

COMMUNITY



 **cool living** 
ed. 'Hot Dry'

A guidebook for making your house cooler with no powercard when it is hot

Bobbie Bayley | www.cooliving.info

I would like to acknowledge that where ever we are in this big country, that we are with deep time and deep stories with a long history and future of people and place co-existing.

To all the communities I have worked with and the people who have entrusted stories of their lived experiences with me and showed me their homes - thank you.

To my mentors - new and old, especially Healthabitat - for continuing to invest in me and weaponise me with knowledge, awareness and gratitude - thank you isn't enough.

Thank you to all the people who have contributed to my thesis journey..

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Chriss Bayley / Dad & model assistant
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This project is based on this quote:

"Without action to stop climate change, people will be forced to leave their Country and leave behind much of what makes them Aboriginal.

*Climate change is a clear and present threat to the survival of our people and their culture."*¹

¹ - (Allam and Evershed 2019) from 2021 AHURI Report, 'Sustainable Indigenous housing in regional and remote housing'

About the author:



This book is part of the 'cool living' project.

This project is by Bobbie Bayley as a part of her final year of the Masters of Architecture program at the University of Newcastle (UON) in 2023.

Bobbie began her studies and architectural journey in 2012 at UON. She has spent the last 6 years working with Healthabitat and carrying out Australian-centric thinking, arid architectural journeys, research, discovery and community engagement.

The year-long Independent Design Thesis was the vehicle to explore a topic which is of increasing concern to many:

Sub-par community housing and the threat of climate change. People's houses will cost them their lives, or people will have to walk away.

This project attempts to create a suite of tools which don't currently exist -

- A hierarchical list of what you do first and what you do last to improve thermal comfort in existing community housing
- An action list backed by data and relevant for the patterns of living often experienced in remote communities
- Work that can be used by community who are tired of hot houses OR by the organisations who have the 'power' over the 'asset,' not just the powercard

Who is this for & why should you care?

WHO FOR?

This book is the 'cool living' TECHNICAL EDITION. It is for professionals such as building designers, architects and builders, and Housing organisations who may be planning house upgrades or carrying out proposals for grant funding and research.

This work is to convince people of the importance of passive upgrades to improve thermal comfort. This is a suite of tools to inform prioritised upgrades to community housing to improve thermal comfort in summer. See page 7 for project parts.

For best possible outcomes, in any venture, it is long known that if you involve the people who the outcome is for in the process, you get far better and long term results. It is expected the Community Edition will be used by the professionals to carry out tenant education and community consultation

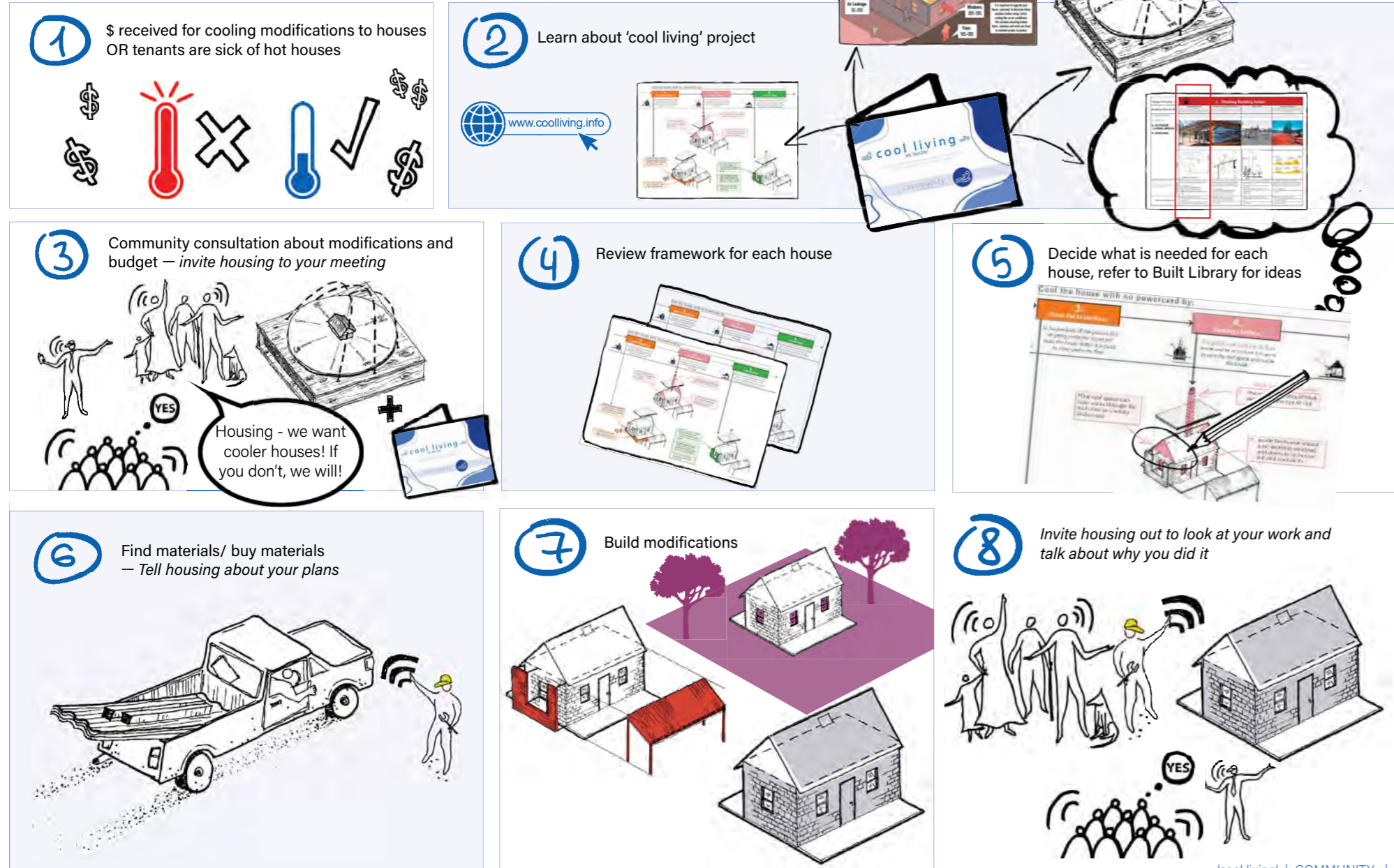
WHY CARE?

With climate change, this will become more important because the weather will be hotter for more days a year.

When people don't have power on hot days, they can't use the air-conditioner to stay cool and their health is at risk. Sub-par community houses are a burden to its often already disadvantaged tenants and their hip pocket. 74.6% of the NT's Aboriginal population live in remote or very remote areas, meaning climate change will disproportionately affect Aboriginal people.

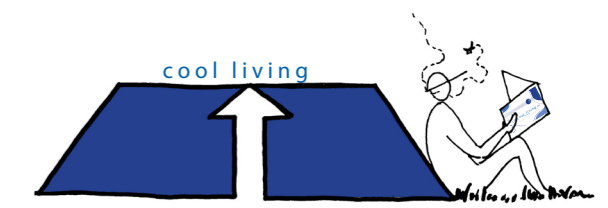
When temperatures soar, people's houses will cost them their lives, or people will have to walk away from their Country, family and identity.

How do you use 'cool living'?



'cool living' Community Edition Project Parts

Explanation of the Community Edition suite of tools



The COMMUNITY EDITION is the blue book and is for community members who are sick of hot houses, or would like to talk to housing about house upgrades or apply for grant funding.

The Community Edition suite of tools include:

1. 'cool living' process diagram (community)
2. House Survey + Modifications
3. How to use our house
4. Built Examples Gallery
5. Interactive Model

The content frames the problems faced in community housing, and gives tools to understand how it is best to use houses in summer, a survey tool to audit all houses and ideas for house upgrades.

All of this is communicated through the cool living website and blue book.

1. 'cool living' process diagram (community)

2. House Survey + Modifications

3. How to use our house

4. Built Examples Gallery

5. Interactive Model

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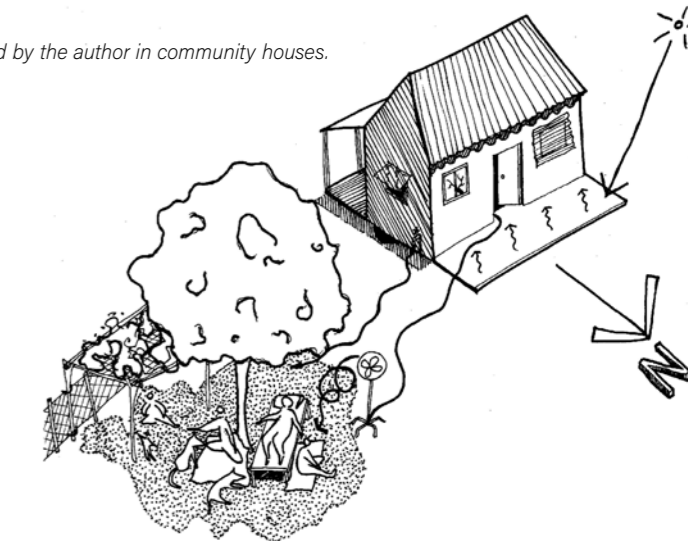
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This sketch shows common things experienced by the author in community houses.



Common Questions on this topic:

Q - Why is my house so hot?

Answer - Depending how old your house is, what your house is built from, which walls face the sun, if you have insulation in the walls or roof, if you have verandahs or shading or how good windows and doors work will depend how hot your house is without a power card. A powercard to use the fans and Air-Conditioner will help cool the house down, but if the house is not designed right for the climate, you will have to spend more money (\$) on power.

Action - Use the House Survey to work out what your house does and does not have to make it cool.

Q - Will Housing make my house cooler?

Answer - Housing have a responsibility to the tenants of their houses to make sure they are safe and the houses do not make them sick. Houses should be well built and have working air-conditioners. If your house does not have verandahs, shaded walls, insulation or a working air-conditioner, you need to talk to housing and tell them it is a health problem on hot days and they need to fix it.

Action - Show them this book and the website, tell them research shows my house needs these things to keep us cool, healthy and safe.

Q - Can i build the verandah and window awning myself?

Answer - Try to talk to Housing first before you build anything yourself. Make sure you record what day and time you have the meeting and what you talk about. At the meeting, tell them your house must be appropriate for the climate and be safe and liveable. If not, they are breaching the residential tenancy law ([see recent news on Santa Teresa law suit](#)).

Action - Use the House Survey to see what each house needs. Take this to your meeting with Housing and demand better housing.

Q - Who will pay for the house upgrades?

Answer - Housing get money from rent collection and money from the government. At the end of financial year (June every year), Housing might need to spend money quick. Depending how much money (\$) is in their budget will depend how much they can spend.

Action - Talk to Housing at the start of the year before June about what the houses need and much money they have for your community for cooling house upgrades.



Chapter 1



The Climate

- What is the 'hot dry' climate?
- What is climate change?
- What is the right temperature for a house?
- Healthabitat & HLP8
- Heat & Health

Climate Profile - Arid / 'hot dry' ▪ Alice Springs

Arid/ 'hot dry' are areas that have little rain (arid <250mm rain & semi arid <350mm rain¹) and high temperatures in summer. This covers about 70% of Australia. Australia is the driest inhabited continent in the world.

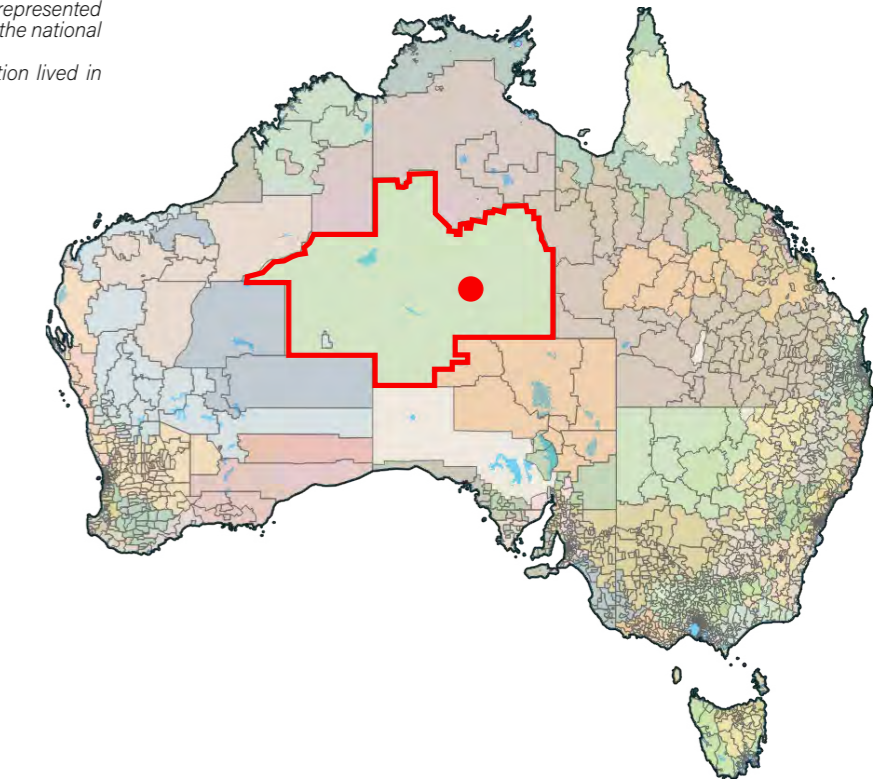


NT government is responsible for about 5,498 houses across 73 remote communities, Alice Springs town camps, and Tenant Creek community living areas.²

In June 2021, Aboriginal people represented 30.8% of NT's population and 78% of the national Aboriginal population. 74.6% of the NT's Aboriginal population lived in remote or very remote areas.⁴

National Construction Code (NCC) Climate Divisions Map

This map has 8 climate zones. Government says new homes in each zone must be built to certain rules. This project is focusing on Zones 3 and 4.
 'Climate zone 3 - hot dry summer, warm winter'
 'Climate zone 4 - hot dry summer, cool winter'



Alice Springs (zone 6) NatHERS Map

NatHERS = Nationwide House Energy Rating Scheme map has 67 climate zones. Government says new homes built in each zone must reach a certain star between 1 to 10, with 10 being the best performing house thermally. Government says all new houses and renovations to existing houses in Alice Springs should be built to at least 5 stars.³

¹ - Department of Climate Change, E, the Environment and Water. (2023). Outback Australia - the rangelands. Australian Government. <https://dcceew.gov.au/environment/land/rangelands>

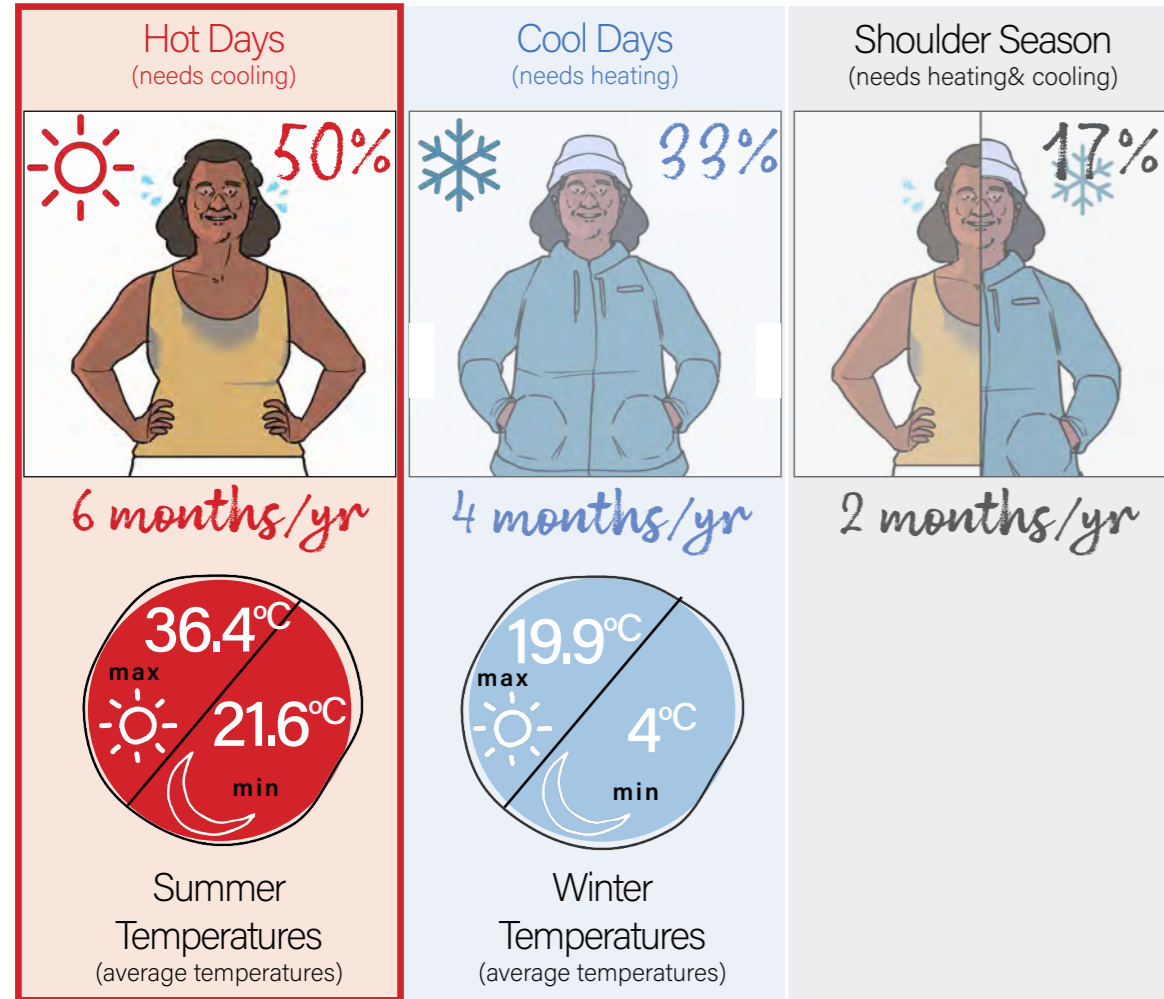
² - Grealy, L. (2023). Healthy Homes Monitoring and Evaluation Project Final Report.

³ - Government, N. (2023). Residential building and energy efficiency. NT Government. <https://nt.gov.au/property/building/build-or-renovate-your-home/building-and-energy-efficiency>

Climate Profile - Arid / 'hot dry' ▪ Alice Springs

A building in Alice Springs should be built right for the Arid/ 'hot dry' climate.

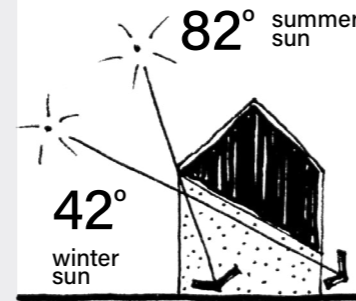
Yearly Heating & Cooling need ⁴



"In Alice Springs... there were 55 days above 40°C in the year to July 2019, which included the hottest summer on record and the driest in 27 years [65.8mm of rain that year]" ¹

Key climate characteristics: ²

- Distinct summer and winter seasons; very hot summers with hot, dry winds and cool winters with cold dry winds
- Very high day–night (diurnal) temperature range
- Very low rainfall



Seasonal Sun
[Giasma](#)



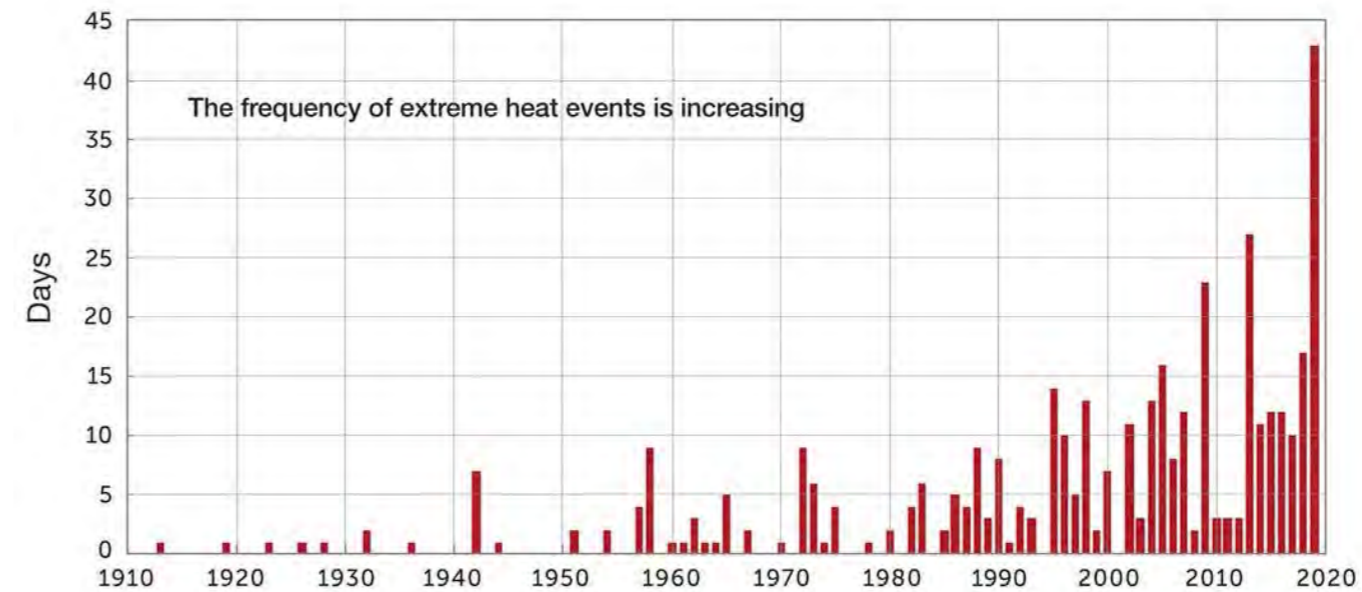
Rainfall ³
(avg/yr BOM 1941-2023)



Wind Speed
(avg/yr BOM 1941-2014)

Climate Change

Climate change means a change in weather patterns because the temperature of the Earth is getting hotter because of the impacts people have had from burning fossil fuels (like coal), cutting down trees and farming. Climate change means rising sea levels, hotter days more often and more extreme floods and fires.



This graph shows that extreme heat events (very hot days for a long time) are becoming more and more often every year. ²

"CSIRO modeling estimates that without climate action, Darwin would experience a rise in days above 35°C, from 22.2 days/yr to 132 days/yr in 2030 and 275 days/yr in 2070. " ¹

¹ - Tess Lea, L. G. (2021). FINAL REPORT NO. 368: Sustainable Indigenous housing in regional and remote Australia. AHURI.

² - Reardon, C. (2013, 2020). Your Home; Design for Climate. DCCCEW. <https://www.yourhome.gov.au/passive-design/design-climate>

³ - Majority of rainfall falls between October - March

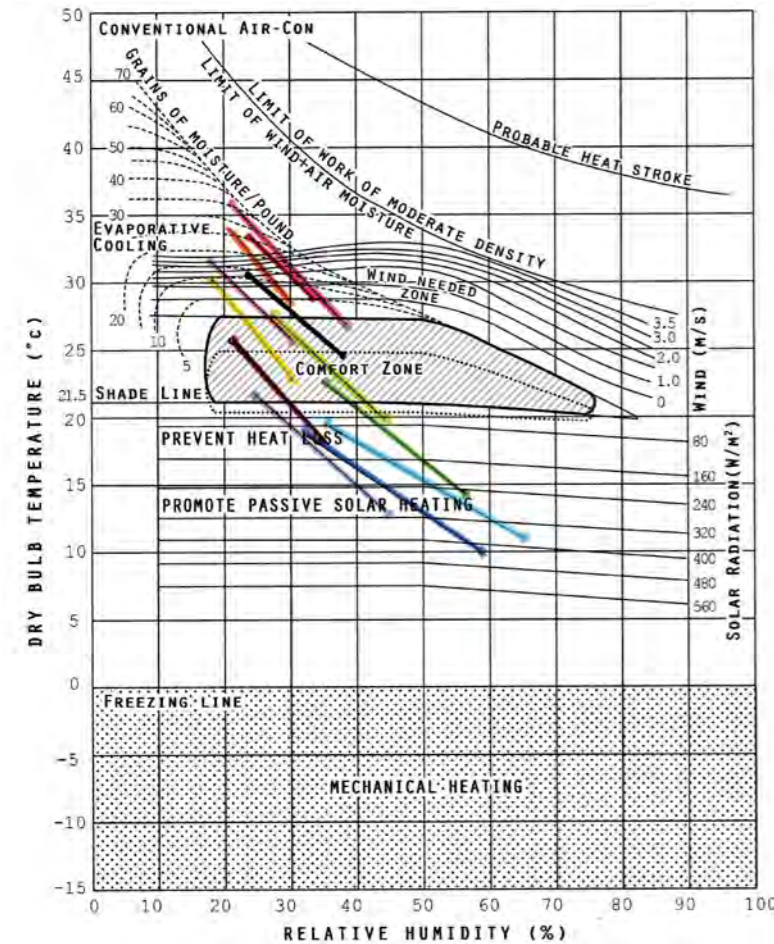
⁴ - Hill, J. (2004). Improving thermal performance of social housing for better health of occupants and to reduce costs of temperature control University of Sydney]

¹ - Elizabeth Hanna, M. O. (2018). Cooked with Gas, Extreme heat in Darwin. <https://australiainstitute.org.au/report/cooked-with-gas-extreme-heat-in-darwin/>

² - Shiel, D. J. J. (2021). Cooling your home: Home retrofits, appliances and adaptations for a hotter future. B. Z. E. Inc. <http://bze.org.au>

What is the right temperature for a house?

Thermal comfort is how hot or cold a person feels because of the environment they are in. Our houses should help to keep us at a comfortable temperature.



Our bodies need to stay at a stable temperature. If heat is lost or gained too fast or too slowly, the temperature of the body is changed and the environment needs to help cool the body by:

1. Conduction (from touching cold floors and walls)
2. Convection (air flowing across the body)
3. Evaporation (sweat drying to keep you cool) ¹

If it's too hot and dry (i.e. low humidity) we need shade and cool surrounding surfaces. Air movement can be an irritant because it is at a higher temperature than the skin (approximately 32C) ³ so will make you take on heat and feel hotter (evaporative heat gain).

The comfortable temperature for people in summer is:
20-27°C when relative humidity is below 60%. ⁴



Qualitative Bioclimatic Chart with Alice Springs data ²

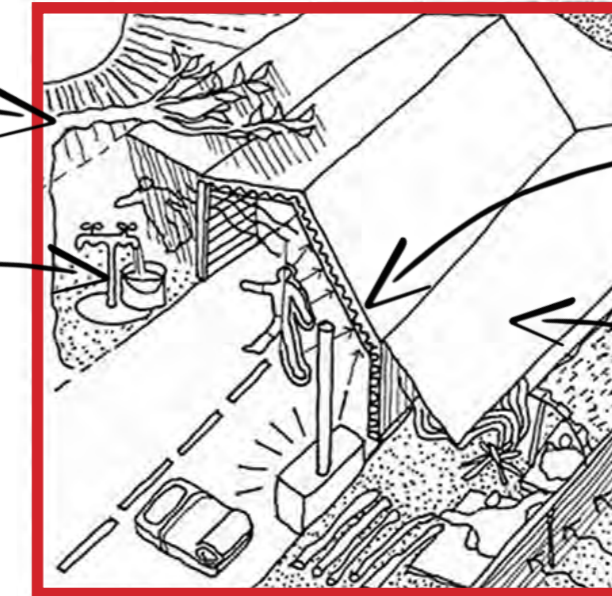
The high and low temperature and humidity of every month is marked on the chart and a line is drawn between them. Where the line is drawn shows what is needed in the environment to help get the body closer to The Comfort Zone. As the climate gets hotter, the house will have to work harder to keep people cool inside.

Healthabitat's Healthy Living Practices (HLP's) & HLP8

Healthabitat has an increasing interest in the importance of temperature control and HLP8. ¹

Yards should have shade trees to cool down the ground and the air temperature around the house

There should be working yard taps for watering plants and for people camping in the yard



Houses should have insulation in the roof and walls to help cool the house down

Houses should have wide awnings around the walls to create shaded areas in the yard for people camping in the yard. The awnings should shade the walls to help cool down the house.

HLP8 - Controlling the temperature of the living environment

Healthabitat

Since 1985, Healthabitat has worked with Indigenous communities throughout Australia to improve the health performance of more than 10,000 houses. Housing for Health—the methodology that underpins this work—adopts nine Healthy Living Practices (HLPs) to understand how the built environment hierarchically impacts upon people's health.

As climate change continues to destabilise who gets to live where and on what terms, architects must understand how their particular skillset—and the labour that sits behind it—can meaningfully assist communities in resisting the broader forces of uneven development. ²

HLP8 - Controlling the temperature of the living environment

Living in houses that are too cold or too hot can contribute to a range of physical illnesses and can cause emotional distress for residents. Extended exposure to high temperatures can also result in illness, with increased risk of dehydration and heat stress for sick children and elderly people.

It can be expensive to use 'active' heating and cooling systems, such as heaters and air conditioners to make poorly performing houses more comfortable. Houses that incorporate passive design features will require less days of active heating and cooling and less energy will be required to heat or cool the house on extreme temperature days. This means reduced costs for the resident.

¹ & ² - Olgyay, V. (2015). *Design with Climate: Bioclimatic Approach to Architectural Regionalism* (new and expanded edition). Princeton University Press.
³ & ⁴ - Hollo, N. (2011). *Warm House Cool House - inspirational designs for low-energy housing* (Second Edition ed.). NewSouth Publishing.

¹ - Healthabitat. (2023). B.8 - Controlling the temperature of the living environment
² - 2 - UON ARBE 6231 Hot House Course Guide

Heat & Health

Extreme heat makes people's existing health conditions worse.

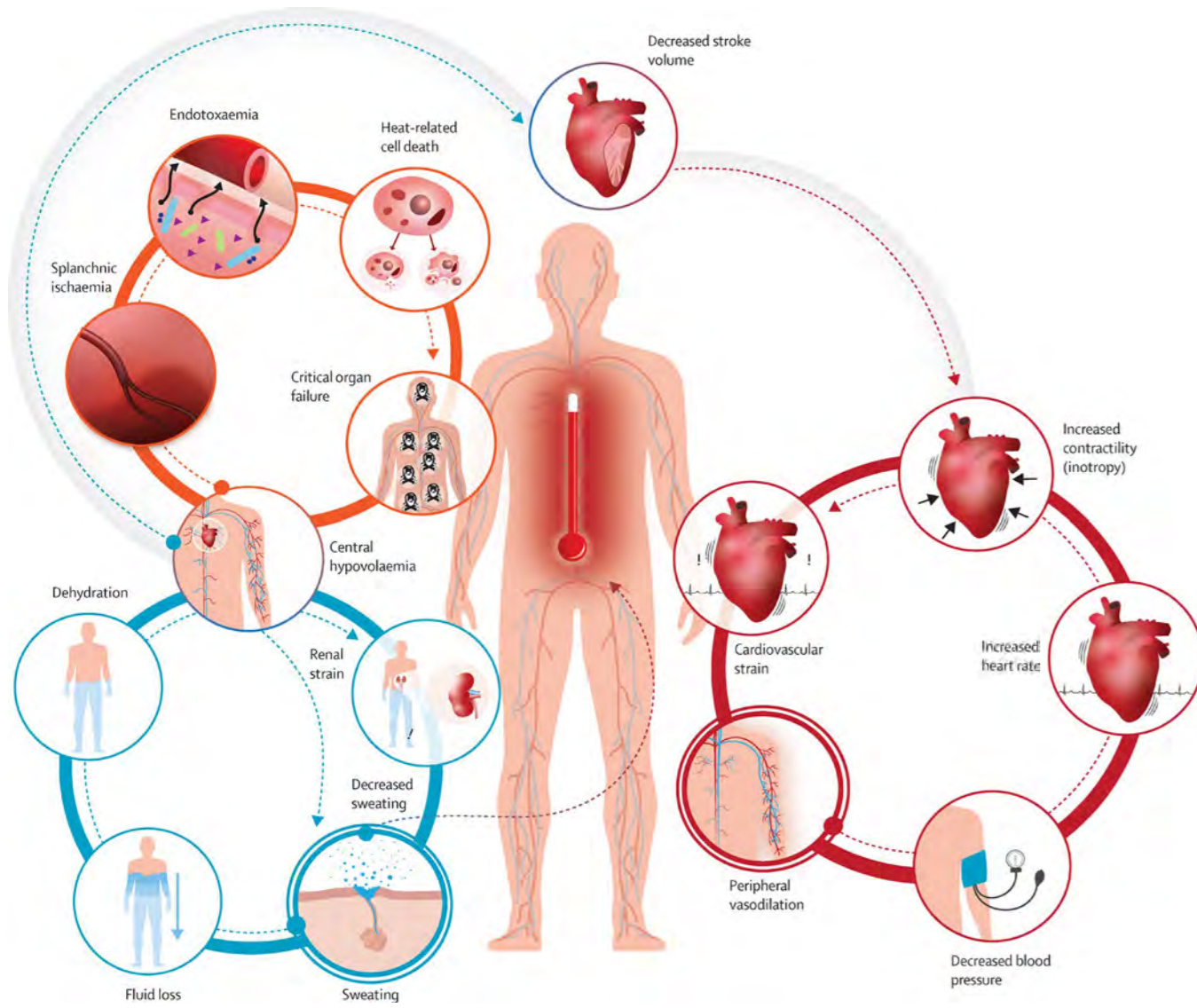


Diagram showing how heat affects people ¹

Health conditions associated with hot temperatures are called 'heat stress' and include heatstroke, heat exhaustion, heat syncope (fainting/unconsciousness) and heat cramps.

Infants and young Children ²

Young children are more vulnerable to heat illness due to their reduced ability to sweat, larger body surface area per body mass, increased risk of dehydration and rapid rises in core body temperature if dehydrated. Also, infants and children under five years are sensitive to heat.

Aboriginal infants have a lower average birth weight, and during high temperatures, Aboriginal children with malnutrition are at risk of heat-related illness and death.

Elderly (susceptible population) ²

The elderly are susceptible to heat-related illness due to their reduced ability to adjust to physical changes in the body, which occur when exposed to excessive heat. The elderly are also at greater risk of heatstroke because of their increased likelihood of chronic medical conditions.

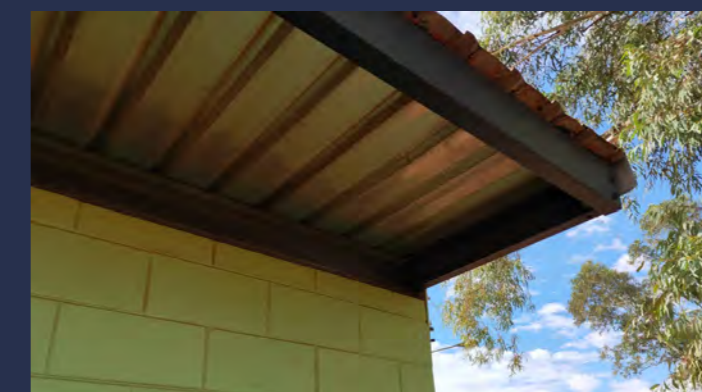
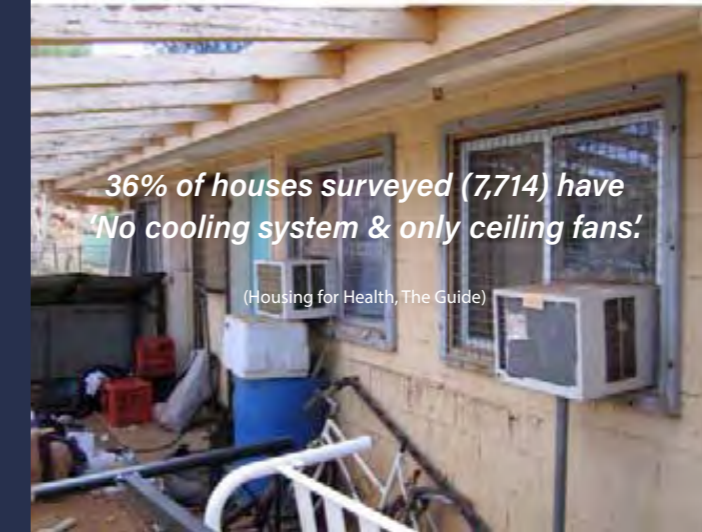
Some of the medications taken by elderly people increase the risk for heat-related illness as they can decrease the body's capacity to sweat.

¹ - Ebi, K. L. (2021). Hot weather and heat extremes: health risks. *The Lancet*, 398(10301), 698-708.
² - Pitts, A. (2004). *Social and Health impacts of temperature in Aboriginal Housing; a Review of Literature*. N. Health.

Chapter 2

Community Houses

- Community Living - The yard is a house
- Common types of community houses
- 3 Key problems with these houses



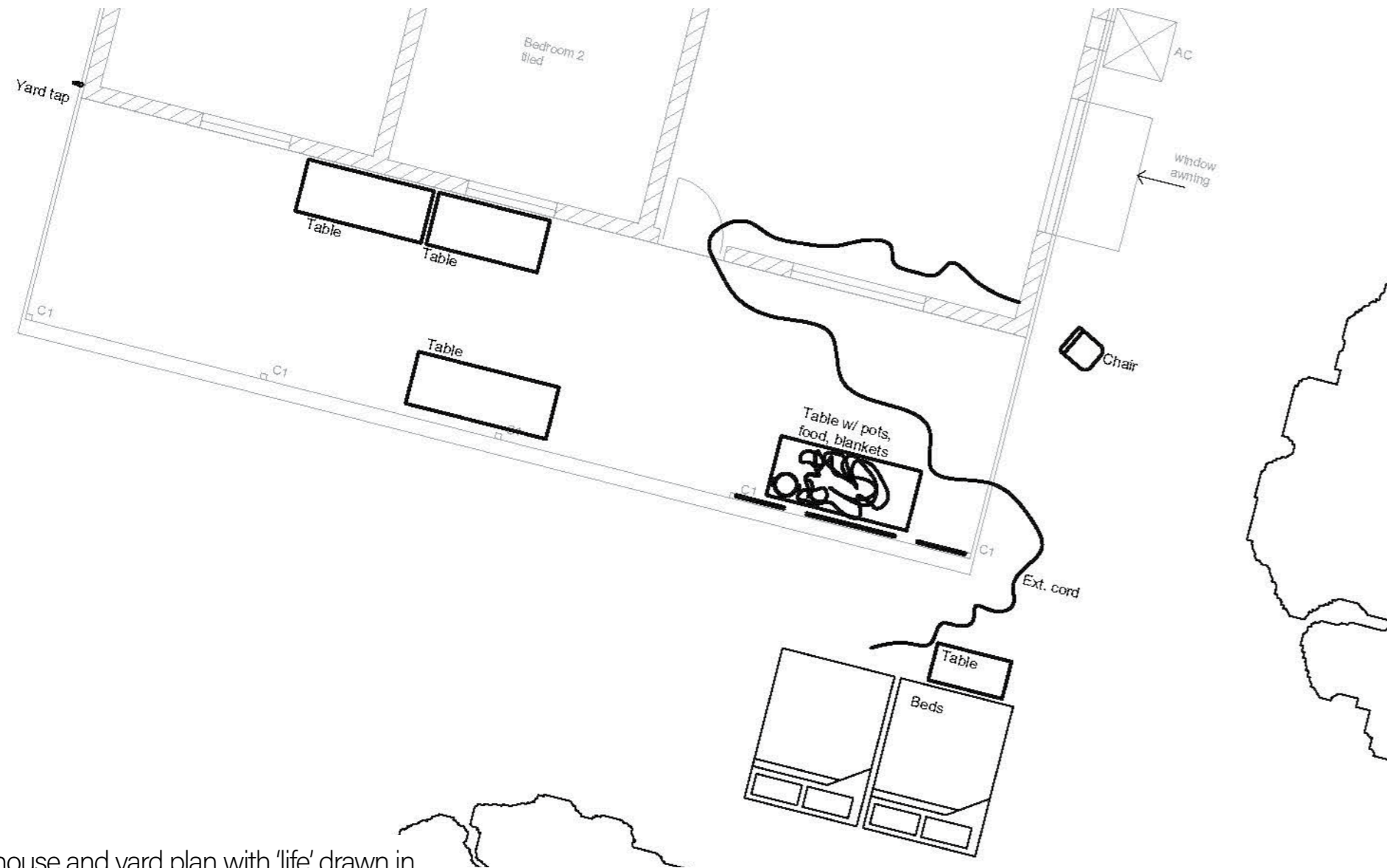
The 2014-15 National Aboriginal and Torres Strait Islander Social Survey (NATSISS) showed that more than one-third (38%) of remote Indigenous people over 15 years lived in crowded conditions, compared to 13% elsewhere.



community houses

Community Living - The yard is a house

When 'life' is filled into house and yard plans from stories and photographs, it shows the yard is a 'house' with many families living there. It shows the yard is important to focus on to reduce the negative effects of crowding.

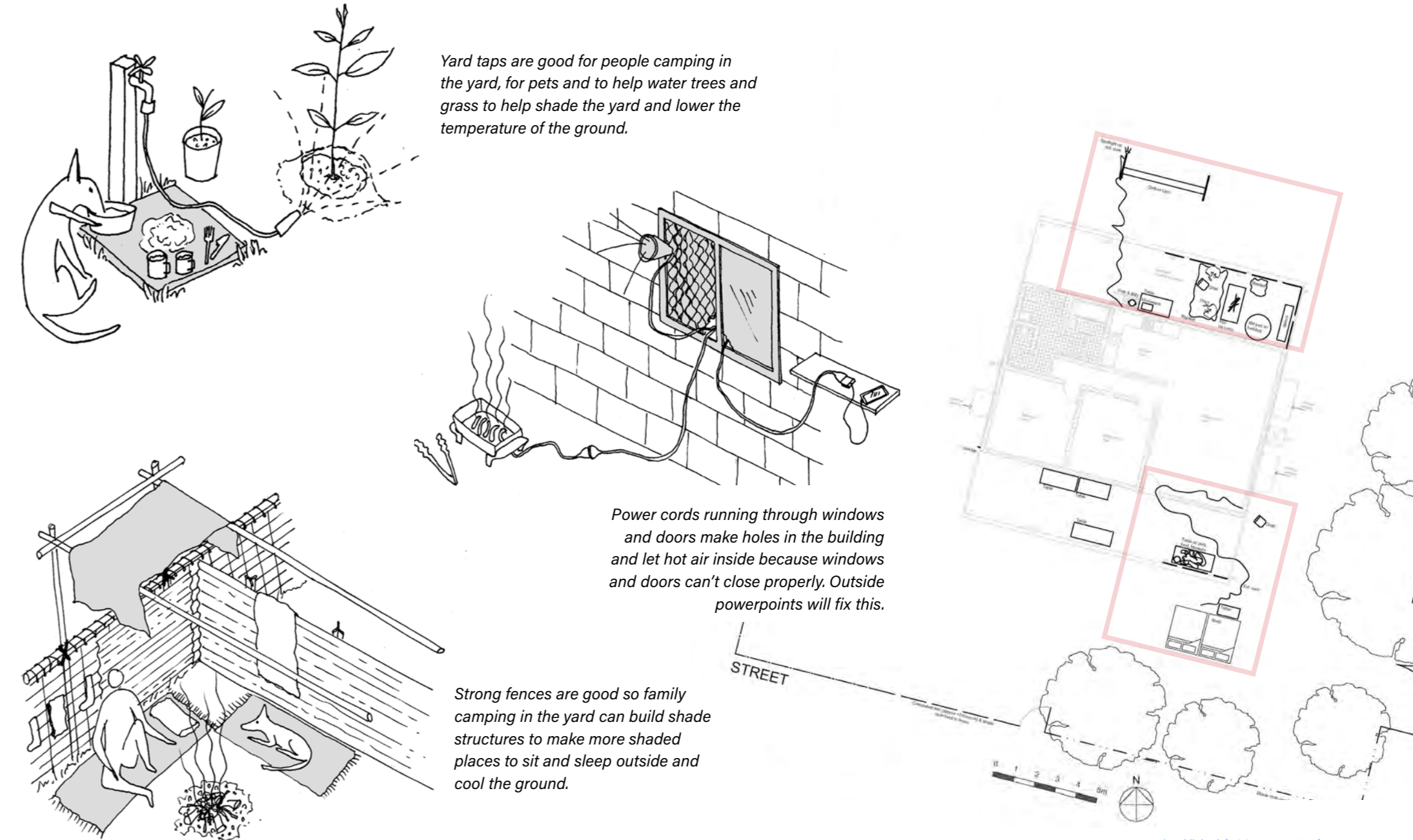


Community house and yard plan with 'life' drawn in

Base house plans from UON 'Hot House' semester 1 2023 stream with Healthabat and Dr. Jasper Ludewig

Community Living - The yard is a house

The drawings show yard taps, outside powerpoints, strong fences and shade planting is important to help cool the house and yard and reduce the negative effects of crowding.



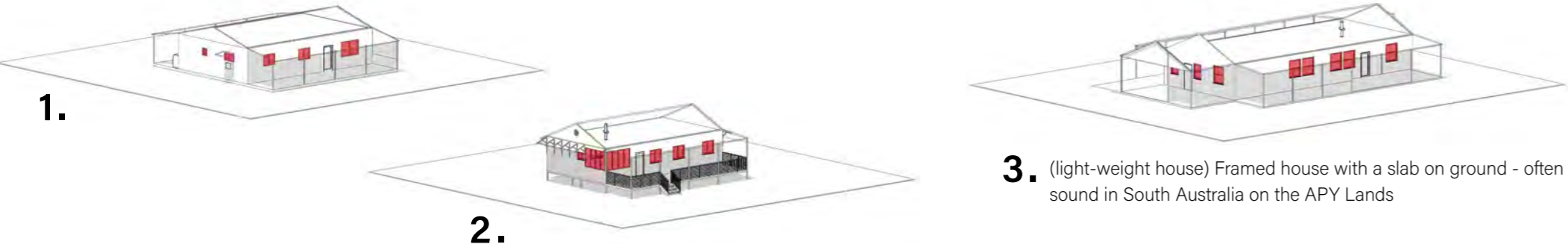
Yard taps are good for people camping in the yard, for pets and to help water trees and grass to help shade the yard and lower the temperature of the ground.

Power cords running through windows and doors make holes in the building and let hot air inside because windows and doors can't close properly. Outside powerpoints will fix this.

Strong fences are good so family camping in the yard can build shade structures to make more shaded places to sit and sleep outside and cool the ground.

Common types of community houses

Across the 5,498 houses the NT Government is responsible for¹, these are 3 common types.



1. (Heavy-weight house) Block wall house with a slab on ground³

- Verandahs on long ends of the house (often facing the street) and no shading on short ends of the house
- Awnings over windows on short ends
- Single skin block wall (190mm) with no insulation
- Often no ceiling or roof insulation



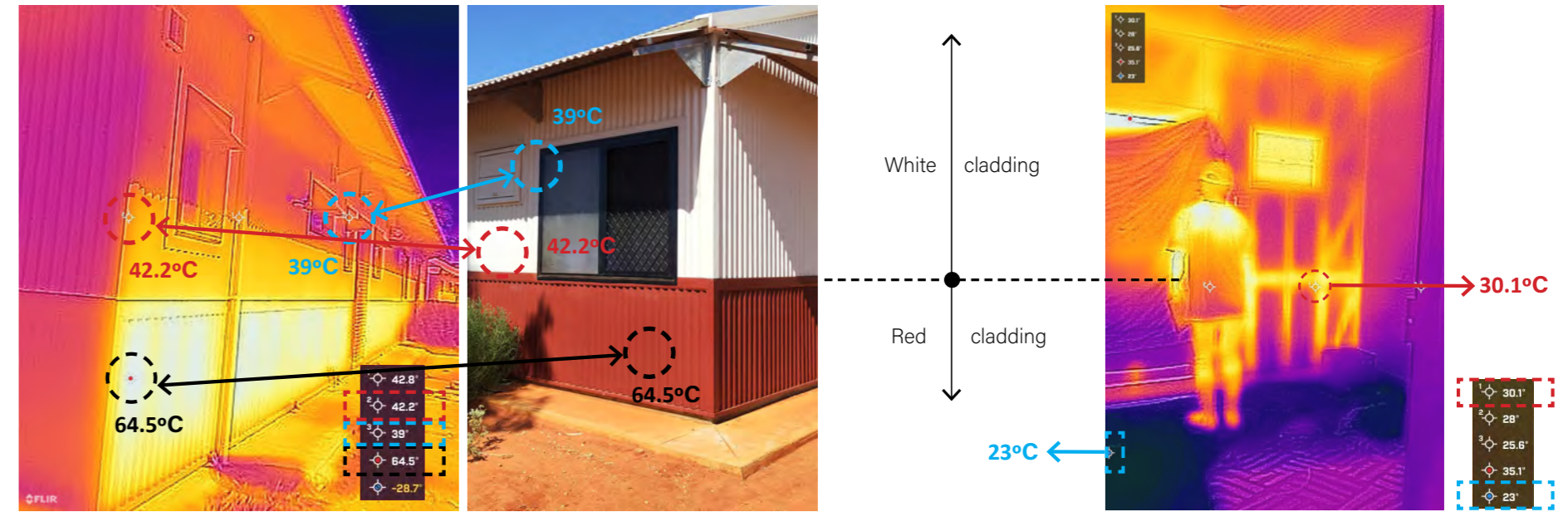
2. (Light-weight house) Framed house built off the ground²

- Verandah to one long end of house (often facing the street)
- Mesh to the perimeter of the underfloor to stop pets, but no edge cladding
- Often no insulation under the floor
- Steel framed walls with metal cladding to the outside, fibre-cement lining to inside with bulk insulation inside the cavity
- Often can't access the roof cavity to see if there is insulation
- Small awnings to short ends of house and other long end

3. (light-weight house) Framed house with a slab on ground - often found in South Australia on the APY Lands

3 Key problems with these houses - Thermal bridging

These Thermal Image pictures of community houses show where hot and cold parts of the house are. These pictures show a lot of heat is coming from outside to inside the house through the walls, ceiling, lights and vents.



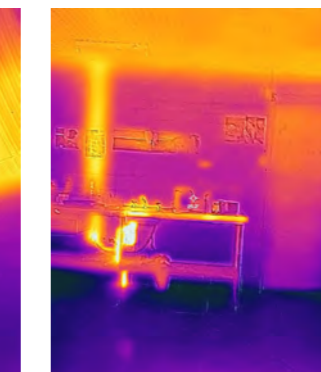
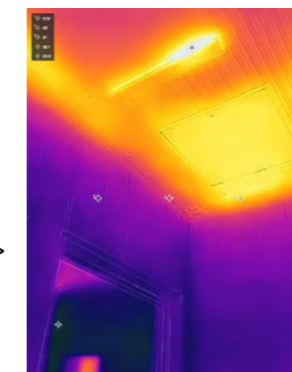
The red cladding in full sun at the bottom is very hot at 64.5°C
The white cladding in full sun above the red is 22.3°C cooler, at 42.2°C

The wall inside behind the red cladding at the bottom is 30°C
The wall inside behind the white cladding at the top is cooler



< This picture shows the metal frame inside the wall (yellow) at the end of the hallway is very hot.

> This picture shows a lot of heat comes through the light fittings and ceiling access hole to the roof.



< This picture shows the ceiling (yellow) is hotter than the walls and floor and makes inside the house hotter.

> This picture shows a lot of heat comes through the air-conditioner vents in the ceiling and makes inside the house hotter



¹ - Grealy, L. (2023). Healthy Homes Monitoring and Evaluation Project Final Report.

² - DIPL, N. T.G. (2022, 08 December 2022). Designing and building homes for our remote communities <https://dipl.nt.gov.au/news/2022/designing-and-building-homes-for-our-remote-communities>

³ - Image from UON 'Hot House' semester 1 2023 stream with Healthabit and Dr Jasper Ludewig

**FLIR photos taken with Healthabit in August 2023. Outside ambient temperature was 26C/ Inside ambient temperature was 24.3C (no active cooling in use at time of test)

3 Key problems with these houses - Bad Orientation

Orientation means the way a house faces. Good orientation (passive solar design) can make a house hotter in winter and colder in summer because the house is using the sun and wind to help.¹ Bad house orientation can make a house hotter in summer. This means you need an air conditioner more, and more money (\$) spent on power cards.

The shaded area shows best house orientation - when a house faces between 20 degrees west of north to 30 degrees east of north.²

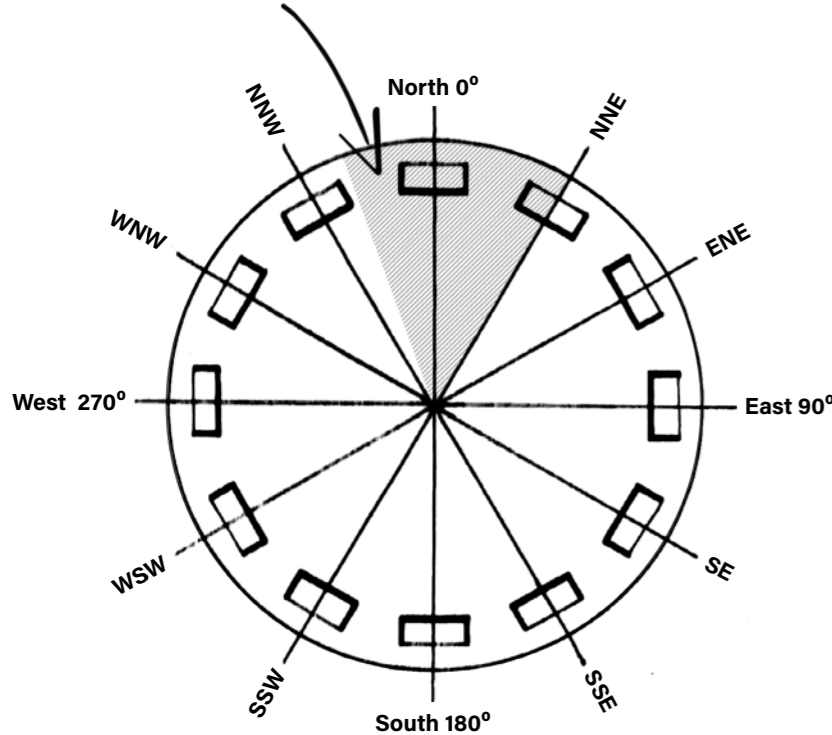
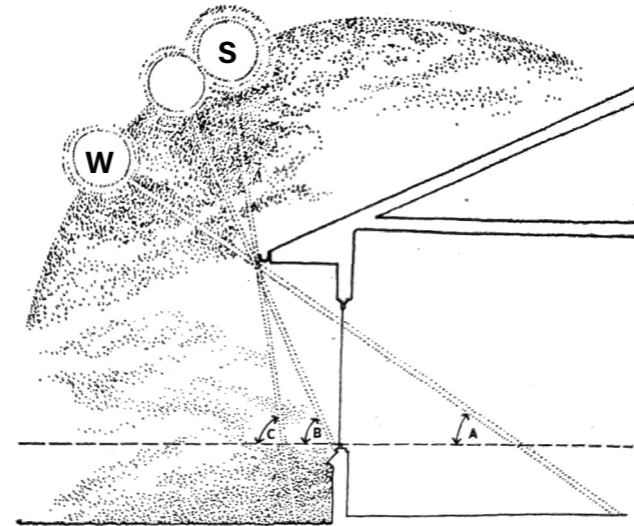


Diagram to explain house orientation³

This diagram shows which direction a house faces means it has that orientation. For example, if a long house has the long side facing north, it has a north orientation.

A house NEEDS to block sun coming inside in summer to keep it cool. Because we know the path of the sun all year, we can work this out when we design a house to make it work best.

The house should be orientated for the sun and wind, not where the street is. The diagram below shows how the sun moves in winter and summer²:



In Alice Springs, the best orientation for hot periods is to:

- **Face the long side of the house north, or up to 30 degrees east of north and 20 degrees west of north**
- **Short ends of the house should face east and west**

3 Key problems with these houses - Not right for the climate

Houses should be made with different materials and have different size verandahs in different climates. For example, Alice Springs is in a 'Hot Dry' (arid) climate but Sydney in NSW where it snows, is in a 'cool' climate.

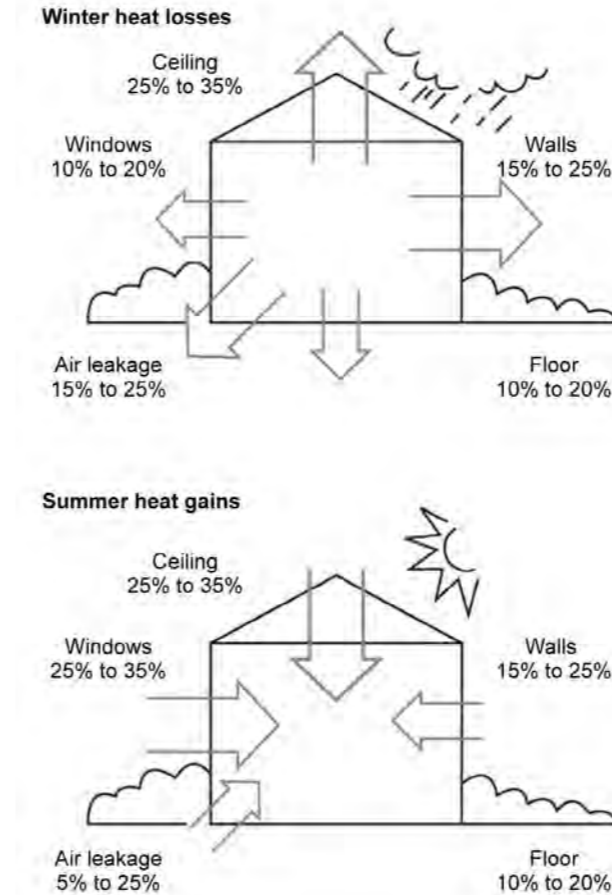


Diagram showing typical heat losses and gains without insulation²

Many community houses are not built right for the climate.

Because of the key climate characteristics (on page 12), houses in Alice Springs should have some key things¹ to help keep them cool on hot days:

Have good shading:

- **Shade all walls to stop direct sun hitting them and heating them up, especially on the west and east. There should be a big verandah to the north, east and west. South is good too.**
- **Shade all windows to stop any sun hitting the glass and coming inside**
- **Shade the ground around house to stop radiant heat bouncing off the hot ground and heating up the house**

Insulation

- **Insulation in the floors (if built off the ground), walls, ceiling and roof will lessen how much heat from outside comes inside**

Heavy-weight materials:

- **Houses should have a concrete slab-on-ground and not be raised off the ground with a light-weight framed floor. A shaded concrete slab can help keep the house cool**
- **Block walls inside (if shaded) will help keep the house cool**
- **All block walls to outside walls must be shaded**

Less Air Leaks:

- **If not sealed and insulated - hot air comes through air-conditioner vents, kitchen and bathroom exhaust fans and gaps around windows, doors and the corner of the wall and ceiling**
- **Windows and doors should close properly and have seals at the top and bottom**

¹ - McGee, C. (2020). *Your Home; Orientation*. DCEEW. <https://www.yourhome.gov.au/passive-design/shading>

² - Hollo, N. (2011). *Warm House Cool House - inspirational designs for low-energy housing* (Second Edition ed.). NewSouth Publishing.

³ - Olgyay, V. (2015). *Design with Climate: Bioclimatic Approach to Architectural Regionalism* (new and expanded edition). Princeton University Press.

¹ - Drysdale, J. W. (1952). *Designing Homes for Australian Climates* (Second ed.). Commonwealth Experimental Building Station.

² - Mosher, C. M. M. (2010). *Your Home; 4.7 Insulation*. DCEEW. <https://www.yourhome.gov.au/passive-design/insulation>



Chapter 3



How to use our house

- How a house gets hot
- What to do when it's hot outside
- What to do when it's cool outside
- Other actions to stay cool

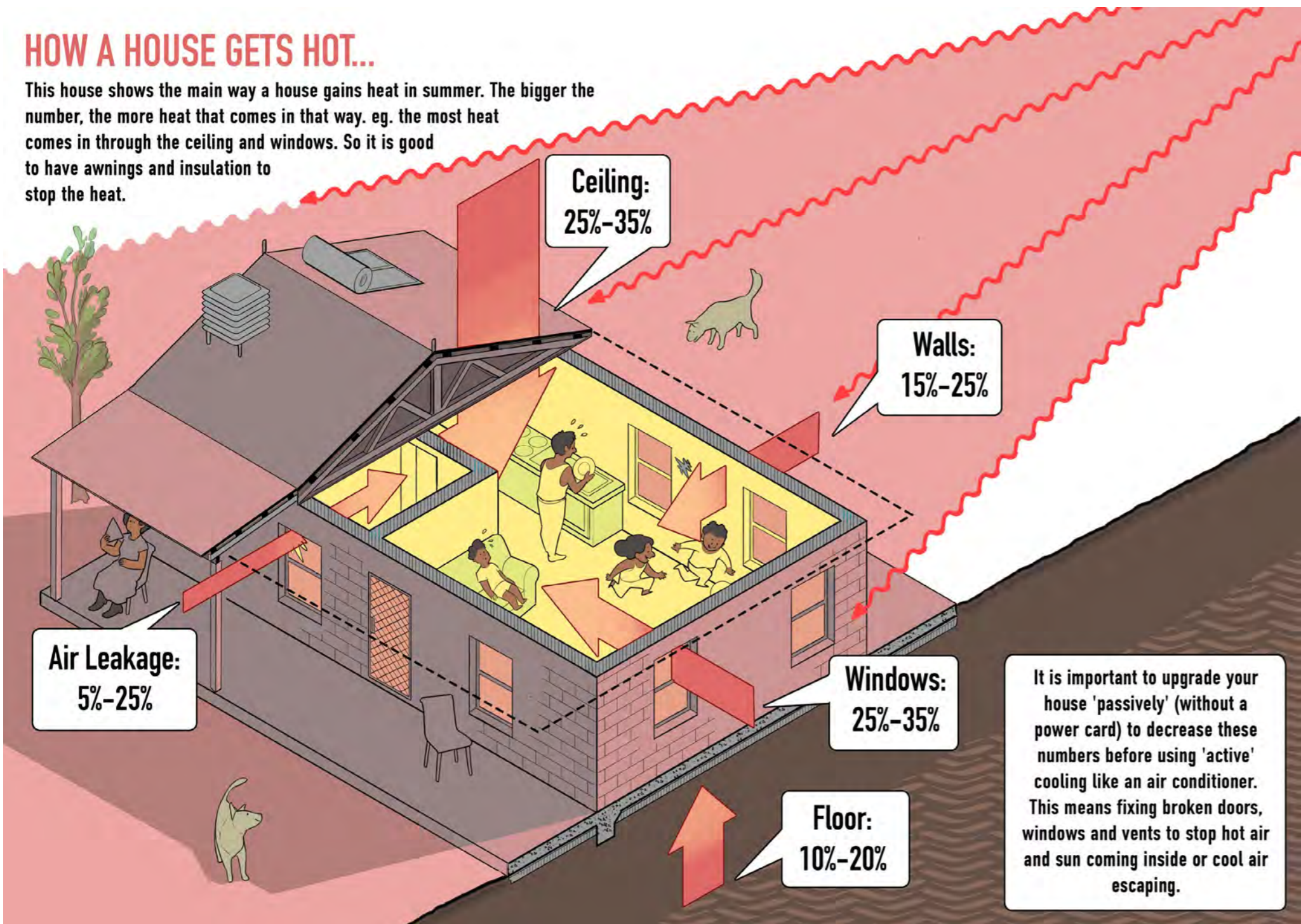
A house needs to be 'operated' by people to make it work the best and make the temperate inside the house comfortable.

*When it is hot, all of the windows and doors should be closed (except if you have evaporative air-conditioner, you need to leave a window open).
Vents should be closed or sealed up and fans and air conditioners should be turned on.*

In the night-time in summer when it is cooler, the windows, doors and vents should be opened to let the cool air in and "flush the house".

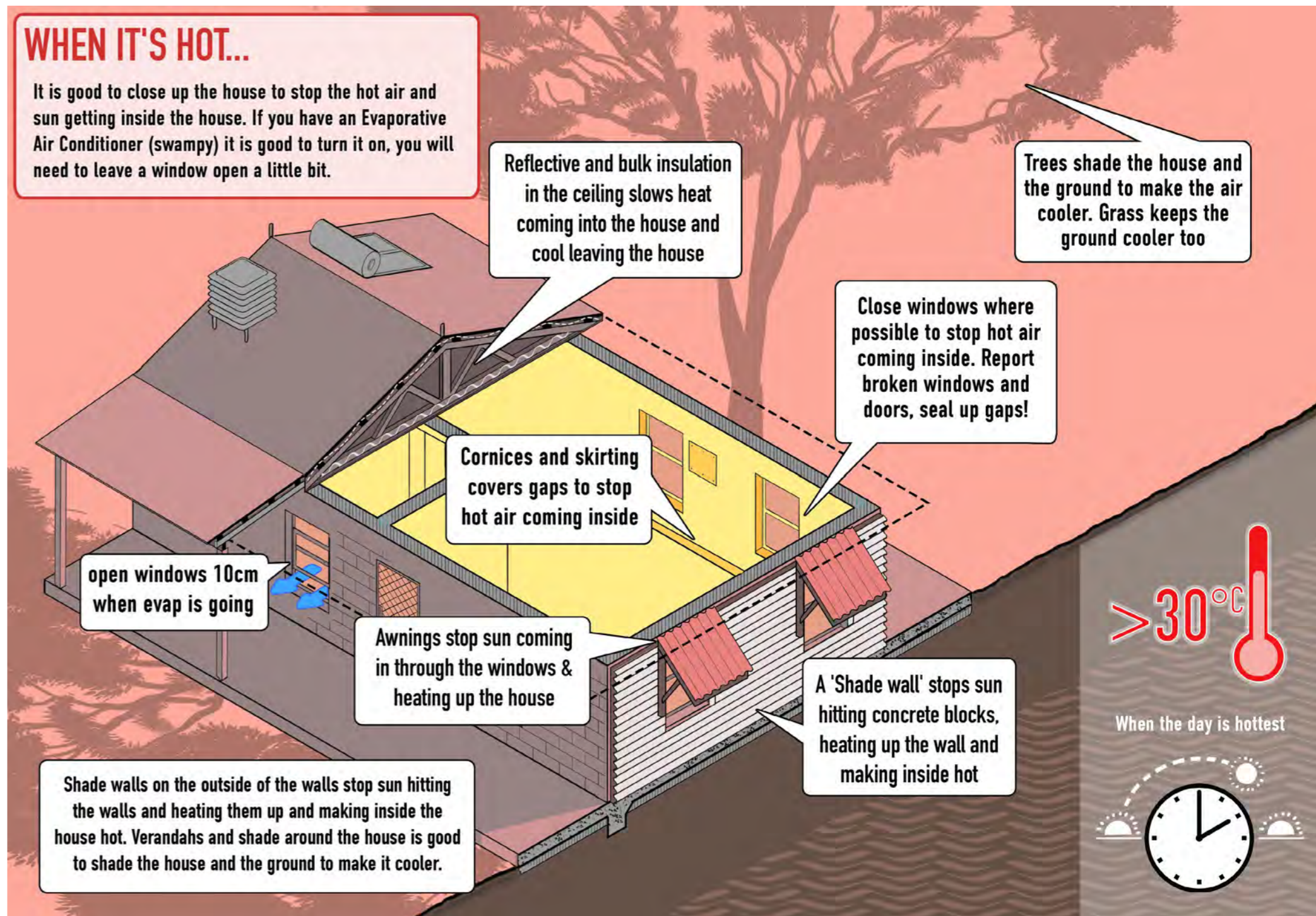
HOW A HOUSE GETS HOT...

This house shows the main way a house gains heat in summer. The bigger the number, the more heat that comes in that way. eg. the most heat comes in through the ceiling and windows. So it is good to have awnings and insulation to stop the heat.



WHEN IT'S HOT...

It is good to close up the house to stop the hot air and sun getting inside the house. If you have an Evaporative Air Conditioner (swampy) it is good to turn it on, you will need to leave a window open a little bit.



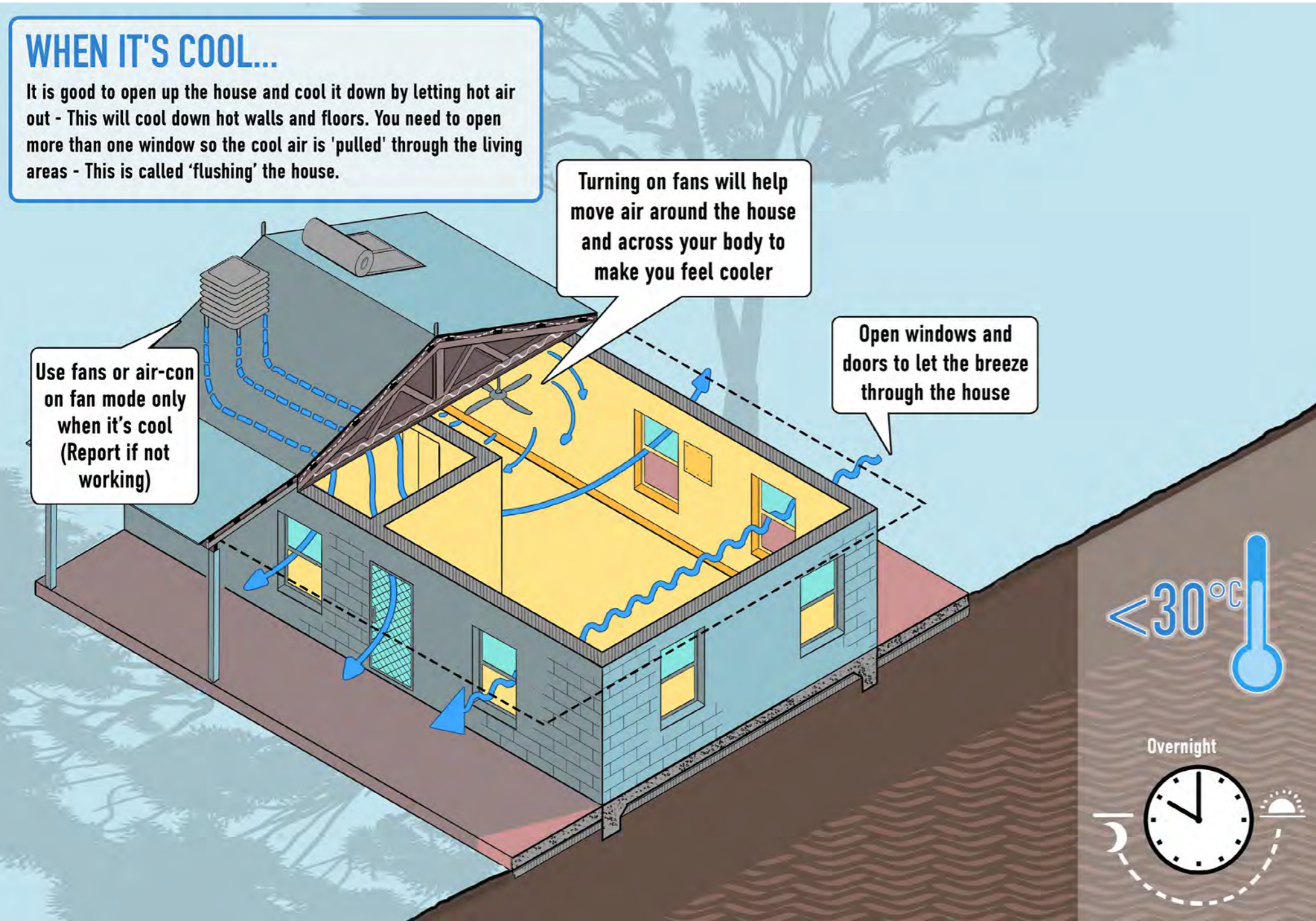
WHEN IT'S COOL...

It is good to open up the house and cool it down by letting hot air out - This will cool down hot walls and floors. You need to open more than one window so the cool air is 'pulled' through the living areas - This is called 'flushing' the house.

Turning on fans will help move air around the house and across your body to make you feel cooler

Open windows and doors to let the breeze through the house

Use fans or air-con on fan mode only when it's cool (Report if not working)



Drawings produced in collaboration with Illustration Artist Bill Hope - www.billhope.com.au

Other actions to stay cool in the heat

Residents should follow these actions around the home and outdoors to stay cool in the heat. This may even mean leaving the house if necessary.



Schedule activities in the coolest part of the day



Avoid exercising in the heat



If you must go outside, wear a hat and sunscreen



Monitor the colour of your urine to detect dehydration and increase water intake if it is dark



Lower your body temperature with cold drinks or cool packs



Stay hydrated, drink fluids even if not thirsty, and carry a water bottle



Dial 000 and call an ambulance if you or anyone in your home has heat stress symptoms

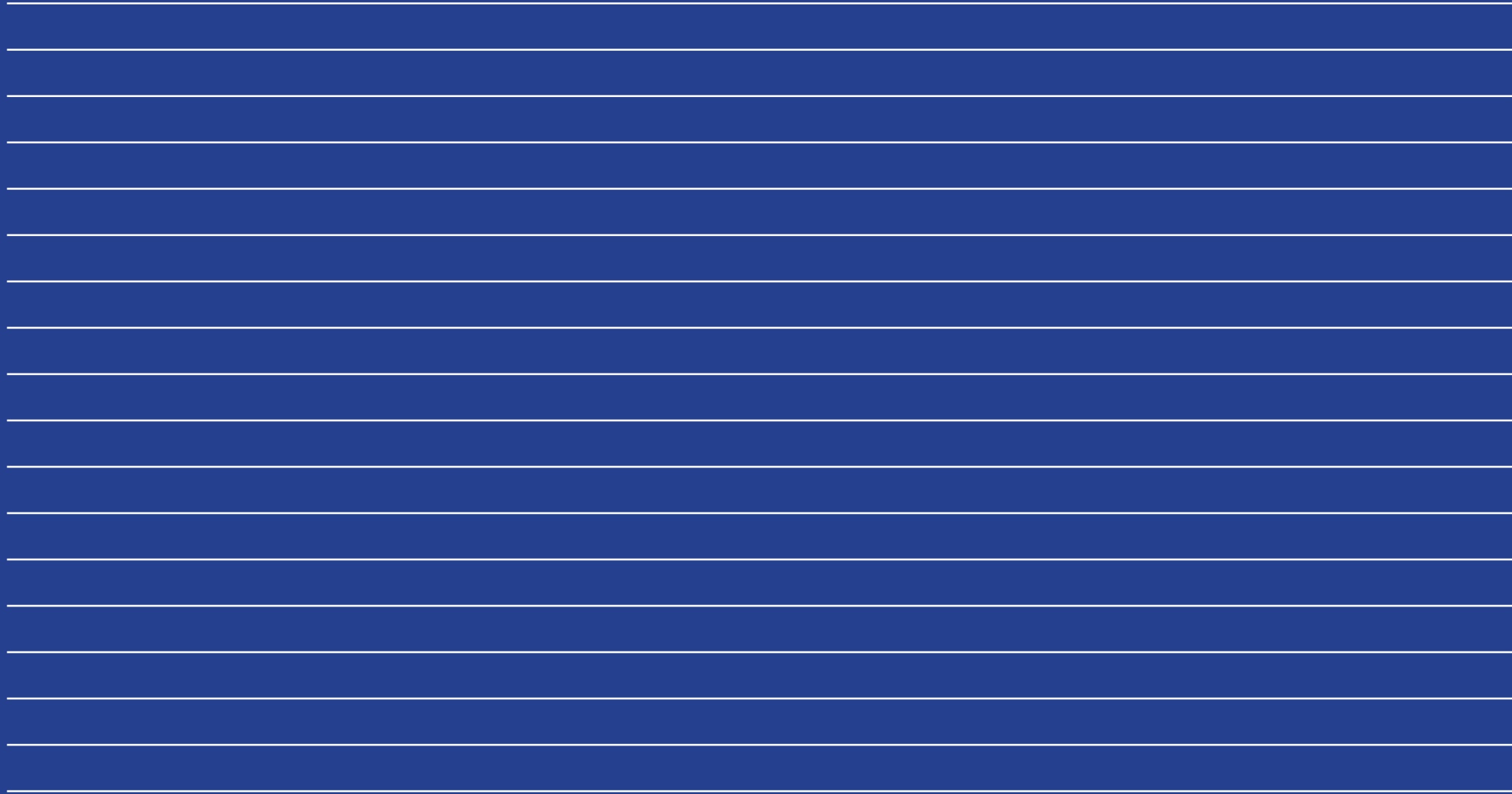


Speak to neighbours or friends and ask if they could visit you, if in an isolated area e.g. on a rural property



If residents have feel uncomfortable at home, they may need to leave and find a cool refuge e.g. air conditioned shopping centre, public library, friend's home

Shiel, D.J.J. (2021). Cooling your home: Home retrofits, appliances and adaptations for a hotter future. B.Z.E. Inc. <http://bze.org.au>



Chapter 4



Interactive community model

- How to use the model - step-by-step

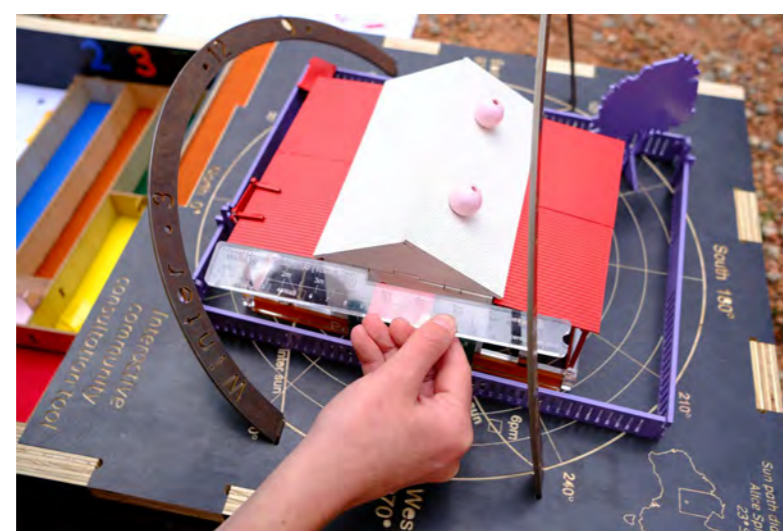
Taylor and Mitch use the model...



1. They read the house survey document step by step and face the model box north.



2. They started at #1 and add each model part to see how the sun and shade changes. They think about if their houses have these things.



3. They used the scale ruler on the model box to see how big the new verandah needs to be.

How to use the model - step by step...

The model is a tool to explain to community about passive solar design principles and the parts of this project that help make the house cooler. Start with the base model and add each part starting at #1. Read from the sheet to explain each part and use the light to see how the sun and shade changes in summer and winter.

1. Set up the box in a good spot inside or outside in the sun with the community. Install winter and summer sun arcs

* If outside, face the box north
* If inside, turn on the light

2. Take out the drawer and build the base house and sit it on top of the box

3. Go through each step of the house survey and install the model pieces of each step. Talk about what happens to the sun and shade, what the upgrade does and why it is important.



1.



2.



3.



1. Shading the Building

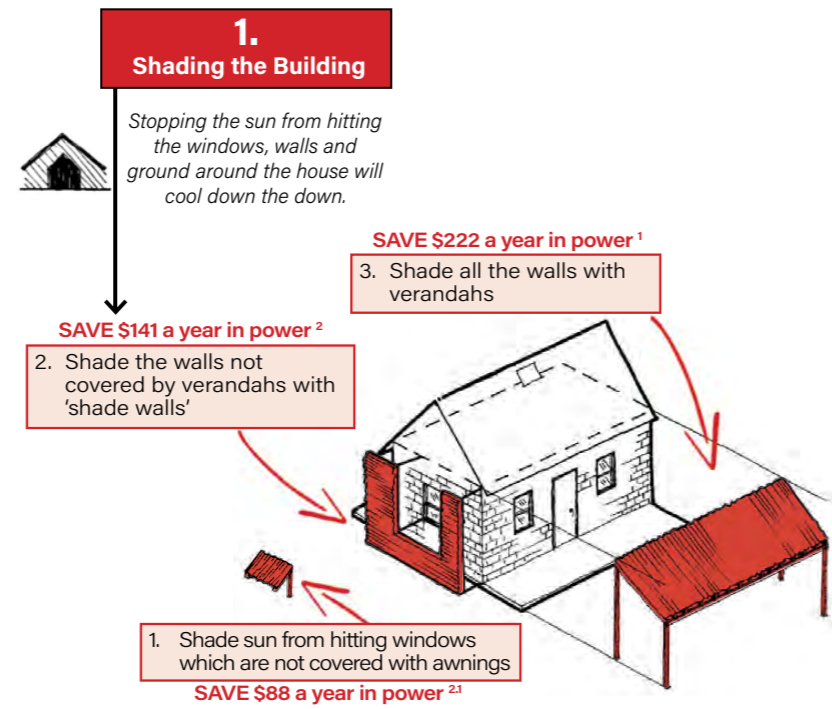
Remember, it is good for houses to have good shading:

- Shade all walls to stop direct sun hitting them and heating them up, especially on the west and east. There should be a big verandah to the north, east and west. South is good too.
- Shade all windows to stop any sun hitting the glass and coming inside
- Shade the ground around house to stop radiant heat bouncing off the hot ground and heating up the house

Add the 'shading' parts to the model -

1. Add 1 x Verandah
2. Add 1 x Verandah
3. Add 6 x Window Awning

Turn on the light on or use the model in the sun outside - what impact does the shading have on the sun hitting the ground, floor, walls and windows?



2. Insulation

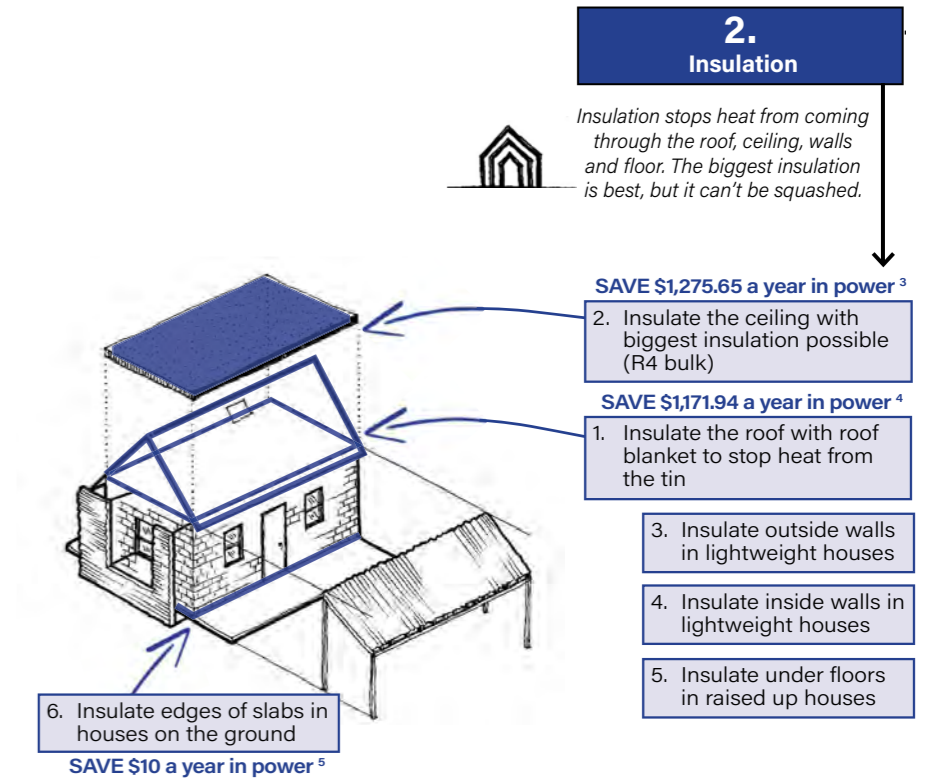
Remember, it is good houses to have Insulation:

- Insulation in the floors (if built off the ground), walls, ceiling and roof will lessen how much heat from outside comes inside

Add the 'insulation' parts to the model -

1. Add the Ceiling Insulation
2. Add the Roof Insulation
3. Add the Floor Insulation (if the house is raised)

Insulation can have a BIG impact on the temperature of the house and how much air-conditioning is needed. Does your house have insulation in the walls, ceiling and roof?



3. Close the Underfloor

Remember, it is good for houses built off the ground to have enclosed floors:

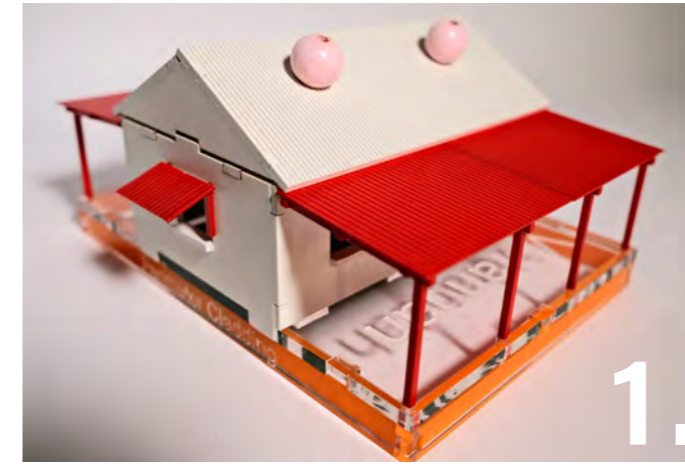
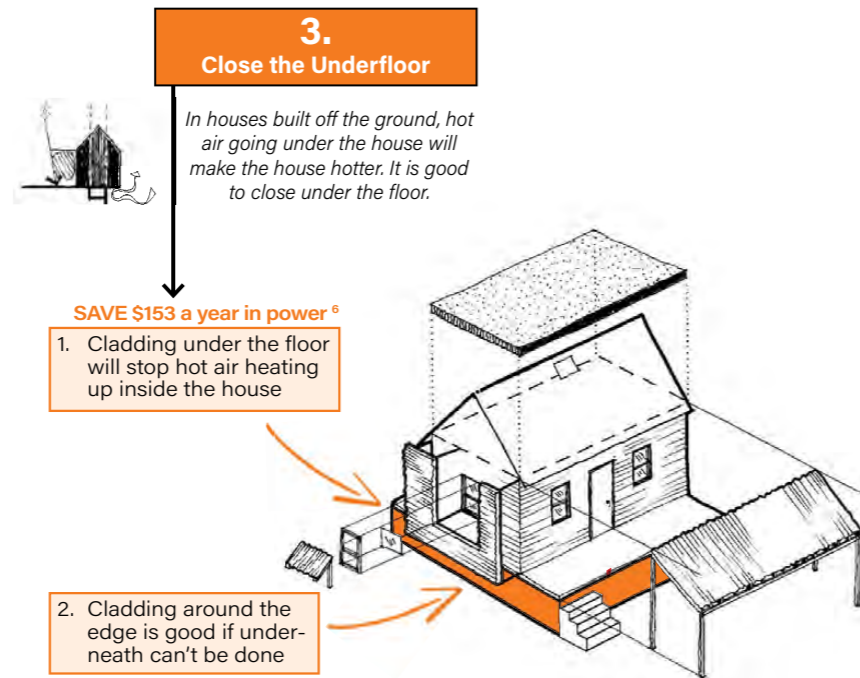
- Houses should have a concrete slab-on-ground and not be raised off the ground with a light-weight framed floor. A shaded concrete slab can help keep the house cool
- If the floor is raised, either around the perimeter should be lined with solid sheeting and have some vents OR be lined directly underneath the floor

ONLY FOR RAISED HOUSES

Add the 'underfloor' parts to the model -

1. (Install the underfloor cladding - this is not in the model)
2. Install the cladding around the edges of the underfloor

If your house is raised, does it have cladding around the edge or underneath the floor?



4. Venting/ Airflow

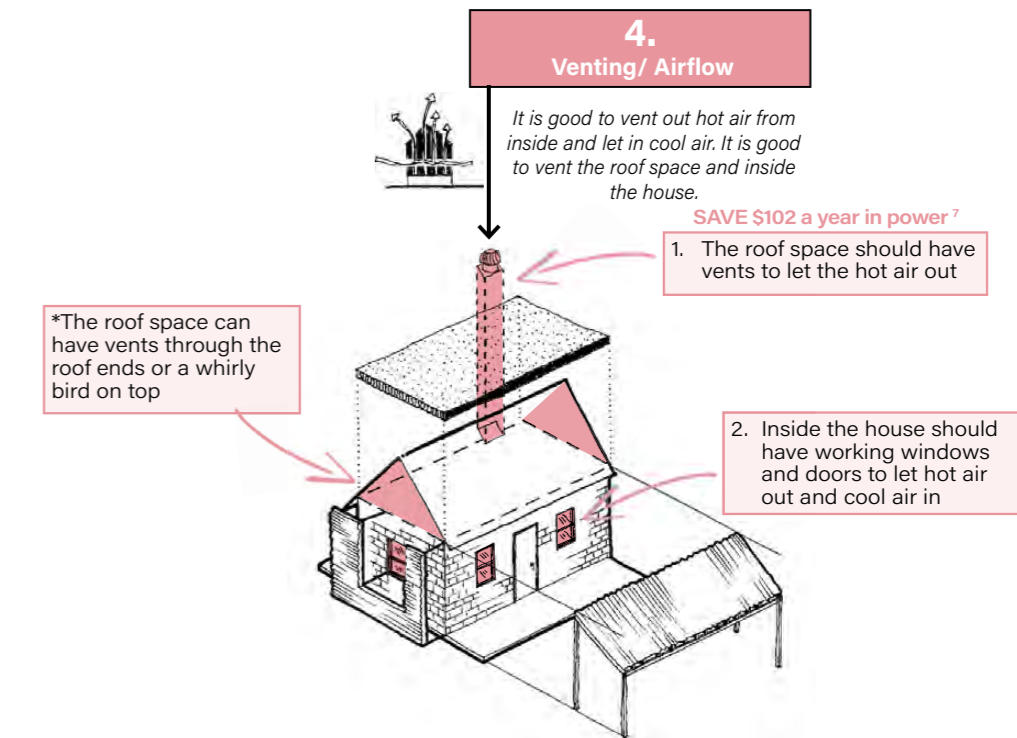
Remember, it is good for houses to vent out hot air and have airflow:

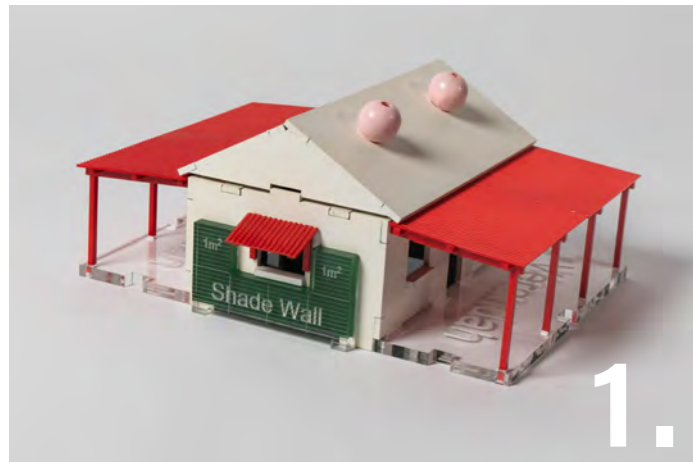
- Windows and doors should work so you can open them at night when it is cooler and let out the hot air from the day
- The roof space should have vents to let out the hot air inside. This will keep the house cooler underneath.

Add the 'Venting/Airflow' parts to the model -

1. Add the roof vents to the model (these balls simulate whirly birds)
2. (inside the house, windows and doors should open and close to be able to vent the house - this is not in the model)

Does your house have vents in the roof space and working windows and doors?





5. Thermal Mass

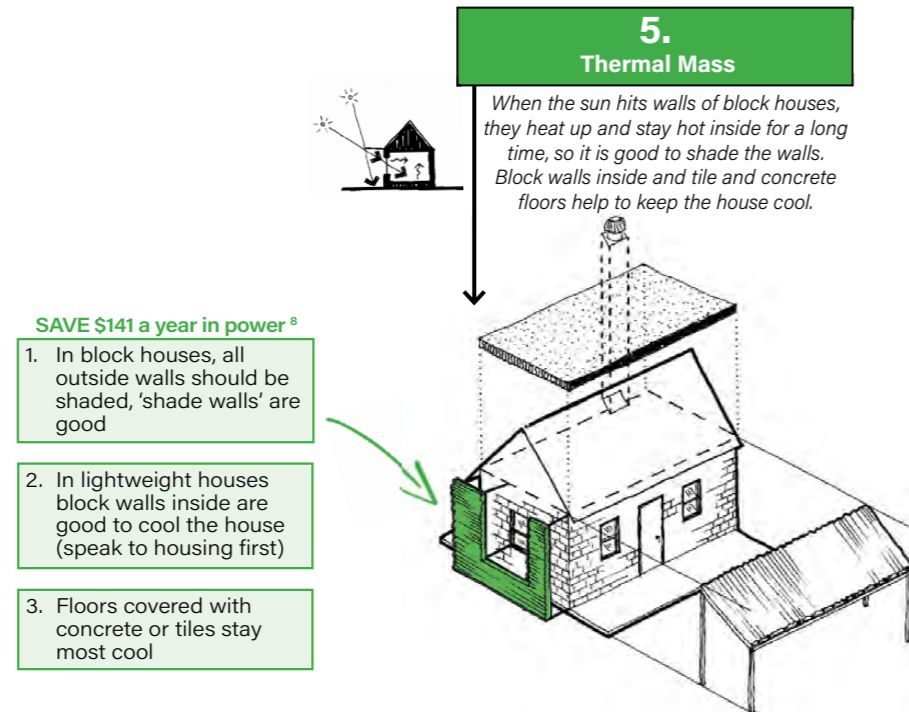
Remember, it is good for houses to have heavy-weight materials done right:

- Houses should have a concrete slab-on-ground and not be raised off the ground with a light-weight framed floor. A shaded concrete slab can help keep the house cool
- Block walls inside (if shaded) will help keep the house cool
- All block walls to outside walls must be shaded

Add the 'Thermal Mass' parts to the model -

1. Install the 'shade walls' to the short ends of the house
2. (In lightweight houses, block walls inside will keep the house cool - this is not in the model)
3. (concrete floors or floors with tiles is best to keep the house cool - this is not in the model)

Turn on the light on or use the model in the sun outside - what impact does the shade wall have on the end walls? Are the floors in your house concrete or tile?



6. Less Hot Air Inside

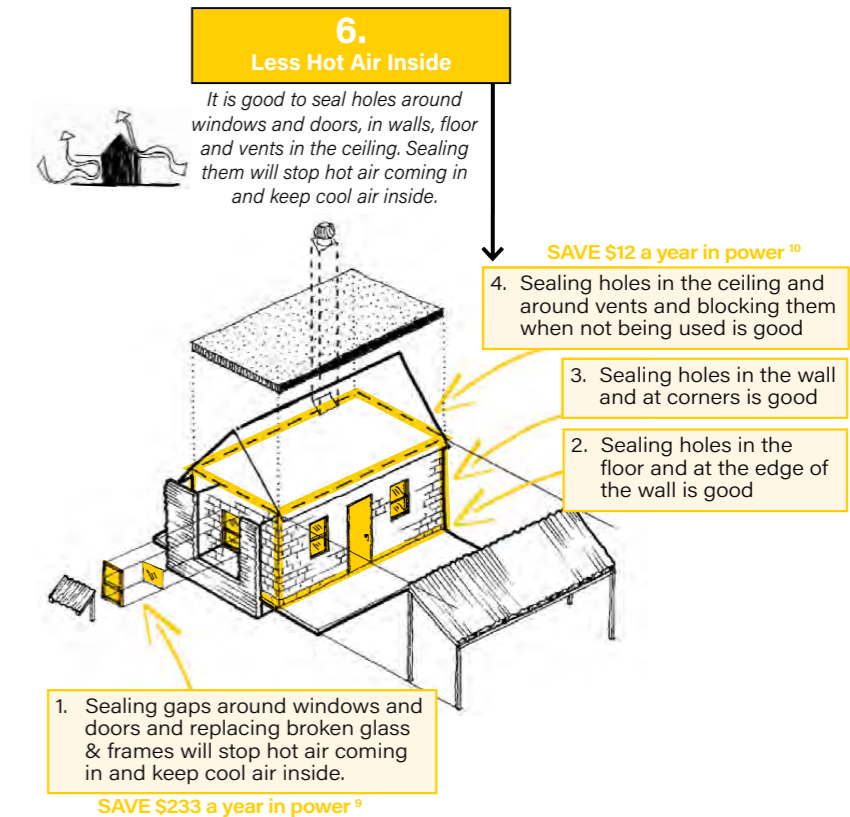
Remember, it is good for houses to have good seals:

- It is good to seal up all holes around windows, doors, at corners of walls and ceiling and holes in walls and the floor to stop hot air coming in, or cold air from the air-conditioner leaking out

Add the 'Less Hot Air Inside' parts to the model -

1. Add the windows & doors - gaps around them should be sealed and fixed if broken
2. (Fix holes in the floor and the edge of the wall - this is not in the model)
3. (Fix holes in the walls and at corners - this is not in the model)
4. (Fix holes in the ceiling and around vents and chimneys - this is not in the model)

Does your house have holes around the windows, doors, floor, walls and ceiling?





7. Paint/ Surface Colour

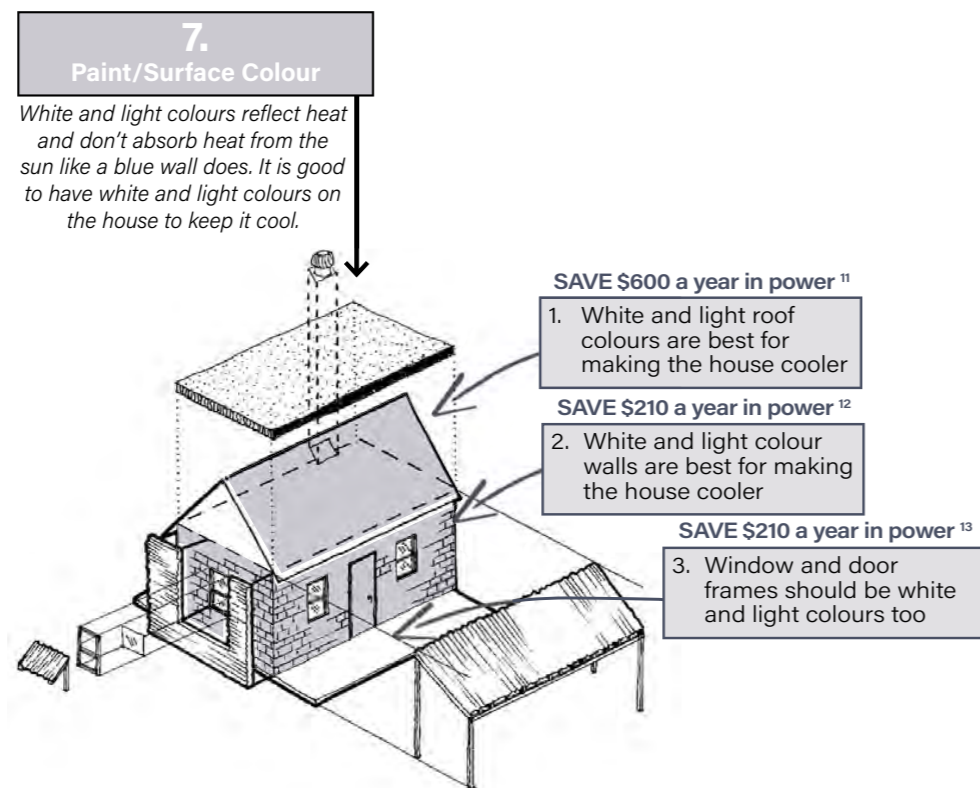
Remember, it is good for houses to have light colours:

- Colours are broken into light, medium and dark colours in the Australian Building rules
- The lighter the colour, the lower the number or Solar Absorptance (SA) - lighter is better
- The lighter the colour, the more light it reflects and doesn't absorb to make it cooler
- If it is a dark colour, it doesn't reflect much light and absorbs it making it hotter

There are no 'Paint/Surface colour model parts, but talk about -

1. What colour is the roof?
2. What colour are the walls?
3. What colour are the windows and door frames?

Look at the colours in the Built Examples Gallery to learn more.



1.



2. & 3.

8. Yard Improvements

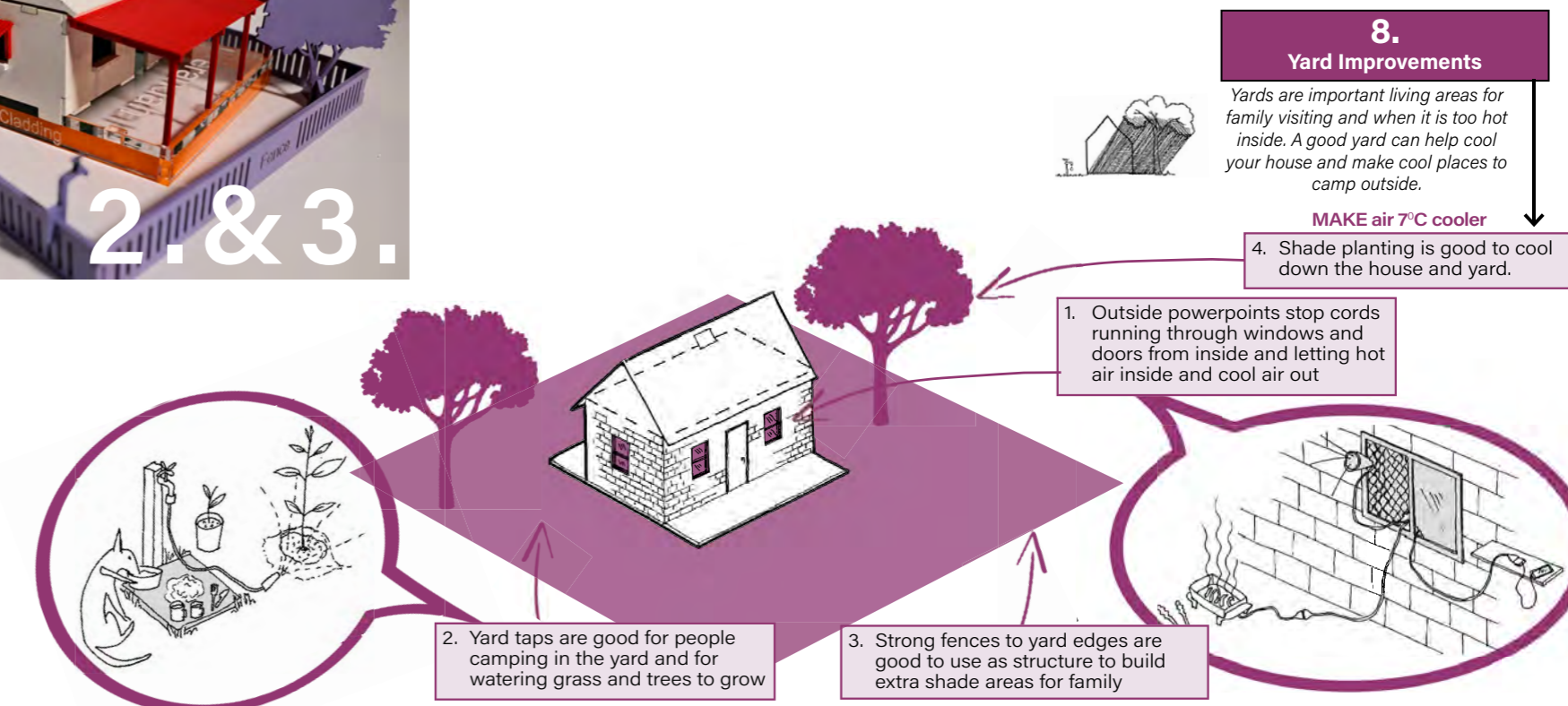
Remember, houses should have good yard spaces for people visiting:

- Outside powerpoints means extension cords don't have to run through windows and doors and let hot air inside
- Yard taps are good to be able to water trees, people to wash under, and people and pets to drink from
- Trees help keep the ground cooler and lower the air temperature to make it cooler around the house

Add the 'Yard Improvements' parts to the model -

1. (Powerpoints outside - this is not in the model)
2. Add yard taps (to the fences or there is one hole on the verandah)
3. Add fences
4. Add tree (shade planting)

Does your house have outside powerpoints, taps, strong fences and trees with good shade?



'cool living' House Survey - How to fill out...

The 'cool living' COMMUNITY House Survey is good to fill out at every house in the community to see what is missing on every house to make it cooler. Use a new copy of this survey for every house and circle the parts the house DOES NOT HAVE.

These are the parts you will look at the Built Examples Gallery for ideas about what to build or talk to housing about what upgrades they should think about. Everything on this list of 8 things is important to have on a house in the Alice Springs climate, but #1 is the most important.

1. What type of house is the one you are about to survey - #1 or #2? - circle it

2. Write down the community name, house #, date and who is filling it out - see example

3. Read 'how to use', so you know how to fill it out at every house

Cool the house with no powercard by starting at 1:

1. Shading the Building Stopping the sun from hitting the windows, walls and ground around the house will cool down the down. **SAVE \$222 a year in power¹**

2. Insulation Insulation stops heat from coming through the roof, ceiling, walls and floor. The biggest insulation is best, but it can't be squashed.

3. Shade all the walls with verandahs **SAVE \$222 a year in power¹**

2. Shade the walls not covered by verandahs with 'shade walls' **SAVE \$141 a year in power²**

1. Shade sun from hitting windows which are not covered with awnings **SAVE \$88 a year in power^{2,1}**

1. Shade sun from hitting windows which are not covered with awnings **SAVE \$88 a year in power^{2,1}**

2. Insulate the ceiling with biggest insulation possible (R4 bulk) **SAVE \$1,275.65 a year in power³**

1. Insulate the roof with roof blanket to stop heat from the tin **SAVE \$1,171.94 a year in power⁴**

3. Insulate outside walls in lightweight houses

4. Insulate inside walls in lightweight houses

5. Insulate under floors in raised up houses

6. Insulate edges of slabs in houses on the ground **SAVE \$10 a year in power⁵**

Community Name: Papunya community
House #: # 56 Date: 1/09/23 By: B Bayley

HOW TO USE:

- Look at the Cool Living 'Blue book' & website
- Use the model to talk with the community about what cool parts houses need
- Look at the house, circle on this survey what upgrades the houses needs to stay cool
- Find materials and build cool parts for houses
- Invite housing to come and look at your work and talk why you did it

'cool living community SURVEY' | sheet 1/3



COMMUNITY 'cool living' House Survey

Make your house cooler without a powercard

This document works for both house types below, but energy & money savings are based off house type 1



1. Block wall house with a slab on ground (Heavy-weight house)
2. Framed house built off the ground (Light-weight house)

Community Name: _____
House #: _____ Date: _____ By: _____

HOW TO USE:

- Look at the Cool Living 'Blue book' & website
- Use the model to talk with the community about what cool parts houses need
- Look at the house, circle on this survey what upgrades the houses needs to stay cool
- Find materials and build cool parts for houses
- Invite housing to come and look at your work and talk why you did it

Cool the house with no powercard by starting at 1:

1. Shading the Building Stopping the sun from hitting the windows, walls and ground around the house will cool down the down. **SAVE \$222 a year in power¹**

2. Insulation Insulation stops heat from coming through the roof, ceiling, walls and floor. The biggest insulation is best, but it can't be squashed.

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2. Insulate the ceiling with biggest insulation possible (R4 bulk) **SAVE \$1,275.65 a year in power³**

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3. Insulate outside walls in lightweight houses

4. Insulate inside walls in lightweight houses

5. Insulate under floors in raised up houses

6. Insulate edges of slabs in houses on the ground **SAVE \$10 a year in power⁵**

'cool living community SURVEY' | sheet 1/3

Cool the house with no powercard by starting at 1:

Cool the house with no powercard by:

3. Close the Underfloor

In houses built off the ground, hot air going under the house will make the house hotter. It is good to close under the floor.

4. Venting/ Airflow

It is good to vent out hot air from inside and let in cool air. It is good to vent the roof space and inside the house.

5. Thermal Mass

When the sun hits walls of block houses, they heat up and stay hot inside for a long time, so it is good to shade the walls. Block walls inside and tile and concrete floors help to keep the house cool.

6. Less Hot Air Inside

It is good to seal holes around windows and doors, in walls, floor and vents in the ceiling. Sealing them will stop hot air coming in and keep cool air inside.

7. Paint/Surface Colour

White and light colours reflect heat and don't absorb heat from the sun like a blue wall does. It is good to have white and light colours on the house to keep it cool.

8. Yard Improvements

Yards are important living areas for family visiting and when it is too hot inside. A good yard can help cool your house and make cool places to camp outside.

*The roof space can have vents through the roof ends or a whirly bird on top

SAVE \$153 a year in power⁶
1. Cladding under the floor will stop hot air heating up inside the house

2. Cladding around the edge is good if underneath can't be done

SAVE \$102 a year in power⁷
1. The roof space should have vents to let the hot air out

2. Inside the house should have working windows and doors to let hot air out and cool air in

SAVE \$141 a year in power⁸
1. In block houses, all outside walls should be shaded, 'shade walls' are good
2. In lightweight houses block walls inside are good to cool the house (speak to housing first)
3. Floors covered with concrete or tiles stay most cool

SAVE \$12 a year in power¹⁰
4. Sealing holes in the ceiling and around vents and blocking them when not being used is good

3. Sealing holes in the wall and at corners is good

2. Sealing holes in the floor and at the edge of the wall is good

1. Sealing gaps around windows and doors and replacing broken glass & frames will stop hot air coming in and keep cool air inside.
SAVE \$233 a year in power⁹

SAVE \$600 a year in power¹¹
1. White and light roof colours are best for making the house cooler

SAVE \$210 a year in power¹²
2. White and light colour walls are best for making the house cooler

SAVE \$210 a year in power¹³
3. Window and door frames should be white and light colours too

MAKE air 7°C cooler
4. Shade planting is good to cool down the house and yard.

1. Outside powerpoints stop cords running through windows and doors from inside and letting hot air inside and cool air out

2. Yard taps are good for people camping in the yard and for watering grass and trees to grow

3. Strong fences to yard edges are good to use as structure to build extra shade areas for family

COSTING REFERENCE Refer to Bang for your Buck spreadsheet: ¹ Row 10 | ² Row 15 | ²¹ Row 31 + 34 | ³ Row 1 | ⁴ Row 4 | ⁵ Row 23
⁶ From Modifications List House Type 31 | ⁷ Row 16 | ⁸ Row 15 | ⁹ Row 9 | ¹⁰ Row 22 | ¹¹ Row 7 | ¹² Row 11 | ¹³ Row 12



Chapter 6



Built Examples Gallery

- Principles for building in community
 - Built Examples Gallery - How to use it...
1. Shading Building Fabric
 2. Insulation
 3. Close the Underfloor
 4. Venting/ Airflow
 5. Thermal Mass
 6. Less Hot Air Inside
 7. Paint/ Surface Colour
 8. Yard Improvements

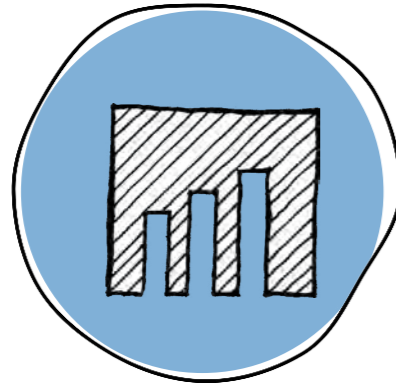
Principles for building in community

8 important things to remember when designing and selecting things to build in community housing.



Appropriate

Appropriate climatically, culturally, socially and for remote community living. Community is always consulted.



Data Driven

Data to drive decisions, not ideas, wants or box ticking. Data is collected over its lifetime.



Modular + Minimal Labour + Replaceable Parts

Made of easy to source and replaceable parts which don't need highly skilled trades. All work is inspected and checked for accountability.



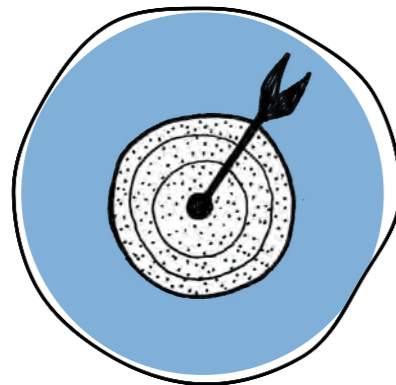
Low Maintenance + life cost

Doesn't need much attention or money over its life.



Secure + Robust + Durable

Made strong to not break when traveling to site and once built.



Targeted

Data is used to identify problem areas and these are targeted for measurable gains.



Resourceful

Good design, well built, adaptable, recycled materials could be used.



Long-Life

Long-term solutions. Something that is strong, designed well + built well will last a long time.

Built Example Gallery - How to use it...

This is a gallery of pictures showing ideas for house upgrades to help the house stay cool. This will give you different ideas of what you could do and gives more information about why it is important.

The title of the example will tell you what the pictures are of

Name and number of the cooling priority (same as on house survey)



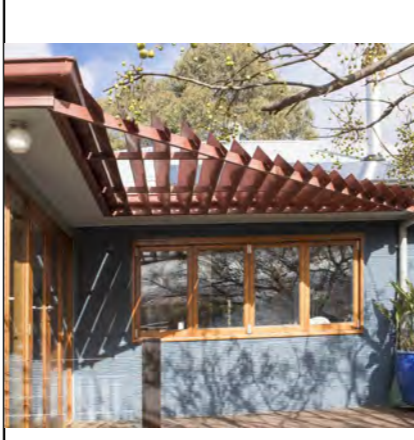

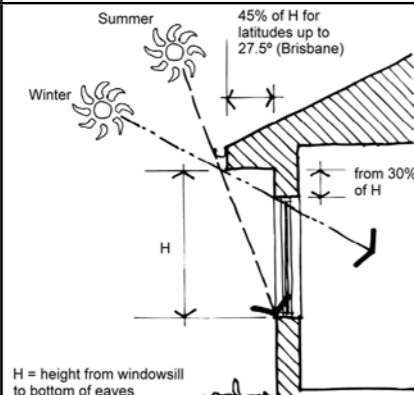

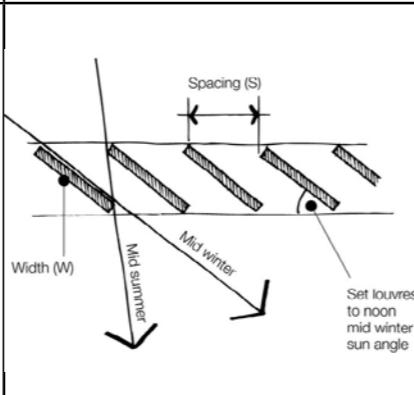
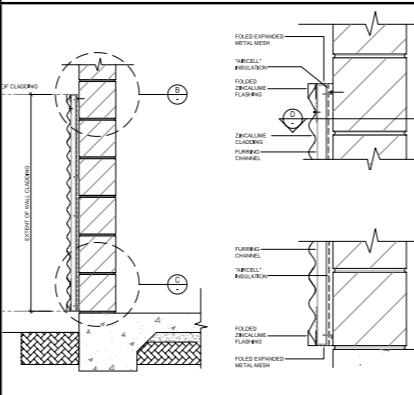
Cooling Priorities →	1. Shading Building Fabric			
Upgrades Focus ↓	Fixed Window Awning June 2009 Reference: 'Healthabit RD4c Temperature Control Final Report - Healthabit' & 'Your Home - Shading'	Window Awning & 'Shade Wall' Reference: 'Tropical and Temperature Climates Temperature Control Project' - Healthabit	Louvered Shading Structure Reference: 'External Louvers may help manage changing climate conditions' - 'Your Home'	'Shade Wall' June 2009 Reference: 'Healthabit RD4c Temperature Control Final Report - HH & Tangentyere Documentation'
1. WINDOWS 2. WALLS 3. VERANDAHS	ASPECT: North	ASPECT: East & West (vertical for low sun)	ASPECT: North	ASPECT: North & East & West
Photograph				
Drawing				
Details & Notes	<p>Modifications were a part of a 5 house modification project.</p> <p>BUILDING ELEMENTS</p> <ul style="list-style-type: none"> Prefabricated steel awning bracket & prop Corrugated iron roof sheeting Fixings - Masonry anchors to fix into brick wall Fixings - Colorbond Roofing Tek Screws to fix roof sheets 	<p>Modifications were a part of a 9 house Tropical climate case study & retrofit.</p> <p>BUILDING ELEMENTS</p> <ul style="list-style-type: none"> Prefabricated Rigid steel frame attached to wall Horizontal battens/ aluminum slats screwed to steel frame Fixings - Custom to engineers specification 	<p>Project example is apart of examples of shading advice in YourHome: Shading.</p> <p>BUILDING ELEMENTS</p> <ul style="list-style-type: none"> Prefabricated steel frame fixed to fascia board below gutter Custom steel fins fixed into custom frame (designed for sun angles of location) Fixings - Custom to engineers specification 	<p>Modifications were a part of a 50 house modification project.</p> <p>BUILDING ELEMENTS</p> <ul style="list-style-type: none"> Steel top hats fixed to wall Corrugated iron sheeting fixed horizontally to frame Reflective insulation fixed to top hats Flashing to cap sheets and wire to close cavity Fixings - Masonry anchors to fix into block wall Fixings - Colorbond Roofing Tek Screws for sheets
Maintenance & Suggestions	<p>Maintenance: LOW MAINTENANCE</p> <ul style="list-style-type: none"> Ensure Brackets are firm to brick wall (tighten/replacing fixings if loose) Ensure no rust spots on brackets & roof sheeting (clean and cold gal if so) 	<p>Maintenance: LOW MAINTENANCE</p> <ul style="list-style-type: none"> Ensure brackets are rigid and fixed firmly to wall Ensure horizontal batten fixings are not rusted or fallen out 	<p>Maintenance: MEDIUM MAINTENANCE</p> <ul style="list-style-type: none"> Ensure structure and fins are rigid and fixed firmly to the building fascia and frame Clean out branches/ leaves caught in fins and structure 	<p>Maintenance: LOW MAINTENANCE</p> <ul style="list-style-type: none"> Ensure top hats are fixed firmly to the wall with masonry anchors Ensure insulation has not deteriorated and fixed tight Ensure flashing & wire to surrounds is fixed down


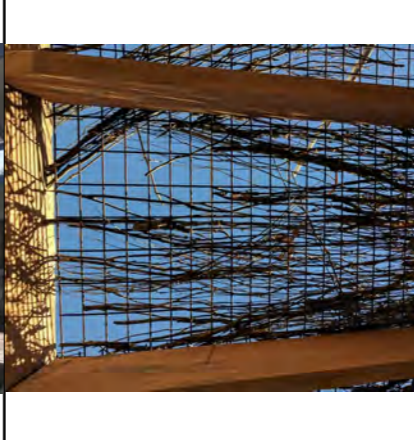


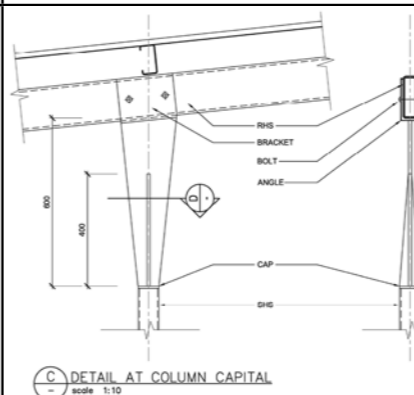
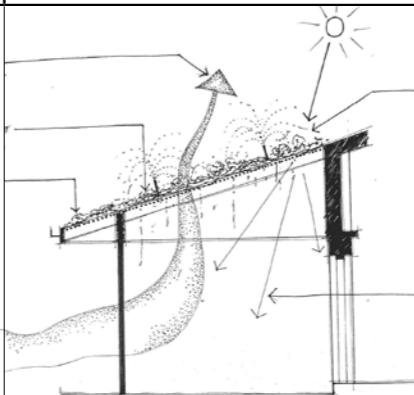

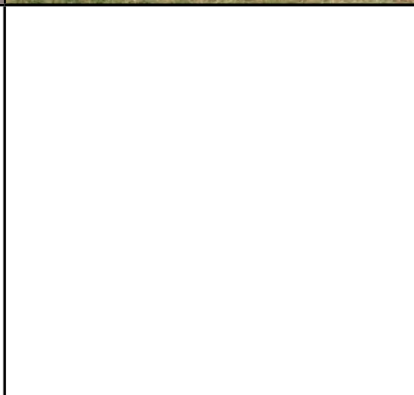
Photo





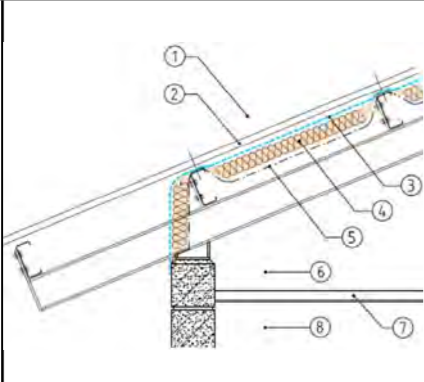
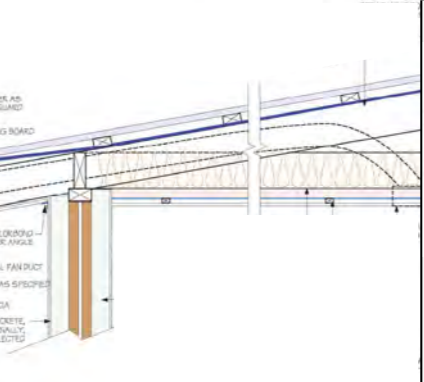
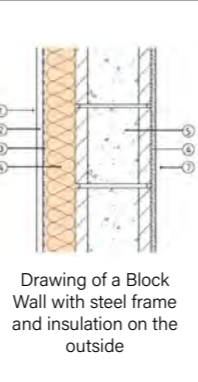
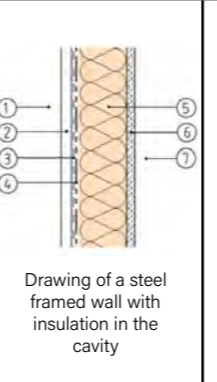
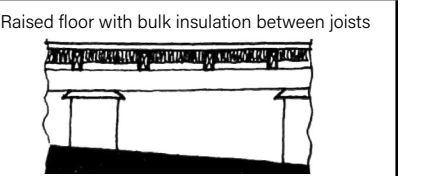
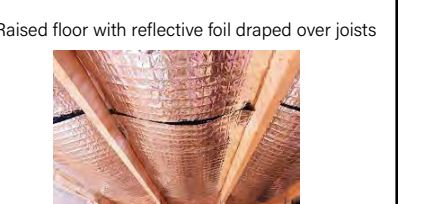
Drawing


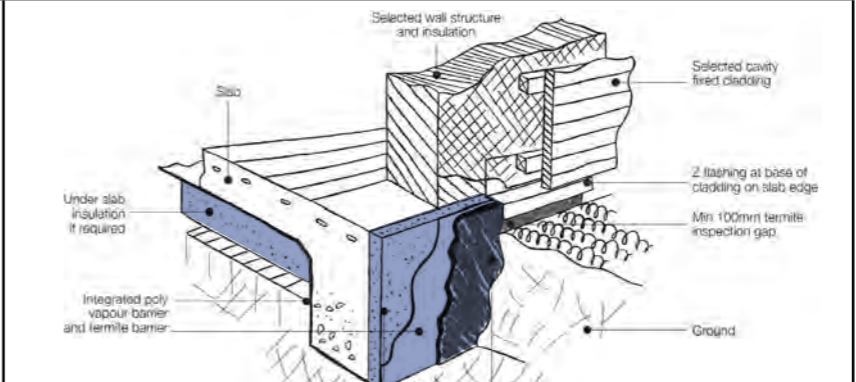
Information about it and what it is made from



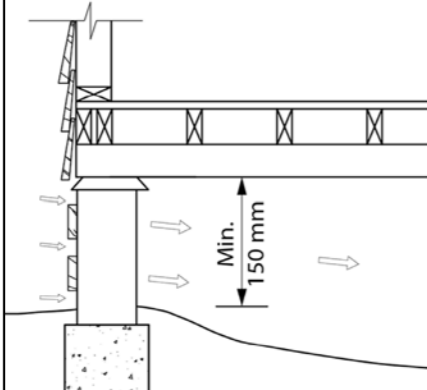
Information about what to think about for maintenance





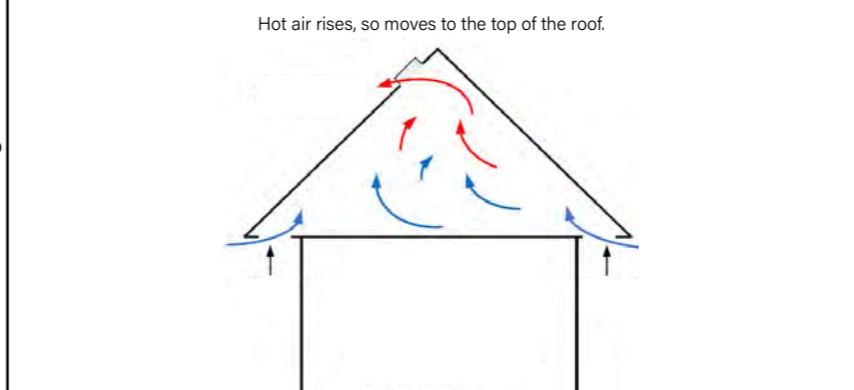
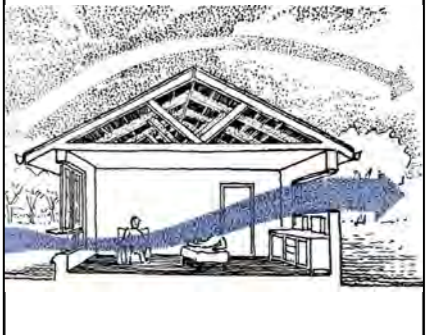
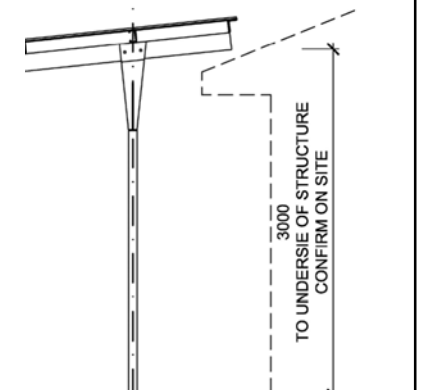
Cooling Priorities →		1. Shading Building Fabric			
Upgrades Focus ↓	Fixed Window Awning June 2009 Reference: 'Healthabitat RD4c Temperature Control Final Report' - Healthabitat & Your Home - Shading	Window Awning & 'Shade Wall' Reference: 'Tropical and Temperature Climates Temperature Control Project' - Healthabitat	Loured Shading Structure Reference: 'External Louvers may help manage changing climate conditions' - YourHome	'Shade Wall' June 2009 Reference: 'Healthabitat RD4c Temperature Control Final Report' - HH & Tangentyere Documentation	
	ASPECT: North	ASPECT: East & West (vertical for low sun)	ASPECT: North	ASPECT: North & East & West	
1. WINDOWS 2. WALLS 3. VERANDAHS	Photograph				
					
1. WINDOWS 2. WALLS 3. VERANDAHS	Drawing				
					
1. WINDOWS 2. WALLS 3. VERANDAHS	Details				
	Modifications were a part of a 5 house modification project. BUILDING ELEMENTS • Prefabricated steel awning bracket & prop • Corrugated iron roof sheeting • Fixings - Masonry anchors to fix into brick wall • Fixings - Colorbond Roofing Tek Screws to fix roof sheets	Modifications were a part of a 9 house Tropical climate case study & retrofit. BUILDING ELEMENTS • Prefabricated Rigid steel frame attached to wall • Horizontal battens/ aluminum slats screwed to steel frame • Fixings - Custom to engineers specification	Project example is apart of examples of shading advice in YourHome: Shading. BUILDING ELEMENTS • Prefabricated steel frame fixed to fascia board below gutter • Custom steel fins fixed into custom frame (designed for sun angles of location) • Fixings - Custom to engineers specification	Modifications were a part of a 50 house modification project. BUILDING ELEMENTS • Steel top hats fixed to wall • Corrugated iron sheeting fixed horizontally to frame • Reflective insulation fixed to top hats • Flashing to cap sheets and wire to close cavity • Fixings - Masonry anchors to fix into block wall • Fixings - Colorbond Roofing Tek Screws for sheets	
Maintenance	Maintenance: LOW MAINTENANCE • Ensure Brackets are firm to brick wall (tighten/replacing fixings if loose) • Ensure no rust spots on brackets & roof sheeting (clean and cold gal if so)	Maintenance: LOW MAINTENANCE • Ensure brackets are rigid and fixed firmly to wall • Ensure horizontal batten fixings are not rusted or fallen out	Maintenance: MEDIUM MAINTENANCE • Ensure structure and fins are rigid and fixed firmly to the building fascia and frame • Clean out branches/ leaves caught in fins and structure	Maintenance: LOW MAINTENANCE • Ensure top hats are fixed firmly to the wall with masonry anchors • Ensure insulation has not deteriorated and fixed tight • Ensure flashing & wire to surrounds is fixed down	



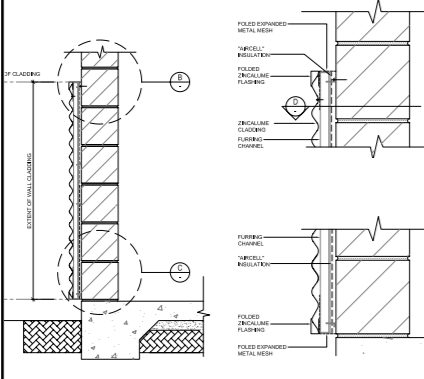

Cooling Priorities →		1. Shading Building Fabric			
Upgrades Focus ↓	Freestanding Pergola June 2009 Reference: 'Healthabitat RD4c Temperature Control Final Report' - HH & Tangentyere Documentation	Contemporary Bough Shade Verandah May 2017 Reference: Birdsville - The Grand Section study	Shade Awning June 2009 Reference: 'Healthabitat RD4c Temperature Control Final Report' - Healthabitat	Shade Awning June 2011 Reference: 'Tangentyere Thermal Efficiency Project, Community Research Report'	
	ASPECT: North & East & West	ASPECT: North & East & West	ASPECT: North & East & West	ASPECT: North & East & West	
1. WINDOWS 2. WALLS 3. VERANDAHS	Photograph				
					
1. WINDOWS 2. WALLS 3. VERANDAHS	Drawing				
					
1. WINDOWS 2. WALLS 3. VERANDAHS	Details				
	Modifications were a part of a 50 house project. Image & Drawings from Tangentyere Design. BUILDING ELEMENTS • SHS steel posts (painted) concreted into ground • Custom steel column capital/ bracket • RHS pergola rafter & C-Purlins above • Fixings - structural bolts, steel triple grips and tek screws	A part of an Architectural study of Birdsville, this contemporary Bough shade is a great example of an old technology on a new building. You could also use living vines or plants. See on page 18 of zine document (link) BUILDING ELEMENTS • Light gauge reinforcing mesh fixed to rafters • Branches, spinifex, leaves placed on top • Sprinkler put on top in summer months	Existing shade structures attached to external walls were fitted with new metal roof sheeting BUILDING ELEMENTS • Bent 50mm galvanised pipe structure with end plate at wall and footing, 50mm gal pipe cross members • Proprietary Interclamp (or similar) fittings • 1 x sheet of corrugated iron roof sheeting • Fixings - Colorbond Roofing Tek Screws to fix roof sheets	A part of an upgrade project to add sun shading to west and east ends of the house. BUILDING ELEMENTS • Square steel posts (painted) concreted into ground • Timber roof frame - bearer, rafter and battens • Corrugated iron roof sheeting • Flashing to both ends to cover sharp edges of the roof sheeting • Fixings - Colorbond roof tek screws, steel triple grips	
Maintenance	Maintenance: LOW MAINTENANCE • Ensure Brackets are firm to posts (tighten/replacing fixings if loose) • Ensure posts are fixed into concrete & no rust spots (clean and cold gal or replace & build off the ground)	Maintenance: MEDIUM MAINTENANCE • Ensure fixings holding mesh are secure • Ensure roof structure is in good condition • Regularly collect new branches with leaves and add on top of mesh	Maintenance: LOW MAINTENANCE • Ensure brackets are rigid and fixed firmly to wall • Ensure pipe connections to ground are rigid and not damaged or rusted • Ensure roof sheeting is fixed securely down	Maintenance: LOW MAINTENANCE • Ensure posts are strong into concrete & no rust spots especially where it meets the ground (clean and cold gal or replaces) • Ensure no termites eating roof structure	





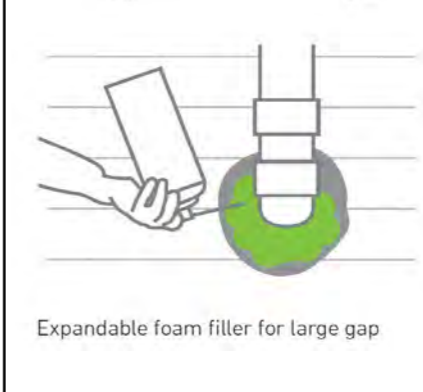

Cooling Priorities →	2. Insulation			
Upgrades Focus ↓	Reflective roof Insulation (silver) December 2021 Building Sustainable Design Guidelines - DIPL & author project photos	Ceiling (bulk) Insulation Your Home - Insulation	Wall (bulk) Insulation December 2021 Building Sustainable Design Guidelines - DIPL & photo from Bluesky Modular Buildings	Underfloor Insulation (for raised houses) Warm House Cool House - Nick Hollo & author project photos
1. ROOF 2. CEILING 3. EXTERIOR WALLS 4. INTERIOR WALLS 5. UNDER-FLOOR 6. SLAB INSULATION	Installed to the whole roof underneath the tin	Installed to above the whole ceiling	Installed to all outside walls (if light-weight walls)	Installed to the underneath of all the floor if raised
Photograph				
Drawing			  <p>Drawing of a Block Wall with steel frame and insulation on the outside</p> <p>Drawing of a steel framed wall with insulation in the cavity</p>	  <p>Raised floor with bulk insulation between joists</p> <p>Raised floor with reflective foil draped over joists</p>
Details	<p>Reflective roof insulation (roof blanket) should be installed properly at the time the house is built and the roof is put on.</p> <p>This is very important to stop heat coming into the house.</p> <p>If a house does not have roof insulation, it is best to take off the roof sheets and install it.</p>	<p>Many old houses do not have ceiling insulation. Ceiling (bulk) insulation is very important to stop heat coming into the house. BUT IT SHOULD BE INSTALLED PROPERLY - IF NOT, IT WON'T WORK PROPERLY.</p> <p>It is easy to install insulation after a house is built, but should be done by a professional. The builder will have to crawl into the roof space and install the insulation.</p>	<p>Wall insulation is inside the wall so has to be installed when the house is built.</p> <p>This is very important to stop heat coming into the house.</p> <p>If it is damaged or gets holes in it because of mice living in the wall, the wall lining will have to be taken off and the insulation replaced.</p>	<p>Underfloor insulation should be installed properly at the time the house is built. It should not have holes or gaps.</p> <p>This is very important to stop heat coming into the house.</p>
Maintenance	It is very hard to carry out any maintenance on roof insulation. If it is damaged or gets holes in it, it should be taped with reflective tape.	No maintenance is needed on ceiling insulation, When dust goes into the roof space over time, it will squash the insulation and make it less effective. (approx loses 1R value every decade).	It is very hard to carry out any maintenance on wall insulation.	It is very hard to carry out any maintenance on floor insulation. If it is damaged or gets holes in it, it should be taped with reflective tape. This can be installed after the house is built but if the space under the house is small, it will be hard.



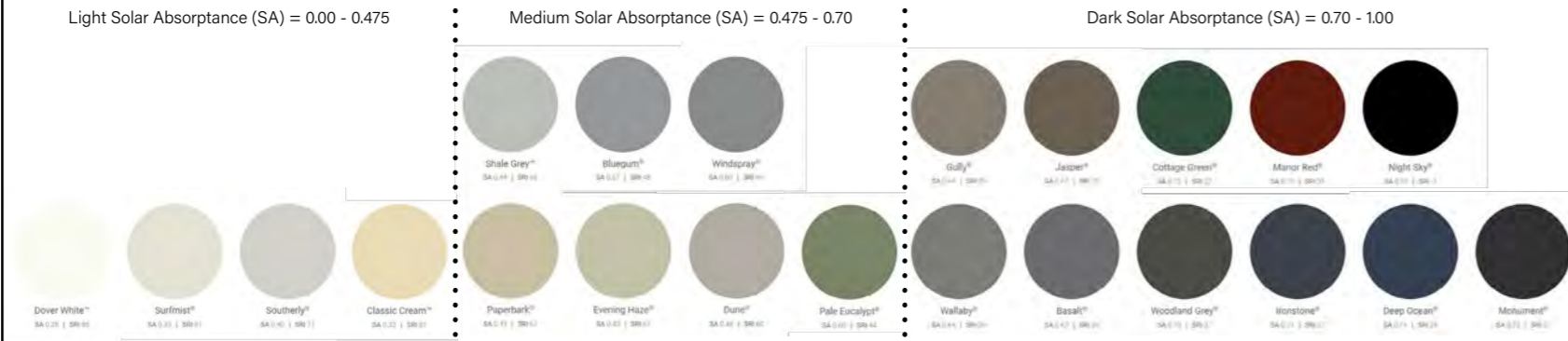
Cooling Priorities →	2. Insulation
Upgrades Focus ↓	Slab Insulation (for slab-on-ground houses) Your Home - Insulation
1. ROOF 2. CEILING 3. EXTERIOR WALLS 4. INTERIOR WALLS 5. UNDER-FLOOR 6. SLAB INSULATION	Installed to the underneath or edge of the slab
Photograph	
Drawing	
Details	<p>Underslab insulation should not be used in the 'hot dry' climate. It is important for the slab to be connected directly to the ground. Slab edge insulation helps stop hot outside air heating up the edge of the slab and travelling into the house to make it hot.</p> <p>This is helpful to make a house cooler, but not the most important insulation to have in a house.</p>
Maintenance	<p>Maintenance : (depending how much insulation is exposed to outside)</p> <ul style="list-style-type: none"> Ensure there are no holes in the insulation to let hot air touch the slab Tape or seal up holes in insulation





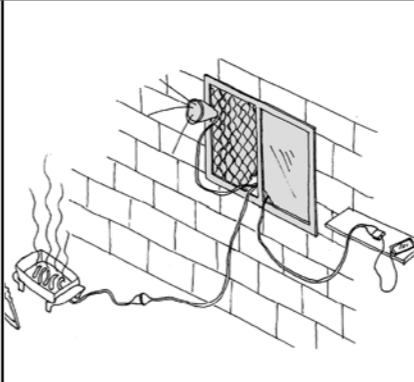


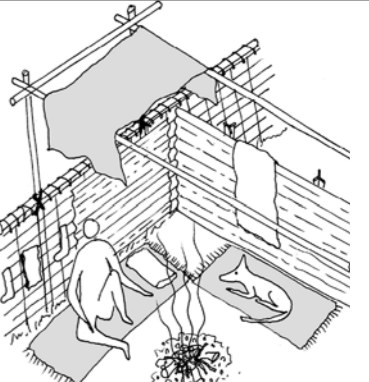
Cooling Priorities →		3. Close The Underfloor	
Upgrades Focus ↓	Underfloor Cladding Author photo	Perimeter Cladding to underfloor Reference: Photo from CSIRO & Diagram from NCC Subfloor ventilation	
Slab on Ground (+0mm AGL)	ASPECT: all sides of house	ASPECT: all sides of house	
NA	Photograph		
Low-set & High-set House (+600 to 2400mm AGL)			
1. UNDERFLOOR CLADDING 2. PERIMETER CLADDING			
	Drawing		
			Cladding to the inside of the floor stops the hot air going underneath the house and heating up the floor and air coming inside. If you clad the underside, you do not need to clad the perimeter. This can be done with sheets of materials or with board insulation. (see a broken insulation picture in insulation section)
Maintenance	<u>Maintenance: REGULAR MAINTENANCE</u> • Check no holes have been made in the cladding • If there are holes, try to cover them up or report it to housing	<u>Maintenance: REGULAR MAINTENANCE</u> • Check no holes have been made cladding • Check the vents are not blocked • If there are holes, try to cover them up or report it to housing	



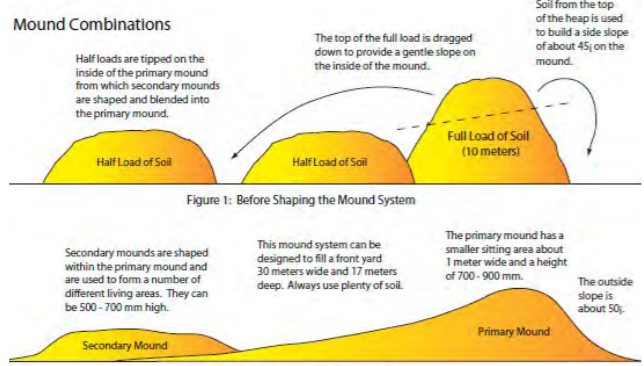
Cooling Priorities →		4. Venting/ Airflow							
Upgrades Focus ↓	Whirley Birds Reference: Photo from online source - Evo Building Products, drawing from online source - Roof ventilation blog	Roof vents Reference: Photo from online source - The spruce - attic venting	Freestanding Pergola Reference: 'Tangentyere Thermal Efficiency Project, Community Research Report' & Drawing from 'Warm House Cool House pg 45)	Freestanding Pergola June 2009 Reference: 'Healthabitat RD4c Temperature Control Final Report' - HH & Tangentyere Documentation					
1. ROOF SPACE 2. INTERNAL LIVING SPACES 3. VERANDAH ROOF	Install a few whirley birds along the roof ridge	Install vents at gable ends of the roof and along eave	ASPECT: North & East & West	ASPECT: North & East & West					
	Photograph								
						Drawing			
Maintenance	Ensure whirley birds are installed properly to the roof sheet. Check from the ground by looking at the roof that the whirley bird cap is still there and spinning in the wind.	Ensure vents are installed properly. Check from the ground by looking at the roof that the vent is in place and is not damaged.	Ensure windows and doors are installed properly and can open and close fully. If window framed or glass is broken, they need to be fixed - report to housing.	<u>Maintenance: LOW MAINTENANCE</u> • Ensure Brackets are firm to posts • Ensure posts are fixed into concrete & no rust spots (clean and cold gal or replace & build off the ground)					

Cooling Priorities →	5. Thermal Mass		
Upgrades Focus ↓	'Shade Walls' June 2009 Reference: 'Healthabitat RD4c Temperature Control Final Report' - HH & Tangentyere Documentation	'Shade Walls' June 2009 Reference: 'Healthabitat RD4c Temperature Control Final Report' - HH & Tangentyere Documentation	Floor Covering (tiles are best) & Internal thermal mass walls 2022 Reference: Indigenizing practice: Inclusive Indigenous community housing
1. SHADE WALLS	ASPECT: North & East & West	ASPECT: North & East & West	Throughout all floors inside house
Block (heavy-weight) House ONLY	Photograph		
2. INTERNAL THERMAL MASS			
Metal Frame (light-weight) House ONLY	Drawing		
3. FLOOR COVERING			
	Details	Modifications were a part of a 50 house modification project. BUILDING ELEMENTS <ul style="list-style-type: none"> Steel top hats fixed to wall Corrugated iron sheeting fixed horizontally to frame Reflective insulation fixed to top hats Flashing to cap sheets and wire to close cavity Fixings - Masonry anchors to fix into block wall Fixings - Colorbond Roofing Tek Screws for sheets 	Modifications were a part of a 50 house modification project. BUILDING ELEMENTS <ul style="list-style-type: none"> Steel top hats fixed to wall Corrugated iron sheeting fixed horizontally to frame Reflective insulation fixed to top hats Flashing to cap sheets and wire to close cavity Fixings - Masonry anchors to fix into block wall Fixings - Colorbond Roofing Tek Screws for sheets
Maintenance	Maintenance: LOW MAINTENANCE <ul style="list-style-type: none"> Ensure top hats are fixed firmly to the wall with masonry anchors Ensure insulation has not deteriorated and fixed tight Ensure flashing & wire to surrounds is fixed down 	Maintenance: LOW MAINTENANCE <ul style="list-style-type: none"> Ensure top hats are fixed firmly to the wall with masonry anchors Ensure insulation has not deteriorated and fixed tight Ensure flashing & wire to surrounds is fixed down 	Maintenance: LOW MAINTENANCE <ul style="list-style-type: none"> Ensure tiles are not cracked or have missing grout in-between them, if there are cracked tiles - tell housing Ensure there are no big cracks in the walls between the blocks, if there are holes - tell housing

Cooling Priorities →	6. Less Hot Air Inside			
Upgrades Focus ↓	Weather strips to doors & windows 2016 Reference: 'Draught Sealing Retrofit Trial' Sustainability Victoria 2016	Sealing gaps in floor and walls 2016 Reference: 'Draught Sealing Retrofit Trial' Sustainability Victoria 2016 & author photo	Sealing gaps at wall & floor corners 2016 Reference: 'Draught Sealing Retrofit Trial' Sustainability Victoria 2016 & author photo	Sealing Ceiling Vents 2016 Reference: 'Draught Sealing Retrofit Trial' Sustainability Victoria 2016 & 'Evapseal' vent covers
Upgrade Doors & Windows where possible	To all outside doors and windows	To all walls and floors where there are holes	To all walls and floor corners where there are holes	To all vents inside house
1. AROUND WINDOWS & DOORS	Photograph			
2. HOLES IN FLOOR & WALL				
3. CORNER OF WALL & CEILING / FLOOR (CORNICE & SKIRTING)	Drawing			
4. CEILING VENTS				
	Details	Modifications were a part of a 16 house sealing trial. Doors need draught proofing at the top, bottom and between the door and door frame. Windows need to be draught proofed about the sash and frame. Sliding windows and doors are very hard to seal.	Modifications were a part of a 16 house sealing trial. Larger holes or gaps expandable foam filler can be used or it can be covered by a builder with a board. This includes holes for window airconditioners (RAC). It is good to seal up big holes to stop hot air coming in or cold air from the air-conditioner escaping outside.	Modifications were a part of a 16 house sealing trial. Smaller holes or gaps can be filled with a gap filler or silicone. This is easy to do and can be done by the tenant of the house. It is good to seal up small holes to stop hot air coming in or cold air from the air-conditioner escaping outside.
Maintenance	Maintenance: REGULAR MAINTENANCE <ul style="list-style-type: none"> Check there are no gaps around door frames Check door and window seals are installed properly and working - if not, fix them or report to housing 	Maintenance: REGULAR MAINTENANCE <ul style="list-style-type: none"> Check no holes have been made in the walls or floor If there are holes - cover them up or report to housing 	Maintenance: REGULAR MAINTENANCE <ul style="list-style-type: none"> Check there are no holes at the corner of the walls and floor AND walls and ceiling If there are holes - cover them or fill them or report to housing 	Maintenance: REGULAR MAINTENANCE <ul style="list-style-type: none"> Check there are no holes around the vents Check vents can be closed tight when not being used If there are holes - cover them or fill them or report to housing

Cooling Priorities →	7. Paint/ Surface Colour	
Upgrades Focus ↓	Roof Colour and Wall Colour Author project photo & Colour photos and information from Colorbond and BASIX	Window / Door Frames Photo by ATTMA
1. ROOF COLOUR 2. WALL COLOUR 3. WINDOW / DOOR FRAMES	ASPECT: To all of roof and walls to all sides of house	ASPECT: all outside winows and doors
	 	
Photograph		
	<p>Light Solar Absrptance (SA) = 0.00 - 0.475</p> <p>Medium Solar Absrptance (SA) = 0.475 - 0.70</p> <p>Dark Solar Absrptance (SA) = 0.70 - 1.00</p> 	
Drawing		
Details	<p>The Australian Building Rules has classified what number light, medium and dark colours are.</p> <p>The lower the number, the lighter the colour and which means it reflects more sun.</p> <p>Dark colours have a high number and don't reflect but absorb more sun and make a roof or wall heat up more.</p> <p>In a 'Hot Dry' climate it is better to have light colours on the roof, walls, floor, window and door frames, especially on anything that the sun hits in summer.</p>	
Maintenance	<p>Maintenance: LOW MAINTENANCE</p> <ul style="list-style-type: none"> Clean down the walls and roof when they get dirty or are covered in dust or leaves to show the light colour to the sun 	

Cooling Priorities →	8. Yard Improvements			
Upgrades Focus ↓	Power Points (GPO) 2023 Author project photos	Yard Taps 2022 Author project photos	Infrastructure for additional shade areas (frame off verandah) 2023 Author project photos	Infrastructure for additional shade areas (Bough Shade) ?
1. POWER POINTS (GPO) 2. YARD TAPS 3. INFRASTRUCTURE FOR ADDITIONAL LIVING AREAS & SHADING 4. SHADE PLANTING & SHADE AREAS	ASPECT: all sides of house	ASPECT: all sides of house and in the yard	ASPECT: North, East, South, West - in the yard	ASPECT: North, East, South, West - in the yard
	   			
Photograph				
	   			
Drawing				
Details	<p>Weatherproof GPO's should be installed around the outside of the house. They should be weatherproof to make sure they are safe to use in all weather.</p> <p>BUILDING ELEMENTS</p> <ul style="list-style-type: none"> IP-rated weatherproof GPO installed by electricians 	<p>The yard tap is protected by a steel universal column. The splash pad is important to stop erosion, pooling for mosquito breeding, and to help people wash their faces and drink from the tap.</p> <p>BUILDING ELEMENTS</p> <ul style="list-style-type: none"> Gal steel water pipe and brass yard tap Concrete splash pad Steel Universal Column 	<p>Steel pipe structure in front yard off verandah structure</p> <p>BUILDING ELEMENTS</p> <ul style="list-style-type: none"> Bent 50mm galvanised pipe structure with end plate at verandah, 50mm gal pipe cross members Posts should be dug or concreted into the ground Proprietary Interclamp (or similar) fittings 	<p>A DIY constructed bough shade gives welcome shade and provides support for a growing sapling.</p> <p>BUILDING ELEMENTS</p> <ul style="list-style-type: none"> Found timber sticks for structure, dug into ground and backfilled Wire mesh roof between posts and tie wires Found branches with leaves, grass etc. laid on top of wire netting Fixings - wire
Maintenance	<p>Maintenance: REGULAR MAINTENANCE</p> <ul style="list-style-type: none"> Ensure powerpoint check done regularly to ensure GPO is electrically safe and secure to wall 	<p>Maintenance: REGULAR MAINTENANCE</p> <ul style="list-style-type: none"> Do tap check regularly (turn on and off 3 times) to ensure tap is not leaking and has good flow and handle is easy to use 	<p>Maintenance: LOW MAINTENANCE</p> <ul style="list-style-type: none"> Ensure brackets are rigid and fixed firmly to wall Ensure pipe connections to ground are rigid and not damaged or rusted 	<p>Maintenance: MEDIUM MAINTENANCE</p> <ul style="list-style-type: none"> Regularly tighten wire fixings around posts and mesh Regularly collect new branches with leaves and add on top of mesh

Cooling Priorities→	8. Yard Improvements	
Upgrades Focus ↓	Landscape Mounding April 2002 Reference: The use of Mounds to improve community environments on the APY Lands - MW Last	Landscape Mounding April 2002 Reference: The use of Mounds to improve community environments on the APY Lands - MW Last
1. POWER POINTS (GPO) 2. YARD TAPS 3. INFRASTRUCTURE FOR ADDITIONAL LIVING AREAS & SHADING 4. SHADE PLANTING & SHADE AREAS	ASPECT: North, East, South, West - in the yard	ASPECT: North, East, South, West - in the yard
Photograph		
	 <p>Mound Combinations</p> <p>Half loads are tipped on the inside of the primary mound from which secondary mounds are shaped and blended into the primary mound.</p> <p>Half Load of Soil</p> <p>Half Load of Soil</p> <p>Full Load of Soil (10 meters)</p> <p>The top of the full load is dragged down to provide a gentle slope on the inside of the mound.</p> <p>Soil from the top of the heap is used to build a side slope of about 45° on the mound.</p> <p>Figure 1: Before Shaping the Mound System</p> <p>Secondary mounds are shaped within the primary mound and are used to form a number of different living areas. They can be 500 - 700 mm high.</p> <p>This mound system can be designed to fill a front yard 30 meters wide and 17 meters deep. Always use plenty of soil.</p> <p>The primary mound has a smaller sitting area about 1 meter wide and a height of 700 - 900 mm.</p> <p>The outside slope is about 50°.</p> <p>Figure 2: After Shaping the Mound System</p>	
Details	A trial program at Pipalyatjara by Nganampa Health Council, to build 5 mounds 12-18m wide by 40-60m long to improve traffic control, manage storm water, wind protection and dust control. <i>BUILDING ELEMENTS</i> <ul style="list-style-type: none"> • Tonnes of earth shaped by trucks, hand shovels and excavators • Plants, fence structures and watering systems 	A trial program at Pipalyatjara by Nganampa Health Council, to build 5 mounds 12-18m wide by 40-60m long to improve traffic control, manage storm water, wind protection and dust control. <i>BUILDING ELEMENTS</i> <ul style="list-style-type: none"> • Tonnes of earth shaped by trucks, hand shovels and excavators • Plants, fence structures and watering systems
Maintenance	Maintenance: LOW MAINTENANCE <ul style="list-style-type: none"> • Ensure mounds are not being eroded by stormwater or damage by vehicles • Water plants and continue to plant out the mounds where low points are for water to pool 	Maintenance: LOW MAINTENANCE <ul style="list-style-type: none"> • Ensure mounds are not being eroded by stormwater or damage by vehicles • Water plants and continue to plant out the mounds where low points are for water to pool



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