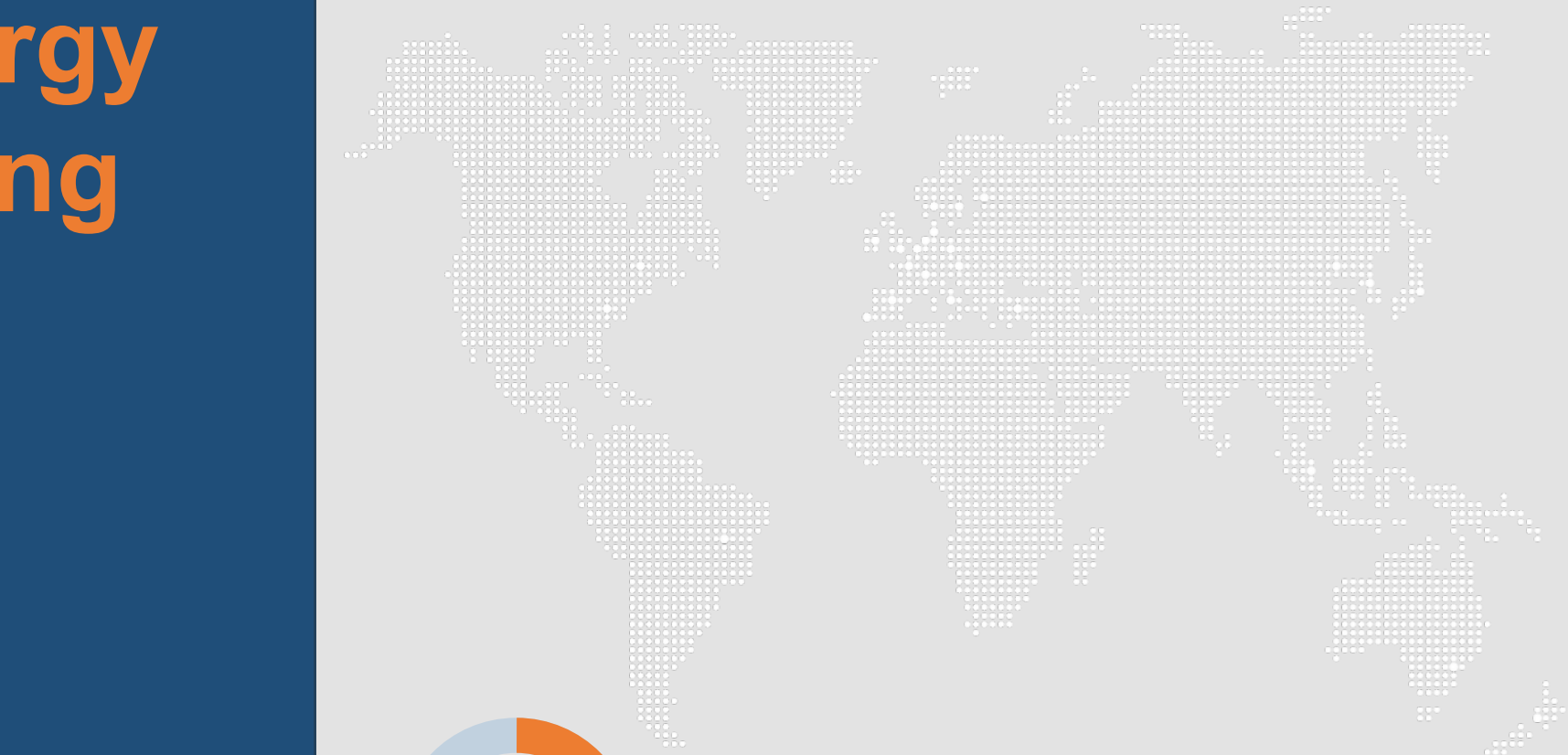
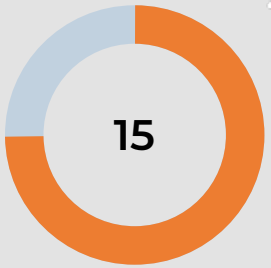
IEA EBC Annex: Building Energy Codes Working Group

Overheating Update Australia

Mike Dodd/
Dr Mahsan Sadeghi

EBC
Energy in Building and Communities Programme





Number of Annex participants who have completed the Impact Masterclass

29 April 2026

Summary

Overheating in Australia's Building Code

Current State (Mike)

- What are the existing requirements in Australia's building codes relevant to overheating?

Future State (Mahsan)

- Current research on overheating to inform future building codes.

Current Requirements – Function of a Building

H6F1 ENERGY EFFICIENCY FUNCTIONAL STATEMENT: RESIDENTIAL

A building must-

….

(c) improve occupant health and amenity by mitigating the impact of extreme hot and cold weather events, and energy blackouts.

J1F1 ENERGY EFFICIENCY FUNCTIONAL STATEMENT: COMMERCIAL/ COMMUNITY

A building must-

….

(d) protect occupant health and amenity by ensuring the building envelope assists in the maintenance of acceptable internal conditions while the building is occupied;

Current Requirements – Residential Buildings 2022

New Standalone and Attached Housing

1. **No specific overheating requirement, assumes air conditioning is present.**
2. **Energy efficiency is used as a proxy for preventing overheating**
3. **Different requirements dependent on climate zone**
4. **Past Climate used**

Compliance by either:

Elemental

- Setting minimum standards for at the elemental level for building fabric, windows and building sealing by climate zone. Requires ceiling fans in hotter climates.

Energy Model (most common)

- A whole of dwelling energy modelled benchmark that is based on balancing predicted heating and cooling loads (three targets: annual, summer, winter)

Multi-unit residential (apartments)

As per standalone/ attached

- A whole of apartment building energy model that is based on predicted heating and cooling loads

Current Requirements – New Commercial/ Community Buildings 2025

1. Elemental compliance pathway

No specific overheating requirement

Energy efficiency is used as a proxy for preventing overheating

- Setting minimum standards for thermal resistance at either the elemental level for building fabric, sealing, windows by climate zone
- Requiring night purge/ economy cycles/ HVAC control
- Light colored roofs in most climate zones

Future weather file RCP 8.5 2050 used to develop provisions

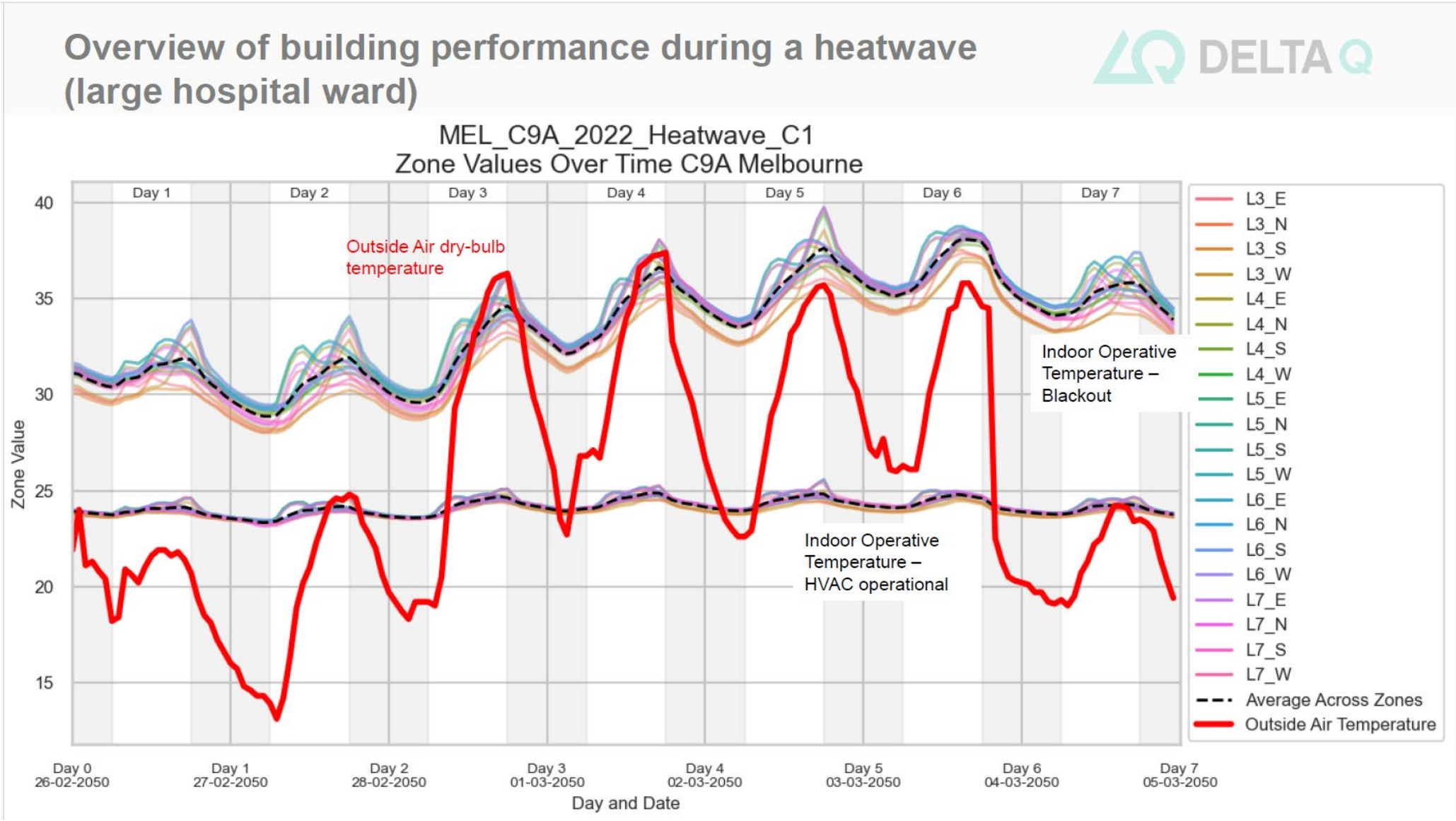
2. Energy modelling pathway

No specific overheating requirement

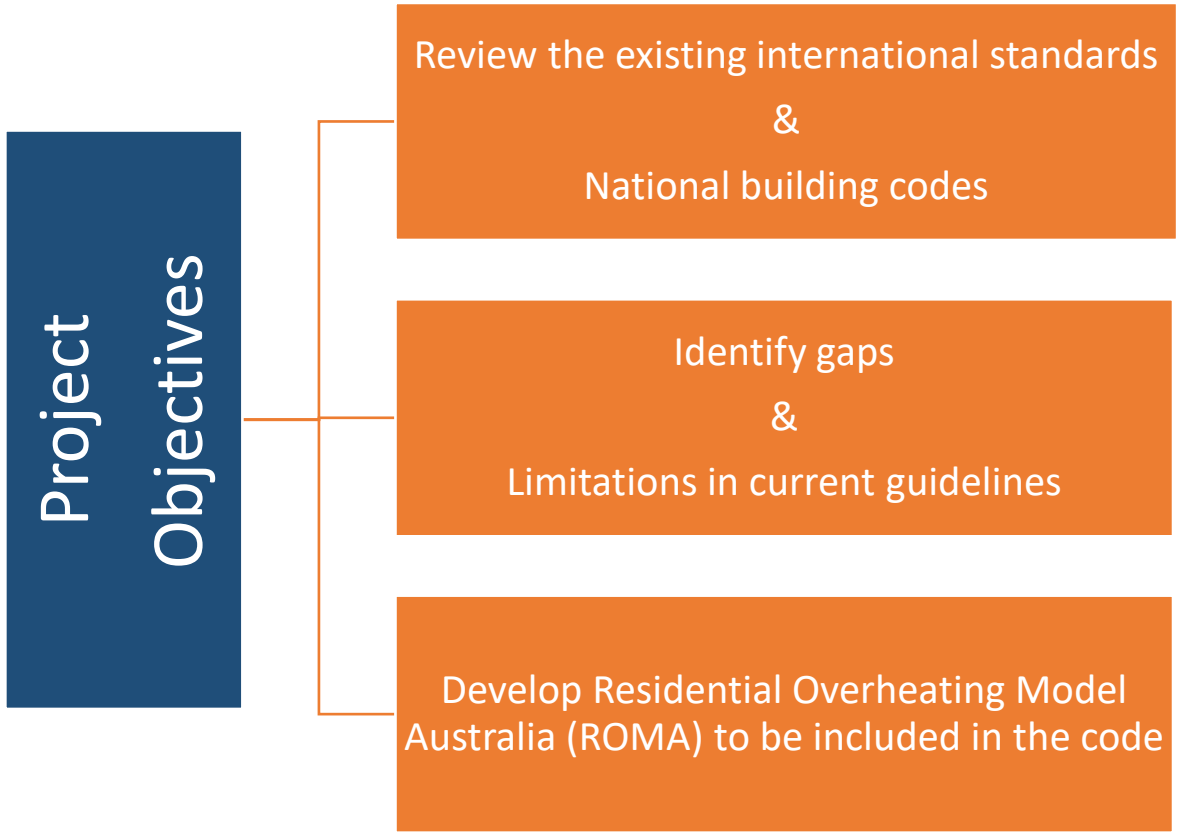
Energy model must show that one of three specific comfort-based parameters will be achieved:

- Predicted Mean Vote of +/- 1
- Dry bulb temperature in occupied areas is 21-24° Celsius
- Comparing “peak” cooling and/or heating load limits between proposed and a reference building.

Will it Perform in a Heatwave?



Residential Overheating Model Australia



Literature Review

energies

MDPI

Review

A Critical Review of Overheating Risk Assessment Criteria in International and National Regulations—Gaps and Suggestions for Improvements

Mahsan Sadeghi [1,2,3,*], Dong Chen [1] and Anthony Wright [1]

International Standards

Table 1. Analytical and critical comparison of international standards. Avg = average, *%OhOR* = percentage of occupied hours outside the range; T_{oi} = indoor operative temperature; *%hOR* = percentage of hours outside the range; *%ShOR* = percentage of sleeping hours outside the range; *Dh* = degree hours; *Eh* = exceedance hours; NV = natural ventilation; and mechanical ventilation = MV.

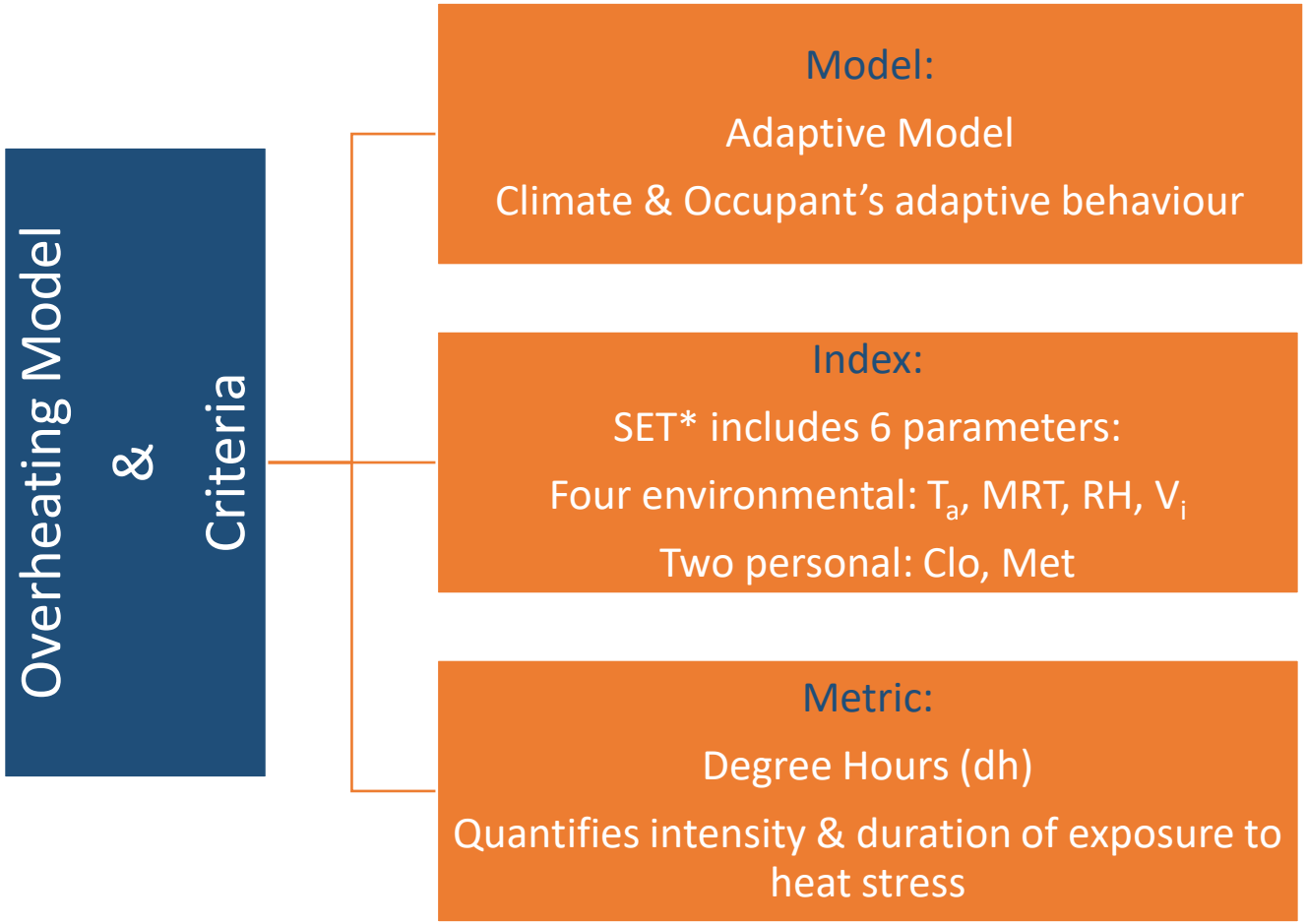
Standard	Metrics	Index	Threshold Limit	Thermal Comfort Model	Building Type	Building Operation System
EN 15251[19]	*%OhOR*; *Dh*; weighted *PPD*	*PMV*; T_{oi}	Acceptable deviation of 3–5% of *%OhOR* for daily, weekly, monthly, and yearly periods during the occupied hours.	Static and adaptive model	All building types, with occupants' availability to adaptation response.	MV and NV
EN 16798 [33]	*%OhOR*; *Dh*; weighted *PPD*	*PMV*; T_{oi}	Acceptable deviation of 20–50% of *%OhOR* (weekly); 12–25% (monthly); 3–6% (annually) deviation during occupied hours.	Static and adaptive model	All with occupant availability to adaptation response.	MV and NV
ISO 7730 [34]	*%OhOR*; *Dh*; weighted *PPD*; average *PPD*; total *PPD*	*PMV*	Not specified	Static and adaptive model	All with occupant availability to adaptation response.	MV and NV
ASHRAE 55 [29,30]	Exceedance hours (*Eh*); degree exceedance hours (*DEh*)	*PMV*; T_{oi}	Not specified	Static and adaptive model	All with occupant availability to adaptation response.	MV and NV

Literature Review
National Building Codes

National Building Code	Standard	Index	Threshold Limit	Thermal Comfort Parameters Included	Occupant's Adaptive Response	Building Type	Building Operation System
Belgium (Brussels)	Passive House	T_{oi}	Max 25 °C by 5% during the occupied hours over a year.	T_{ai}; MRT_i	No	Resi	NV
Belgium (Wallonia and Flanders)	ISO 13790	IO	1000 $Dh < I_{oh} < 6500$ Dh	No	No	Resi	NV
Germany	DIN 4108	T_{oi}	Compliance through passing one of the criteria. Criteria I: $S_{oh} \leq S_{zul}$ (sum of solar input parameters given in DIN 4108). Criterion II: threshold temperature depends on climatic region (25 °C, 26 °C, and 27 °C), $Dh < 1200$ Dh during a year.	T_{ai}; MRT_i	N0	Resi	Passive cooling and active cooling
France	EN 15251	T_{oi}	$Dh < 1250$	T_{ai}; MRT_i	Yes	Resi	NV
UK	SAP	IT	NA	T_{ai}	No	Resi	NV
Netherlands	NS	T_{OJULY}; GTO; PMV	Criteria I: max limit value of 1 for T_{OJULY}. Criteria II: max threshold value of 450 for GTO in living area (when PMV exceed +0.5).	T_{ai}; MRT_i	No	Resi	NV

Source: Sadeghi et al., 2024

Key Lessons From Literature Review



CSIRO Research

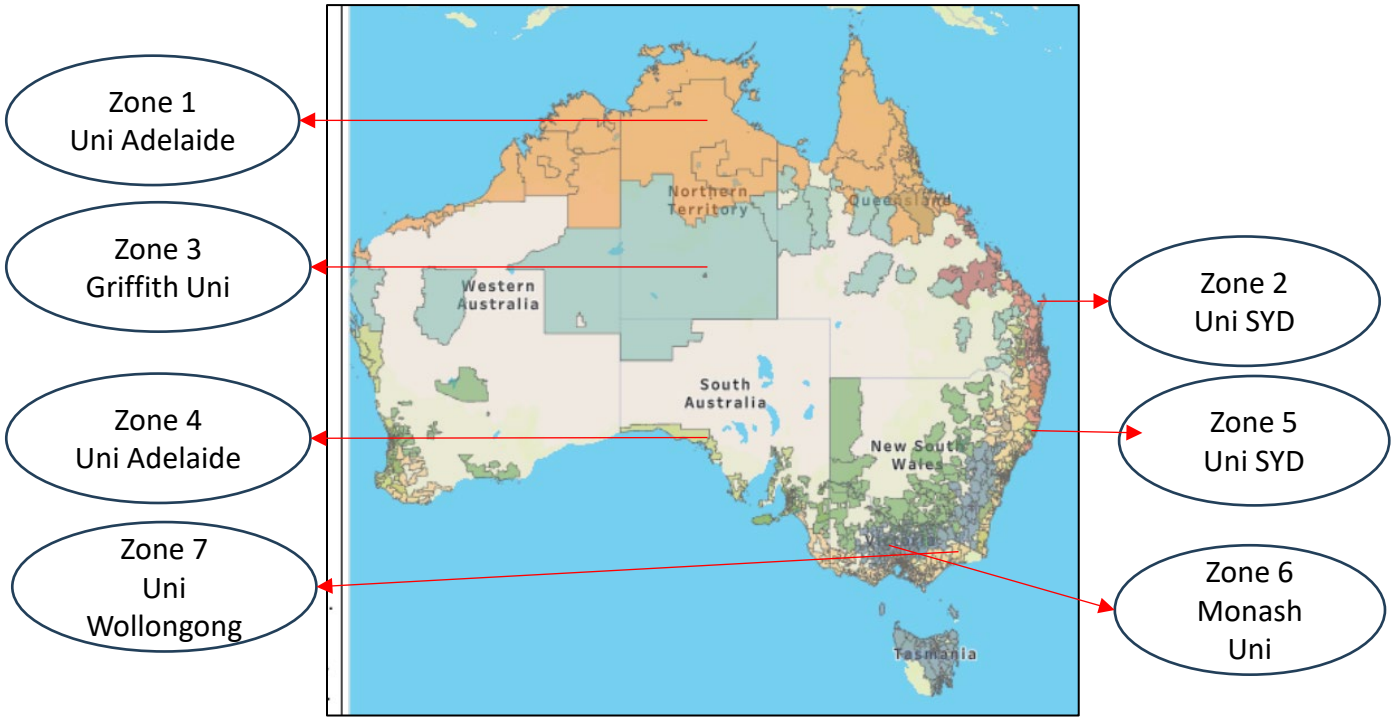
Commonwealth Scientific & Industritall Research Organization

Research Method

- National project:

Collaborated with 5 Australian universities

- 7 Australian Climate Zones



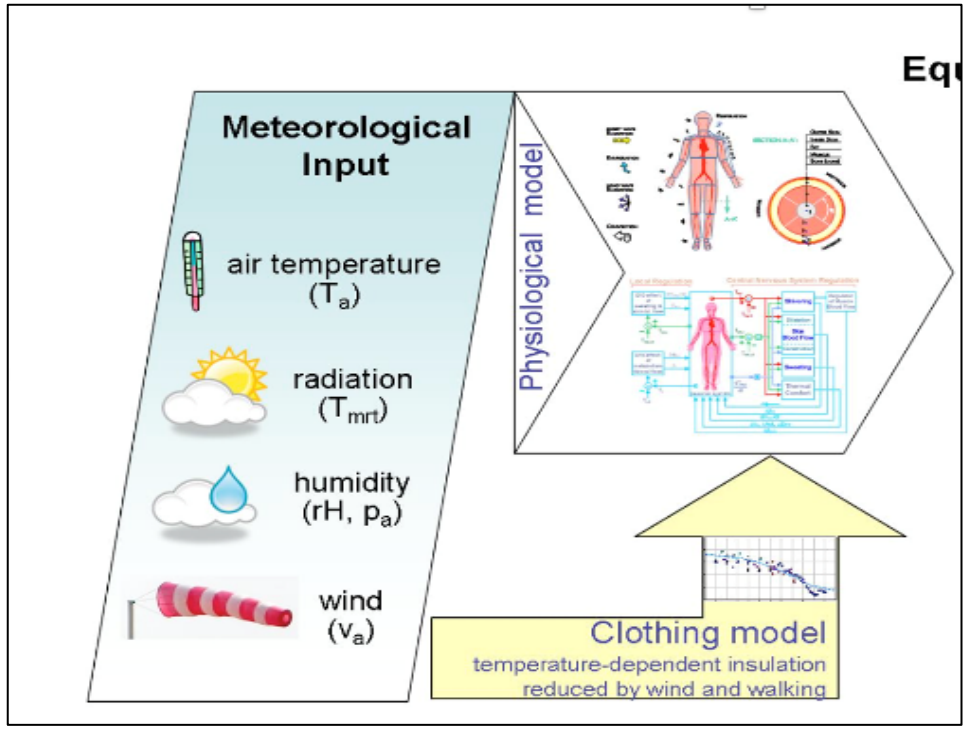
Source: https://ahd.csiro.au/dashboards/energy-rating/ncc-climates/

CSIRO Research

Commonwealth Scientific & Industritall Research Organization

Field Study & Measurements

Human thermal regulation



Source: Brode et al., 2012

Environmental parameters:

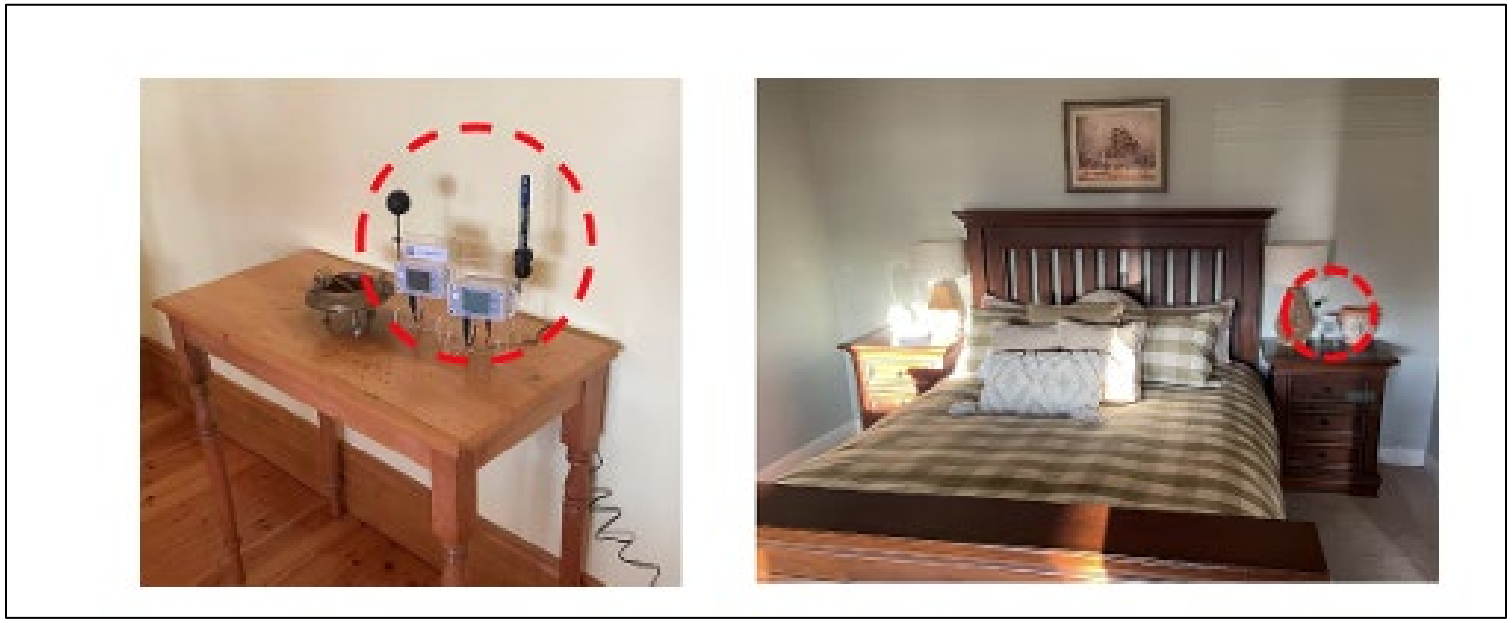
- Air temperature, T_a (°C)
- Mean Radiant Temperature, MRT (°C)
- Humidity, RH (%)
- Air speed, V_i(m/s)

Field Study & Measurements

Measurement solutions

- Data logger: Ta, RH.
- Assembled globe temperature measurement.
- Connected anemometer and globe temperature to data logger
- Data logger save reading for one year
- Devices had sim card for internet

Field Study & Measurements

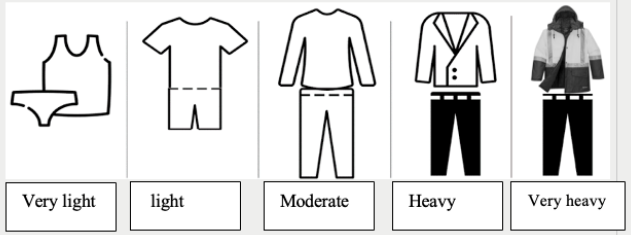


Two sets of data laggers were installed in each home, one set in the living room, and one st in the bedroom.
Duration: One year
Source: Soebarto et al., 2025.

Field Study & Surveys

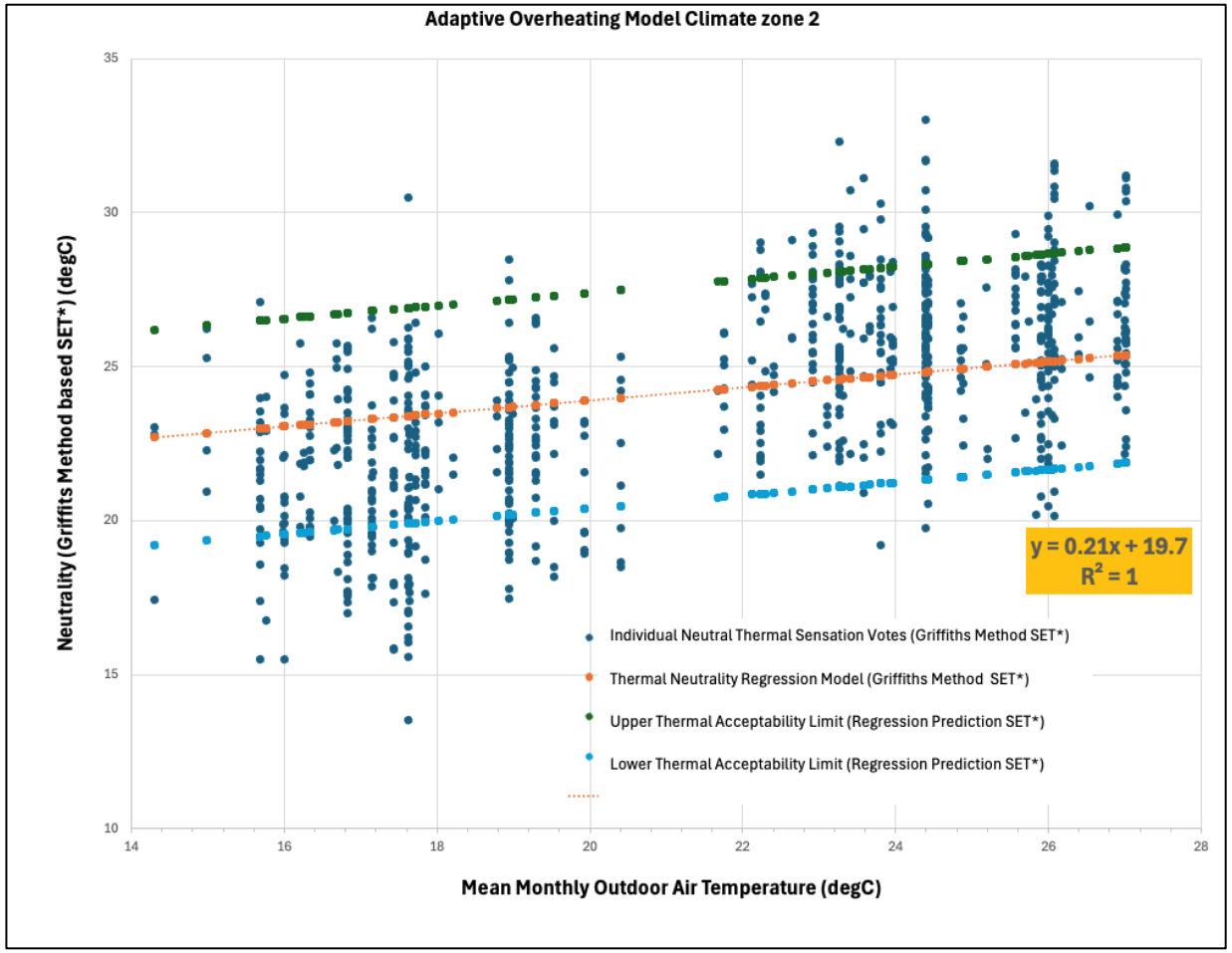
Unified questioner across climate zones

- Survey 11 questions:
- Thermal sensation and acceptability votes
- Occupant's clothing value
- Occupant's metabolic rate
- Occupant's adaptive response:
  - Window operation, ceiling fan, shading, blind, etc.

4. Thermal sensation: Thinking about your thermal environment right now, how do you feel?	- Hot - Warm - Slightly warm - Neutral - Slightly cool - Cool - Cold	Required
5. Thermal acceptability: Is the thermal environment acceptable to you right now?	- Yes - No	Required
6. Thermal preference: What do you like to be?	- Warmer - No change - Colder	Required
7. Clothing insulation: Which of the following best describes the type of clothing you are wearing right now?	- Very light (Clo=0.2) - Light (Clo=0.4) - Moderate (Clo=0.6) - Heavy (Clo=1.0) - Very Heavy (Clo=1.4)  	Required

Development of Adaptive Overheating Model

- Developed the regression model for each climate zone
- Example: Climate zone 2
- Equation predicts Upper Overheating Threshold (UOT)
- UOT= 0.21x Mean T_a (out)+22.7



Thank you