Australian Government

YourHome
Australia's guide to environmentally sustainable homes

Design For Place

WELL-DESIGNED
COMFORTABLE
FUNCTIONAL SPACES
SUN-FILLED
CLIMATE SPECIFIC
ADAPTABLE

TELOPEA

Telopea House

A two-storey family home with lots of natural light and connection to outdoor living areas. Receives warmth from the sun in winter and is shaded from the direct sun in summer. Includes four bedrooms, two full bathrooms and flexible living spaces.

4 bedroom

3 bathroom

2 living

203m^2 (excluding garage)

Potential to achieve an energy star rating of:

8.2
The more stars the more energy efficient
NATIONWIDE HOUSE ENERGY RATING SCHEME

Designed for Melbourne

To be read with the Telopea House Melbourne Technical Drawings.

Ideal for a block with north to the side but can be adapted for blocks with other orientations.

How to use these design options

This design options document offers construction, material and appliance options for the Telopea House, as well as a snapshot of key principles to consider when designing any sustainable home.

The Telopea House provides a best practice example to help you apply energy-efficient design principles to your home. It has been designed by an architect in collaboration with an energy assessor and is ready to use or can be adapted to best suit your climate, block and orientation.

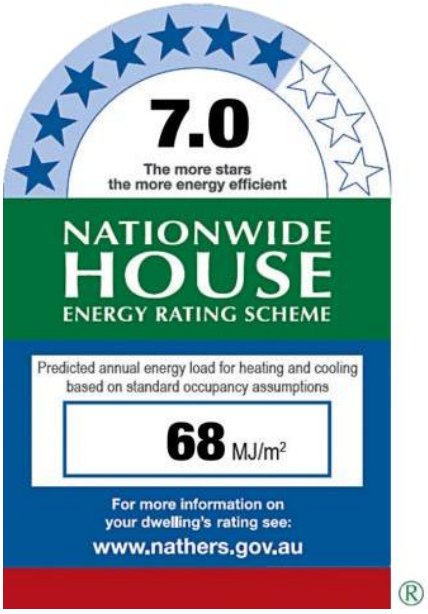
Your architect, designer or builder can help you change these plans to meet your needs. You could also use the Telopea House design options to:

- develop a concept for your own design brief to take to an architect, designer or builder
- incorporate design features into your house design or renovation
- understand key principles to consider when designing a sustainable home
- consider how to adapt the specifications for your climate and local requirements
- choose your heating and cooling, hot water, cooking and solar PV systems.

Telopea House street view

NatHERS Thermal Star Rating

The Nationwide House Energy Rating Scheme (NatHERS) star rating measures how efficient it is to heat and cool a new home relative to the building's unique design features, including orientation, materials and climate.

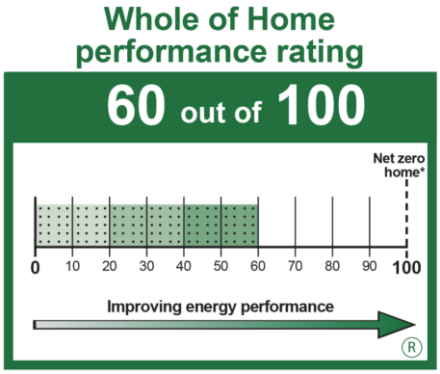


A NatHERS star rating is the most common method used to show that a new home complies with the minimum energy efficiency (or "thermal performance") requirements in the National Construction Code (NCC) 2022. A 7-star rating is the minimum standard in most states and territories.

An energy assessor calculates the star rating using a NatHERS software tool to determine the thermal performance of the home. This is expressed as the number of megajoules of energy per square metre of floor area used for heating and cooling over a year. Assessors are generally engaged by the architect, designer or builder on your behalf, but you can also hire your own. Engaging an assessor early in the process will help you adapt your design to get the best outcome.

NatHERS Whole of Home Rating

In addition to the star rating, NatHERS has a Whole of Home (WoH) performance rating. WoH measures the energy use of the entire home, including common household appliances such as heating, cooling, hot water, lighting, pool/spa pumps and on-site energy generation and storage (i.e. solar panels and batteries). The rating predicts costs for the consumer, to the energy network and to the environment in greenhouse gas emissions.



The WoH rating produces a number from 0 to 100, where 60 is the minimum standard for compliance with NCC 2022 and 100 is a "net-zero" energy home. It is possible to have a rating beyond 100 if the home generates more energy than it uses. The NCC 2022 includes a whole-of-home annual energy use budget for the appliances above.

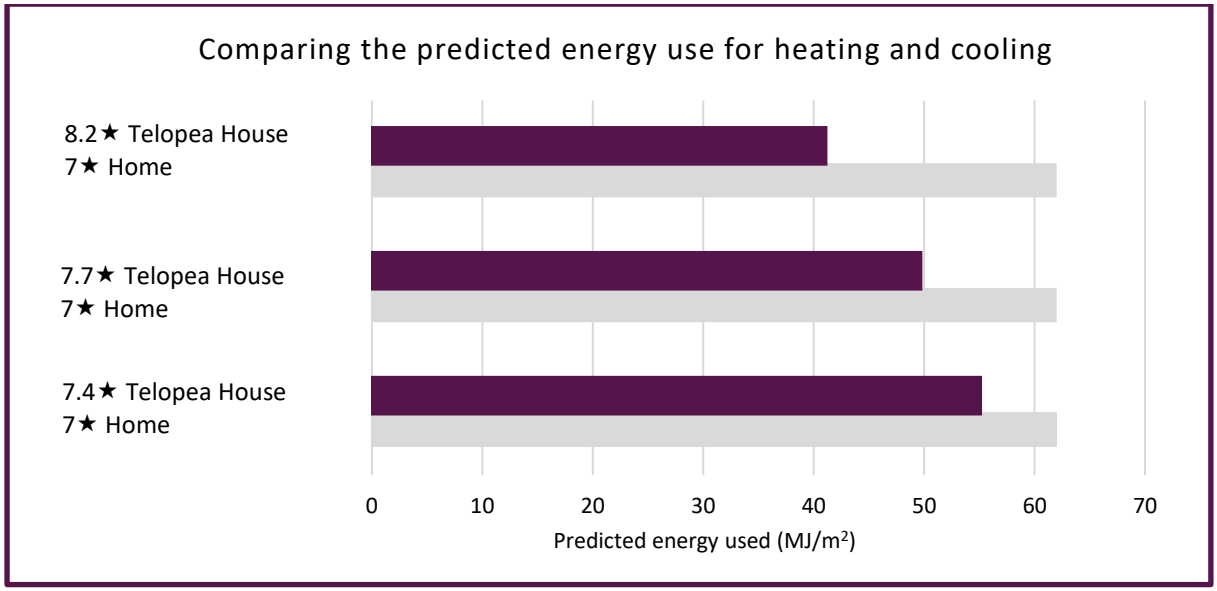
Benefits of a higher star rating

Your home will need to be rated by an energy assessor even if you decide not to alter the Telopea House. Local conditions, site parameters and any changes to the Telopea House specifications or drawings will affect your energy rating. Engaging an assessor early can help you compare options before decisions are locked in.

Aiming for a higher star rating than the minimum standard of 7 stars can significantly improve the comfort and reduce the cost of running your home. Homes with higher star ratings rely less on heating and cooling systems. Less energy use means lower energy bills.

Telopea House in Melbourne has three variations that meet or exceed the minimum of 7 stars. The graph below shows the energy savings from heating and cooling for these three variations.

Telopea House 8.2★ requires 34% less energy[1] to heat and cool than a 7★ house.



[1] This number is the amount of heat that needs to be added or removed to keep that home comfortable, measured in megajoules per square metre (MJ/m²). This is calculated by NatHERS software based on the specific design, specifications, and location. The actual annual energy use for heating and cooling would depend on the chosen appliances, how efficient they are and how much they are used.

Design features

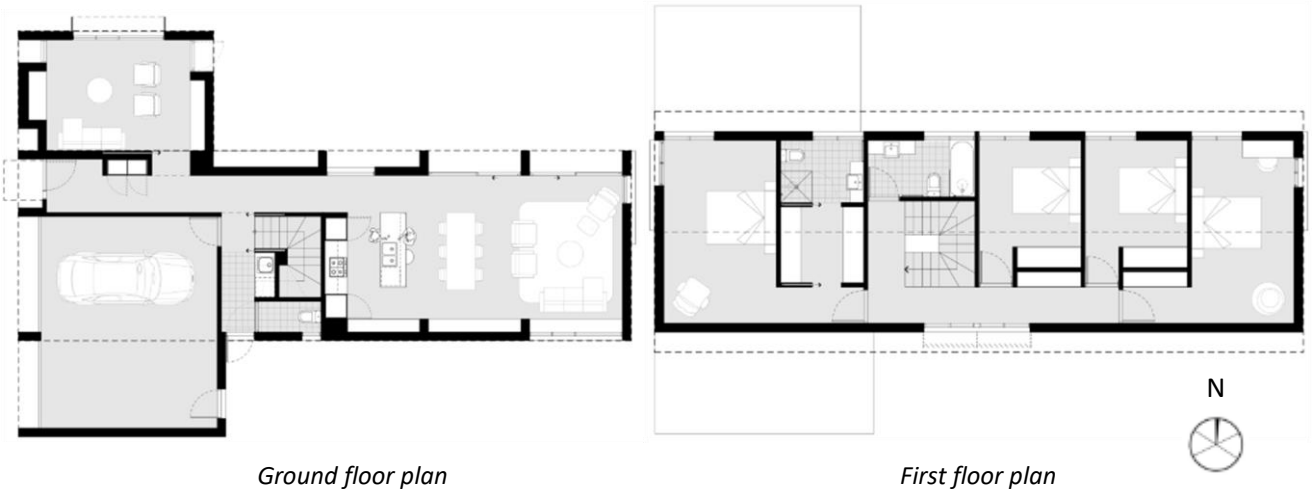
The Telopea House design offers a home with desirable features, such as:

- generously sized bedrooms to fit a queen bed
- separate study space
- living areas open to outdoor spaces with connection to the yard
- a functional floor plan with minimal circulation space
- simple layout of rooms to support ease of construction and reduce build costs
- accessible bathroom and toilet and practical bathroom and laundry layouts
- a single garage with additional storage space
- open plan kitchen/dining/living and separate second living area.

The design also incorporates sustainability principles and considerations to maximise energy efficiency and comfort.

The Telopea House design:

- provides a great outcome for a small block with north to the side
- has doors to separate rooms and provides zoned internal spaces, so you can heat and cool only the rooms you need
- includes windows sized and positioned for solar orientation, natural light and cross-flow ventilation
- reduces construction and heating and cooling costs due to compact layout
- optimises eaves and shading devices for summer shade, while allowing in winter sun
- provides natural light and winter sun to fill all living areas and bedrooms
- includes burnished concrete floor for thermal mass
- has approximately 160m^2 roof space available for solar panels.



Ground floor plan

First floor plan

See **Telopea House Melbourne Technical Drawings** for detailed floor plan

Visit *Your Home* for detailed information on key sustainable design principles

Building specifications

The building specifications outlined below show what construction materials you will need to help you reach your desired star rating. Discuss these options with your architect, designer or builder, so they can customise it to suit your needs. Higher star rated options often do not cost significantly more and can result in longer-term savings and increased comfort. These construction details have been optimised for the Telopea House designed for Melbourne. See the technical drawings for more details.

Construction details				
NatHERS Thermal Star Rating		**7.4★**	**7.7★**	**8.2★**
Floor	Ground floor: 100mm concrete slab with R1.0 insulation to underside and edges	✓		
	Ground floor: 100mm concrete slab with R1.8 insulation to underside and edges		✓	✓
	Upper floor: Timber joists and timber flooring with R4.0 insulation in floor framing between ground and upper levels	✓		
	Upper floor: Timber joists and timber flooring with R5.0 insulation in floor framing between ground and upper levels		✓	✓
	Finishes: Burnished concrete to ground floor (except Living Room 2), carpet to bedrooms and Living Room 2, ceramic tiles to wet areas	✓	✓	✓
Ceiling	Ground and upper floors: 10mm plasterboard on timber framing with R5.0 batt insulation in ceiling space above	✓		
	Ground and upper floors: 10mm plasterboard on timber framing with R6.0 batt insulation in ceiling space above		✓	
	Ground and upper floors: 10mm plasterboard on timber framing with R7.0 batt insulation in ceiling space above			✓
Roof	Ground and upper floors: Metal sheet roofing on timber battens with R1.5 Anticon blanket	✓	✓	✓
External walls	Ground floor (all) and upper floor (east and west): Brick veneer, timber frame, R2.5 batt insulation, sarking to code, 10mm plasterboard	✓		
	Ground floor (all) and upper floor (east and west): Brick veneer, timber frame, R2.7 batt insulation, sarking to code, 10mm plasterboard		✓	✓
	Upper floor (north and south): 18mm fibre cement weatherboards on double battens, R2.5 batt insulation, sarking to code, 10mm plasterboard	✓		
	Upper floor (north and south): 18mm fibre cement weatherboards on double battens, R2.7 batt insulation, sarking to code, 10mm plasterboard		✓	
	Upper floor (north and south): 18mm fibre cement weatherboards on double battens, R3.3 batt insulation, sarking to code, 10mm plasterboard			✓
Internal walls	10mm plasterboard on timber framing with R2.0 batt insulation	✓	✓	
	10mm plasterboard on timber framing with R2.7 batt insulation			✓
Windows	Double glazed (argon filled), high solar gain low E glass, thermally broken aluminium frame	✓		
	Double glazed (argon filled), clear glass, uPVC frame		✓	
	Double glazed (argon filled), clear glass, timber frame (ground floor north-facing)			✓
	Double glazed (argon filled), high solar gain low E glass, timber frame (all other windows)			✓

General Notes

- Insulation is often measured as an R value – a measure of resistance to heat through a specific thickness of a material. Higher values indicate better insulating properties.
- uPVC (unplasticised polyvinyl chloride) window frames have similar insulating properties to timber frames.
- Burnished concrete allows maximum thermal mass and works particularly well in cool locations. For the thermal mass of a concrete slab to work effectively, it must not be covered with floor coverings. This allows it to absorb/expel heat when used in conjunction with good solar passive design.
- Draught sealing is achieved by weather strips to all windows and sliding doors, seals and weather strips to hinged external doors, and sealed exhaust fans to bathroom, ensuite, powder room, and kitchen rangehood.
- There are 1500mm diameter ceiling fans in living, dining and bedroom spaces.

Appliance specifications

The appliances described below suggest what might help you reach your desired Whole of Home rating. A range of options are shown, from those that achieve the minimum NCC2022-compliant rating (60/100) to those that achieve much higher ratings. **Option 3** appliances are assessed with the lowest star-rated house and **Option 1** appliances with the highest star-rated house. Different situations and locations may inform appliance choices, such as whether heating demands or cooling demands dominate, what energy sources are available and how much they cost.

The floor area of this design is 203m^2. This location is a "cold" air conditioning zone. This information has been used to inform the selections below.

Appliance details		Option 3	Option 2	Option 1
NatHERS Thermal Star Rating		**7.4★**	**7.7★**	**8.2★**
NatHERS Whole of Home Rating		**62/100**	**85/100**	**92/100**
Heating and cooling	Multi-head VRF RCAC, 22.4kW 3-star cooling, 25kW 4-star heating	✓	✓	
	Split RCAC, 7.1kW 3.5-star cooling, 8kW 2.5-star heating, for living area Split RCAC, 2.6kW 6.5-star cooling, 2.7kW 3.5-star heating, for landing/stairs Split RCAC, 2kW 4.5-star cooling, 2.7kW 3.5-star heating, for Living 2 Split RCAC, 4.6kW 4.5-star cooling, 4.7kW 3-star heating, for bedroom 1 Split RCAC, 2.0kW 4.5-star cooling, 2.7kW 3.5-star heating, one for bedroom 2, one for bedroom 3 Split RCAC, 2.5kW 4.5-star cooling, 3.2kW 3.5-star heating, for bedroom 4			✓
Hot water	Heat pump hot water (off-peak), 315L, 35STCs	✓	✓	✓
Cooking	Electric cooktop and electric oven	✓	✓	
	Electric induction cooktop and electric oven			✓
Lighting	LED ceiling mounted oyster fittings, hanging pendant over kitchen island bench	✓	✓	✓
On-site energy generation and storage	No solar panels, no battery	✓		
	3kW solar panels, 3kW inverter, no battery		✓	
	3kW solar panels, 3kW inverter, 4kWh lithium battery			✓
Operating outcomes	Running cost ($/year)	$1,251	$487	$250

General Notes

- Lighting energy consumption is based on floor area, LED lighting and an assumption of 4W/m^2.
- Heating and cooling appliances are sized using data from the Whole of Home assessment tool. Installers may recommend larger appliances by default as many homes are not as thermally efficient as these.
- Hot water tank size based on a minimum of 50L/person/day. A different sized tank/system with similar STCs may be chosen with little/no effect on Whole of Home rating.

Windows and doors

Windows and glass doors can be a major source of heat gain in summer and heat loss in winter. Up to 87% of a home's heat gain and up to 40% of its heat loss can be through windows and glass doors. Improving the thermal performance of windows reduces these heat gains and losses and reduces energy use. The building specifications on the previous page show examples of the impact of different frame materials and glass types.

Generally, windows and glass doors transfer heat faster than a well-insulated wall. This is one reason why the type of glazing has a significant impact on an energy rating. Other considerations include optimising glazing-to-floor area ratios for each room and adequate shading.

The estimated NatHERS star ratings on the previous page are based on generic window performance values. Your architect, designer or builder can tell you what products are available to match the window specifications. Engaging an energy assessor as soon as your window selection has been made or, even better, working with an energy assessor on your window selection and optimisation will ensure you achieve the best outcome for your home.

See the technical drawings for window sizes and types which have been optimised for the Melbourne climate.

Visit *Your Home*'s Glazing section to learn more about the influence of glass on the thermal properties and comfort of a home.

Shading

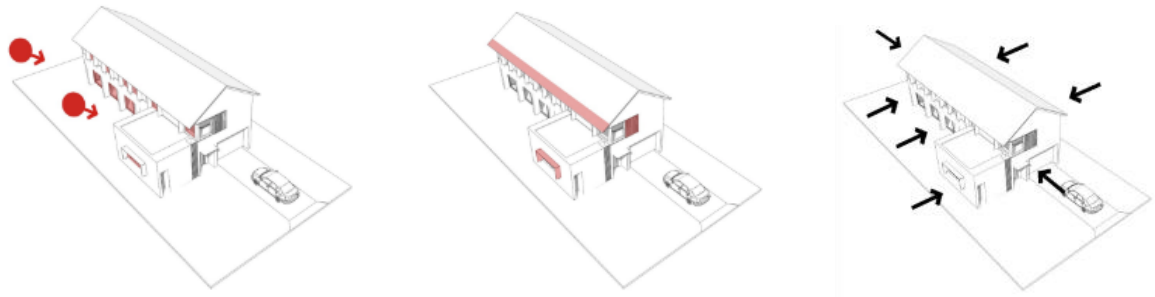
Shading can make a big difference to your comfort and energy use. In summer, and in warmer climates, external barriers like eaves and sunshades can be used to block the sun from entering windows. In winter, and in colder climates, shading can be reduced to allow the sun to naturally warm your home. Good design will use shading to optimise or limit solar access for your specific climate.

North-facing sides of your home benefit most from fixed shading, such as eaves and awnings. When designed well, shading can self-regulate solar access throughout the year without requiring any user effort.

Adjustable shading that is vertical, such as external blinds or screens, is often recommended for the eastern and western sides of your home. This is because the sun rises and sets at lower angles in the sky to the east and west and horizontal shading from eaves and awnings will generally not keep the sun out. Shade cloth and deciduous planting can also be used to provide self-adjusting seasonal shading.

The roof and eaves of the Melbourne Telopea design have been carefully designed to improve solar gain in a cold climate. They have been optimised for adequate summer shading while still allowing solar heat gain in winter.

Visit *Your Home*'s Shading section to learn how shading can be used to optimise the comfort and energy efficiency of a home.



Concept sketches of key principles – design shaped to maximise northern exposure and preserve pleasant outdoor spaces, and various features used to shade windows from the summer sun.

Heating, cooling and appliances

Very little energy is needed to make a well-designed house comfortable. Appropriate insulation, which is essential for a comfortable house, combined with passive solar design and effective draught sealing, can minimise energy requirements for heating and cooling.

Heating and cooling systems and other appliances are considered in NatHERS Whole of Home ratings. It is important to incorporate these factors into your design process, to achieve your energy efficient home.

When choosing heating and cooling appliances, consider options that allow you to heat and cool only the occupied areas of your home. Fans are an excellent choice for cooling in a well-designed home. Typically, the air flow created by a fan provides a similar improvement to comfort as reducing the temperature by around 3°C.

Choosing a correctly sized system is also very important, as is careful consideration of its position. An undersized system will need to work hard for longer and will therefore not be as efficient. An oversized system will use more energy than is necessary. Expert advice is recommended.

Most heating and cooling systems must display either an Energy Rating Label or a Zoned Energy Rating Label in store to help you choose the most efficient model. Predicted running costs and energy ratings for these systems can be found at the Australian Government's Energy Rating Calculator. Visit *Your Home*'s Heating and cooling section to learn more about heating and cooling options.

Careful selection of other appliances can also save money and reduce your environmental impact without compromising lifestyle. The key appliances with higher energy use include hot water heaters, fridge-freezers, cooking appliances and TVs. Many of these appliances also require Energy Rating Labels. Consider the lifetime costs of energy efficient appliances, not just the purchase cost. Energy-efficient appliances can save you hundreds of dollars each year in running costs. Further advice on selecting appliances for the home can be found in *Your Home*'s Energy section.

Talking to your designer or builder

Use the information on the following page to guide your conversations with architects, designers or builders, to help you get the most out of your Design for Place project. Talk to a few to find one that understands your needs and ask for references from their clients.

Consider your needs

Take some time to consider your needs, including likely changes to your lifestyle over time. Think about how you use the spaces in your current home. Prioritise these needs and weigh up whether more space will deliver the best outcome over time. Bigger isn't always better—a larger home means more space to heat, cool and maintain. In many cases a smaller but well-designed, flexible space is more practical and better able to meet your long-term needs.

Discuss key principles

Review the Design for Place Design option specifications and the technical drawings and discuss these with an architect, designer or builder. Talk about how you can apply these principles, plans and energy performance ideas to build a more sustainable, efficient and liveable home. You may wish to use the checklist on the following page as a guide to what to ask and discuss.

Visit *Your Home*'s Building a home section for more advice on selecting and engaging with an architect, designer or builder.

Checklist

□ ORIENTATION AND SITE

Choose the Design For Place plan most applicable to your local climate and block. In most Australian climates, keeping living areas facing north but with adequate shading will be critical to keep your home comfortable. You may need to ask:

- Are there constraints to my block that should be considered when selecting and personalising my home plan?

□ ENERGY ASSESSOR

Early engagement with an experienced energy assessor will give you the best chance to optimise your home for energy efficiency and comfort before it is finalised and changes to key design principles are no longer possible. You could ask:

- Is the energy assessor NatHERS accredited and experienced with optimising energy-efficient designs beyond minimum standards?
- Can I organise my own energy assessment?
- Can I engage an assessor early to compare options and design decisions such as orientation and eaves?

□ MATERIALS

Builders may have preferred construction methods and material availability can differ across Australia. Changing the construction will affect the thermal performance of the design. You could ask:

- Are the specified construction materials available and affordable?
- Would any of the specifications require alteration? Can any changes be reviewed by the energy assessor before deciding?

□ CONSTRUCTION

Retaining or excluding heat effectively depends on insulation and adequate shading. Careful consideration of airtightness and sealing can also make a big difference to how your house performs. You could ask:

- How do you seal and ensure airtightness?
- Once built, do you inspect homes to confirm they are built as designed, for example checking insulation installation?
- If LED downlights are used, are they sealed and insulated?

□ WINDOWS

These designs have been developed with careful consideration of windows. Engage an energy assessor if changes are suggested, as window selection, sizes and locations will affect the star rating. This will ensure position, size and performance is optimised, with optimal glazing-to-floor area ratios for each room and adequate shading to suit your climate. You could ask:

- What window options are possible?
- What are the cost differences and benefits?
- Where do you usually source your windows?
- Can you provide the window types and sizes specified?

□ COST

The technical drawings and specifications include all the details builders should need to estimate construction costs and timeframes. You could ask:

- What is the estimated cost, based on this design and these specifications?
- What is included or excluded?
- How is the cost calculated? Is it $/m^2?

□ APPLIANCES

The choice of appliances, including heating, cooling and hot water systems, will impact ongoing running costs. The position and size of these will affect efficiency. You could ask:

- How do you determine the appropriate size and position for heating and cooling systems?
- Can you recommend energy-efficient appliance options?

□ COMPLIANCE

The design will need to be submitted for approval with your local planning authority. An architect, designer or builder should be experienced in meeting the requirements of the National Construction Code, as well as any state or local requirements. You could ask:

- Are there local council and state building requirements that must be considered?
- Does the proposed design pose any issues for meeting compliance?

Further information

Visit *Your Home* for further information about building a home, including:

Building a home: Learn about the general process of building a house, from pre-construction all the way to final hand-over.

Passive Design: Read more on the concept of 'passive design', and how it is used to design homes that reduce or eliminate the need for additional heating or cooling.

Orientation: Discover how a house's orientation on the block affects its heating and cooling needs and overall comfort.

Materials: Learn about the different materials and construction systems that are used in building a house.

Insulation: Understand the role of insulation in managing the flow of heat through a house.

Windows and glazing: Learn about the role of glass in a home's design and how it affects the heating, cooling and overall comfort of the home.

Energy and appliances: Read about how energy is used in homes and what your options are, such as hot water systems, solar panels and heating and cooling solutions.