

# Drivers and barriers to heat stress resilience in the urban context

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## Heatwaves in Australia now

- Heatwaves are the most **deadly natural hazard** (Coates 2014)
- Cooling demand drives **peak electricity demand** (Australian Electricity Market Operator, 2011), contributing to soaring **electricity prices** and **energy poverty**
- **Air-conditioning (AC)** is one of the **most frequently used adaptation** techniques
- **Negative impacts** of AC:
  - Increased carbon emission
  - Increased dependence on it (Candido, 2010)
  - Warming up the outdoors

## Heatwaves in Australia in the future

- Heatwaves are exacerbated by **Urban Heat Islands** with 89% of Australians living in **cities** (UN DESA 2011)
- The **frequency and intensity** of heatwaves are rising due to climate change (Nairn and Fawcett 2013)
- Population is **ageing**
- New buildings with high insulation and air-tightness rely even more on **AC**

>>>**A wicked, interdisciplinary problem.**



# Framework for the population heat stress resilience

Adaptation



Electricity



**RESILIENCE**

**IMPACTS**



Vulnerability



Built environment



Water



Ambulance

Photos from <https://unsplash.com/>

## 1. Impacts

### **Time-series and regression analyses in Adelaide and Sydney**

Daily data of: electricity consumption, demand; water demand and morbidity

## 2. Population resilience

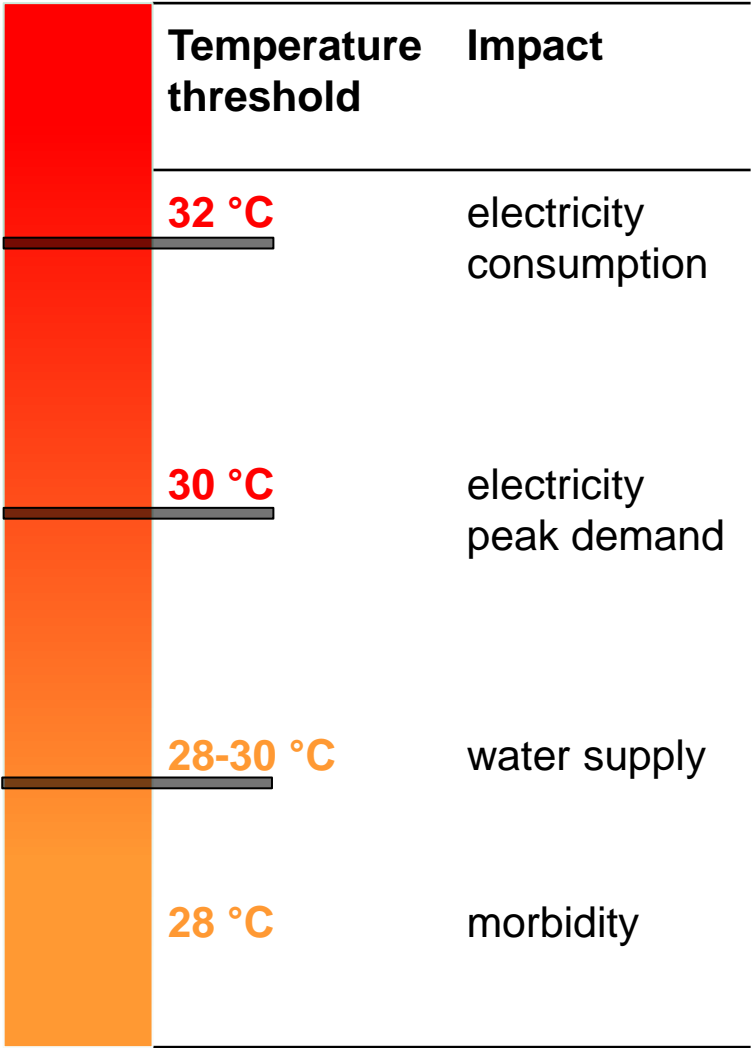
### **Online survey**

Representative sample from Adelaide (N=393) and questions about: demography, built environment, retrofitting activity, adaptation, heat-related health problems.

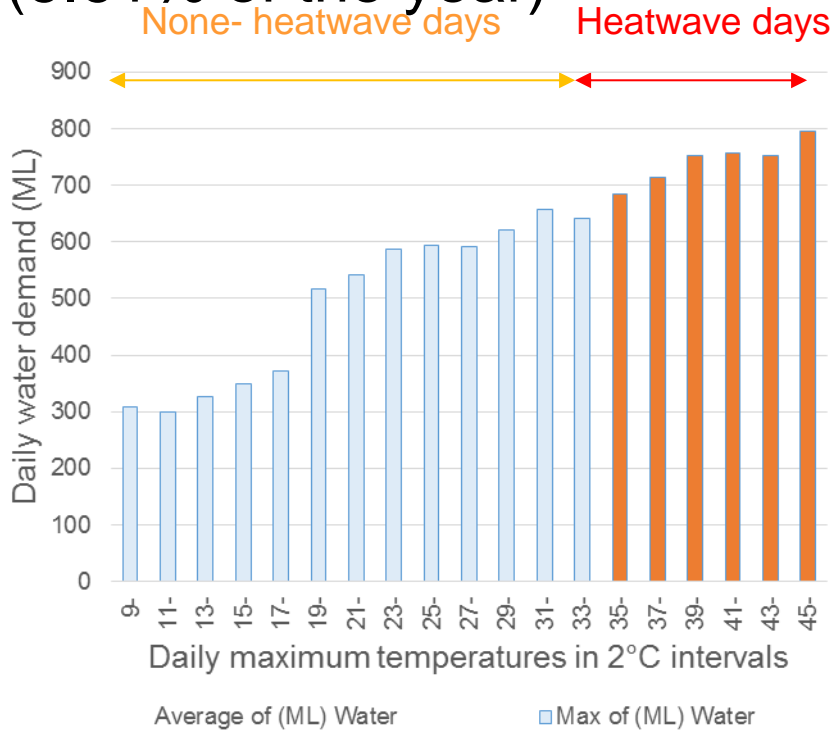
## 3. Heat stress resistance of buildings

AccuRate building energy simulation of a typical residential floor plan with different design scenarios

# Results, impacts threshold temperatures



- One fifth of water and electricity supply occur during heatwave days (6.61% of the year)

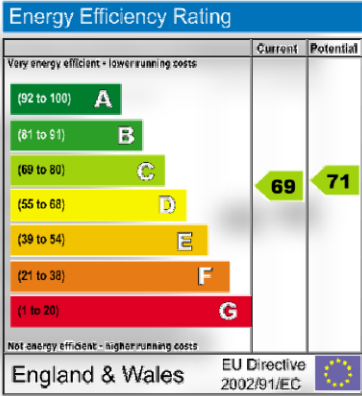


Water demand duration and temperature graph

# Results, online survey on heat stress resilience

- The **health of one fifth** of the population was impacted by a medium heatwave.
- **Three quarters of dwellings** were reported having insufficient heat stress resistance.
- **Tenants** tended to have more health issues and live in less heat stress resistant homes
- Homes with roof insulation had less health issues

- >>>  
Implement  
the Energy Performance Certificate



## Results, online survey on heat stress resilience

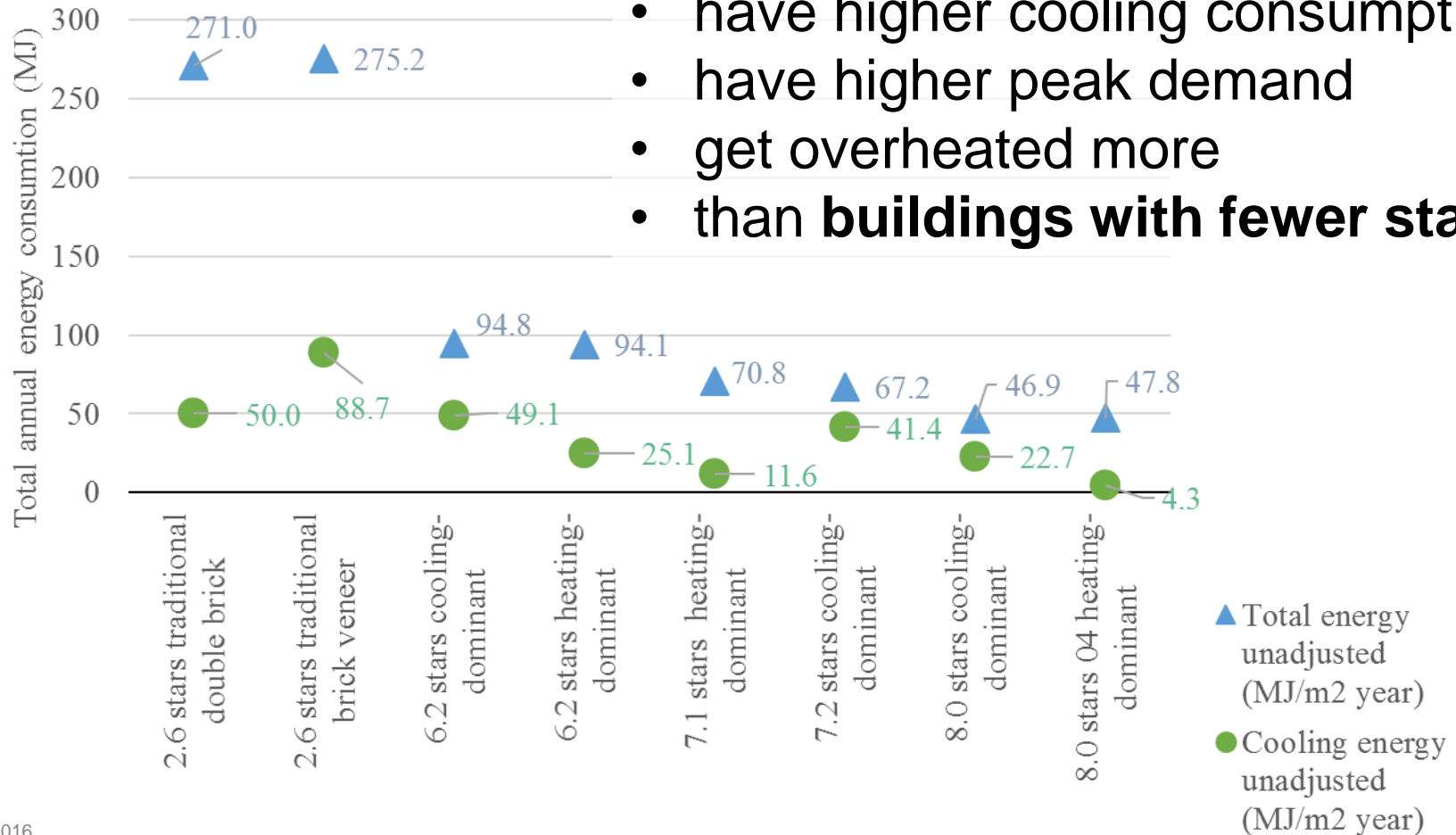
- **Pre-existing health conditions** predicted higher vulnerability and they were oblivious of their vulnerability
- In contrast, **older people adapt more** and live in more resistant homes
- 6-9% of the population lives among poor housing conditions and suffers from **energy poverty**



# Results: AccuRate simulation

## Homes with more stars can

- have higher cooling consumption
- have higher peak demand
- get overheated more
- than **buildings with fewer stars**



# Conclusion

- **To assess vulnerability** we have to consider energy poverty, adaptation capacity and the built environment
- **AC is not a final solution** >> impact of electricity and morbidity have to be managed together
- Built environment has a **triple positive impact** on resilience
  - Save energy
  - Increase adaptation
  - Decrease health issues
- **Holistic building design** is important to create energy efficient AND heat stress resistant homes

# Thank you for your attention!

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CRC LCL research project webpage

<http://www.lowcarbonlivingcrc.com.au/research/program-2-low-carbon-precincts/rp2005-urban-micro-climates>

PhD talk in the Science Show on the ABC RN, 2<sup>nd</sup>  
April, 2016,

<http://www.abc.net.au/radionational/programs/scienceshow/coping-with-heatwaves/7291978>