion when planning and designing a home renovation. Each item may contribute towards improving the efficiency performance of the house. Depending on the scope and project area not all items may be relevant. Tick elements that you have been able to include during the design phase. Consider areas that have not been ticked as opportunities for additional improvement.

Renovation Checklist		Yes/No
1	Plan for quality design and layout that is clever rather than bigger.	
2	Rework layout to support passive design.	
3	Maximise northern windows in living areas to apply passive design. Ensure suitable shading options over summer months.	
4	Create opportunities for air flow to cool the house. Fit doors and windows to promote good cross ventilation using cooling breezes over summer.	
5	Use materials with high thermal mass in northern facing living areas to capture winter sun for solar passive heating purposes, e.g. concrete flooring or tiles.	
6	Maximise window efficiency by installing double glazing, pelmets and heavy drapes to retain heat in winter.	
7	Introduce external shading options to reduce penetration of hot summer sun.	
8	Install or upgrade insulation with a high quality product in roof, walls and floors.	
9	When painting the exterior of the house chose light coloured paints that reflect more heat. Use light colours or solar paints when upgrading roofs.	
10	Minimise draughts.	
11	Use zoning to reduce additional heating and cooling needs.	
12	Install highly energy efficient, size appropriate heating and cooling appliances.	
13	Install ceiling fans to aid cooling and air movement.	
14	Install solar electricity to reduce grid electricity consumption.	
15	Install advanced solar thermal hot water.	
16	Improve insulation of water pipes and hot water storage tanks.	
17	Install water efficient, size appropriate devices and appliances, e.g. AAA rated water devices such as shower heads, dual flush toilets and tap aerators.	
18	Use natural lighting or install energy efficient, task specific lighting.	
19	Install cabinetry made from natural materials or low emission particle boards and finishes.	
20	Select low VOC emission paints and carpets.	
21	Separate recycled building materials from general waste and dispose of responsibly.	
22	Install a large rain water tank for selected household activities and the garden.	
23	Where appropriate, divert waste water from the laundry for use in the garden.	
24	Reduce chemical use and pump operation for pools and spas.	
25	Landscape to support passive design, e.g. summer shading and channelling of breezes for cross ventilation.	
26	Plant locally indigenous drought tolerant plant species to reduce water requirements.	
27	Create a vegetable patch, composting site, worm farm and an external clothes drying area.	

Resources

Information Links

Alternative Technology Association (ATA)

A leading non-for-profit organisation promoting sustainable technology and practice.

<http://ata.org.au>

Asbestos in the home – Health and safety in the home.

A booklet by Victoria's Department of Health that has been developed for householders intending to work with or remove asbestos from their property.

<http://www.environment.gov.au/atmosphere/airquality/publications/pubs/leadpaint.pdf>

Choice Magazine

Independent magazine and website that offers product reviews, comparisons, buying guides and advice for Australian consumers.

<http://www.choice.com.au/1/index3.aspx>

Green Saving Calculator

A helpful online tool to help measure potential saving when planning to build a new home or renovate an existing house.

<http://www.greensavingscalculator.com.au/>

Living Green

Australian Government site, administered by the Department of Climate Change and Energy Efficiency, with information on how-to's, rebates and sustainable living.

<http://www.livinggreener.gov.au>

Sustainability Victoria (SV)

An agency of the Victorian Government that provides valuable resource material on various key concepts and design elements for building as well as information on grants, funding, rebates and various sustainability programs.

<http://www.sustainability.vic.gov.au/www/html/1517-home-page.asp>

Sustainable Rebuilding Ideas – Complete Fact Sheets. Smart Choices for better homes.

Comprehensive series of fact sheets to help improve the energy efficiency and comfort when building a new home.

http://www.resourcesmart.vic.gov.au/documents/Sustainable_Rebuilding_Ideas_-_Complete_Fact_Sheets.pdf

Sustainable Energy Info Fact Sheets including:

Windows and Glazing Solutions, Insulation, Thermal Mass, Hot water

http://www.sustainability.vic.gov.au/resources/documents/Window_placement.pdf

http://www.sustainability.vic.gov.au/resources/documents/Window_protection.pdf

http://www.sustainability.vic.gov.au/resources/documents/Insulation_types.pdf

http://www.sustainability.vic.gov.au/resources/documents/Thermal_mass.pdf

http://www.sustainability.vic.gov.au/resources/documents/SHW_Factsheet_07.pdf

The Six Step Guide to Painting Your Home.

Produced by the Australian Government Department of the Environment, Water, Heritage and the Arts, the guide provides information and advice on lead based paints.

<http://www.environment.gov.au/atmosphere/airquality/publications/pubs/leadpaint.pdf>

Your Home – Design for Lifestyle and the Future

Extensively used across this document, the manual and guides offers consumer and technical guidance to promote the design, construction and renovation of comfortable, healthy and environmentally sustainable housing.

Your Home Technical Manual

<http://www.yourhome.gov.au/technical>

Your Home Renovators Guide

<http://www.yourhome.gov.au/renovatorsguide>

Your Home Buyers Guide

<http://www.yourhome.gov.au/buyersguide>

Products and Suppliers

E3 Equipment Energy Efficiency

Government site focused on improving energy efficiency of appliances and products. The site features many programs including energy rating labelling to allow consumers to compare products.

<http://www.energyrating.gov.au>

EcoSpecifier

Developed by the RMIT University's Centre for Design this is a guide to selection of materials on an environmentally preferred basis. The web site helps evaluate life cycles of materials and the sourcing of greener products.

<http://www.ecospecifier.org>

Moreland Greenlist

Provides general information on the properties of various products and construction components

http://www.sustainablesteps.com.au/pdf/Moreland_Greenlist_050905v2.0.pdf

Australian Green Procurement

A green procurement database.

<http://www.greenprocurement.org/php/listCategories.php>

Greenpower

Greenpower is a Government accreditation program for renewable energy generation.

<http://www.greenpower.gov.au>

GreenSmart

GreenSmart was established by HIA in 1999 to promote practical, affordable and durable environmental solutions for residential design and construction.

<http://hia.com.au/hia/channel/builder/region/national/classification/greensmart.aspx>

Green Painters

Green painters is a national initiative providing training, consumer information and skills promotion of environmentally preferable coating technology.

<http://www.greenpainters.org.au>

Green Plumbers

Green Plumbers is a Master Plumbers and Mechanical Services Association of Australia (MPMSAA) initiative to enhance plumbers skills and knowledge about the environmental aspects of their work such as energy efficiency and water conservation.

<http://greenplumbers.com.au>

The Green Directory

Online resource for locating green business, services and products.

<http://www.thegreendirectory.com.au>

Water Efficiency Labelling and Standards (WELS) Scheme

Australia's water efficiency labelling scheme that allows consumers to compare products that use water.

<http://www.waterrating.gov.au>

Window Energy Rating Scheme (WERS)

Independently managed by the Australian Windows Association, WERS rates the energy impact of a window across any climate in Australia.

<http://www.wers.net>

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