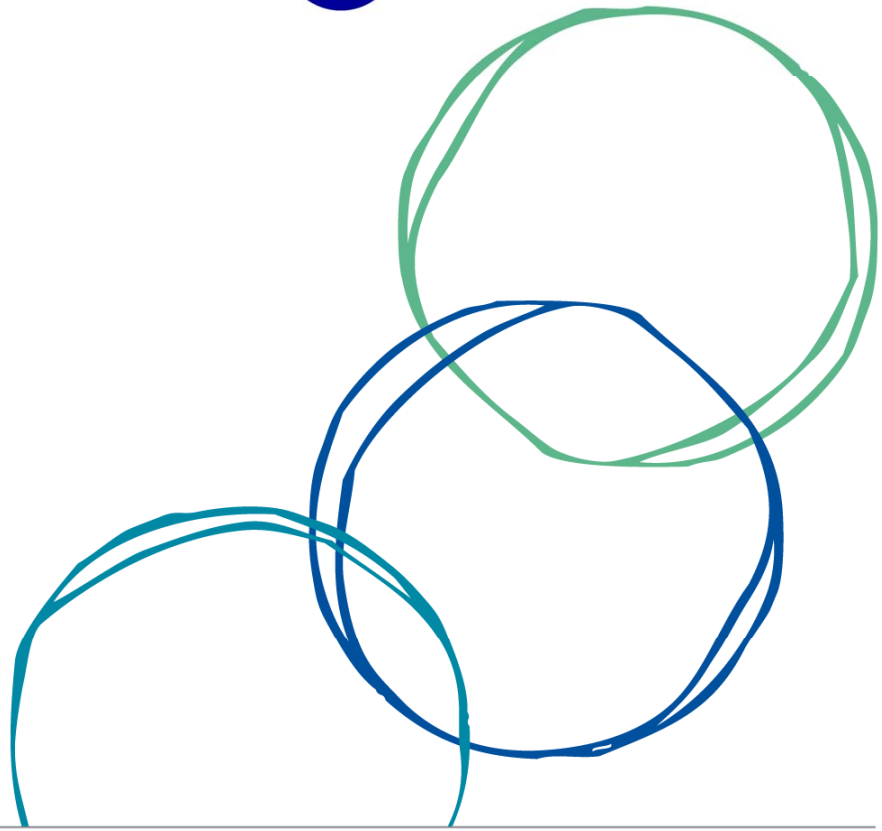
SESSION 2: VENTILATION FOR INDOOR AIR QUALITY AND HEALTH

Heat stress resistance in the Nationwide House Energy Rating Scheme

LOW CARBON LIVING CRC

University of South Australia



Project team

Dr Gertrud Hatvani-Kovacs
Dr Martin Belusko
Dr John Pockett
Professor John Boland

19 March 2018

Heatwaves in Australia

- Heatwaves are the most deadly natural hazard
- The frequency and intensity of heatwaves are rising due to climate change
- Heatwaves are exacerbated by Urban Heat Islands with 89% of Australians living in cities and towns
- Ageing population

LOW CARBON LIVING CRC

Solution: air conditioning

"According to the Australian animal welfare standards and guidelines for exhibited animals, all animal enclosures must provide temperature and humidity control," she said. "So why does the Australian government care enough about the well-being, comfort and care of zoo animals to create legislation in the interests of animal protection, yet does not show the same level of compassion and devotion to our elderly citizens?

G4
G5
G6
G7

Shockingly, half of all public classrooms in Western Sydney have no air-conditioning at all, but we've had three 40 degree days in the last three weeks alone. Can you imagine trying to learn in that environment?

There is a renewed push for air-conditioning to be installed in social housing sites in regional New South Wales, where temperatures exceed 40 degrees Celsius several days per year.

Slide 3

G4 All of these are from public petitions
Gertrud, 19/03/2018

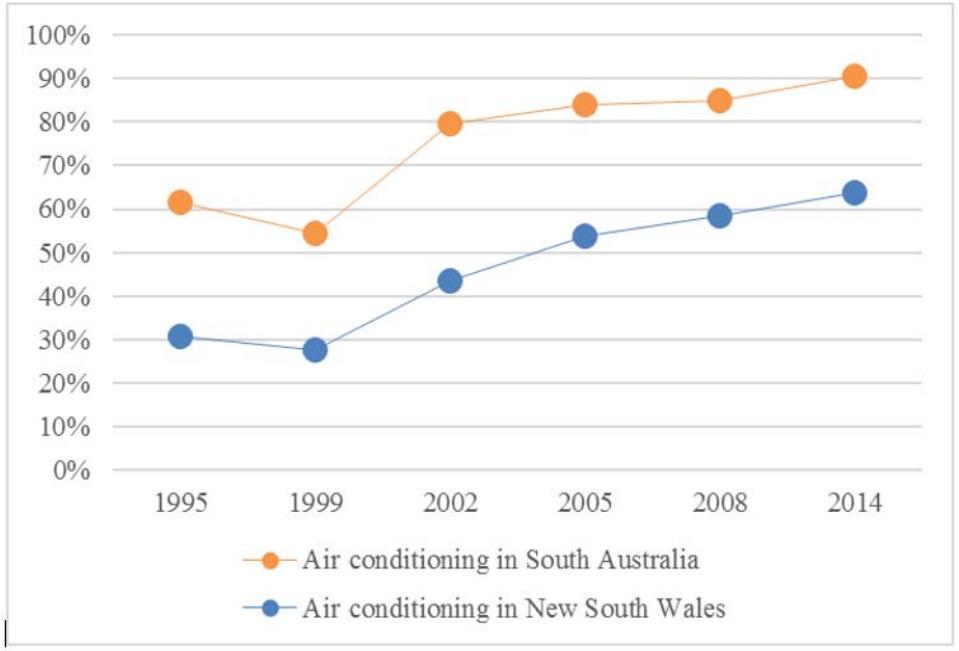
G5 http://www.abc.net.au/news/2016-03-30/calls-for-nsw-government-to-take-air-conditioning-seriously/7284494
Gertrud, 19/03/2018

G6 http://www.dailytelegraph.com.au/rendezview/all-school-classrooms-should-have-airconditioning/news-story/bc4cb132c58034f9a9df3cf9ecd68
Gertrud, 19/03/2018

G7 https://www.thesenior.com.au/news/petition-gathers-momentum/
Gertrud, 19/03/2018

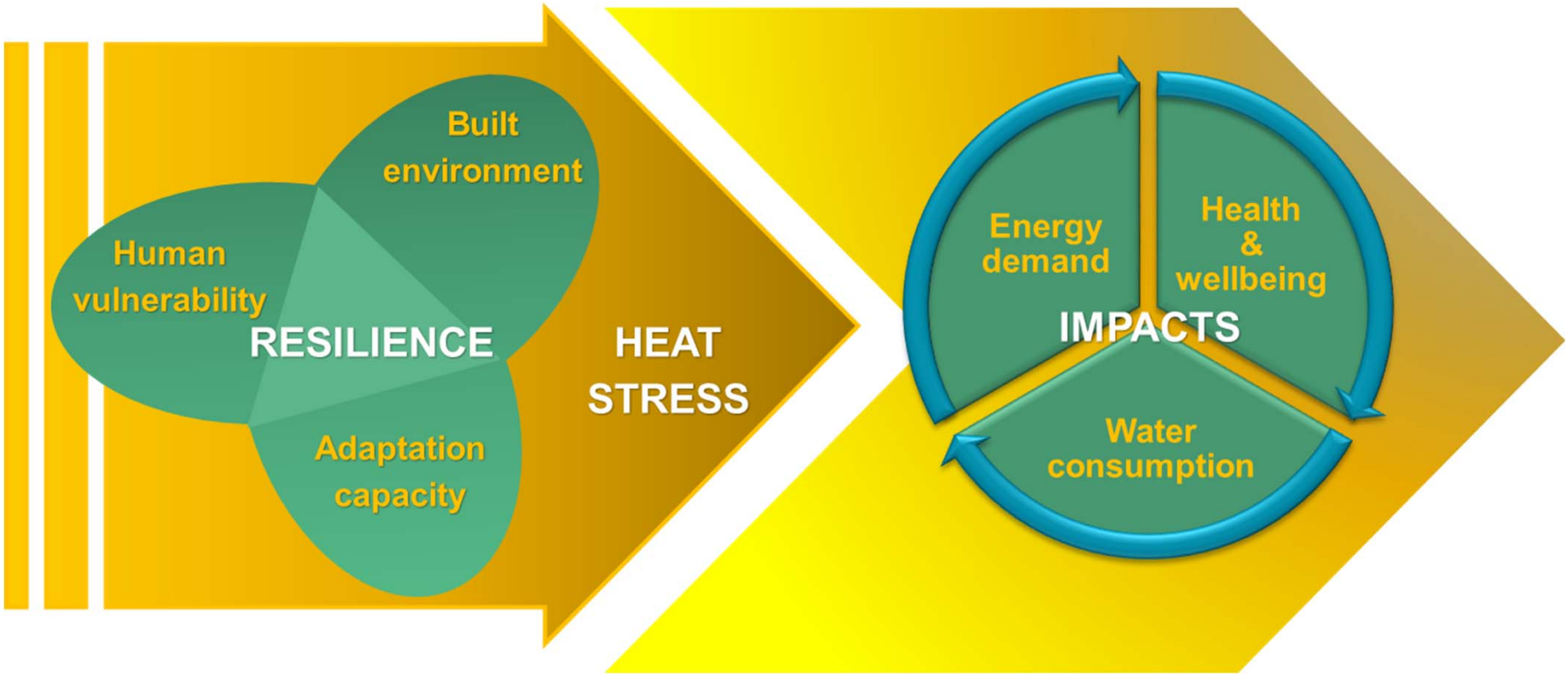
Solution: air conditioning

- drives peak electricity demand, prices and energy poverty
- warms up the outdoors
- increased dependence



LOW CARBON LIVING CRC

What can we do?




Are our buildings
heat stress resistant?

Online survey

- Representative sample from Adelaide (N=393)
- Panel provider

- Questions about
  - Demography
  - Built environment
  - Retrofitting activity
  - Adaptation
  - Heat-related health problems

NatHERS

- Two compliance pathways: elemental approach and simulation compliance
- Rates dwellings from 1 to 10 stars
- Minimum requirement is 6 stars
- NatHERS software
- Based on the annual thermal energy requirement, including both heating and cooling

AccuRate simulation

AccuRate building energy simulation of design variations with a typical floor plan

Traditional double-brick and brick veneer from the 70s

New homes from 6 to 8 stars

LOW CARBON LIVING CRC

Floor plan and section of the simulated home

LOW CARBON LIVING CRC

House design elements

Star rating in Adelaide	2.6 stars (double brick)	2.6 stars (brick veneer)	6.2 stars cooling-dominant	6.2 stars heating-dominant	7.1 stars heating-dominant	7.2 stars cooling-dominant	8.0 stars cooling-dominant	8.0 stars heating-dominant
Star rating in Sydney	2.3 stars (double brick)	2.4 stars (brick veneer)	5.6 stars cooling-dominant	5.7 stars heating-dominant	6.7 stars heating-dominant	6.9 stars cooling-dominant	7.9 stars cooling-dominant	8.1 stars heating-dominant
Roof colour, material and total solar absorptance	light metal (0.30)	light metal (0.30)	dark tiles (0.75)	white, concrete tiles (0.25)	white, concrete tiles (0.25)	dark metal (0.75)	dark metal (0.75)	white, concrete tiles (0.25)
Foil in roof	NIL	NIL	NIL	yes	yes	NIL	NIL	yes
Roof insulation	NIL	NIL	NIL	NIL	NIL	NIL	R2	R2
Ceiling insulation	NIL	NIL	R4.0	R4.0	R4.0	R4.0	R4.0	R4.0
External wall	double brick with cavity	brick veneer	brick veneer, R2.5	brick veneer, R2.5	brick veneer, R2.5	brick veneer, R2.5	brick veneer, R3.5	reverse brick veneer, R3.5
Foil in wall	NIL	NIL	NIL	NIL	NIL	NIL	yes	yes
Internal walls	brick	plasterboard	plasterboard, R1.5	brick	brick	plasterboard, R1.5	plasterboard, R2.0	plasterboard, R2.0
Windows	single, clear glazing	single, clear glazing	single, high solar gain (U=5.4 W/m^{2}K)	single, low solar gain (U=5.6 W/m^{2}K)	double, low solar gain (U=3.0 W/m^{2}K),	double, argon, high solar gain (U=2.90 W/m^{2}K)	double, high solar gain (U=2.0 W/m^{2}K),	double, low solar gain (U=2.0 W/m^{2}K),
Roller shutters	in western bedrooms	NIL	NIL	in western bedrooms	in western bedrooms	NIL	NIL	all rooms
Floor slab	suspended timber floor	slab-on-ground	slab-on-ground	slab-on-ground	slab-on-ground	225 mm waffle pod	225 mm waffle pod	slab-on-ground
Floor covering	timber	ceramic & carpet	ceramic & carpet	ceramic & carpet	ceramic & carpet	ceramic & carpet	ceramic & carpet	ceramic only
Fan	NIL	NIL	NIL	NIL	NIL	NIL	NIL	in main rooms

Results of the online survey

- The health of one fifth of the population was affected by heatwaves
- Three quarters of dwellings were reported as having insufficient heat stress resistance
- Roof and wall insulation, and double glazing predicted less health issues
- Availability and level of air-conditioning correlate with less natural adaptation

G1
G2

Slide 12

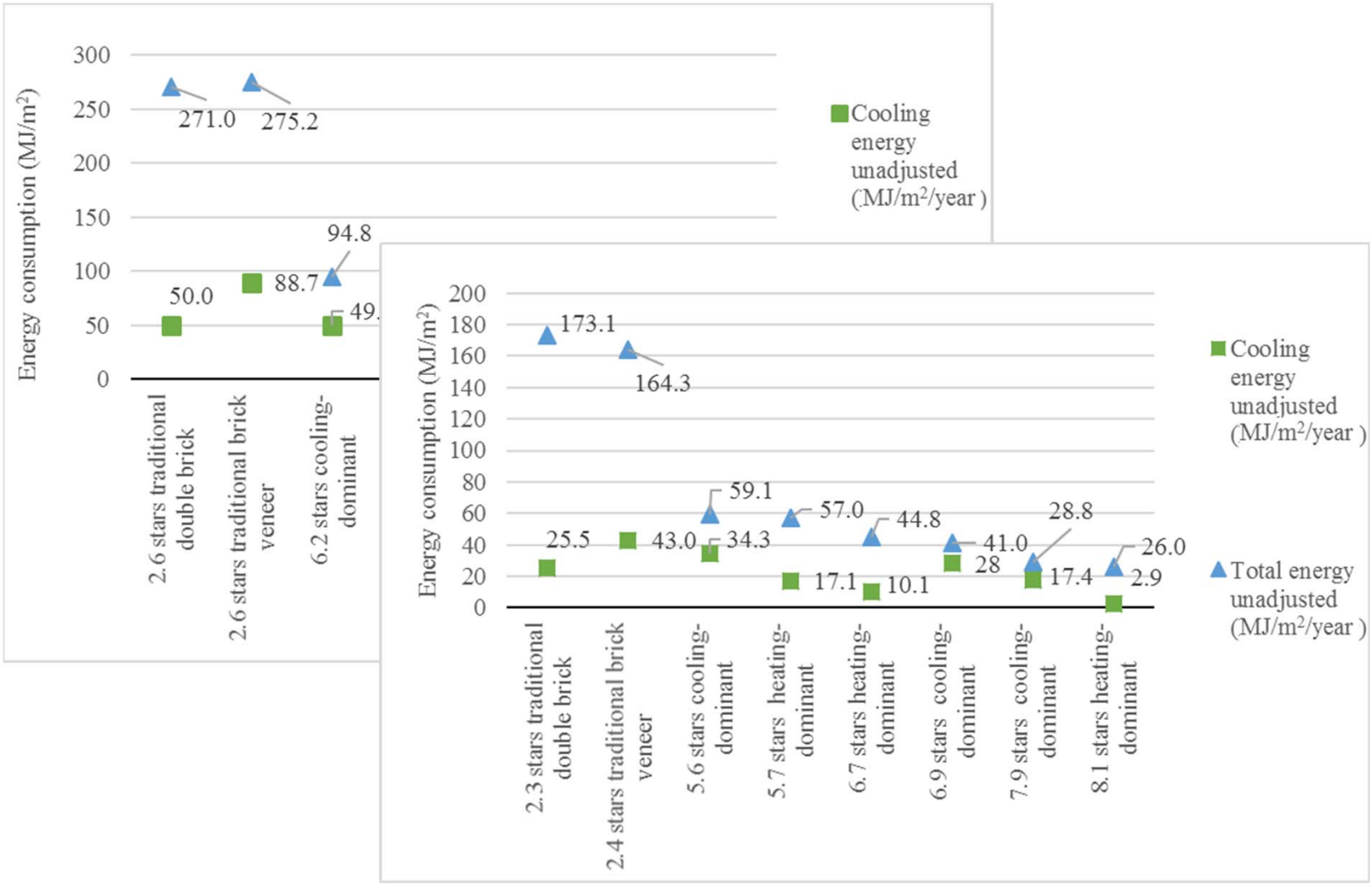
G1 Availability- yes or no

Gertrud, 19/03/2018

G2 Level: one-room, two-rooms or more, whole house

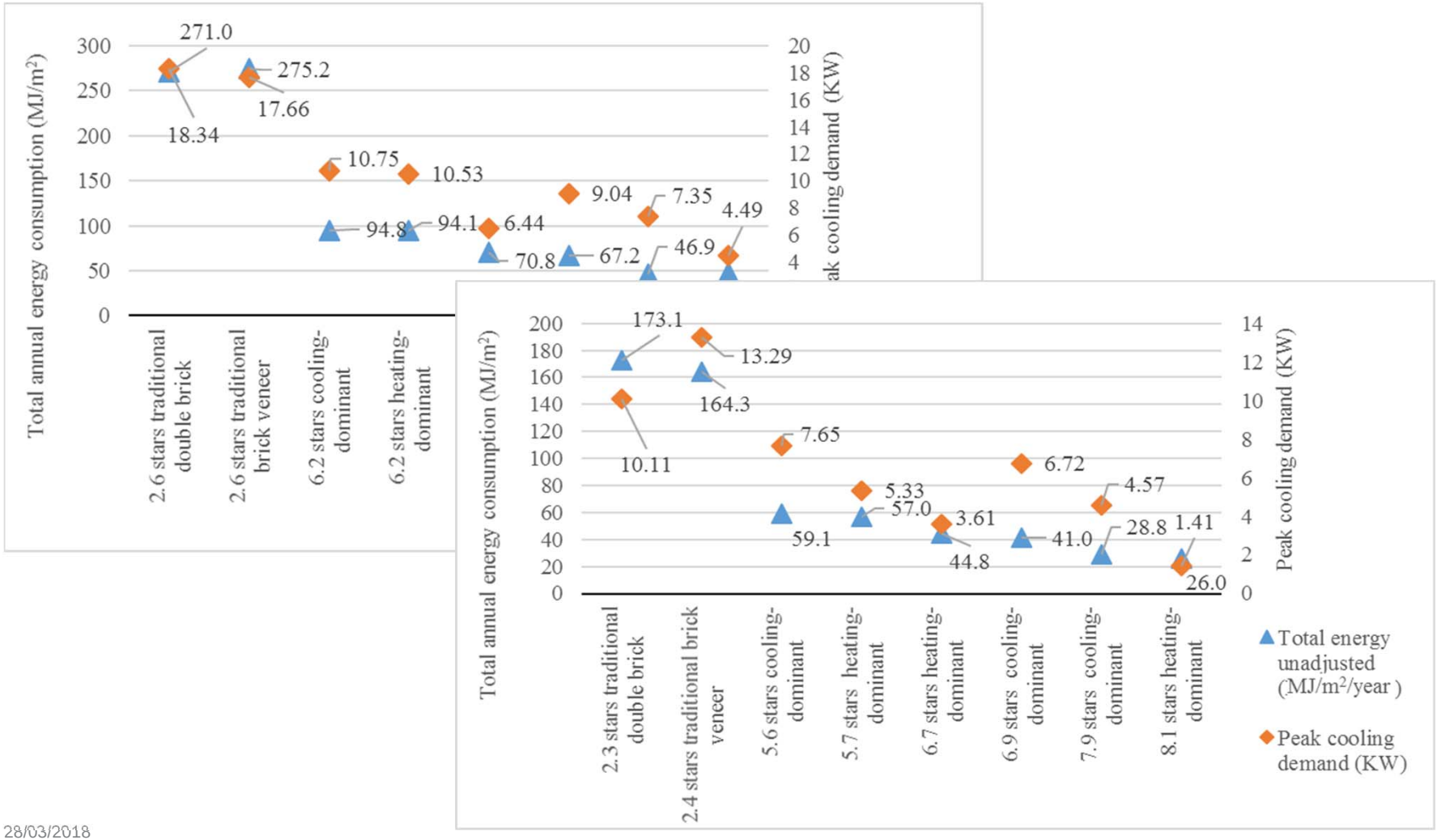
Gertrud, 19/03/2018

Cooling energy and star rating in Adelaide and Sydney



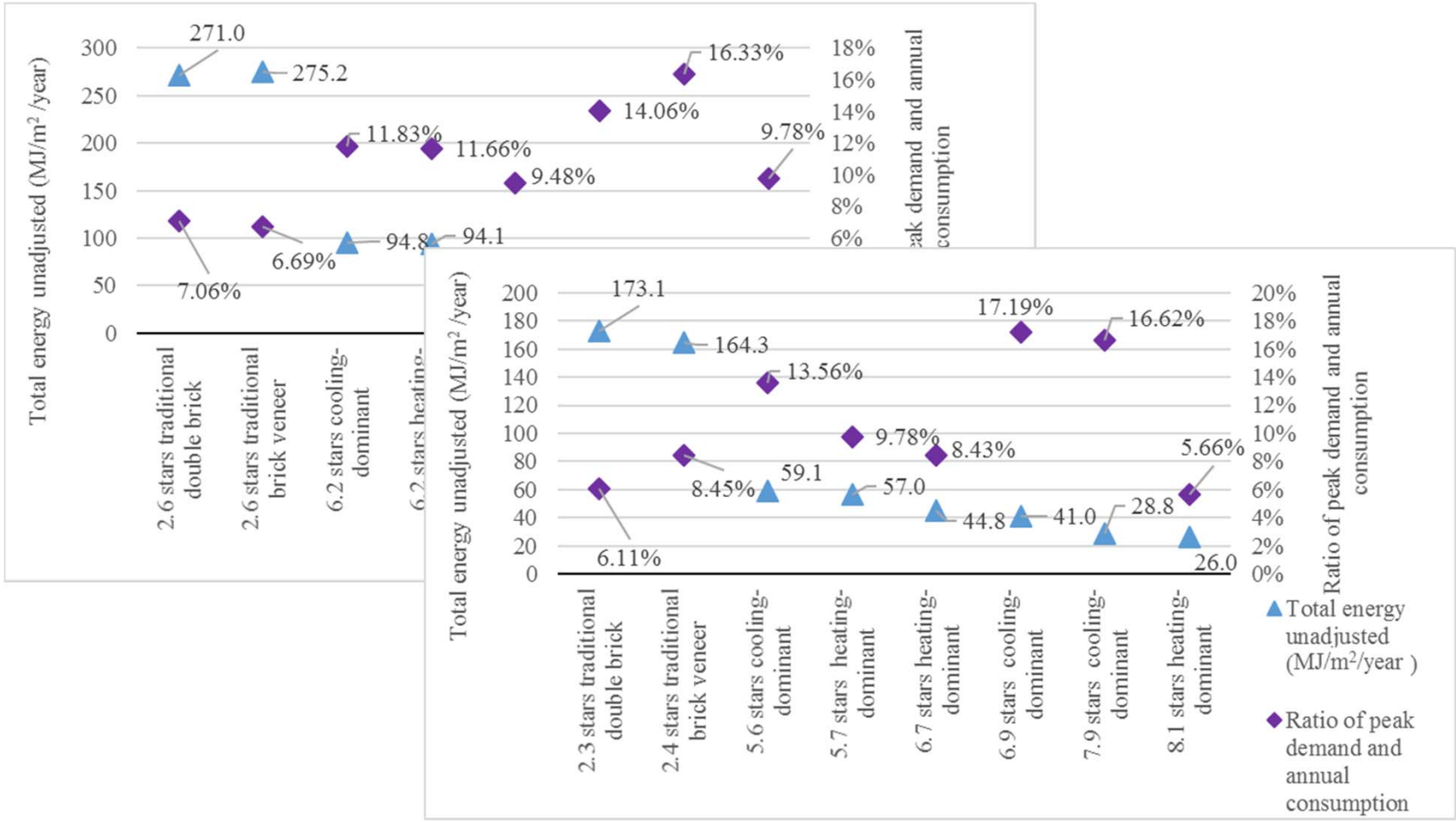
LOW CARBON LIVING CRC

Peak cooling demand and star rating in Adelaide and Sydney



LOW CARBON LIVING CRC

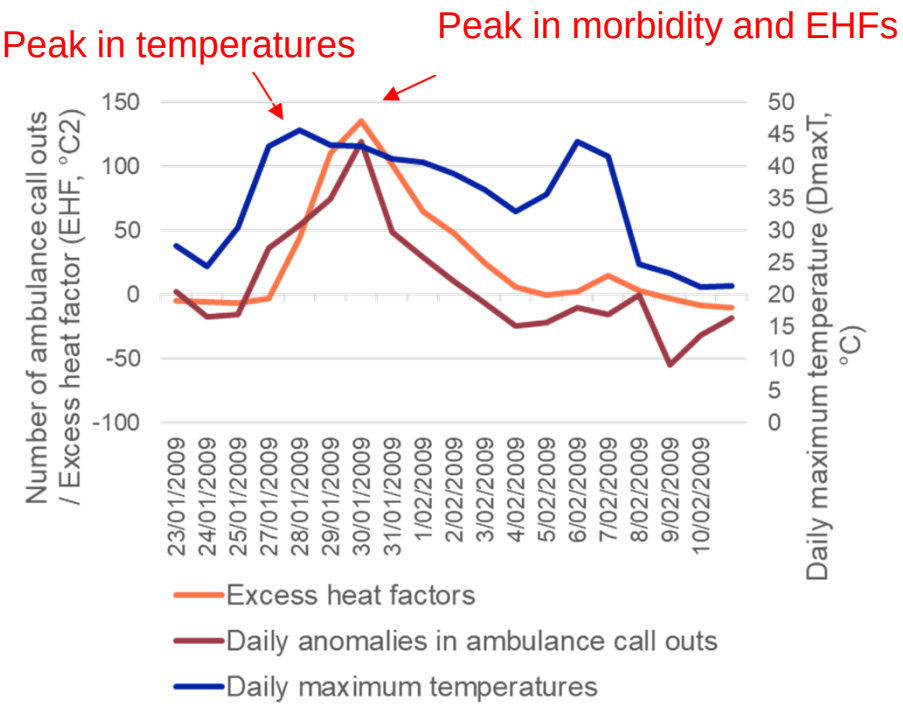
Relative peak cooling demand and star rating in Adelaide and Sydney



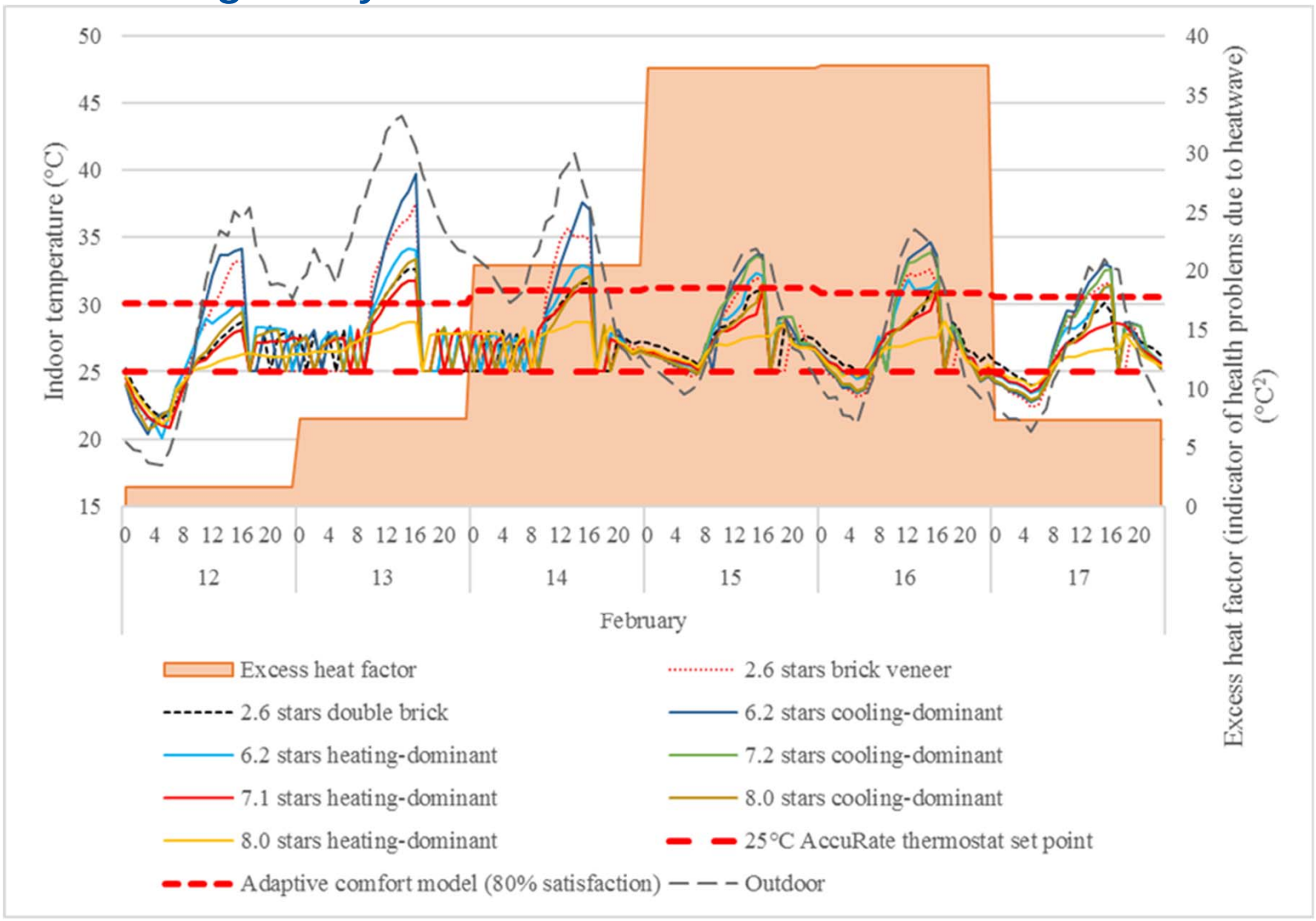
LOW CARBON LIVING CRC

Overheating thresholds

- Static threshold adopted from AccuRate thermostat set point for cooling
- Upper limit of the adaptive comfort model (Morgan and de Dear, 2003)
- Excess heat factor (Nairn and Fawcett, 2015)



Overheating analysis in Adelaide



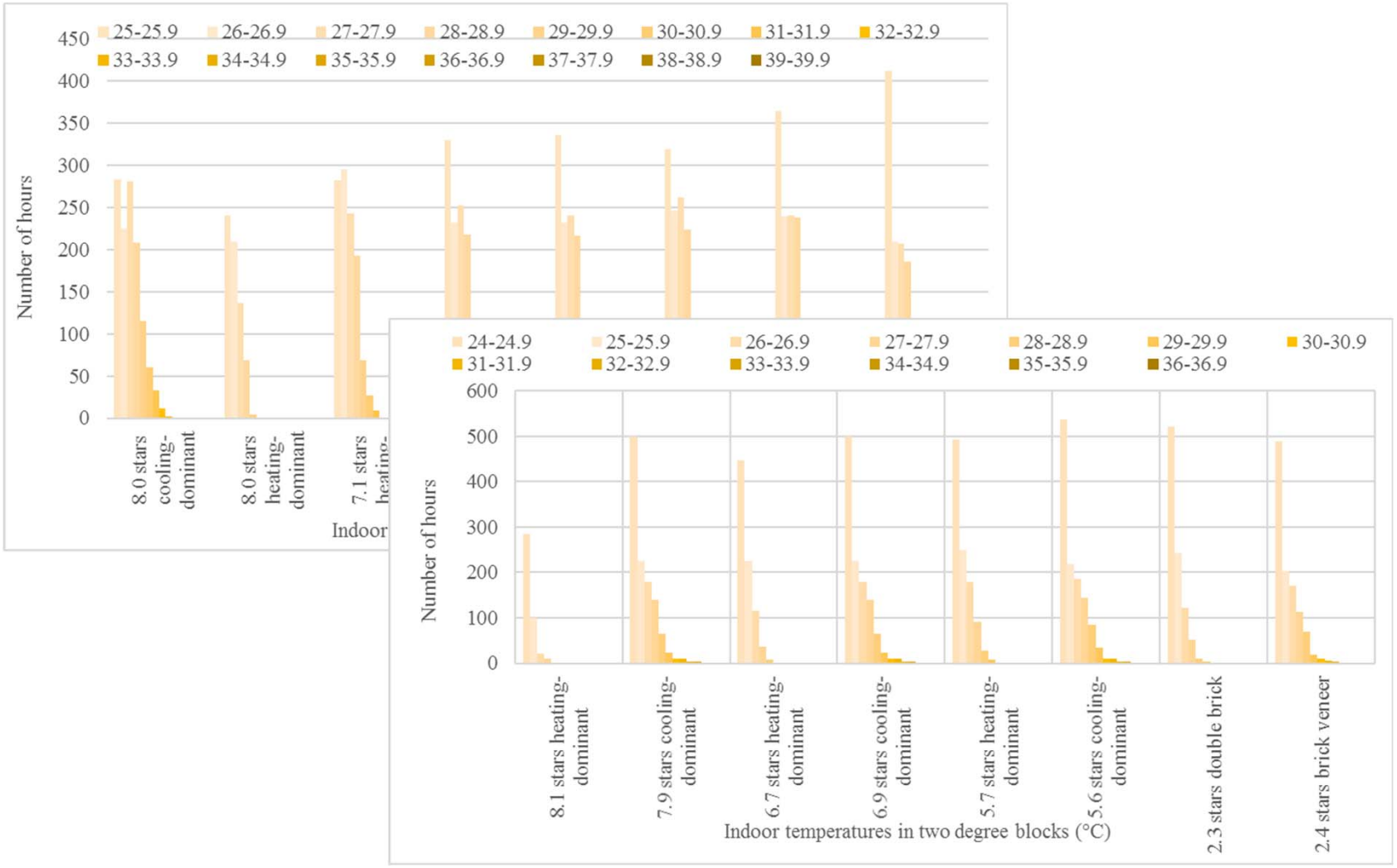
LOW CARBON LIVING CRC

G9 North-facing bedroom

Gertrud, 21/03/2018

G3

Overheating analysis in Adelaide and Sydney



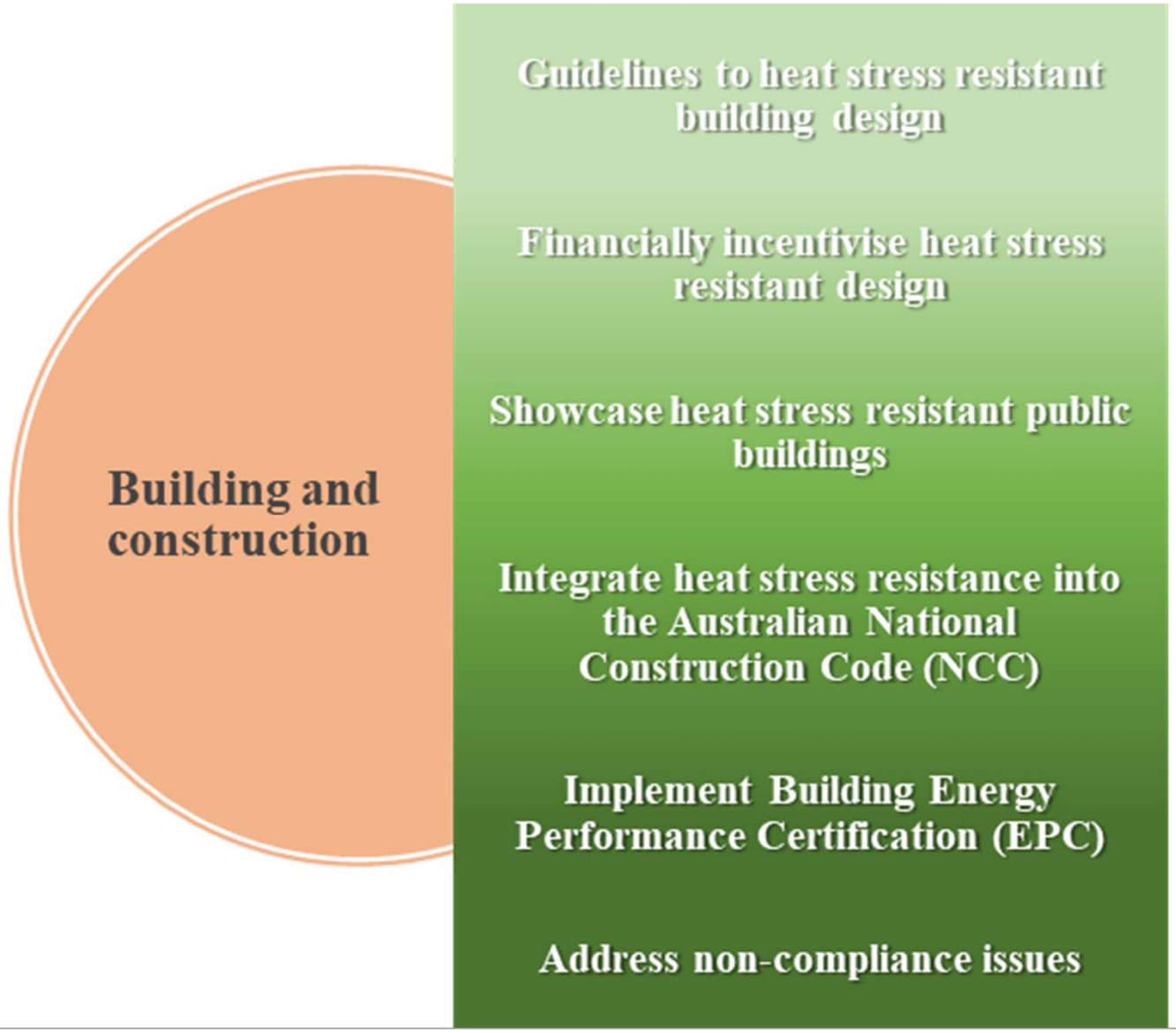
LOW CARBON LIVING CRC

G3 in the bedroom

Gertrud, 19/03/2018

G8

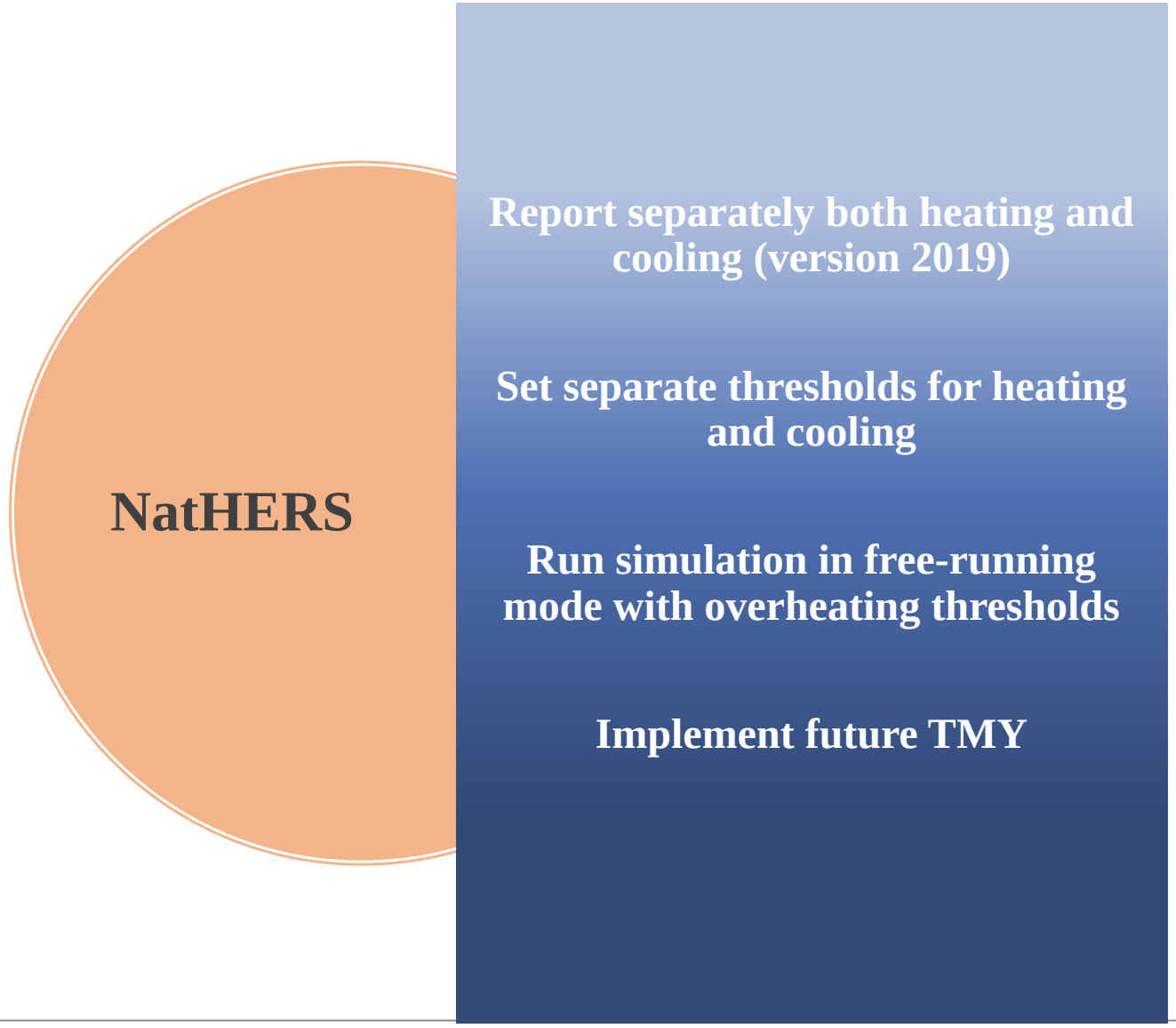
Policy recommendations



G8 Financial incentive: lower tax for white coloured roof materials

Gertrud, 19/03/2018

Review NatHERS and BASIX



Thank you

To find out more, contact

gertrud.hatvani-kovacs@mymail.unisa.edu.au

CRC for Low Carbon Living Ltd

Room 202-207, Level 2,
Tyree Energy Technologies Building
UNSW Sydney NSW 2052 Australia

E: info@lowcarbonlivingcrc.com.au
P: +61 2 9385 5402
F: +61 2 9385 5530

Twitter: @GertrudHatvani
@CRC_LCL