JamesHardie™

Energy Efficiency Guide

A guide to creating low energy homes with Hardie™ products

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Australia — July 2025 | Make sure your information is up to date

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Introduction

Building an energy-efficient home is crucial for anyone looking to invest in a home that not only saves on heating and cooling energy costs but also ensures compliance with modern building codes and standards. Energy-efficient homes are designed with the latest technologies and building practices that ensure lower energy consumption, which translates into cost savings and a reduced carbon footprint.

This guide introduces a set of design principles aimed at improving the energy efficiency of dwellings. These principles should be considered from the early stages of the project.

Additionally, it provides specific recommendations for designing thermally efficient homes in each capital Australian city.

Glossary

Energy Efficiency: Energy efficiency refers to achieving the same outcome with less energy. In a residential context, this means maintaining a stable temperature throughout the year without needing additional energy.

Star Rating: A star rating is a system that rates the energy efficiency of a house, with more stars indicating better performance.

R-Value: The R-value is a property that indicates how well a system or material can prevent heat flow. A higher R-value indicates better insulation measurement.

Insulation: Insulation consists of materials that can slow down heat transfer, separating the temperatures on each side of the material (e.g., keeping warm air in during winter and out during summer) and potentially improving the energy efficiency.

Thermal Mass: Thermal mass refers to the capacity of a material to absorb, store, and release heat, similar to how a battery stores and releases energy.

Reflectivity: Reflectivity is the ability of a material to reflect radiant heat. A reflective material will stay cooler than a non-reflective material under the same conditions.

Glazing: Glazing refers to the layers of glass fitted within a window or door.

Unconditioned Areas: These are spaces within the house which are not heated or cooled with climate control systems, such as heating or air conditioning. This includes areas such as garages, laundries or bathrooms, among others.

Compliance

What are the compliance requirements around Energy Efficiency in residential construction?

The National Construction Code (NCC) 2022 requires all new builds and some renovations to comply with the Energy Efficiency provision outlined in Part H6 of the Code. This Part includes requirements aimed at improving the energy use of the building, and has as its main goals (Clause H601):

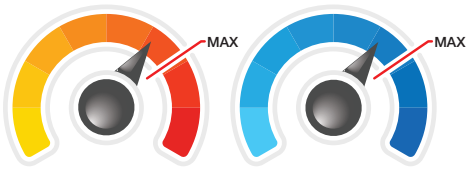
1. Reduce the energy consumption and energy peak demand, and
2. Reduce greenhouse gas emissions, and
3. Improve occupant health and amenity

How can I comply with Part H6 of the NCC 2022?

There are different pathways that can be used to demonstrate compliance to Part H6, however, the main alternative is by following the Deemed-to-Satisfy Provision H6D2 “Application of Part H6”.

Under this section, compliance can be achieved by following the requirements outlined in Specification 42 - House Energy Rating Software, specifically clause S42C2 Heating and Cooling loads.

A house energy rating software must be used to determine the performance of a proposed house design, and compliance will be achieved based on the following criteria:



Heating and Cooling Loads

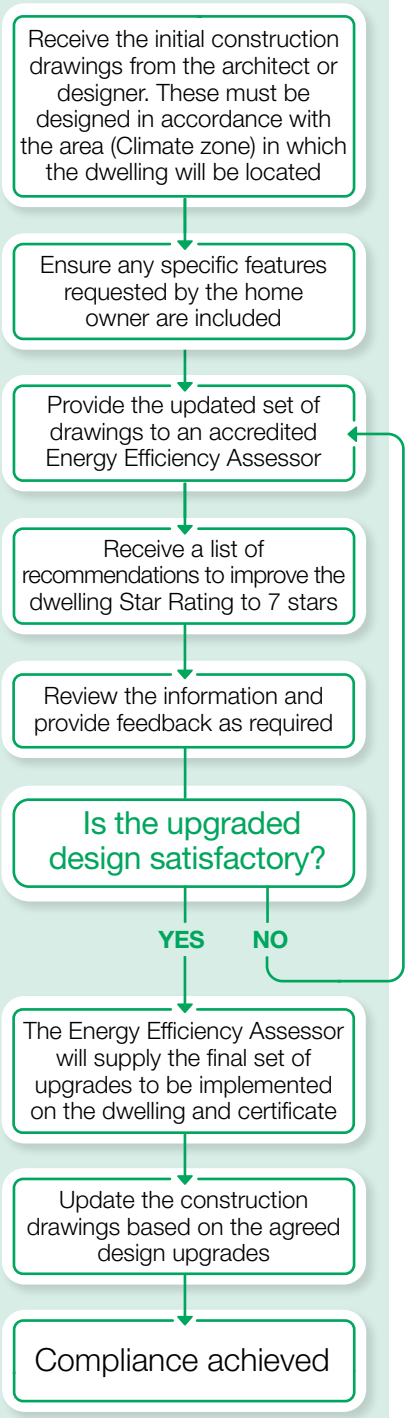
These are the maximum amounts of energy required to increase or decrease the indoor temperature of a home. These values are determined based on the project location and are specified on the ABCB Standard for NatHERS Heating and Cooling Load Limits.

Star Rating

This is a system that rates the energy efficiency of a house between 0 and 10 stars, with more stars indicating better performance. The Minimum Star rating required varies depending on the state and territory.

*This represents an overview of a typical compliance process; however, each project must be assessed separately to adjust the steps as required.

What is the process to comply with Part H6 of the NCC 2022?*



Star Rating Explained

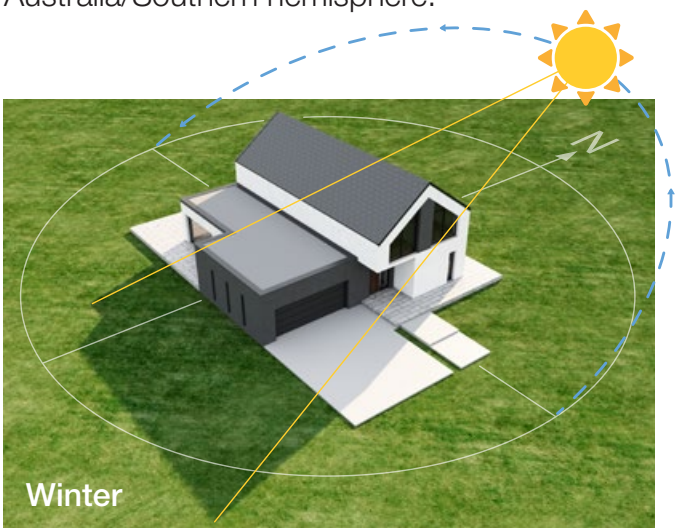
Star Rating	Energy Usage	Common House Characteristics	Performance Improvements
		Minimal ceiling and walls insulation Unshaded East/West glazing Poor orientation Excessive glazing	Increase ceiling insulation to R5.0–R6.0 Add R2.5 wall insulation to all external walls Reduce East/West glazing Shift major windows to North Add fixed eaves over North-facing glazing Limit glazing-to-floor ratio to <25%
		Basic insulation Limited shading on East/West facades Average window placement Sub-floor often uninsulated Thermal mass misplaced externally	Upgrade wall and ceiling insulation (R2.5+ walls, R6.0 ceiling) Introduce slab edge insulation (R1.0–R2.0 where applicable) Change clear glass to low-e or double glazing (U ≤ 3.0) Add eaves to North and vertical fins or awnings to East/West Reduce glazing on bedrooms and Western rooms Ensure window-to-floor ratio is climate-appropriate (typically <25%)
		Ceiling and walls are reasonably insulated North-facing windows with eaves Double glazing common Thermal mass is used strategically	Use double glazing with climate-matched SHGC (0.4–0.6 typical) Add sarking or wrap behind external cladding to control air leakage Apply reflective foil or rigid insulation to lightweight walls Prioritise openable windows on opposite sides for natural ventilation Concentrate glazing on Northern façade (50–80% of total area) Group bathrooms/laundry to South or West to buffer heat loads
		Passive solar principles integrated within the design Floor materials used to stabilise temperature (e.g. tile or polished concrete) Ceiling and wall insulation exceed minimums Glazing size and placement highly optimised by room use Shading and window orientation carefully managed for solar control Windows and openings placed for cross-ventilation	Use slab-on-ground or tiled floor for some thermal mass Optimise SHGC per climate (e.g. 0.4–0.6) Double glazing with good U-value frames Refine shading (e.g. fins, pergolas) Insulate roof and wall junctions carefully
		Advanced passive heating and/or cooling principles Glazing minimised or removed on East/West, and adjusted by room type Lightweight envelope made high-performing via continuous insulation Minimal thermal bridges on external walls and windows High-performance glazing	Use high specification frames with thermal breaks (U ≤ 2.0) Floor insulation under all habitable zones (R2.5 underfloor or edge) Shade all East/West glazing with fixed or operable devices Reduce exposed surface area (compact form) Apply thermal zoning with closing doors/partitions
		All decisions in layout, glazing, and materials made with thermal performance in mind North-facing glazing only Very tight air control Shading fully optimized to the climate Thermal mass used selectively if beneficial, but not essential	All glazing North-facing with eaves tailored to orientation Glazing-to-floor area kept below 18%, SHGC fine-tuned R6+ roof, R2.5–R4.0 walls, R2.5–R3.0 floor insulation Minimal thermal bridging via junction detailing and framing method Slab insulation continuous with perimeter and underside treated Orientation aligned to true North ±15° for main habitable zones

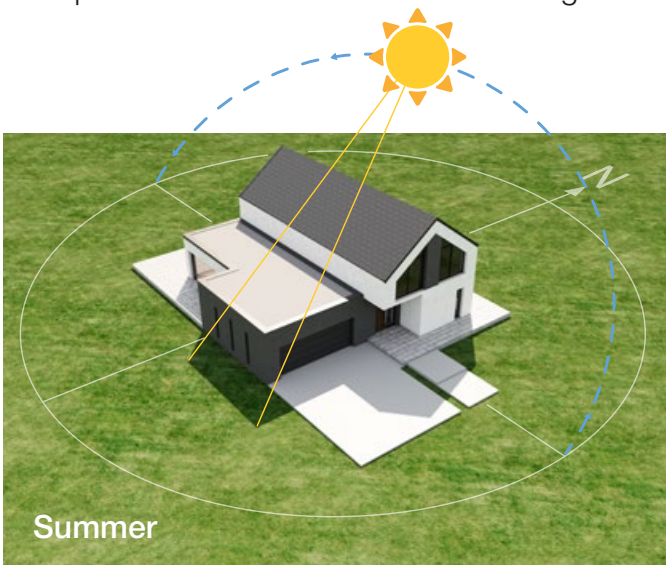
Design Principles

Energy-efficient house design has become a buzzword in the world of architecture and homeownership. With a growing awareness of environmental issues and the desire to reduce energy costs, people are increasingly seeking homes that not only look beautiful but also requires less energy to heat during winter or cool during summer. This section will guide you through the different design principles that must be considered to achieve an energy-efficient design and the importance of each during the design process.

Orientation

The orientation refers to the positioning of the majority of windows and openings in relation to the path of the sun within that region. North facing stands as the optimal orientation to increase solar gains in Australia/Southern hemisphere.





TIPS:

It is recommended to position:

- Living areas on the North of the house to maximise natural light and heat gain
- Sleeping areas on the South for cooler, more comfortable sleep

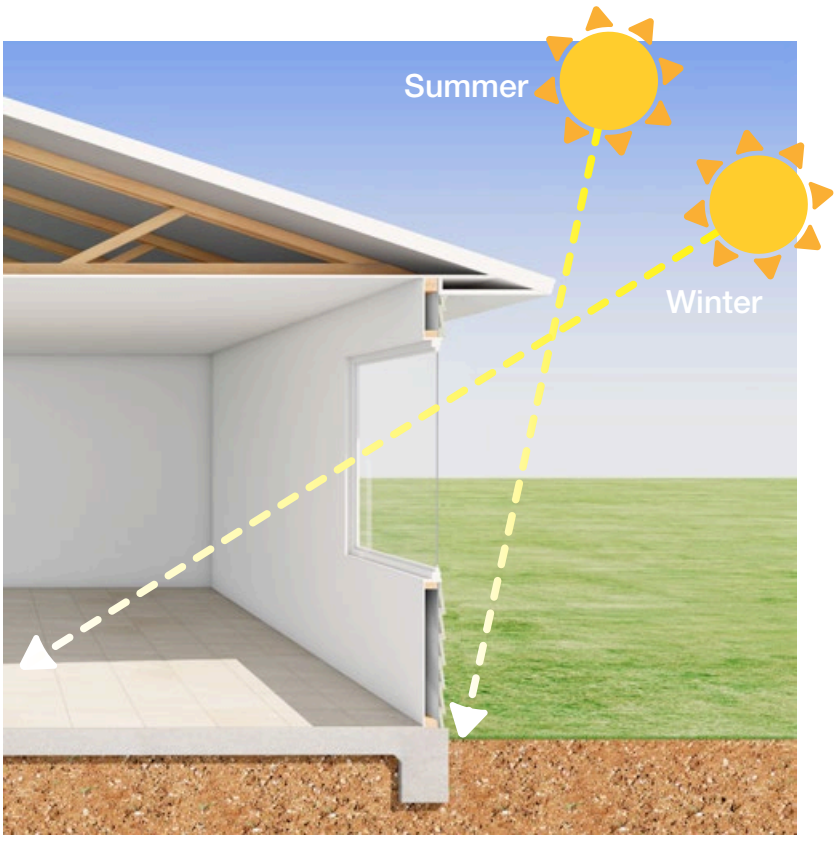
Reduce glazing on East/West facades

Manage solar exposure based on the climate zones:

- Cold climate: Maximise solar exposure
- Warm climate: Reduce solar exposure to minimise unwanted heat gain.

Shading

This refers to the inclusion of building or external elements that can block direct sunlight.



It's important to pay special attention to surrounding elements, particularly in colder climates where passive heating becomes critical. During the winter months, the sun travels closer to the horizon, casting larger shadows compared to summer when it is high in the sky.

When possible:

- Avoid placing structures in heavily shaded areas that may block the winter sun.
- Consider nearby trees, building and other structures.

TIPS:

Manage solar exposure based on the climate zones

In cold climates, increase solar exposure:

- Remove window shrouds
- Reduce eaves and awnings
- Ensure there are no external elements (such as trees or neighbouring buildings) blocking the sun particularly during the winter months.

In warm climates reduce solar exposure:

- Add window shrouds
- Increase eaves and awnings

Windows

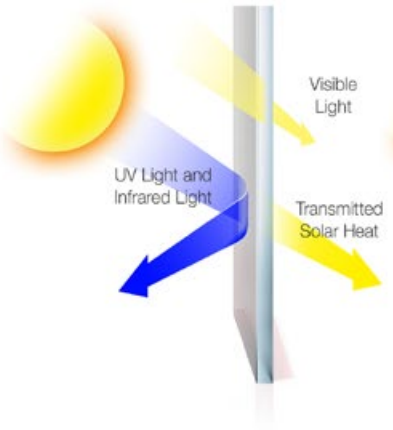
Windows are critical components when discussing energy efficiency, as they are openings through which heat can either enter or escape, affecting the indoor comfort, energy consumption and by consequence the thermal performance of the house. There are two key components of every window, which are the frame and the glass. The frame can be made out of different materials, such as timber, aluminium or uPVC (Unplasticised Polyvinyl Chloride), to name a few; and there are also different frame types such as:

Single Glazed
A single layer of glass separating the internal from the external of the house.

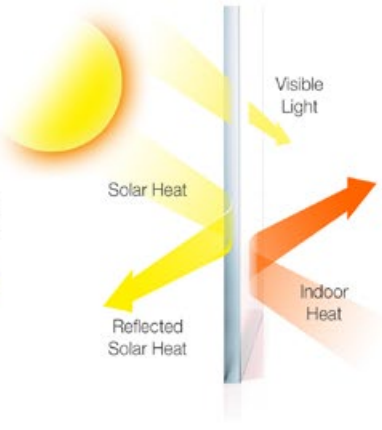
Double Glazed
Two layers of glass, filled with a gas (such as Argon) that can reduce the heat transfer from one side to the other.

Thermally Broken
Features a thermal break that disconnects the internal side of the frame from the external side, reducing heat transfer.

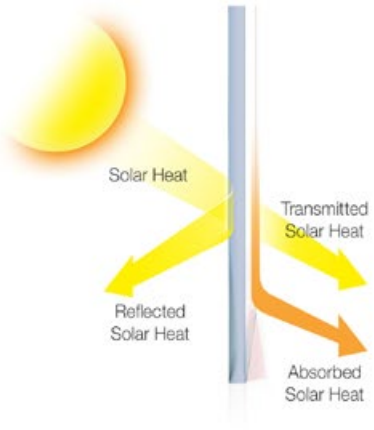
There are also different types of glass that can contribute to the thermal performance of the house at various levels. Some of these include:



Toned/Tinted
Treated with a film or coating to reduce the amount of light passing through.



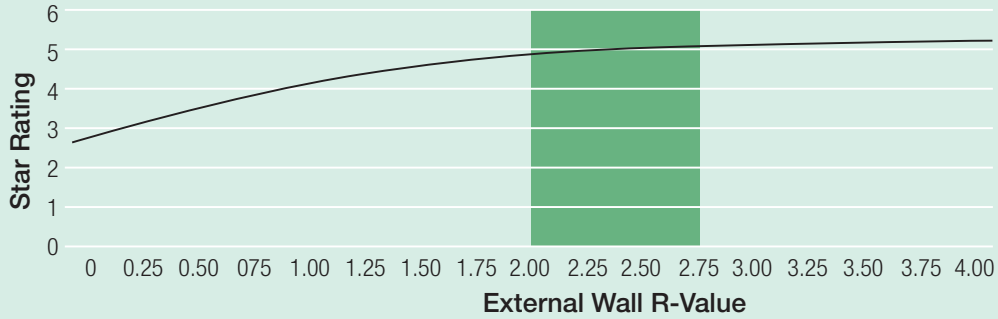
Low-e
Low-e (low-emissivity) glass has a heat reflecting coating, without limiting the amount of light that passes through.



Low-SHGC
Designed to absorb and transfer less heat compared to other glass types, reducing the amount of heat that can access the dwelling.

Insulation

Insulation can improve a homes thermal performance by reducing heat transfer through the roof, walls and floor. This helps to maintain stable indoor temperature by reducing the need for heating and cooling. However, it's important to highlight that more insulation does not always mean better performance, as heat will find a different path of less resistance to travel. For example, in walls, when the R-Value of the system is at its optimum level, heat will primarily travel through the windows, so adding more insulation won't proportionally improve the performance.



TIP:

Depending on the location and orientation of your dwelling, the optimum external wall R-Value may be anywhere between R2.0 and R2.7. Beyond this, the wall will hit a point of diminishing returns.

Thermal Mass

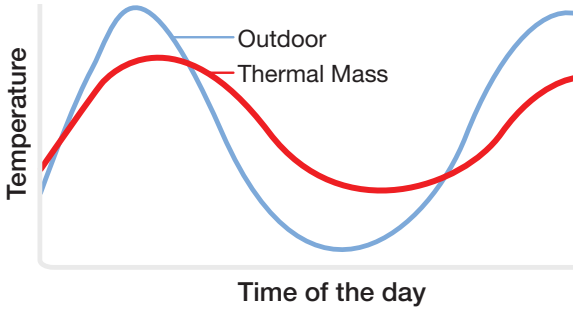
What is Thermal Mass?

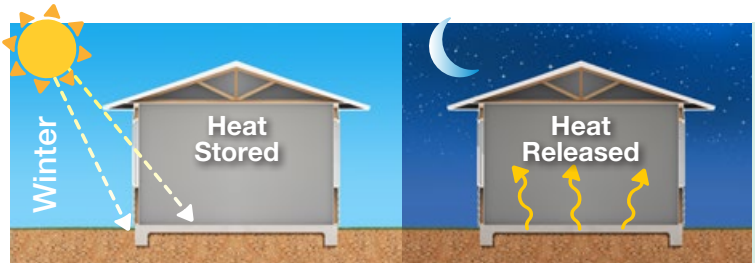
Thermal mass is the capacity of a material to absorb, store and release heat. In the residential construction, thermal mass can help regulate the temperature of a dwelling by absorbing heat during the day and releasing it at night, thereby slowing down the rate at which the dwelling warms up and cools down.

Where can I find Thermal Mass?

In residential construction, thermal mass can be found on different elements such as:

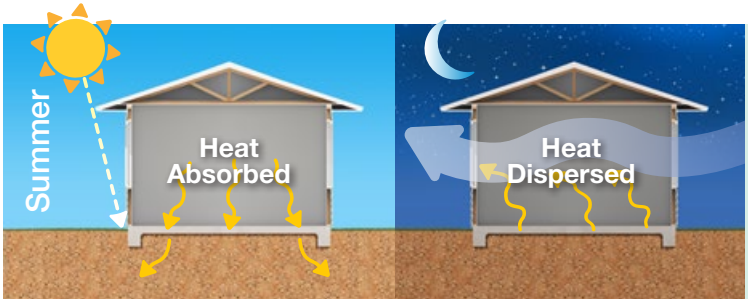
- House foundations, such as slab on ground
- Masonry walls
- Water tanks
- High-mass floor finishes like tiles or polished concrete





Where should you locate the thermal mass?

To improve **passive heating** the thermal mass must be exposed to direct sunlight or other source of heat, then during the night time this heat will be released into the house.



To improve **passive cooling**, the thermal mass must be protected from direct sunlight or other sources of heat. This allows the thermal mass to absorb some of the heat, regulating the internal temperature of the dwelling, and then releasing and dispersing it during the night.

TIPS:

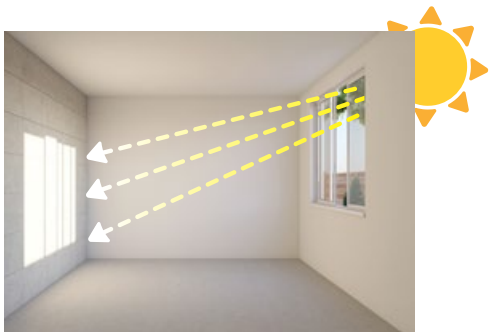
Thermal mass is most effective when located inside the house, where it can be exposed during winter and shaded during summer. This can be achieved by adding tiles to the floor or exposing concrete slabs.

- Place thermal mass on the Northern side of the home to maximize exposure during the winter months.
- Avoid placing thermal mass in areas with limited sun exposure during the winter months.

Where is Thermal Mass beneficial?

Thermal mass must be used strategically, otherwise it can have a negative impact on the thermal performance of the dwelling. It also works best on areas where there's a reasonable difference between the maximum and minimum day temperatures.

Some of these applications are:



Internally, in rooms with good solar access during winter

In rooms with good ventilation and limited sun exposure during summer

Exposed slab-on ground or tiled floors during winter

Where is Thermal Mass detrimental?

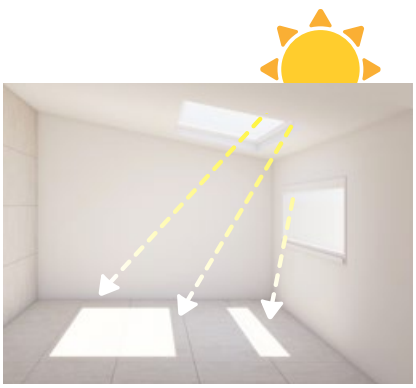
Thermal mass can work against performance when it doesn't have the correct sun exposure, and can push the room temperature on the opposite direction, such as:

- Thermal mass without sun exposure, next to an area that is too cold - In this situation the thermal mass will absorb the available heat, making the room colder.
- Thermal mass over exposed to the sun, next to an area that is too hot - In this situation the thermal mass will absorb heat from the sun and release it into the room, making the area warmer.

Some of these applications are:

Unshaded East or West facade

Fully shaded facade, located next to a living area



Rooms with poor ventilation during summer

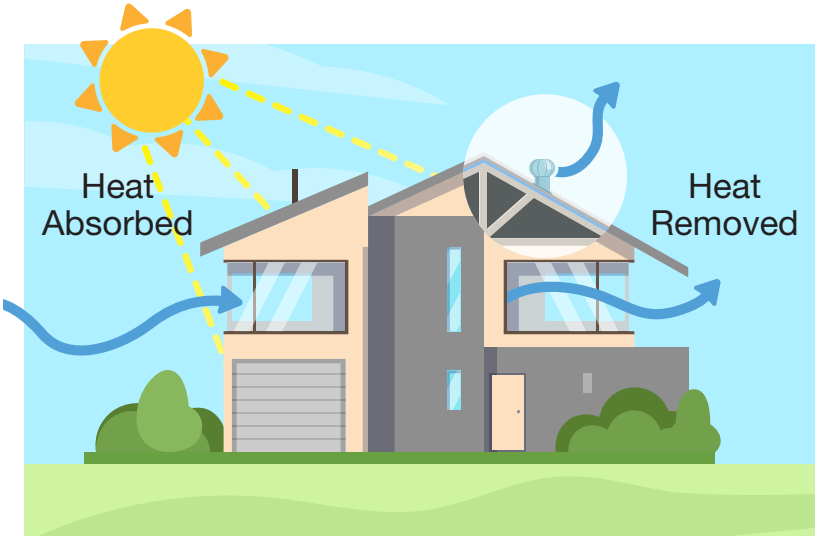
Ventilation

Proper ventilation enhances the movement of air through the house, which helps to disperse some of the heat that accumulated inside of the house.

Types of Ventilation:

Natural Ventilation: Windows, doors and vents that allow fresh air to flow freely.

Mechanical Ventilation: Fans and exhausts help control airflow.

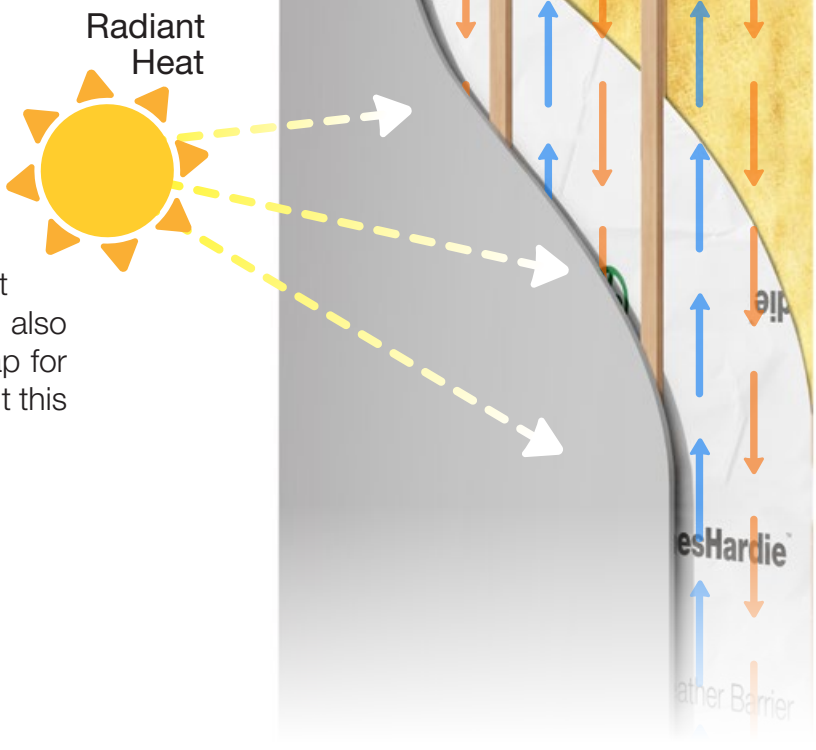


TIPS:

Adding a ventilated roof space, or including windows with full openability on opposite ends of the house (i.e., North and South facades) can improve the thermal performance by increasing cross-ventilation.

Wall Cavities

Similar to adding ventilation inside the house, incorporating wall cavities can help disperse some of the radiated heat through the wall cladding, reducing heat transfer through external walls. This can also be combined with a reflective building wrap for improved thermal performance; more about this on the following page.



Reflectivity

Reflectivity is the effectiveness of a material to reflect radiant energy, which means it can act as a mirror and reflect heat. This allows the material to stay cooler compared to a non-reflective material under the same conditions.

TIPS:

Hardie™ Wrap Weather Barrier:

- Includes a reflective surface that can improve the performance of the house up to 0.2 stars (when installed behind a drainage cavity).
- It is also a water barrier and vapour permeable membrane meaning that it can be used on Climate Zones 2-8.
- Reflective sarking can also be added to the roof space for better performance.

Colour

Different colours will absorb different amounts of energy, which means one same material on different colours can have different temperatures under the same conditions. Light colours will remain cooler compared to darker tones. This is particularly important for roofs, which generally receive the highest solar exposure in a house. These are examples of Dulux® exterior colour options ranked based on their likelihood of heat absorption.

Lexicon® Quarter	Natural White	Sea Foam Quarter	Light Rice	Grey Pebble	Grey Pail	Stoneware	Timeless Grey	Colorbond® Basalt	Woodland Grey	Colorbond® Monument	Domino

Includes light colours (White, Beige, Pastel tones)
Least heat absorption - Cooler surfaces

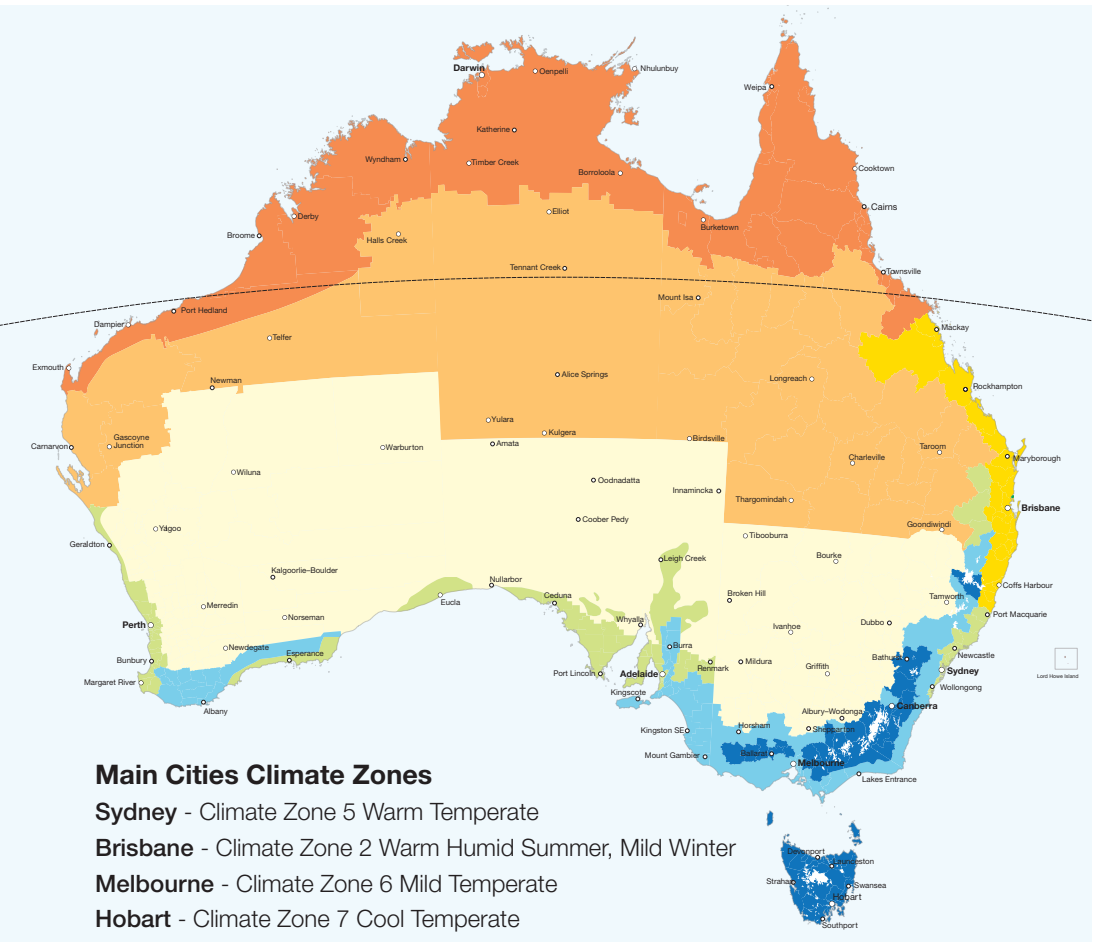
Includes dark colours (Black, Charcoal, Deep colours)
High heat absorption - Warmer surfaces

Design Recommendations

Australian Climate Zones

Australia is divided into eight different climate zones, ranging from 'Hot Humid Summer, Warm Winter' to 'Alpine' regions. Each climate zone has specific cooling and heating requirements, meaning that all design considerations for a house must take this into account to improve its thermal performance.

- **Hotter climates**: In the Northern part of Australia it's important to protect the house from external heat, as cooling will be most critical.
- **Colder climates**: In the Southern part it's important to maximise the available heat and protect the house from the cold climate, as heating will be the critical factor.



	Hot humid summer, warm winter	1
	Warm humid summer, mild winter	2
	Hot dry summer, warm winter	3
	Hot dry summer, cool winter	4
	Warm temperate	5
	Mild temperate	6
	Cool temperate	7
	Alpine	8

Main Cities Climate Zones

Sydney - Climate Zone 5 Warm Temperate
Brisbane - Climate Zone 2 Warm Humid Summer, Mild Winter
Melbourne - Climate Zone 6 Mild Temperate
Hobart - Climate Zone 7 Cool Temperate
Perth - Climate Zone 5 Warm Temperate
Adelaide - Climate Zone 5 Warm Temperate
Cairns - Climate Zone 1 Hot Humid Summer, Warm Winter

Source: https://www.abcb.gov.au/resources/climate-zone-map

In the following section of the guide we will cover some of the design strategies that can be adopted by location to improve the thermal performance of the house.

Melbourne | Climate Zone 6 Mild Temperate

Performance Features

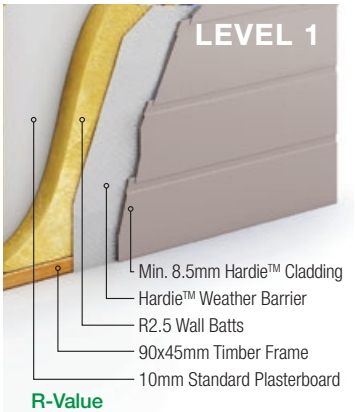
The following table presents a series of design features and commonly used specifications ranked by performance, with Level 1 being the lowest and Level 3 the highest. This table can serve as a guideline to enhance the product specifications of a home design, considering its location and specific climate zone requirements. Each performance feature must be based on project-specific requirements and evaluated by a qualified energy efficiency assessor to determine its impact on overall thermal performance.

	MELBOURNE	LEVEL 1	LEVEL 2	LEVEL 3
WINDOWS	**Windows Glass**	Clear	Low-e clear glass	High SHGC Low-e glass
	Window Frame	Aluminium Standard Single Glazing	Aluminium Standard Double Glazing	Thermally-broken/uPVC Double Glazing
	Orientation[1]	E, SE, S, SW & W	NW & NE	N
	Openability[2]	None	Include full openability on North/South windows	Include full openability on all windows
	Shading	Remove window shrouds	Reduce awnings	Reduce eaves/soffits (Max: 450mm)
INSULATION	**External Wall R-Value**[3&4]	R2.0	R2.5	R2.7
	Suspended Floor Insulation	R2.0	R3.0	R4.0
	Slab Insulation	Raft Slab	Waffle Pod 225/85 (310 mm)	Waffle Pod 300/85 (385 mm)
	Ceiling Insulation	R4.0	R5.0	R6.0
	Wall Cavities	Reduce wall cavities on all facades	Reduce wall cavities on East/West facades	Include wall cavities on all external walls
	Ventilation[5]	Include ceiling fans in living areas	Include ceiling fans in bedrooms	Include ceiling fans in bedrooms and living areas
	Reflectivity	None	Include non-reflective sarking	Include reflective sarking
	Colour	Light tones	Medium tones	Dark tones

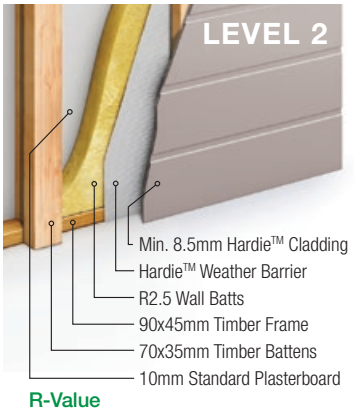
[1] Orientation refers to the main location of windows in relation to the path of the sun.
[2] On double storey dwellings only, installing fall protection screens on the upper storey windows enables the use of windows with full openability, increasing cross-flow ventilation and potentially reducing the cooling loads and proving a better thermal performance.
[3] Inclusion of internal walls insulation on the garage area can act as a barrier to the external environment, potentially improving the energy rating.
[4] External Wall Insulation refers to the overall R-Value of the wall as a system.
[5] Inclusion of ceiling fans and ventilation on mild to cool temperate climates will have minimal effect on the thermal performance of the dwelling.
[6] Thermal mass can slow down the rate at which the dwelling warms up and cools down and must be used strategically to moderate internal temperatures. Thermal mass can be found on different elements of the dwelling, such as concrete slabs, tiled finished floors or walls, among others.

External Walls

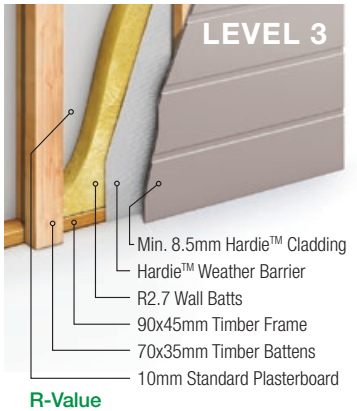
The following wall systems have been assessed in accordance with AS/NZS 4859:2018 “Thermal Insulation Materials for Buildings. Part 1: General Criteria and Technical Provision, and Part 2: Design" and provide an R-Value as set out in the “External Wall R-Value” row on the Performance Features Table above.



R-Value
Summer: 2.26
Winter: 2.37



R-Value
Summer: 2.69
Winter: 2.84



R-Value
Summer: 2.83
Winter: 2.97

What does a thermally efficient home in Melbourne look like?

Melbourne has a mild temperate climate which can result on moderate temperatures across seasons. Managing heat loss and heat gain is vital to ensuring a thermally comfortable condition within the house.

Optimise orientation of the house by having walls and windows to living areas face North to help heat gain during winter.

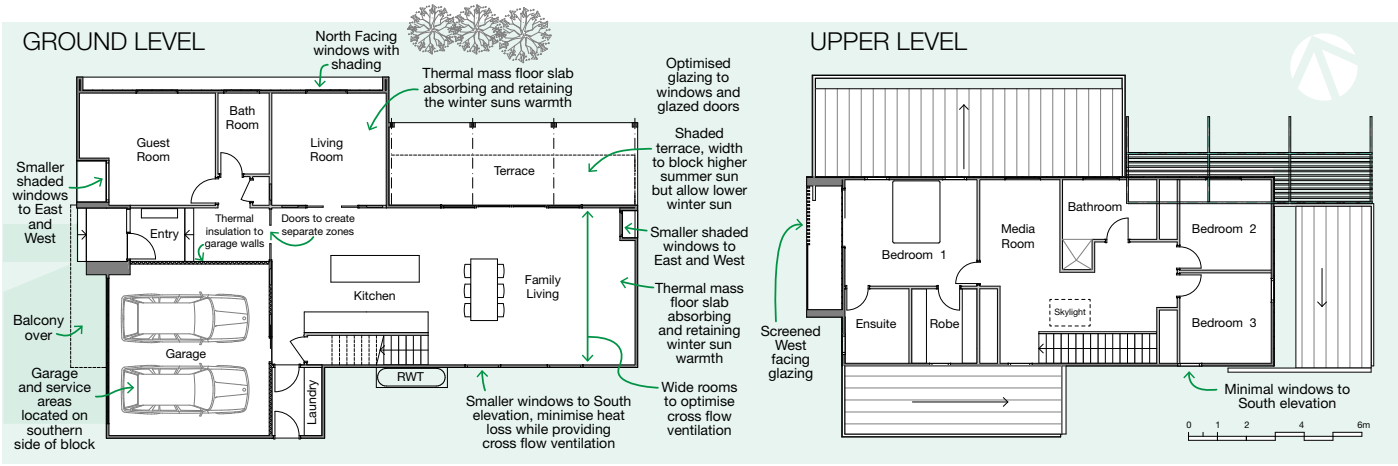
Minimise any shading to the North facing walls and windows to increase heat gain during winter.

Reduce glazing facing to the East and West to lessen heat gain during summer.

Remove unnecessary South facing glazing and limit glazing area to below 5% of the house floor area.

Set total glazing area to a room to below 15% of the room floor area.

Upgrade to double glazed windows to reduce heat transfer between indoor and outdoor.



This is an example of what a good set of initial inclusions can look like and the upgrade hierarchy that can be adopted to improve the thermal performance. The order can vary depending on specific project requirements or costs.

Baseline Inclusions

House Specifications	
Slab Type	Waffle Pod Slab
Wall Type	Hardie™ cladding products on 70x35mm timber battens
Wall Wrap	Vapour Wrap
Roof	Sarking
Glazing	Single Glazed
House Insulation	
External Wall Insulation	R 2.0
Internal Wall Insulation	None
Ceiling Insulation	R 4.0
Upper Floor Insulation (for double storeys)	R 4.0 (above garage or outdoor areas)
Garage Insulation	
External Wall Insulation	None
Internal Wall Insulation	R 2.0
Ceiling Insulation	None

Upgrade Hierarchy*

UPGRADE ORDER

Cost Increase

- Add R2.0 insulation to the Bath, Laundry and Water Closet internal walls
- Upgrade ceiling insulation from R4.0 to R5.0
- Upgrade ceiling insulation from R5.0 to R6.0
- Use reflective sarking on external walls (Hardie™ Wrap Weather Barrier)
- Upgrade house external wall insulation from R2.0 to R2.5 — $
- Upgrade garage internal wall insulation from R2.0 to R2.5
- Add R2.5 insulation throughout the upper floor
- Upgrade insulation throughout the upper floor from R2.5 to R4.0
- Add fall protect screens to applicable upper floor windows
- Upgrade Southern glazing to double glazed
- Upgrade all glazing to double glazed
- Upgrade house external wall insulation from R2.5 to R2.7
- Upgrade garage internal wall insulation from R2.5 to R2.7
- Add R2.0 insulation throughout internal walls — $$
- Upgrade insulation throughout internal walls from R2.0 to R2.5
- Upgrade insulation throughout internal walls from R2.5 to R2.7
- Add roof blanket in lieu of sarking to the roof space
- Upgrade Southern glazing to double glazed with low-E
- Upgrade all glazing to double glazed with low-E
- Recommending better colours to the roof, walls and window frames:
  a. Dark colours for houses that are too cold
  b. Light colours for houses that are too hot — $$$
- Reducing large window sizes to South-facing glazing
- Reducing large window sizes to East or West-facing glazing

*The proposed upgrade hierarchy should be used as a reference only and does not guarantee specific performance outcomes, as these are unique to each project.

Sydney | Climate Zone 5 Warm Temperate

Performance Features

The following table presents a series of design features and commonly used specifications ranked by performance, with Level 1 being the lowest and Level 3 the highest. This table can serve as a guideline to enhance the product specifications of a home design, considering its location and specific climate zone requirements. Each performance feature must be based on project-specific requirements and evaluated by a qualified energy efficiency assessor to determine its impact on overall thermal performance.

WINDOWS

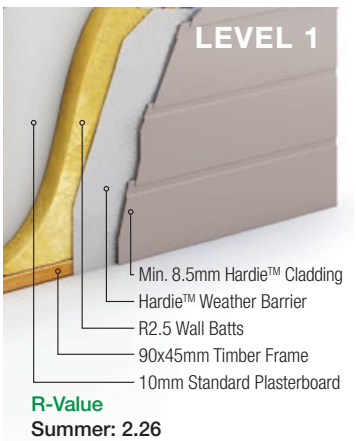
INSULATION

SYDNEY	LEVEL 1	LEVEL 2	LEVEL 3
Windows Glass	Clear	Low-e glass	Argon-filled clear glass
Window Frame	Aluminium Standard Single Glazing	Aluminium Standard Double Glazing	Thermally-broken/uPVC Double Glazing
Orientation[1]	E, SE, S, SW & W	NW & NE	N
Openability[2]	None	Include full openability on North/South windows	Include full openability on all windows
Shading	450mm depth eaves	Deeper eaves over East/West	Deep East/West eaves + minimal North
External Wall R-Value[3&4]	R2.0	R2.5	R2.7
Suspended Floor Insulation	R3.0 over unconditioned areas	R3.0 throughout	R4.0+ throughout
Slab Insulation	Waffle Pod	Waffle Pod + 25mm width slab-edge insulation	Waffle Pod + min 50mm + slab edge insulation
Ceiling Insulation	R4.0	R5.0	R6.0
Wall Cavities	Reduce wall cavities on all external walls	Include wall cavities on East/West facades	Include wall cavities on all external walls
Ventilation	Include ceiling fans in bedrooms	Include ceiling fans in bedrooms + a living area	Include ceiling fans in bedrooms/studies & living areas
Reflectivity	Include non-reflective wall sarking	Include reflective wall sarking	Include wall and roof reflective sarking
Colour	Dark tones	Medium tones	Medium/Light tones

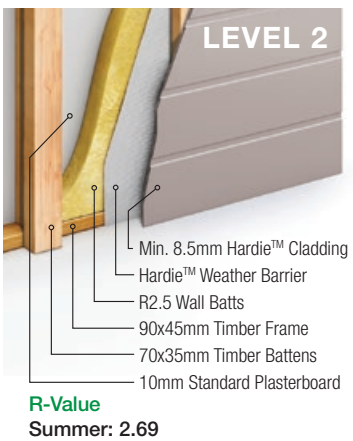
[1] Orientation refers to the main location of windows in relation to the path of the sun.
[2] On double storey dwellings only, installing fall protection screens on the upper storey windows enables the use of windows with full openability, increasing cross-flow ventilation and potentially reducing the cooling loads and proving a better thermal performance.
[3] Inclusion of internal walls insulation on the garage area can act as a barrier to the external environment, potentially improving the energy rating.
[4] External Wall Insulation refers to the overall R-Value of the wall as a system.
[5] Thermal mass can slow down the rate at which the dwelling warms up and cools down and must be used strategically to moderate internal temperatures. Thermal mass can be found on different elements of the dwelling, such as concrete slabs, tiled finished floors or walls, among others.

External Walls

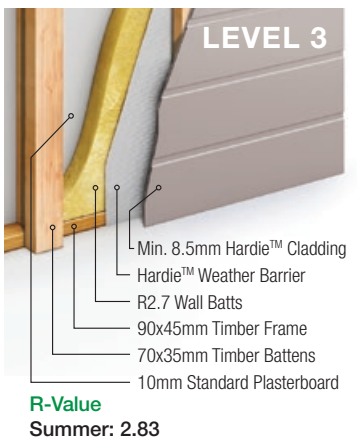
The following wall systems have been assessed in accordance with AS/NZS 4859:2018 “Thermal Insulation Materials for Buildings. Part 1: General Criteria and Technical Provision, and Part 2: Design" and provide an R-Value as set out in the “External Wall R-Value” row on the Performance Features Table above.



R-Value
Summer: 2.26
Winter: 2.37



R-Value
Summer: 2.69
Winter: 2.84



R-Value
Summer: 2.83
Winter: 2.97

What does a thermally efficient home in Sydney look like?

Sydney has a Warm Temperate climate, which can result in warm to moderate temperatures in the summer and moderate to cool during winter. Managing heat loss and maximizing heat gain are vital to ensuring a thermally comfortable condition within the house.

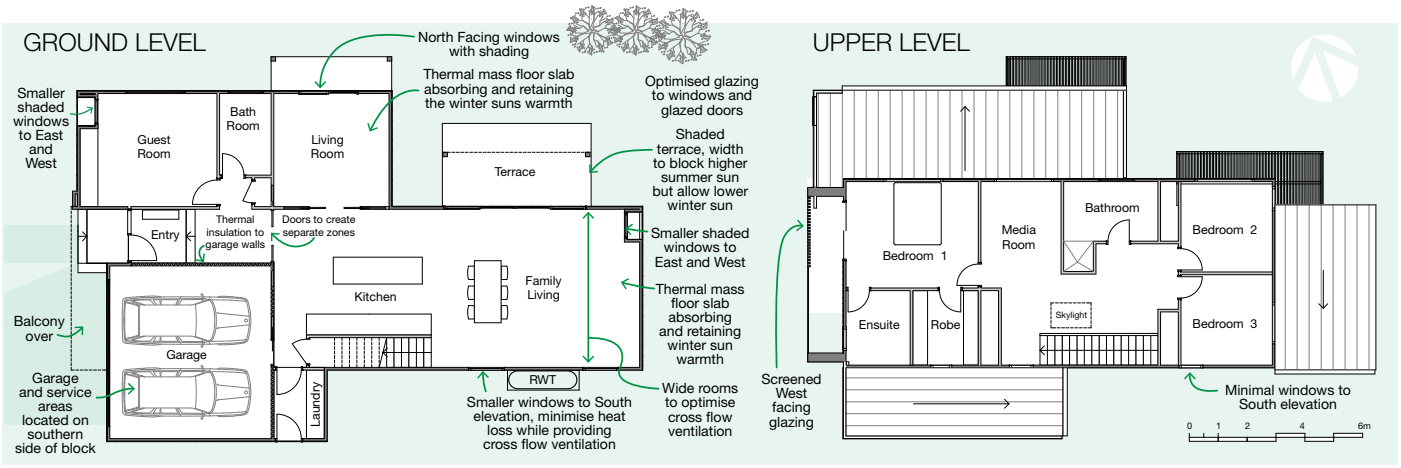
Optimize orientation of the house by having walls and windows to living areas face North to help heat gain during winter.

Minimise any shading to the North facing walls and windows to increase heat gain during winter.

Set total glazing area to a room to below 15% of the room floor area.

Upgrade to double glazed windows to reduce heat transfer between indoor and outdoor.

Use thicker insulation materials in walls and ceilings to minimise heat transfer and keep interiors cooler, minimising heat transfer and keep interiors cooler.



This is an example of what a good set of initial inclusions can look like and the upgrade hierarchy that can be adopted to improve the thermal performance. The order can vary depending on specific project requirements or costs.

Baseline Inclusions

House Specifications	
Slab Type	Waffle Pod Slab
Wall Type	Hardie™ cladding products
Wall Wrap	Vapour Wrap
Roof	Roof Blanket
Glazing	Single Glazed
House Insulation	
External Wall Insulation	R 2.0
Internal Wall Insulation	None
Ceiling Insulation	R 5.0
Upper Floor Insulation (for double storeys)	R 4.0 (above garage or outdoor areas)
Garage Insulation	
External Wall Insulation	None
Internal Wall Insulation	R 2.5
Ceiling Insulation	None

Upgrade Hierarchy*

Cost Increase

These are the typical upgrades added to increase thermal performance.

UPGRADE ORDER

- Add R2.5 insulation to the Bath, Laundry and Water Closet internal walls
- Upgrade East and West facing glazing to double glazed
- Include a cavity on external walls and reflective sarking (Hardie™ Wrap Weather Barrier)
- Upgrade all glazing to double glazed
- Upgrade house external wall insulation from R2.0 to R2.5 — $
- Add R2.5 insulation throughout internal walls
- Add fall protect screens to applicable upper floor windows
- Upgrade all glazing to double glazed with single low-E
- Upgrade ceiling insulation from R5.0 to R6.0
- Upgrade house external wall insulation from R2.5 to R2.7
- Upgrade insulation throughout internal walls from R2.5 to R2.7 — $$
- Upgrade ceiling insulation from R6.0 to R7.0
- Upgrade East and West facing glazing to double glazed with double low-E
- Upgrade all glazing to double glazed with double low-E
- Reducing large window sizes to South-facing glazing
- Reducing large window sizes to East or West-facing glazing — $$$
- Upgrade East and West facing glazing to thermally broken double glazed
- Upgrade all glazing to thermally broken double glazed
- Upgrade East and West facing glazing to thermally broken double glazed with low-E
- Upgrade all glazing to thermally broken double glazed with low-E

*The proposed upgrade hierarchy should be used as a reference only and does not guarantee specific performance outcomes, as these are unique to each project.

Brisbane | Climate Zone 2 Warm Humid Summer, Mild Winter

Performance Features

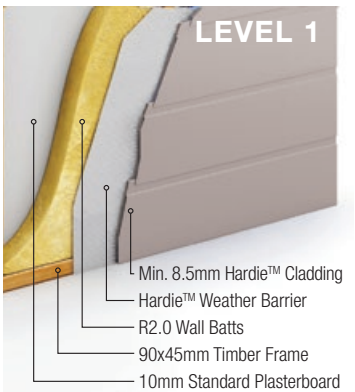
The following table presents a series of design features and commonly used specifications ranked by performance, with Level 1 being the lowest and Level 3 the highest. This table can serve as a guideline to enhance the product specifications of a home design, considering its location and specific climate zone requirements. Each performance feature must be based on project-specific requirements and evaluated by a qualified energy efficiency assessor to determine its impact on overall thermal performance.

	BRISBANE	LEVEL 1	LEVEL 2	LEVEL 3
WINDOWS	**Windows Glass**	Toned glass	Low-E glass	Low SHGC Low-E glass
	Window Frame	Aluminium Standard Single Glazing	Aluminium Standard Double Glazing	Thermally broken Double Glazing
	Orientation[1]	E, SE, S, SW & W	NW & NE	N
	Openability[2]	None	Include full openability on North/South windows	Include full openability on all windows
	Shading	Inclusion of window shrouds	Inclusion of awnings	Increase eaves/soffits
INSULATION	**External Wall R-Value**[3 & 5]	R1.5	R2.0	R2.5
	Suspended Floor Insulation	R2.0	R3.0	R4.0
	Slab Insulation	Waffle Pod	Raft Slab	Raft Slab + R1.5 Slab Edge Insulation
	Ceiling Insulation	R4.0	R5.0	R6.0
	Wall Cavities	Reduce wall cavities on all external walls	Include wall cavities on East/West facades	Include wall cavities on all external walls
	Ventilation	Include ceiling fans in living areas	Include ceiling fans in bedrooms	Include ceiling fans in bedrooms and living areas
	Reflectivity	Include wall reflective sarking	Include roof reflective sarking	Include wall and roof reflective sarking
	Colour	Dark tones	Medium tones	Light colours

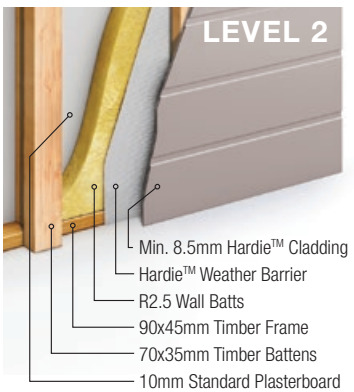
[1] Orientation refers to the main location of windows in relation to the path of the sun.
[2] On double storey dwellings only, installing fall protection screens on the upper storey windows enables the use of windows with full openability, increasing cross-flow ventilation and potentially reducing the cooling loads and proving a better thermal performance.
[3] Inclusion of internal walls insulation on the garage area can act as a barrier to the external environment, potentially improving the energy rating.
[4] The Queensland Government can concede a 1 star credit to dwellings located in Climate Zones 1 or 2, provided:
-Inclusion of an outdoor area as described in S42C2(3) from the NCC 2022 Vol 2.
-The roof covering the outdoor area achieved a total R-Value of at least 1.5 for downward heat flow.
-The outdoor area includes a ceiling fan with a speed controller and a blade rotation diameter of at least 900mm.
Refer to the Queensland Development Code MP 4.1 Sustainable Buildings for further information.
[5] External Wall Insulation refers to the overall R-Value of the wall as a system.
[6] Thermal mass can slow down the rate at which the dwelling warms up and cools down and must be used strategically to moderate internal temperatures. Thermal mass can be found on different elements of the dwelling, such as concrete slabs, tiled finished floors or walls, among others.

External Walls

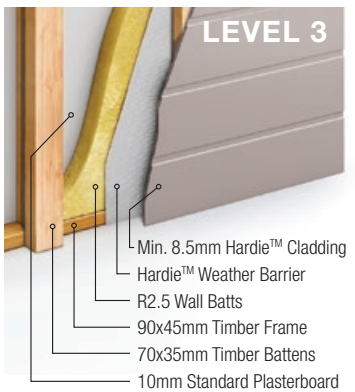
The following wall systems have been assessed in accordance with AS/NZS 4859:2018 "Thermal Insulation Materials for Buildings. Part 1: General Criteria and Technical Provision, and Part 2: Design" and provide an R-Value as set out in the "External Wall R-Value" row on the Performance Features Table above.



R-Value
Summer: 1.93
Winter: 2.04



R-Value
Summer: 2.26
Winter: 2.37



R-Value
Summer: 2.69
Winter: 2.84

What does a thermally efficient home in Brisbane look like?

Brisbane experiences a warm and humid climate, making passive cooling strategies essential for maintaining indoor comfort.

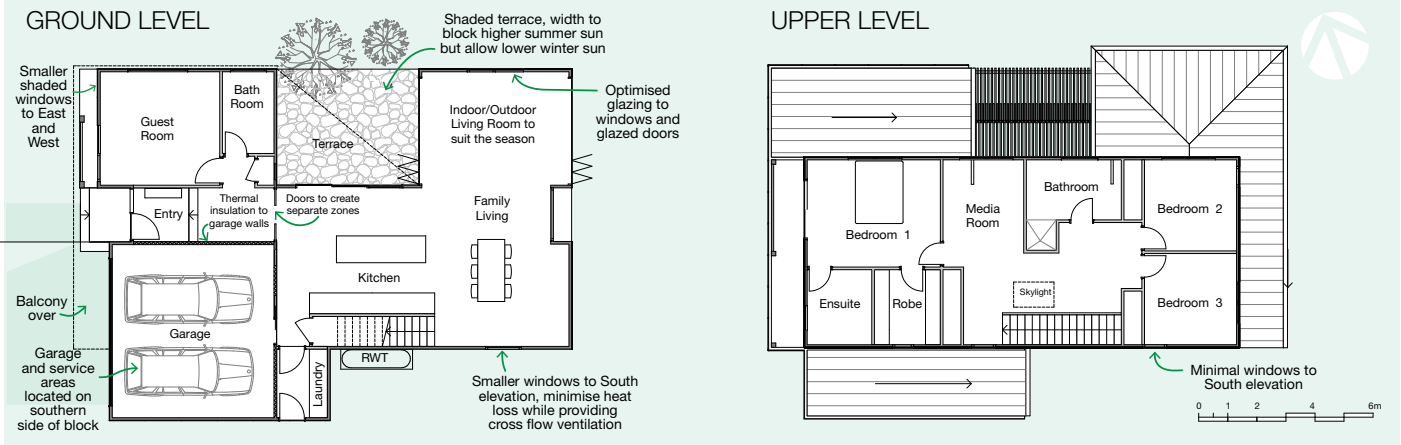
Design the home to facilitate cross-ventilation by aligning windows and openings to prevailing breezes, allowing hot air to escape and cooler air to enter for maximum natural ventilation.

Incorporate wide eaves, verandas, and external shading devices to protect windows and walls for effective shading from direct sunlight and reduce indoor heat gain.

Use reflective insulation materials in walls and ceilings to minimise heat transfer and keep interiors cooler.

Limit high thermal mass materials like concrete and brick, as they can retain heat. Instead, opt for lightweight construction materials that cool down quickly.

Select light-coloured roofing materials to reflect solar radiation and incorporate ventilation in the roof space to dissipate accumulated heat.



This is an example of what a good set of initial inclusions can look like and the upgrade hierarchy that can be adopted to improve the thermal performance. The order can vary depending on specific project requirements or costs.

Baseline Inclusions

House Specifications	
Slab Type	Raft Slab
Wall Type	Hardie™ cladding products
Wall Wrap	Vapour Wrap
Roof	Sarking
Glazing	Single Glazed
House Insulation	
External Wall Insulation	R 1.5
Internal Wall Insulation	None
Ceiling Insulation	R 2.5
Upper Floor Insulation (for double storeys)	R 2.5 (above garage or outdoor areas)
Garage Insulation	
External Wall Insulation	None
Internal Wall Insulation	R 2.0
Ceiling Insulation	None

Upgrade Hierarchy*

Cost Increase

UPGRADE ORDER

These are the typical upgrades added to increase thermal performance.

- Extend the fully covered outdoor living area to a min. of 12 sq. m. with R1.5 insulation to the ceiling
- Add min. 1200mm diameter ceiling fans to the outdoor living area
- Add min. 1200mm diameter ceiling fans to living areas and bedrooms
- Upgrade house external wall insulation from R1.5 to R2.0
- Include a cavity on external walls and reflective sarking (Hardie™ Wrap Weather Barrier)
- Add R1.5 insulation to the Bath, Laundry and Water Closet internal walls
- Add fall protect screens to applicable upper floor windows **$**
- Upgrade house external wall insulation from R2.0 to R2.5
- Upgrade ceiling insulation from R2.5 to R4.0
- Upgrade ceiling insulation from R4.0 to R5.0 **$$**
- Upgrade ceiling insulation from R5.0 to R6.0
- Upgrade East and West facing glazing to single glazed with low-SHGC low-E
- Upgrade all glazing to single glazed with low-SHGC low-E
- Recommending light colours to the roof, walls and window frames **$$$**
- Reducing large window sizes to East or West-facing glazing
- Add a shading screen (external awning, window hood or similar) to unshaded windows

*The proposed upgrade hierarchy should be used as a reference only and does not guarantee specific performance outcomes, as these are unique to each project.

Cairns | Climate Zone 1 Hot Humid Summer, Warm Winter

Performance Features

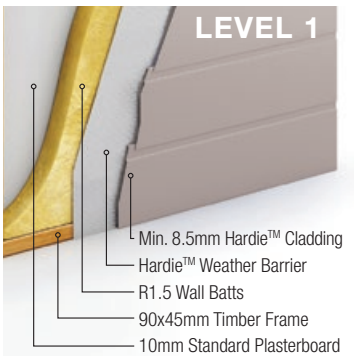
The following table presents a series of design features and commonly used specifications ranked by performance, with Level 1 being the lowest and Level 3 the highest. This table can serve as a guideline to enhance the product specifications of a home design, considering its location and specific climate zone requirements. Each performance feature must be based on project-specific requirements and evaluated by a qualified energy efficiency assessor to determine its impact on overall thermal performance.

	CAIRNS	LEVEL 1	LEVEL 2	LEVEL 3
WINDOWS	**Windows Glass**	Toned glass	Low SHGC Low-E glass	Super Toned Low SHGC Low-E glass
WINDOWS	**Window Frame**	Aluminium standard	Aluminium standard	Aluminium thermally improved
WINDOWS	**Orientation**[1]	E, SE, S, SW & W	NW & NE	N
WINDOWS	**Openability**[2]	None	Include full openability on North/South windows	Include full openability on all windows
INSULATION	**Shading**	Use of deep eaves or overhangs	Use of deeper eaves and external shading	>1,000mm eaves + strategic shading to minimise heat gain
INSULATION	**External Wall R-Value**[3&5]	R1.5	R2.0	R2.5
INSULATION	**Suspended Floor Insulation**	None	Foil or <R2.0 Insulation	R2.0-R4.0 Insulation
INSULATION	**Slab Insulation**	Waffle Pod Slab on ground	Raft Slab	Raft Slab + R1.5 Slab Edge Insulation
INSULATION	**Ceiling Insulation**	R4.0	R5.0	R6.0
INSULATION	**Wall Cavities**	Reduce wall cavities on all external walls	Include wall cavities on East/West facades	Include wall cavities on all external walls
INSULATION	**Ventilation**	Ceiling fans in living areas	Ceiling fans in bedrooms	Ceiling fans in all occupied rooms
INSULATION	**Reflectivity**	Include non-reflective wall sarking	Include reflective wall sarking	Include wall and roof reflective sarking
INSULATION	**Colour**	Medium tones	Light Colours	Very light or reflective colours

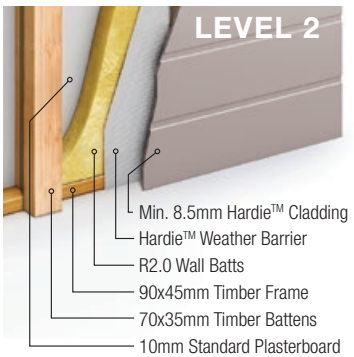
[1] Orientation refers to the main location of windows in relation to the path of the sun.
[2] On double storey dwellings only, installing fall protection screens on the upper storey windows enables the use of windows with full openability, increasing cross-flow ventilation and potentially reducing the cooling loads and proving a better thermal performance.
[3] Inclusion of internal walls insulation on the garage area can act as a barrier to the external environment, potentially improving the energy rating.
[4] The Queensland Government can concede a 1 star credit to dwellings located in Climate Zones 1 or 2, provided:
-Inclusion of an outdoor area as described in S42C2(3) from the NCC 2022 Vol 2.
-The roof covering the outdoor area achieved a total R-Value of at least 1.5 for downward heat flow.
-The outdoor area includes a ceiling fan with a speed controller and a blade rotation diameter of at least 900mm.
Refer to the Queensland Development Code MP 4.1 Sustainable Buildings for further information.
[5] External Wall Insulation refers to the overall R-Value of the wall as a system.
[6] Thermal mass can slow down the rate at which the dwelling warms up and cools down and must be used strategically to moderate internal temperatures. Thermal mass can be found on different elements of the dwelling, such as concrete slabs, tiled finished floors or walls, among others.

External Walls

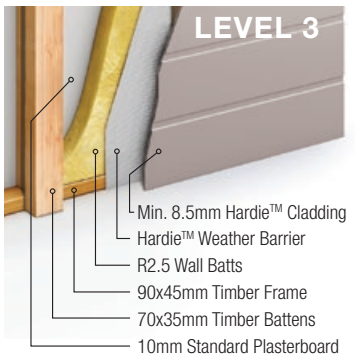
The following wall systems have been assessed in accordance with AS/NZS 4859:2018 "Thermal Insulation Materials for Buildings. Part 1: General Criteria and Technical Provision, and Part 2: Design" and provide an R-Value as set out in the "External Wall R-Value" row on the Performance Features Table above.



R-Value
Summer: 1.93
Winter: 2.04



R-Value
Summer: 2.26
Winter: 2.37



R-Value
Summer: 2.69
Winter: 2.84

What does a thermally efficient home in Cairns look like?

Cairns experiences a hot and humid tropical climate, making passive cooling strategies essential for maintaining indoor comfort.

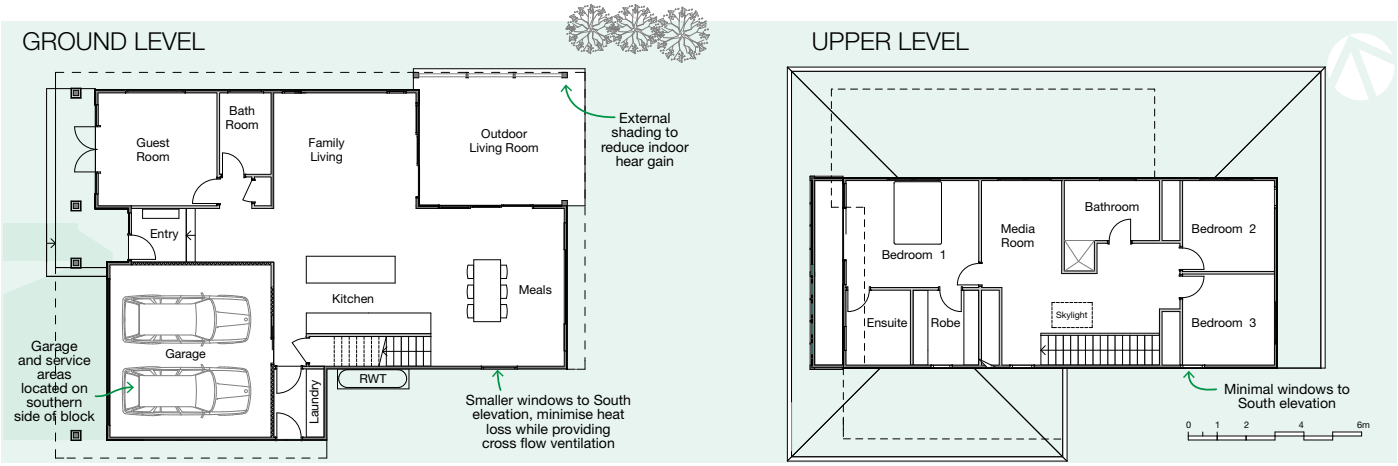
Design the home to facilitate cross-ventilation by aligning windows and openings to prevailing breezes, allowing hot air to escape and cooler air to enter for maximum natural ventilation.

Incorporate wide eaves, verandas, and external shading devices to protect windows and walls from direct sunlight and reduce indoor heat gain.

Use reflective insulation materials in walls and ceilings to minimise heat transfer and keep interiors cooler.

Limit high thermal mass materials like concrete and brick, as they can retain heat. Instead, opt for lightweight construction materials that cool down quickly.

Select light-coloured roofing materials to reflect solar radiation and incorporate ventilation in the roof space to dissipate accumulated heat.



This is an example of what a good set of initial inclusions can look like and the upgrade hierarchy that can be adopted to improve the thermal performance. The order can vary depending on specific project requirements or costs.

Baseline Inclusions

House Specifications	
Slab Type	Raft Slab
Wall Type	Hardie™ cladding products
Wall Wrap	Reflective Wrap
Roof	Sarking
Glazing	Single Glazed
House Insulation	
External Wall Insulation	R 2.0
Internal Wall Insulation	None
Ceiling Insulation	R 2.5 / Reflective Insulation
Upper Floor Insulation (for double storeys)	R 2.5 (above garage or outdoor areas)
Garage Insulation	
External Wall Insulation	R 2.5 / Reflective Insulation
Internal Wall Insulation	None
Ceiling Insulation	None

Upgrade Hierarchy*

Cost Increase

UPGRADE ORDER

These are the typical upgrades added to increase thermal performance.

- Extend the fully covered outdoor living area to a min. of 12 sq. m. with R1.5 insulation to the ceiling
- Add min. 1200mm diameter ceiling fans to the outdoor living area
- Add min. 1200mm diameter ceiling fans to living areas and bedrooms **$**
- Add R2.0 insulation to the Bath, Laundry and Water Closet internal walls
- Add fall protect screens to applicable upper floor windows
- Upgrade house external wall insulation from R2.5 to R4.0
- Upgrade ceiling insulation from R2.5 to R4.0
- Upgrade ceiling insulation from R4.0 to R5.0 **$$**
- Upgrade ceiling insulation from R5.0 to R6.0
- Upgrade East and West facing glazing to single glazed with low-SHGC low-E
- Upgrade all glazing to single glazed with low-SHGC low-E
- Add a shading screen (external awning, window hood or similar) to unshaded windows
- Reducing large window sizes to East or West-facing glazing **$$$**
- Recommending light colours to the roof, walls and window frames

*The proposed upgrade hierarchy should be used as a reference only and does not guarantee specific performance outcomes, as these are unique to each project.

Adelaide | Climate Zone 5 Warm Temperate

Performance Features

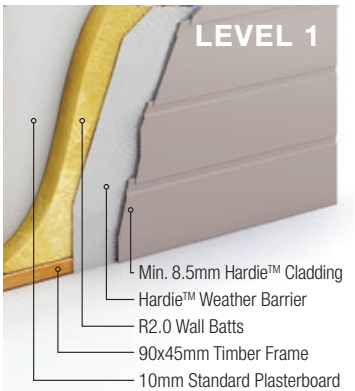
The following table presents a series of design features and commonly used specifications ranked by performance, with Level 1 being the lowest and Level 3 the highest. This table can serve as a guideline to enhance the product specifications of a home design, considering its location and specific climate zone requirements. Each performance feature must be based on project-specific requirements and evaluated by a qualified energy efficiency assessor to determine its impact on overall thermal performance.

	ADELAIDE	LEVEL 1	LEVEL 2	LEVEL 3
WINDOWS	**Windows Glass**	Low-E Glass	Argon-filled Clear	Argon-filled Clear
	Window Frame	Aluminium Single	Aluminium Standard Double Glazing	TB/uPVC Double Glazing (DG) or DG with Double Low-E
	Orientation[1]	E, SE, S, SW & W	NW & NE	N
	Openability[2]	None	Include full openability on North/South windows	Include full openability on all windows
	Shading	450mm depth eaves	Deeper eaves over East/West	Deep East/West eaves + minimal North
INSULATION	**External Wall R-Value**[3&4]	R2.0	R2.5	R2.7
	Suspended Floor Insulation	R3.0 over unconditioned areas	R3.0 throughout	R4.0+ throughout
	Slab Insulation	Concrete Slab (Raft)	Concrete Raft + 25mm width Slab-Edge Insulation	Concrete Raft + 50mm width Slab-Edge Insulation
	Ceiling Insulation	R4.0	R5.0	R6.0
	Wall Cavities	Include wall cavities on all external walls	Include wall cavities on all external walls	Include wall cavities on all external walls
	Ventilation[5]	Include ceiling fans in bedrooms	Include ceiling fans in bedrooms + a living area	Include ceiling fans in bedrooms/studies & living areas
	Reflectivity	Include non-reflective wall sarking	Include reflective wall sarking	Include wall and roof reflective sarking
	Colour	Dark Tones	Medium tones	Medium/Light Tones

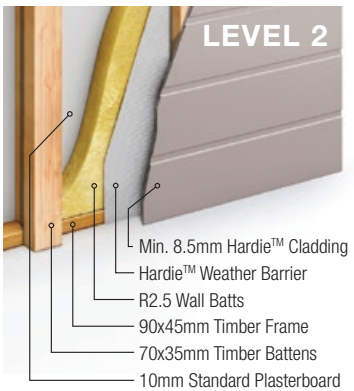
[1] Orientation refers to the main location of windows in relation to the path of the sun.
[2] On double storey dwellings only, installing fall protection screens on the upper storey windows enables the use of windows with full openability, increasing cross-flow ventilation and potentially reducing the cooling loads and proving a better thermal performance.
[3] Inclusion of internal walls insulation on the garage area can act as a barrier to the external environment, potentially improving the energy rating.
[4] External Wall Insulation refers to the overall R-Value of the wall as a system.
[5] Inclusion of ceiling fans and ventilation on mild to cool temperate climates will have minimal effect on the thermal performance of the dwelling.
[6] Thermal mass can slow down the rate at which the dwelling warms up and cools down and must be used strategically to moderate internal temperatures. Thermal mass can be found on different elements of the dwelling, such as concrete slabs, tiled finished floors or walls, among others.

External Walls

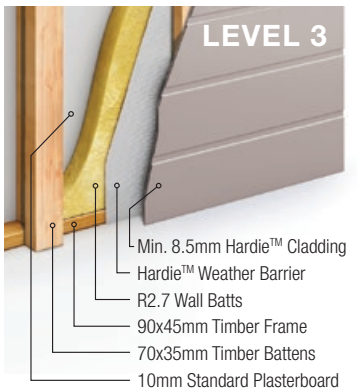
The following wall systems have been assessed in accordance with AS/NZS 4859:2018 “Thermal Insulation Materials for Buildings. Part 1: General Criteria and Technical Provision, and Part 2: Design" and provide an R-Value as set out in the “External Wall R-Value” row on the Performance Features Table above.



R-Value
Summer: 2.26
Winter: 2.37



R-Value
Summer: 2.69
Winter: 2.84



R-Value
Summer: 2.83
Winter: 2.97

What does a thermally efficient home in Adelaide look like?

Adelaide has a warm temperate climate which can result in warm temperatures across seasons. Managing heat loss and heat gain is vital to ensuring a thermally comfortable condition within the house.

Optimise orientation of the house by having walls and windows to living areas face North to help heat gain during winter.

Minimise any shading to the North facing walls and windows to increase heat gain during winter.

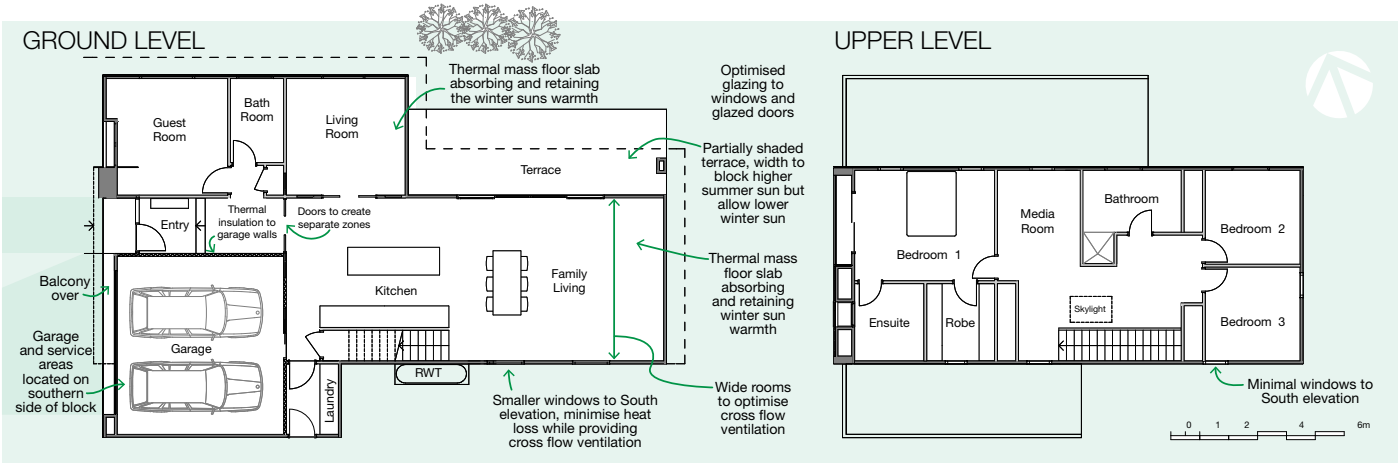
Reduce glazing facing to the East and West to lessen heat gain during summer.

Remove unnecessary South facing glazing and limit glazing area to below 5% of the house floor area.

Set total glazing area to a room to below 15% of the room floor area.

Upgrade to double glazed windows to reduce heat transfer between indoor and outdoor.

Install weather seals or gap insulations to eliminate draught and reduce heat loss.



This is an example of what a good set of initial inclusions can look like and the upgrade hierarchy that can be adopted to improve the thermal performance. The order can vary depending on specific project requirements or costs.

Baseline Inclusions

House Specifications	
Slab Type	Raft Slab
Wall Type	Hardie™ cladding products
Wall Wrap	Vapour Wrap
Roof	Sarking
Glazing	Single Glazed
House Insulation	
External Wall Insulation	R 2.0
Internal Wall Insulation	None
Ceiling Insulation	R 4.0
Upper Floor Insulation (for double storeys)	R 4.0 (above garage or outdoor areas)
Garage Insulation	
External Wall Insulation	None
Internal Wall Insulation	R 2.0
Ceiling Insulation	None

Upgrade Hierarchy*

Cost Increase

UPGRADE ORDER

- Add R2.0 insulation to the Bath, Laundry and Water Closet internal walls
- Upgrade ceiling insulation from R4.0 to R5.0
- Upgrade ceiling insulation from R5.0 to R6.0
- Upgrade house external wall insulation from R2.0 to R2.5 **$**
- Include a cavity on external walls and reflective sarking (Hardie™ Wrap Weather Barrier)
- Upgrade garage internal wall insulation from R2.0 to R2.5
- Add fall protect screens to applicable upper floor windows
- Add R2.5 insulation throughout the upper floor
- Upgrade insulation throughout the upper floor from R2.5 to R4.0
- Upgrade Southern glazing to double glazed
- Upgrade all glazing to double glazed
- Upgrade house external wall insulation from R2.5 to R2.7
- Upgrade garage internal wall insulation from R2.5 to R2.7 **$$**
- Add R2.0 insulation throughout internal walls
- Upgrade insulation throughout internal walls from R2.0 to R2.5
- Upgrade insulation throughout internal walls from R2.5 to R2.7
- Add roof blanket in lieu of sarking to the roof space
- Upgrade Southern glazing to double glazed with low-E
- Upgrade all glazing to double glazed with low-E
- Recommending better colours to the roof, walls and window frames: **$$$**
  a. Dark colours for houses that are too cold
  b. Light colours for houses that are too hot
- Reducing large window sizes to South-facing glazing
- Reducing large window sizes to East or West-facing glazing

*The proposed upgrade hierarchy should be used as a reference only and does not guarantee specific performance outcomes, as these are unique to each project.

Perth | Climate Zone 5 Warm Temperate

Performance Features

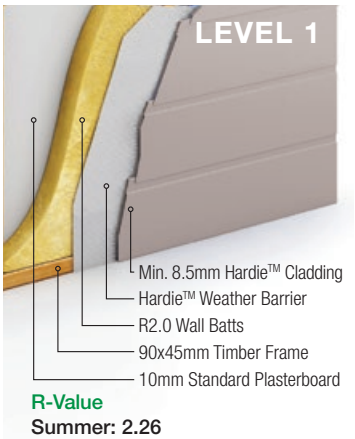
The following table presents a series of design features and commonly used specifications ranked by performance, with Level 1 being the lowest and Level 3 the highest. This table can serve as a guideline to enhance the product specifications of a home design, considering its location and specific climate zone requirements. Each performance feature must be based on project-specific requirements and evaluated by a qualified energy efficiency assessor to determine its impact on overall thermal performance.

	PERTH	LEVEL 1	LEVEL 2	LEVEL 3
WINDOWS	**Windows Glass**	Low-e glass	Argon-filled clear glass	Argon-filled clear glass
	Window Frame	Aluminium Standard Single Glazing	Aluminium Standard Double Glazing	TB/uPVC Double Glazing (DG) or DG with Double Low-E
	Orientation[1]	E, SE, S, SW & W	NW & NE	N
	Openability[2]	None	Include full openability on North/South windows	Include full openability on all windows
INSULATION	**Shading**	450mm depth eaves	Deeper eaves over East/West	Deep East/West eaves + minimal North
	External Wall R-Value[3&4]	R2.0	R2.5	R2.7
	Suspended Floor Insulation	R3.0 over unconditioned areas	R3.0 throughout	R4.0+ throughout
	Slab Insulation	Concrete Slab (Raft)	Concrete Raft + 25mm width Slab-Edge Insulation	Concrete Raft + 50mm width Slab-Edge Insulation
	Ceiling Insulation	R4.0	R5.0	R6.0
	Wall Cavities	Reduce wall cavities on all external walls	Include wall cavities on East/West facades	Include wall cavities on all external walls
	Ventilation	Include ceiling fans in bedrooms	Include ceiling fans in bedrooms + a living area	Include ceiling fans in bedrooms/studies & living areas
	Reflectivity	Include non-reflective wall sarking	Include reflective wall sarking	Include wall and roof reflective sarking
	Colour	Dark tones	Medium tones	Medium/Light tones

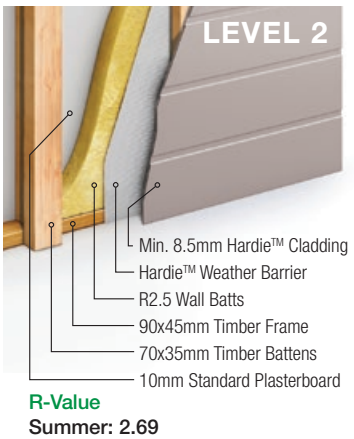
[1] Orientation refers to the main location of windows in relation to the path of the sun.
[2] On double storey dwellings only, installing fall protection screens on the upper storey windows enables the use of windows with full openability, increasing cross-flow ventilation and potentially reducing the cooling loads and proving a better thermal performance.
[3] Inclusion of internal walls insulation on the garage area can act as a barrier to the external environment, potentially improving the energy rating.
[4] External Wall Insulation refers to the overall R-Value of the wall as a system.
[5] Thermal mass can slow down the rate at which the dwelling warms up and cools down and must be used strategically to moderate internal temperatures. Thermal mass can be found on different elements of the dwelling, such as concrete slabs, tiled finished floors or walls, among others.

External Walls

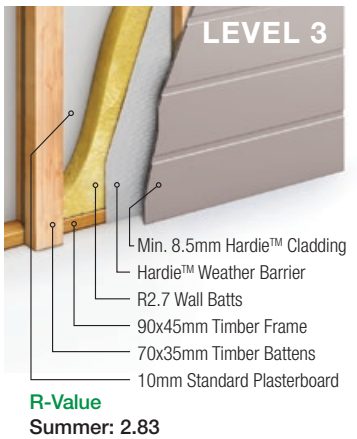
The following wall systems have been assessed in accordance with AS/NZS 4859:2018 “Thermal Insulation Materials for Buildings. Part 1: General Criteria and Technical Provision, and Part 2: Design" and provide an R-Value as set out in the “External Wall R-Value” row on the Performance Features Table above.



R-Value
Summer: 2.26
Winter: 2.37



R-Value
Summer: 2.69
Winter: 2.84



R-Value
Summer: 2.83
Winter: 2.97

What does a thermally efficient home in Perth look like?

Perth has a warm temperate climate which can result in warm temperatures across seasons. Managing heat loss and maximizing heat gain are vital to ensuring a thermally comfortable condition within the house.

Optimise orientation of the house by having walls and windows to living areas face North to help heat gain during winter.

Minimise any shading to the North facing walls and windows to increase heat gain during winter.

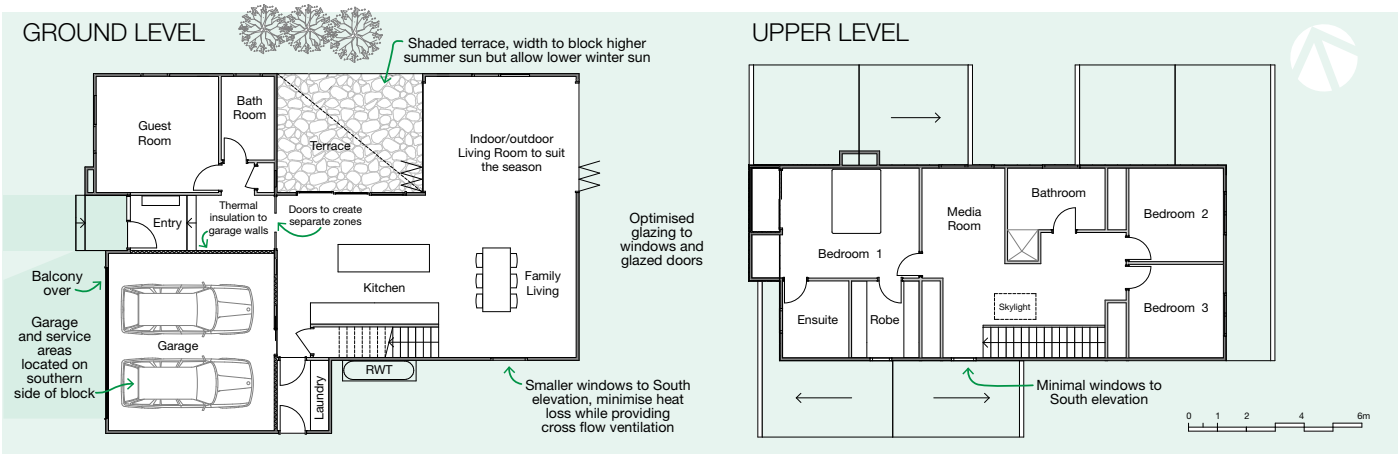
Reduce glazing facing to the East and West to lessen heat gain during summer.

Remove unnecessary South facing glazing and limit glazing area to below 5% of the house floor area.

Set total glazing area to a room to below 15% of the room floor area.

Install weather seals or gap insulations to eliminate draught and reduce heat loss.

Upgrade to double glazed windows to reduce heat transfer between indoor and outdoor.



This is an example of what a good set of initial inclusions can look like and the upgrade hierarchy that can be adopted to improve the thermal performance. The order can vary depending on specific project requirements or costs.

Baseline Inclusions

House Specifications	
Slab Type	Raft Slab
Wall Type	Hardie™ cladding products
Wall Wrap	Vapour Wrap
Roof	Sarking
Glazing	Single Glazed
House Insulation	
External Wall Insulation	R 2.0
Internal Wall Insulation	None
Ceiling Insulation	R 4.0
Upper Floor Insulation (for double storeys)	R 4.0 (above garage or outdoor areas)
Garage Insulation	
External Wall Insulation	None
Internal Wall Insulation	R 2.0
Ceiling Insulation	None

Upgrade Hierarchy*

Cost Increase

UPGRADE ORDER

- Add R2.0 insulation to the Bath, Laundry and Water Closet internal walls
- Upgrade house external wall insulation from R2.0 to R2.5
- Include a cavity on external walls and reflective sarking (Hardie™ Wrap Weather Barrier)
- Upgrade East and West facing glazing to single glaze with low-E
- Upgrade all glazing to single glaze with low-E — $
- Upgrade ceiling insulation from R4.0 to R5.0
- Upgrade ceiling insulation from R5.0 to R6.0
- Add min. 1200mm diameter ceiling fans to living areas and bedrooms
- Add fall protect screens to applicable upper floor windows
- Add R2.5 insulation throughout the upper floor
- Upgrade insulation throughout the upper floor from R2.5 to R4.0
- Upgrade garage internal wall insulation from R2.0 to R2.5
- Upgrade house external wall insulation from R2.5 to R2.7
- Upgrade garage internal wall insulation from R2.5 to R2.7 — $$
- Add R2.0 insulation throughout internal walls
- Upgrade insulation throughout internal walls from R2.0 to R2.5
- Upgrade insulation throughout internal walls from R2.5 to R2.7
- Upgrade East and West facing glazing to double glazed with double low-E
- Upgrade all glazing to double glazed with double low-E
- Add roof blanket in lieu of sarking to the roof space
- Recommending better colours to the roof, walls and window frames:
  a. Dark colours for houses that are too cold
  b. Light colours for houses that are too hot — $$$
- Reducing large window sizes to South-facing glazing
- Reducing large window sizes to East or West-facing glazing
- Add slab-edge insulation to the house area slab edge

*The proposed upgrade hierarchy should be used as a reference only and does not guarantee specific performance outcomes, as these are unique to each project.

Hobart | Climate Zone 7 Cool Temperate

Performance Features

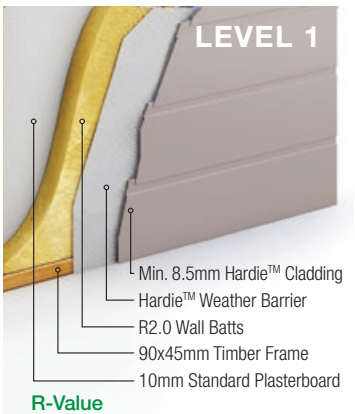
The following table presents a series of design features and commonly used specifications ranked by performance, with Level 1 being the lowest and Level 3 the highest. This table can serve as a guideline to enhance the product specifications of a home design, considering its location and specific climate zone requirements. Each performance feature must be based on project-specific requirements and evaluated by a qualified energy efficiency assessor to determine its impact on overall thermal performance.

	HOBART	LEVEL 1	LEVEL 2	LEVEL 3
WINDOWS	**Windows Glass**	Double glazed standard glass	Double glazed standard glass	Argo-Filled Double glazed with Double Low-E glass
WINDOWS	**Window Frame**	Aluminium Standard	Aluminium thermally-broken	Thermally-Broken, UPVC or timber frames
WINDOWS	**Orientation**[1]	E, SE, S, SW & W	NW & NE	N
WINDOWS	**Openability**[2]	None	Include full openability on North/South windows	Include full openability on all windows
WINDOWS	**Shading**	Eaves for summer sun exclusion	Adjustable shading devices	Automated shading systems
INSULATION	**External Wall R-Value**[3&4]	R2.0 batt insulation	R2.5 batt insulation	R3.0 batt insulation with external wrap
INSULATION	**Suspended Floor Insulation**	R2.0 batt insulation	R2.5 batt insulation	>/=R4.0 batt insulation
INSULATION	**Slab Insulation**	R1.0 edge insulation	R1.5 under-slab and edge insulation	>/=R2.0 under-slab and edge insulation
INSULATION	**Ceiling Insulation**	R4.0 batt insulation	R5.0 batt insulation	>/=R6.0 batt insulation
INSULATION	**Wall Cavities**	Reduce wall cavities on all facades	Reduce wall cavities on East/West facades	Include wall cavities on all external walls
	Ventilation[5]	Natural ventilation	Balanced heat recovery ventilation system	Demand-controlled ventilation with heat recovery
	Reflectivity	None	Include non-reflective sarking	Include reflective sarking
	Colour	Light-Medium	Medium-Dark	Dark tones

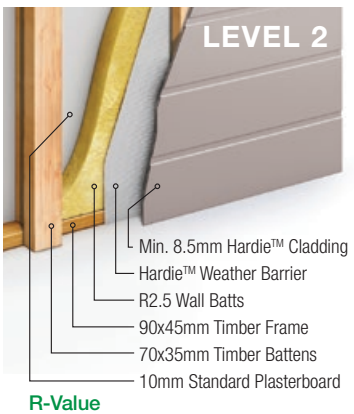
[1] Orientation refers to the main location of windows in relation to the path of the sun.
[2] On double storey dwellings only, installing fall protection screens on the upper storey windows enables the use of windows with full openability, increasing cross-flow ventilation and potentially reducing the cooling loads and proving a better thermal performance.
[3] Inclusion of internal walls insulation on the garage area can act as a barrier to the external environment, potentially improving the energy rating.
[4] External Wall Insulation refers to the overall R-Value of the wall as a system.
[5] Inclusion of ceiling fans and ventilation on mild to cool temperate climates will have minimal effect on the thermal performance of the dwelling.
[6] Thermal mass can slow down the rate at which the dwelling warms up and cools down and must be used strategically to moderate internal temperatures. Thermal mass can be found on different elements of the dwelling, such as concrete slabs, tiled finished floors or walls, among others.

External Walls

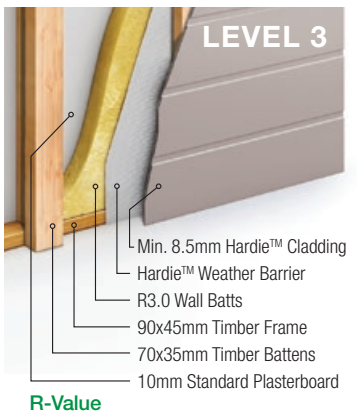
The following wall systems have been assessed in accordance with AS/NZS 4859:2018 “Thermal Insulation Materials for Buildings. Part 1: General Criteria and Technical Provision, and Part 2: Design" and provide an R-Value as set out in the “External Wall R-Value” row on the Performance Features Table above.



R-Value
Summer: 2.26
Winter: 2.37



R-Value
Summer: 2.69
Winter: 2.84



R-Value
Summer: 2.83
Winter: 2.97

What does a thermally efficient home in Hobart look like?

Hobart has a cool temperate climate which can result in very cold temperatures in the winter. Managing heat loss and maximizing heat gain are vital to ensuring a thermally comfortable condition within the house.

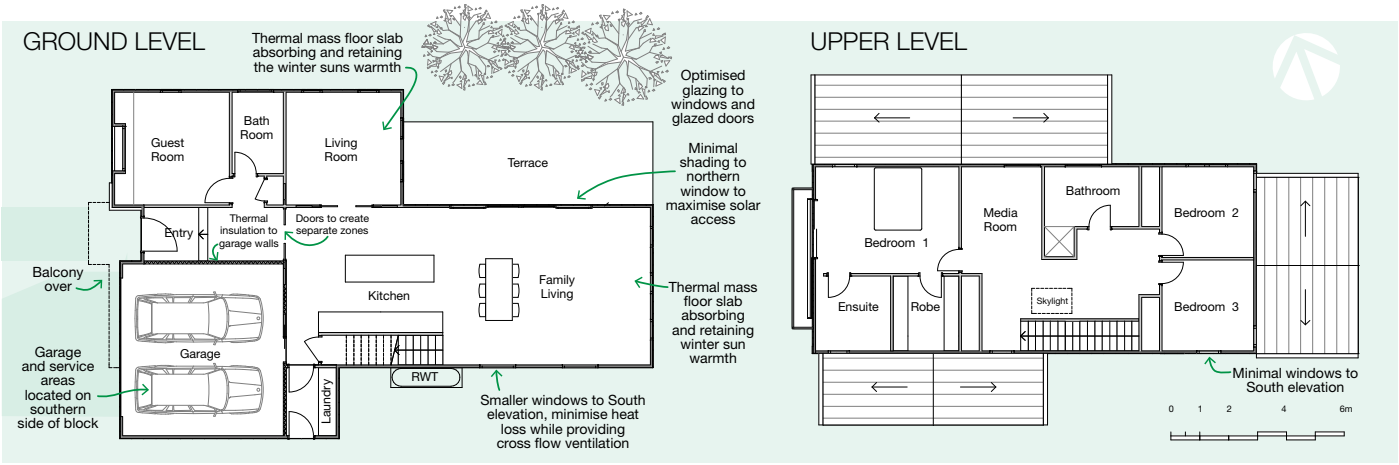
Optimise orientation of the house by having walls and windows to living areas face North to help heat gain during winter.

Minimise any shading to the North facing walls and windows to increase heat gain during winter.

Use thicker insulation materials in walls and ceilings to minimise heat transfer and keep interiors cooler.

Set total glazing area to a room to below 15% of the room floor area.

Upgrade to double glazed windows to reduce heat transfer between indoor and outdoor.



This is an example of what a good set of initial inclusions can look like and the upgrade hierarchy that can be adopted to improve the thermal performance. The order can vary depending on specific project requirements or costs.

Baseline Inclusions

House Specifications	
Slab Type	Waffle Pod Slab
Wall Type	Hardie™ cladding products on 70x35mm timber battens
Wall Wrap	Vapour Wrap
Roof	Sarking
Glazing	Single Glazed
House Insulation	
External Wall Insulation	R 2.0
Internal Wall Insulation	None
Ceiling Insulation	R 4.0
Upper Floor Insulation (for double storeys)	R 4.0 (above garage or outdoor areas)
Garage Insulation	
External Wall Insulation	None
Internal Wall Insulation	R 2.0
Ceiling Insulation	None

Upgrade Hierarchy*

UPGRADE ORDER

Cost Increase

- Add R2.0 insulation to the Bath, Laundry and Water Closet internal walls
- Upgrade ceiling insulation from R4.0 to R5.0
- Upgrade ceiling insulation from R5.0 to R6.0
- Upgrade house external wall insulation from R2.0 to R2.5 — $
- Use reflective sarking on external walls (Hardie™ Wrap Weather Barrier)
- Upgrade garage internal wall insulation from R2.0 to R2.5
- Add fall protect screens to applicable upper floor windows
- Add R2.5 insulation throughout the upper floor
- Upgrade insulation throughout the upper floor from R2.5 to R4.0
- Upgrade minimum amount of glazing to double glazed
- Upgrade all glazing to double glazed — $$
- Upgrade house external wall insulation from R2.5 to R2.7
- Upgrade garage internal wall insulation from R2.5 to R2.7
- Add R2.0 insulation throughout internal walls
- Upgrade insulation throughout internal walls from R2.0 to R2.5
- Upgrade insulation throughout internal walls from R2.5 to R2.7
- Add roof blanket in lieu of sarking to the roof space
- Upgrade minimum amount of glazing to double glazed with low-E
- Upgrade all glazing to double glazed with low-E — $$$
- Recommending better colours to the roof, walls and window frames:
- Reducing large window sizes to South-facing glazing
- Reducing large window sizes to East or West-facing glazing

*The proposed upgrade hierarchy should be used as a reference only and does not guarantee specific performance outcomes, as these are unique to each project.

Case Study 1 | Melbourne

This case study provides a comprehensive evaluation of the building design located in Melbourne. It identifies areas where energy is being wasted and suggests specification improvements to enhance performance to a 7-star rating.

All baseline inclusions are as presented on Page 15 of this document.

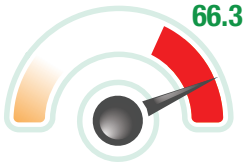
Case Study Initial Rating

Star Rating

Min. Star Rating: **7**

FAIL

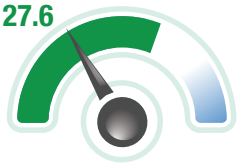
Heating Load (MJ/m²)



Max. Heating Load: **48.0**

FAIL

Cooling Load (MJ/m²)



Max. Cooling Load: **41.0**

PASS

Climate Zone 6
NatHERS Climate Zone 21

4 3 2

Performance Insights - Why it is not meeting the minimum performance

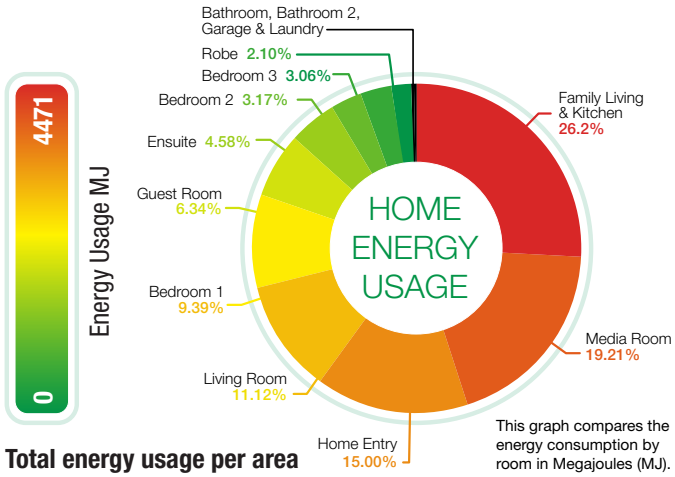
Heat Transfer into Wet Areas: Due to uninsulated internal walls, significant heat transfers from conditioned areas (like bedrooms and living rooms) to unconditioned areas (such as bathrooms and laundry rooms) on both levels, affecting thermal stability.

Increased Shading: The North verandah shading partially blocks beneficial winter sunlight while allowing some summer solar heat to enter the dwelling. This negatively impacts both heating and cooling loads, thus affecting the star rating.

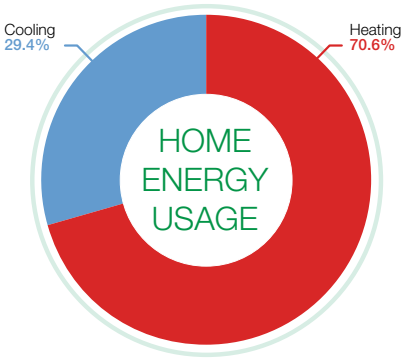
Limited Window Openability: Upper floor windows have limited openability, restricting natural ventilation. This is particularly problematic in summer, as trapped heat forces cooling systems (like air conditioning) to work harder, increasing energy consumption.

West-Facing Glazing: West-facing windows allow sunlight to enter, increasing cooling demands during summer.

Insulation: The suspended floor and external walls lack adequate insulation, leading to heat loss during winter.



Total energy usage per area



Heating and cooling energy distribution

UPGRADE ORDER

Upgrade Hierarchy	Star Improvement	Star Rating	
• Baseline inclusions	-	5.4	
• Add R2.0 insulation to the Bath, Laundry and Water Closet internal walls	0.2	5.6	Refer to Note 1
• Upgrade ceiling insulation from R4.0 to R5.0	0.1	5.7	Refer to Note 1
• Upgrade ceiling insulation from R5.0 to R6.0	0.0	5.7	Refer to Note 1
• Use reflective sarking on external walls (Hardie™ Wrap Weather Barrier)	0.2	5.9	Refer to Note 2
• Upgrade house external wall insulation from R2.0 to R2.5	0.1	6.0	Refer to Note 3
• Upgrade garage internal wall insulation from R2.0 to R2.5	0.0	6.0	Refer to Note 4
• Add R2.5 insulation throughout the upper floor	0.1	6.1	Refer to Note 3
• Upgrade insulation throughout the upper floor from R2.5 to R4.0	0.0	6.1	Refer to Note 4
• Add fall protect screens to applicable upper floor windows	0.0	6.1	Refer to Note 6
• Upgrade Southern glazing to double glazed	0.1	6.2	Refer to Note 5
• Upgrade all glazing to double glazed	0.6	6.8	Refer to Note 5
• Upgrade house external wall insulation from R2.5 to R2.7	0.0	6.8	Refer to Note 4
• Upgrade garage internal wall insulation from R2.5 to R2.7	0.0	6.8	Refer to Note 4
• Add R2.0 insulation throughout internal walls	0.0	6.8	Refer to Note 4
• Upgrade insulation throughout internal walls from R2.0 to R2.5	0.0	6.8	Refer to Note 4
• Upgrade insulation throughout internal walls from R2.5 to R2.7	0.0	6.8	Refer to Note 2
• Add roof blanket in lieu of sarking to the roof space	0.1	6.9	Refer to Note 3
• Upgrade Southern glazing to double glazed with low-E	0.0	6.9	Refer to Note 5
• Upgrade all glazing to double glazed with low-E	0.3	7.2	Refer to Note 5
• Recommending better colours to the roof, walls and window frames:			**Compliance Achieved**
a. Dark colours for houses that are too cold			
b. Light colours for houses that are too hot			
• Reducing large window sizes to South-facing glazing			
• Reducing large window sizes to East or West-facing glazing			

Notes

1. By adding insulation to the bathrooms, laundry, garage, and other areas, the heat transfer between these spaces and conditioned areas (such as bedrooms or the media room on the upper level) is reduced. This decreases energy demand by stabilizing internal temperatures. The same principle applies when adding insulation to the ceiling to reduce heat transfer between levels.
2. The inclusion of reflective sarking within wall cavities can improve the star rating of the house by reflecting radiant heat, which maintains the wall cooler without the need of adding additional insulation.
3. Upgrading the insulation in the components such as roof and external walls reduces heat transfer between their internal and external sides, decreasing the amount of energy required to heat the house. In this climate zone, the heating load is generally the most critical.
4. At this point, heat transfer has already been stabilized, and the “Optimum R-Value” (refer to page 09) has been reached. This means that additional insulation does not proportionally increase thermal performance.
5. Upgrading the windows helps to separate internal and external temperatures and reduce heat transfer. It is important to test different window upgrade configurations and specifications when possible to ensure every improvement in thermal performance is taken into account.
6. At this point, the upper floor has the required ventilation, meaning that the addition of fall protect screens may not provide a star rating improvement by itself.

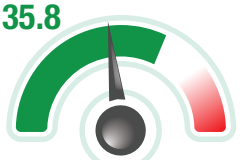
Case Study Final Rating

Star Rating

Min. Star Rating: **7**

PASS

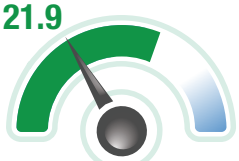
Heating Load (MJ/m²)



Max. Heating Load: **48**

PASS

Cooling Load (MJ/m²)



Max. Cooling Load: **41**

PASS

Case Study 2 | Sydney

This case study provides a comprehensive evaluation of the building design located in Sydney. It identifies areas where energy is being wasted and suggests specification improvements to enhance performance to a 7-star rating.

All baseline inclusions are as presented on Page 17 of this document.

Climate Zone 5
NatHERS Climate Zone 28

4 3 2

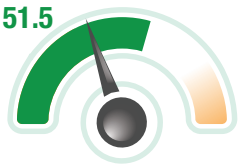
Case Study Initial Rating

Star Rating

Min. Star Rating: **7**

FAIL

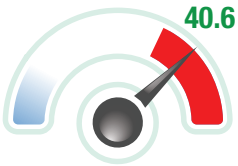
Heating Load (MJ/m²)



Max. Heating Load: **56.0**

PASS

Cooling Load (MJ/m²)



Max. Cooling Load: **37.5**

FAIL

Performance Insights - Why it is not meeting the minimum performance

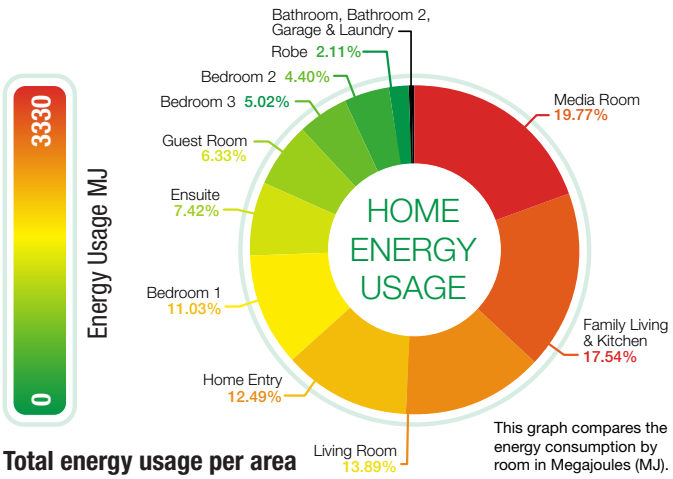
Heat Transfer into Wet Areas: Due to uninsulated internal walls, significant heat transfers from conditioned areas (like rooms and living rooms) to unconditioned areas (such as bathrooms and laundry rooms) on both levels, affecting thermal stability.

Increased Shading: The North verandah shading partially blocks beneficial winter sunlight while allowing some summer solar heat to enter the dwelling. This negatively impacts both heating and cooling loads, thus affecting the star rating.

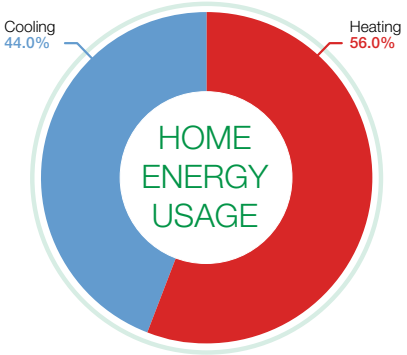
Limited Window Openability: Upper floor windows have limited openability, restricting natural ventilation. This is particularly problematic in summer, as trapped heat forces cooling systems (like air conditioning) to work harder, increasing energy consumption.

West-Facing Glazing: West-facing windows allow sunlight to enter, increasing cooling demands during summer.

Insulation: The suspended floor and external walls lack adequate insulation, leading to heat loss during winter.



Total energy usage per area



Heating and cooling energy distribution

UPGRADE ORDER

Upgrade Hierarchy	Star Improvement	Star Rating	
• Baseline inclusions	-	5.5	
• Add R2.5 insulation to the Bath, Laundry and Water Closet internal walls	0.1	5.6	Refer to Note 3
• Upgrade East and West facing glazing to double glazed	0.2	5.8	Refer to Note 5
• Include a cavity on external walls and reflective sarking (Hardie™ Wrap Weather Barrier)	0.1	5.9	Refer to Note 2
• Upgrade all glazing to double glazed	0.5	6.4	Refer to Note 5
• Upgrade house external wall insulation from R2.0 to R2.5	0.2	6.6	Refer to Note 3
• Add R2.5 insulation throughout internal walls	0.0	6.6	Refer to Note 4
• Add fall protect screens to applicable upper floor windows	0.1	6.7	Refer to Note 1
• Upgrade all glazing to double glazed with single low-E	0.4	7.1	Refer to Note 5
• Upgrade ceiling insulation from R5.0 to R6.0			**Compliance Achieved**
• Upgrade house external wall insulation from R2.5 to R2.7			
• Upgrade insulation throughout internal walls from R2.5 to R2.7			
• Upgrade ceiling insulation from R6.0 to R7.0			
• Upgrade East and West facing glazing to double glazed with double low-E			
• Upgrade all glazing to double glazed with double low-E			
• Reducing large window sizes to South-facing glazing			
• Reducing large window sizes to East or West-facing glazing			
• Upgrade East and West facing glazing to thermally broken double glazed			
• Upgrade all glazing to thermally broken double glazed			
• Upgrade East and West facing glazing to thermally broken double glazed with low-E			
• Upgrade all glazing to thermally broken double glazed with low-E			

Notes

1. Adding fall protection screens to the applicable upper floor windows allows to have full openability, which increases cross flow ventilation across the dwelling improving heat management during the summer months.
2. The inclusion of reflective sarking within wall cavities can improve the star rating of the house by reflecting radiant heat, which maintains the wall cooler without the need of adding additional insulation.
3. Upgrading the insulation in the components such as roof and external walls reduces heat transfer between their internal and external sides, decreasing the amount of energy required to heat the house. In this climate zone, the heating load is generally the most critical.
4. At this point, heat transfer has already been stabilized, and the “Optimum R-Value” (refer to page 09) has been reached. This means that additional insulation does not proportionally increase thermal performance.
5. Upgrading the windows helps to separate internal and external temperatures and reduce heat transfer. It is important to test different window upgrade configurations and specifications when possible to ensure every improvement in thermal performance is taken into account.

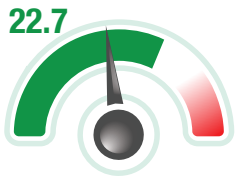
Case Study Final Rating

Star Rating

Min. Star Rating: **7**

PASS

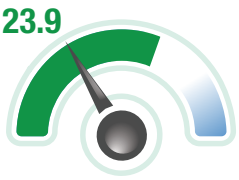
Heating Load (MJ/m²)



Max. Heating Load: **56**

PASS

Cooling Load (MJ/m²)



Max. Cooling Load: **37.5**

PASS

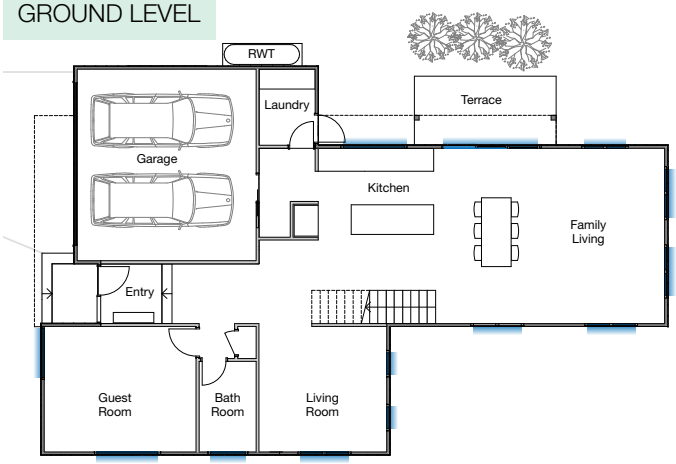
Case Study 3 | Melbourne

This case study examines two houses built on the same plot, with identical orientations and product specifications, but different designs. House 1 uses a traditional design, while House 2 incorporates energy-efficient principles to optimize the performance. The case study highlights the importance of design choices, which lead to significant energy savings and improved living conditions, as well as reduced costs on materials.

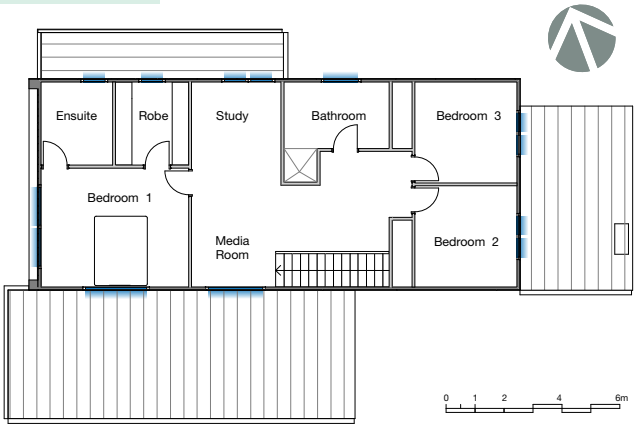
Location: Melbourne VIC 3000 4 3 2

House 1

GROUND LEVEL

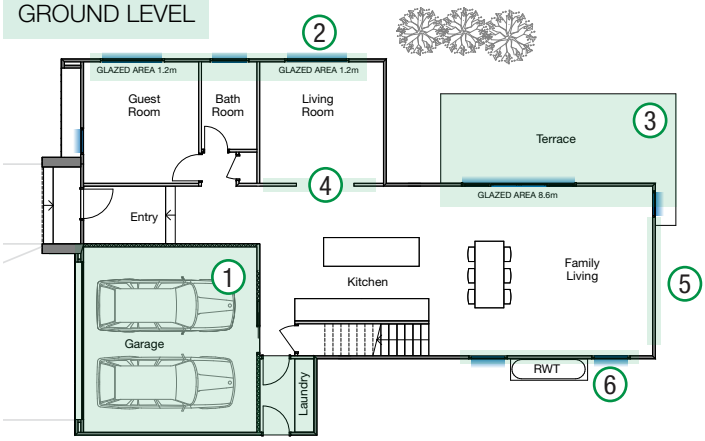


UPPER LEVEL

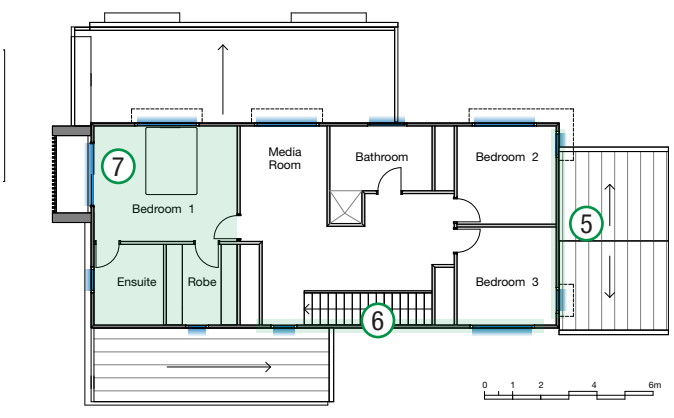


House 2

GROUND LEVEL



UPPER LEVEL



Baseline Inclusions

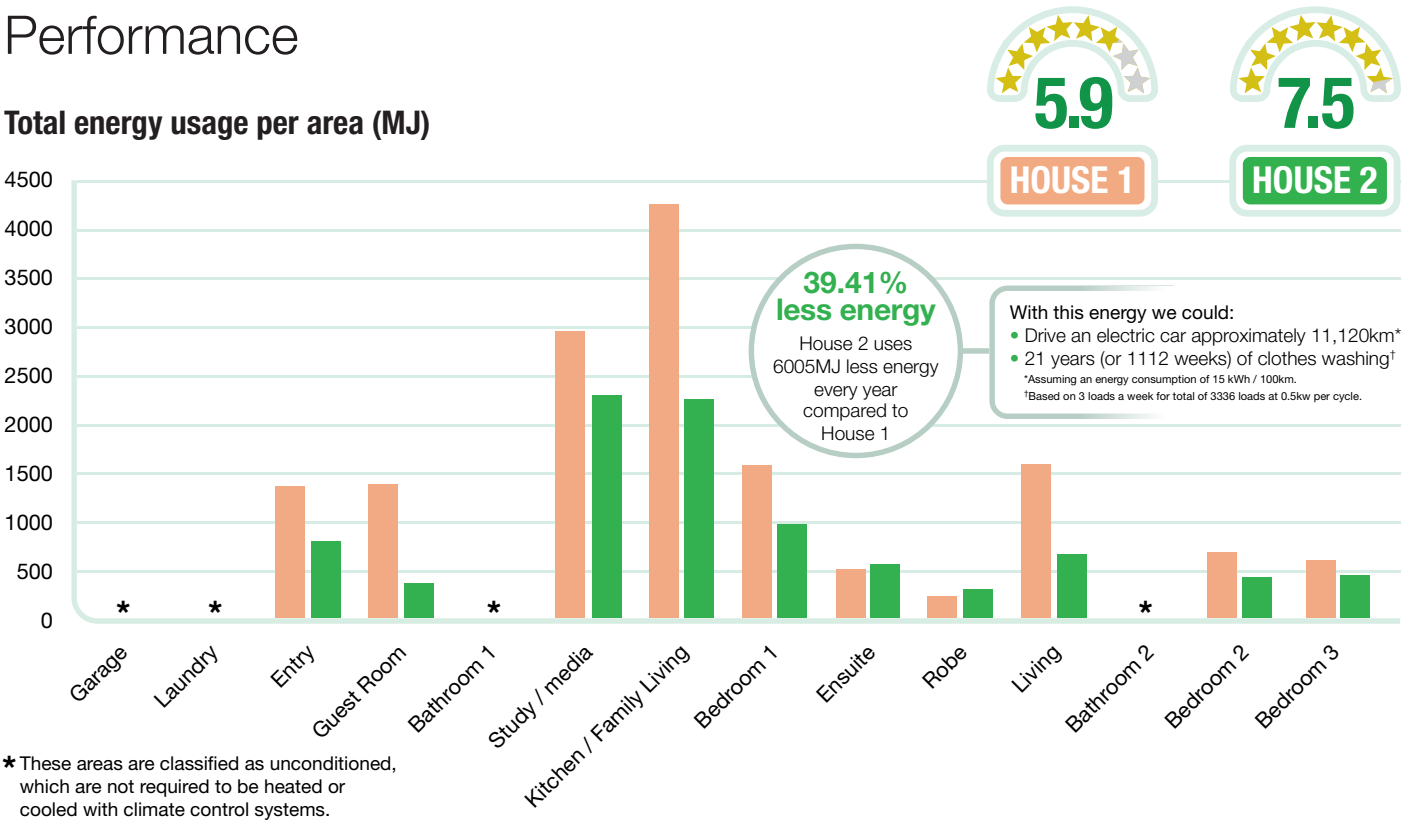
House Specifications	
Slab Type	Raft Slab
Wall Type	Hardie™ cladding products on cavity (70 x 35mm timber battens)
Wall Wrap	Reflective Wrap
Glazing	Double Glazing Standard

House Insulation	
External Wall Insulation	R2.5
Internal Wall Insulation	None
Ceiling Insulation	R6.0 with Roof Blanket
Upper Floor Insulation	R4.0

Garage Insulation	
External Wall Insulation	None
Internal Wall Insulation	R 2.0
Ceiling Insulation	None

Performance

Total energy usage per area (MJ)



* These areas are classified as unconditioned, which are not required to be heated or cooled with climate control systems.

Case Study Insights

1. The garage and laundry are located on the Southern side of House 2, allowing the guest room and living room to be situated on the Northern side. This increases passive heating in these areas, reducing the need for additional heating.
2. The windows on the Northern facade increase solar gains, which also help with passive heating of the dwelling.
3. By removing the shading cover over the terrace, solar gains increase, adding to the passive heating of the house. Additionally, it exposes the floor slab in the family room, which, due to its thermal mass, can absorb and retain some of the winter sun's warmth.
4. Adding separation between spaces can help maintain a more stable temperature within that area and reduce energy consumption for heating or cooling.
5. Reducing or removing West- and East-facing windows can decrease heat gains during the summer months, reducing the energy required to cool the house.
6. Having minimal windows on the Southern facade limits heat loss.
7. Placing unconditioned areas (such as the ensuite and robe) on the Southern side of the dwelling allows the bedroom to be located on the Northern side, taking advantage of solar heat gains.
8. House 2 can be optimized further to achieve 8 stars if desired. To do this, a possible solution is:

Upgrade	Star Improvement	Star Rating
• Add R2.5 insulation to the laundry, ground and upper floor bathroom internal walls	0.1	7.6
• Upgrade all windows & sliding doors further to double-glazing + double low-E	0.4	8.0

Notes

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AUSTRALIA JULY 2025

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