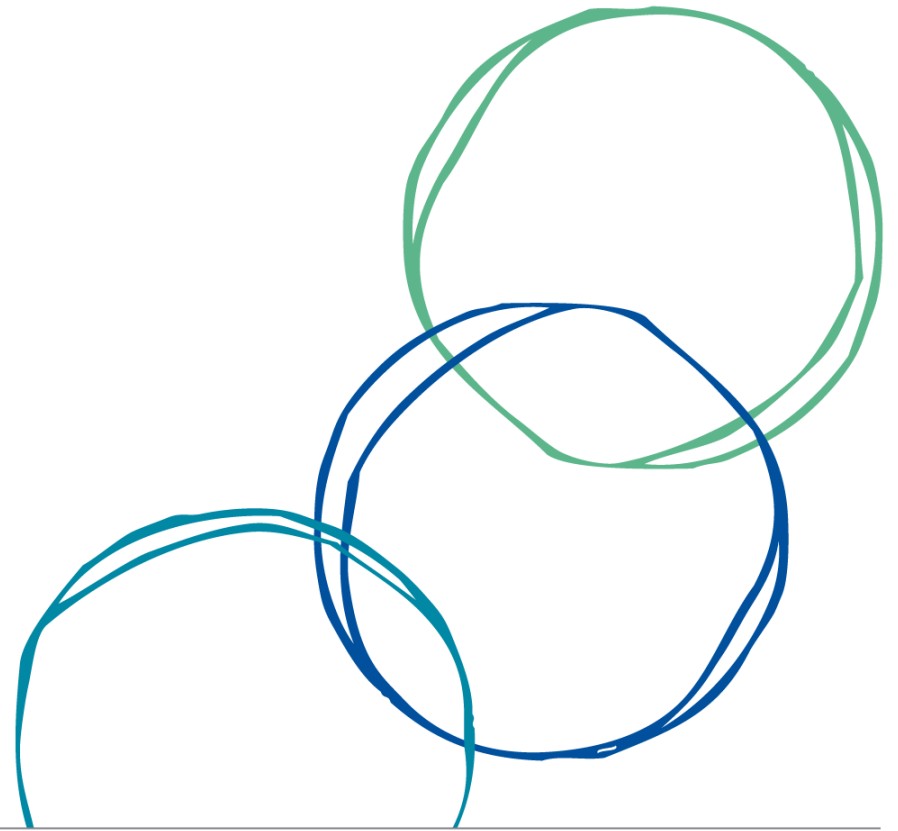


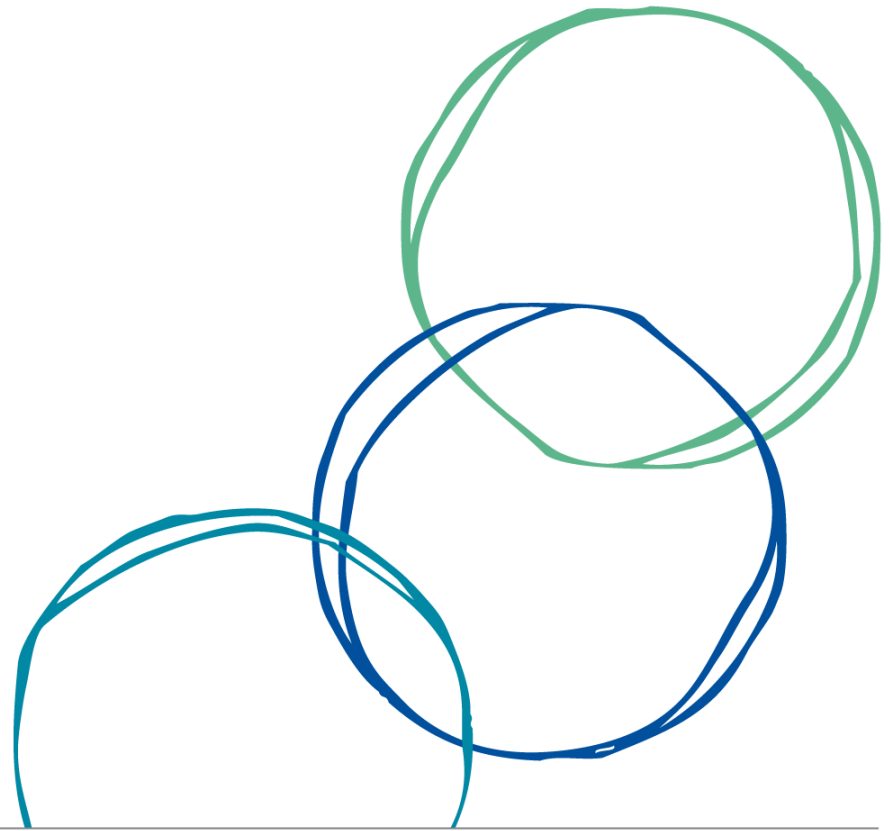
# Participants Annual Forum

23 November 2017



# Welcome

Josh Byrne  
ABC TV, Curtin University



# Panel Discussion Empowering Consumers



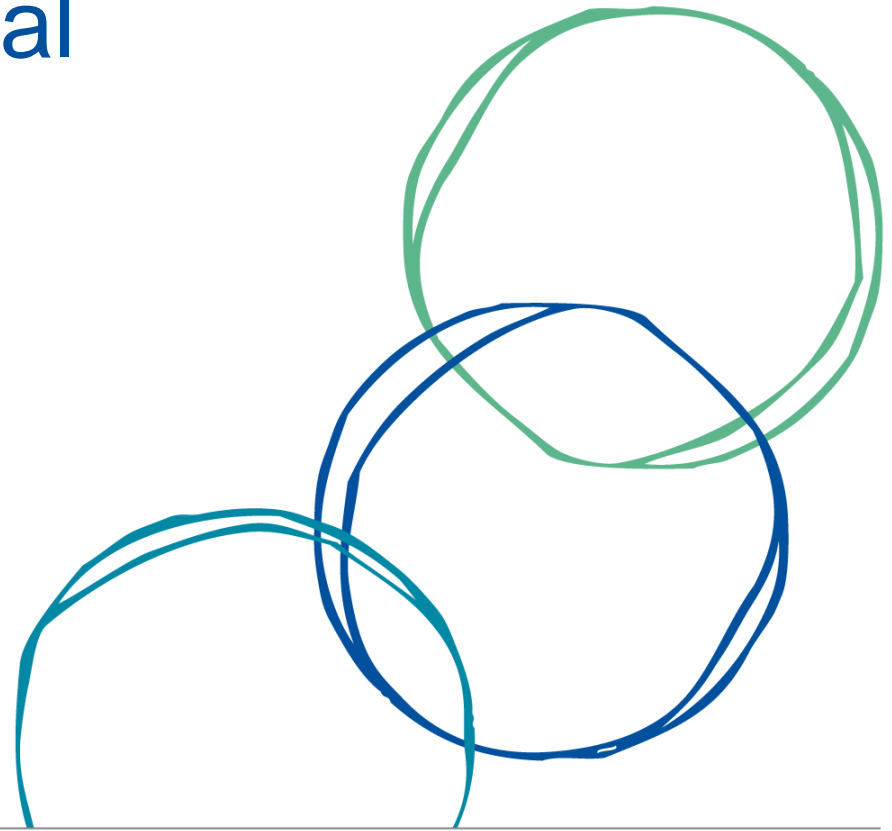
Rachel Hayley, Office of Environment & Heritage  
Anthony Wright, CSIRO  
James McGregor, Blue Tribe Co.  
Jesse Clarke, CSR Building Products

Facilitator: Dr Stephen White (CSIRO)



# Build4Life – A journey from social research to social enterprise

James McGregor  
CEO  
Blue Tribe Co.



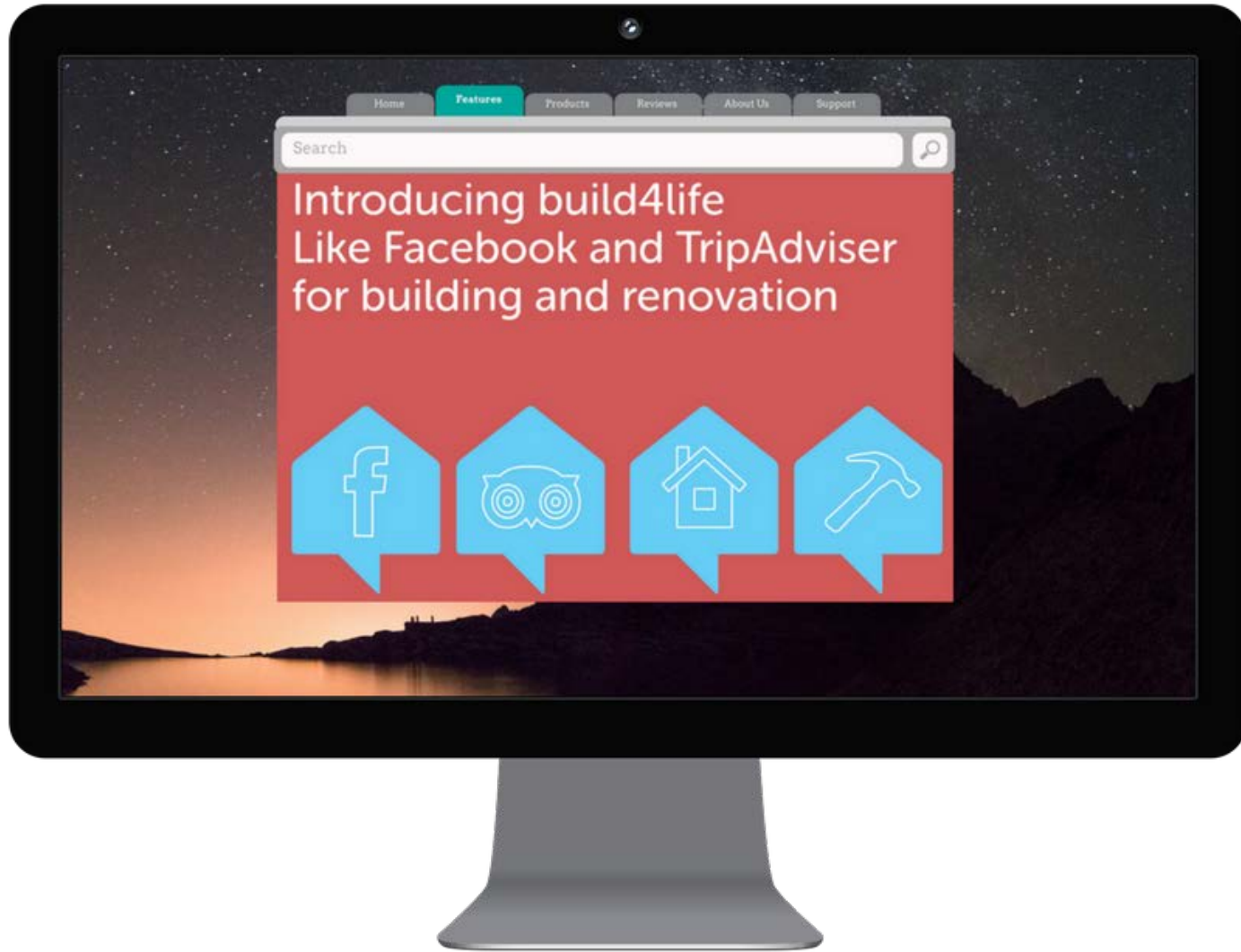
# Overview

- Defining the Challenge
- Build4Life V1.0
- David vs Goliath
- What the research was telling us
- The evolution of Build4Life
- Build4Life V2.0 – Concierge Service
- Next Steps

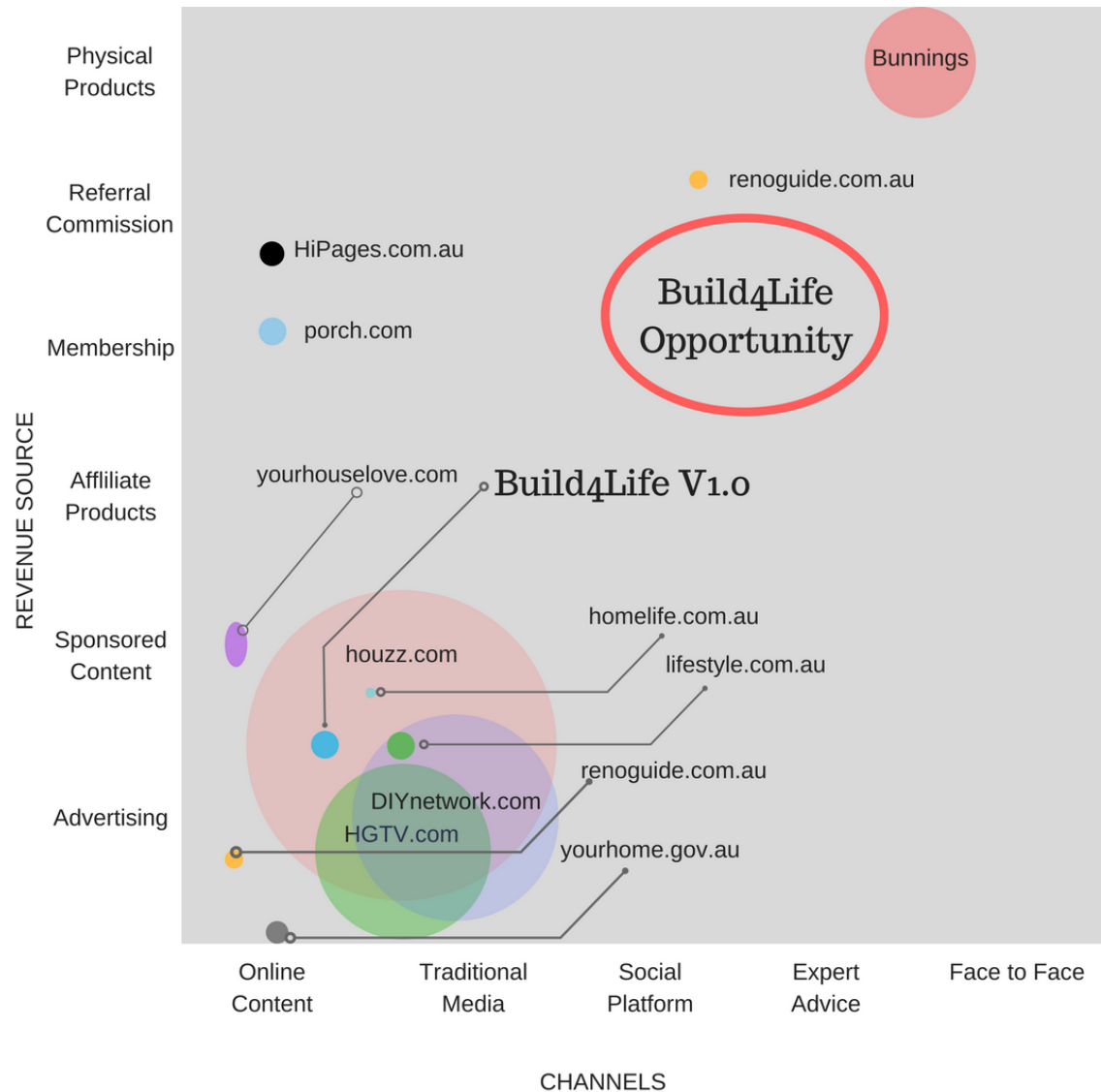
# Defining the Challenge



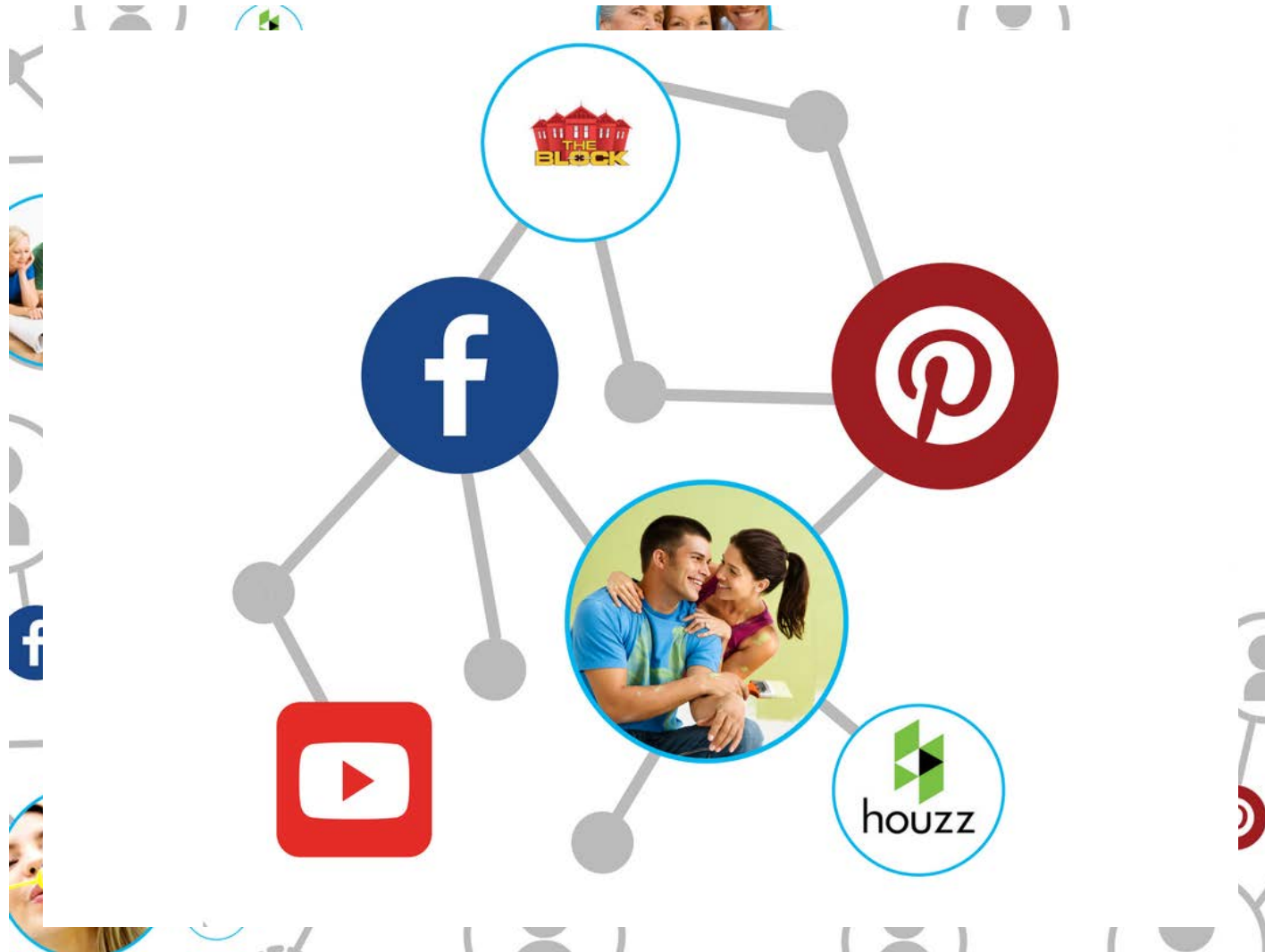
# Build4Life V1.0 circa 2016



# David vs Goliath - Competitive Landscape



# What the research was telling us

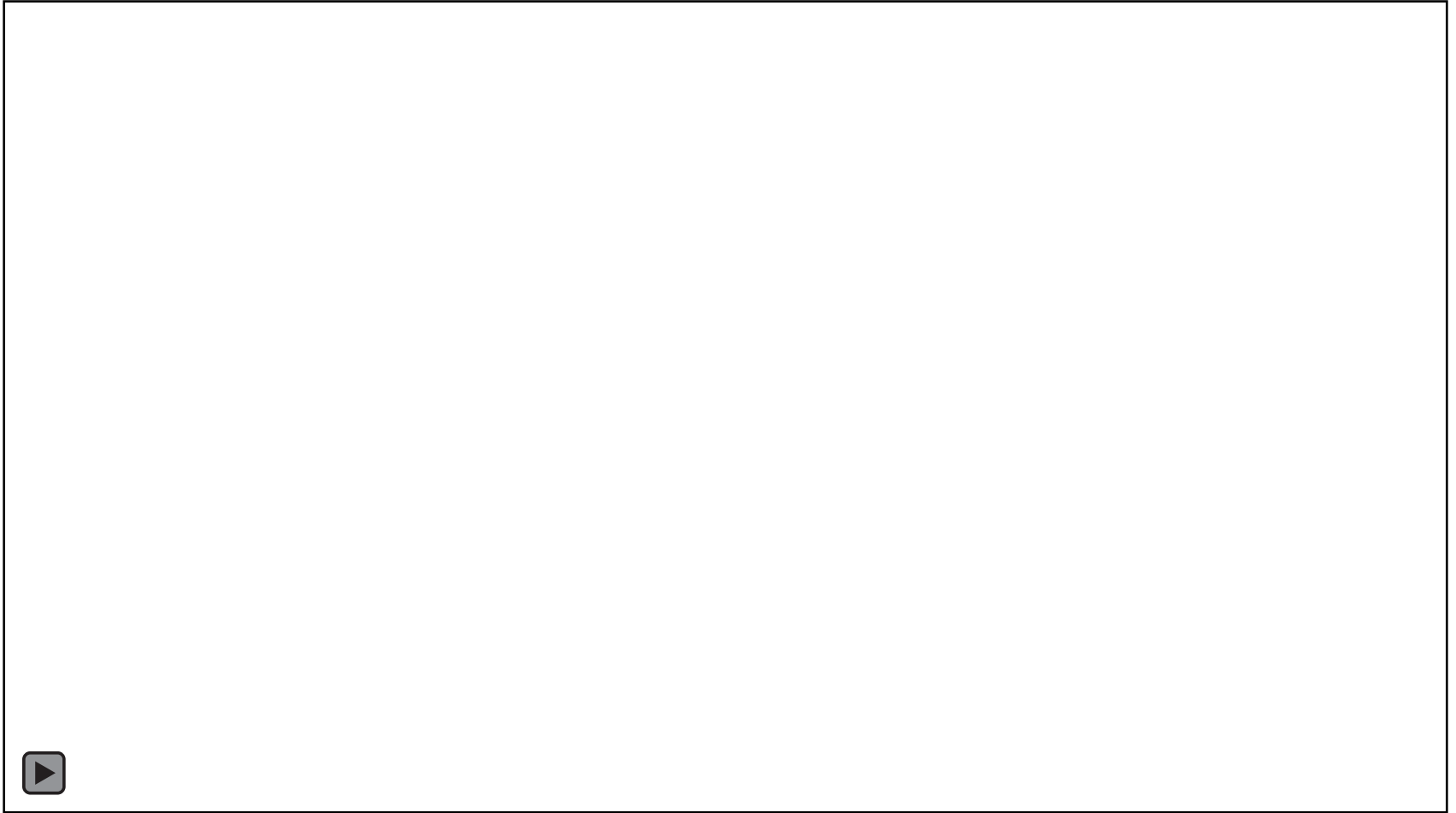


# Build4Life ~~V1.0~~ V2.0

Build4Life is an innovative ~~social media~~ platform to help renovators build better, healthier, more environmentally sustainable homes.



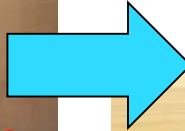
# Build4Life V2.0 – A Concierge Service for your Renovation



# Next Steps?

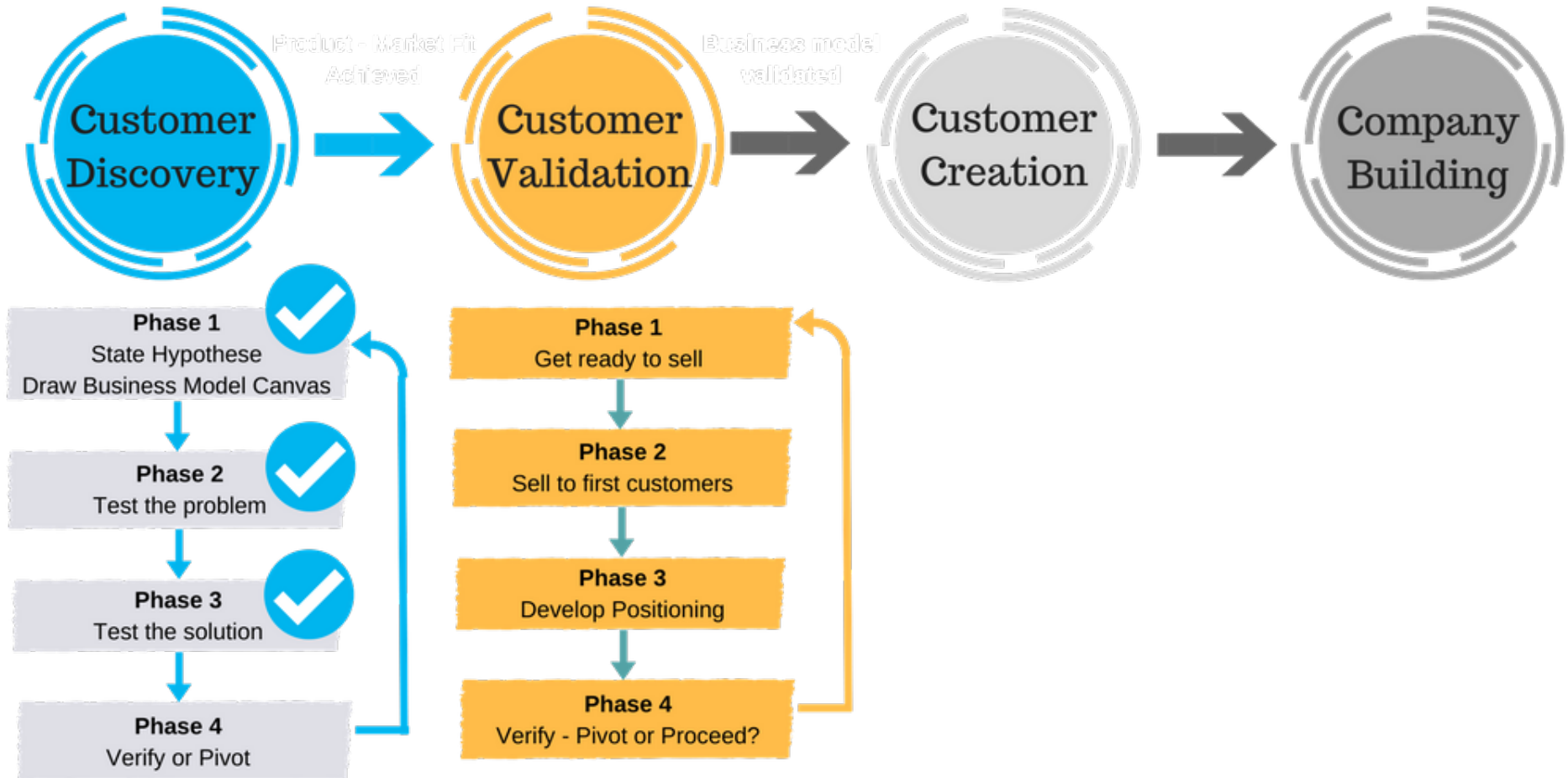


IDEA



PRODUCT

# Next Steps?



# Next Steps?

- Key activities
  - Build of supporting online platform (Jan-May 2018)
  - Validate business model – test core assumptions underpinning business model (Sep 2017 – May 2018)
  - Seek investment to scale business (Mar-Jul 2018)

# Conclusion

- Using a well established start-up methodology Build4Life has iterated to develop a unique market offering and established product-market fit.
- Build4Life offers a new approach for policy makers to consider – taking a policy challenge and developing a financially self-sustaining social enterprise that achieves the policy objectives whilst creating jobs, economic activity, social and environmental benefits for the community.

# Thank you

## To find out more, contact

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](mailto:info@lowcarbonlivingcrc.com.au)  
P: +61 2 9385 5402  
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Twitter: @CRC\_LCL

Anthony Wright  
CSIRO

E: [anthony.wright@csiro.au](mailto:anthony.wright@csiro.au)  
P: +61 3 9662 7349

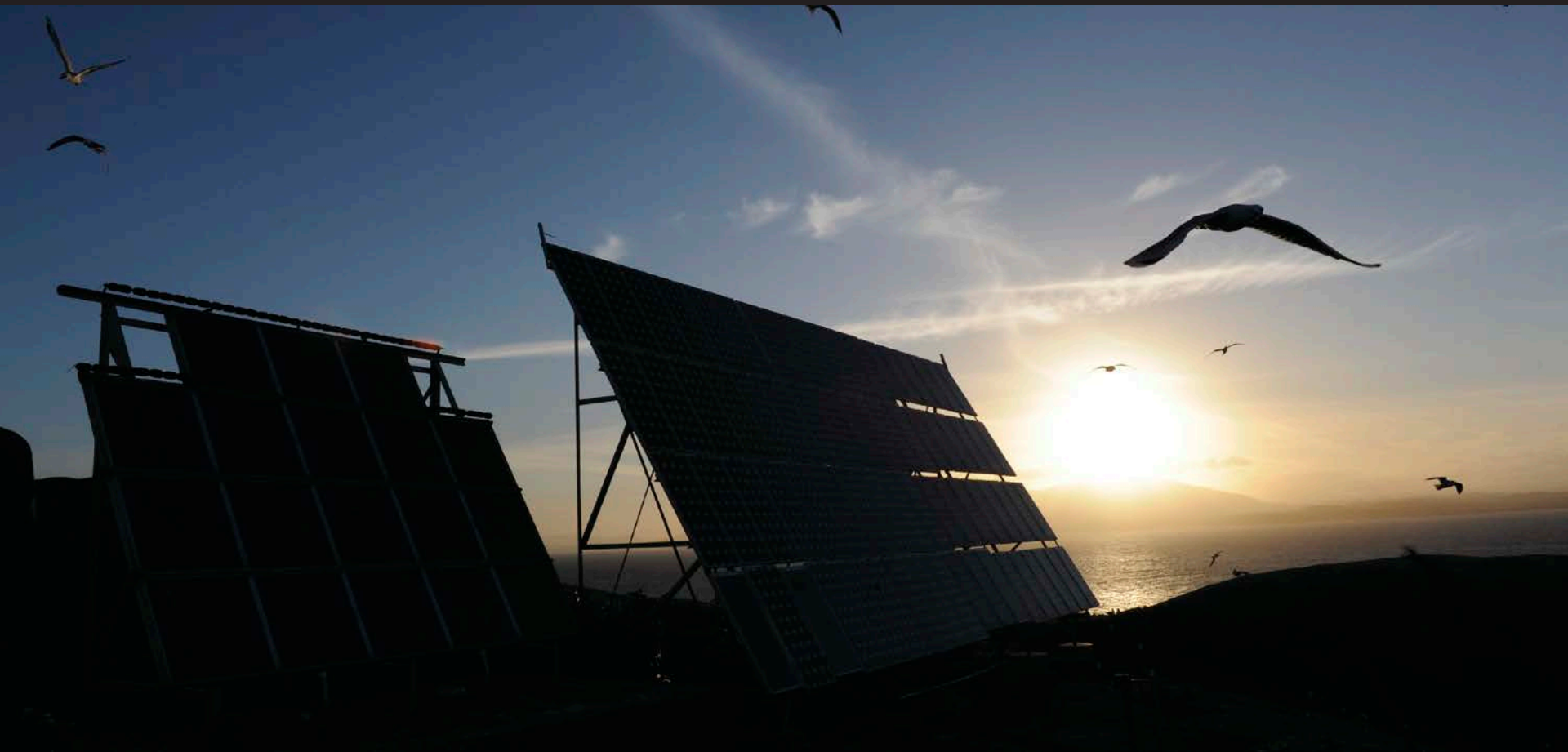
James McGregor  
Blue Tribe Co.

E: [james.mcgregor@bluetribe.co](mailto:james.mcgregor@bluetribe.co)  
P: +61 411 204 570

Twitter: @BlueTribeCo

# The value of strategic partnership with the Low Carbon CRC to the NSW Government

**Kate Wilson**, Executive Director Science, NSW Office of Environment and Heritage





## NSW Government Agencies partnering with the Low Carbon Living CRC



Sydney Water (Michael Storey, Helen Liossis, Nicola Nelson)



Department of Planning and Environment:

- Environment & Building Policy (Dr Kevin Yee, Scott Wilson, Luke Walton, Eamon Leneghan)
- OEH Sustainability Programs (Mary O'Neill, Cristien Hickey, Emily Yip, Rachel Haley, Nina Bailey, Anne-Marie Poirrier)
- Energy Efficiency Research Hub (Kathleen Beyer)



Urban Growth (Landcom – Nicole Campbell)



TAFE NSW (Rick Duynhoven)

- We cannot afford to do research which delivers high quality papers but which “answers yesterday’s question tomorrow” (*UK public servant*)
- “the right evidence must be seen at the right time by the right people” (*Australian public servant*).

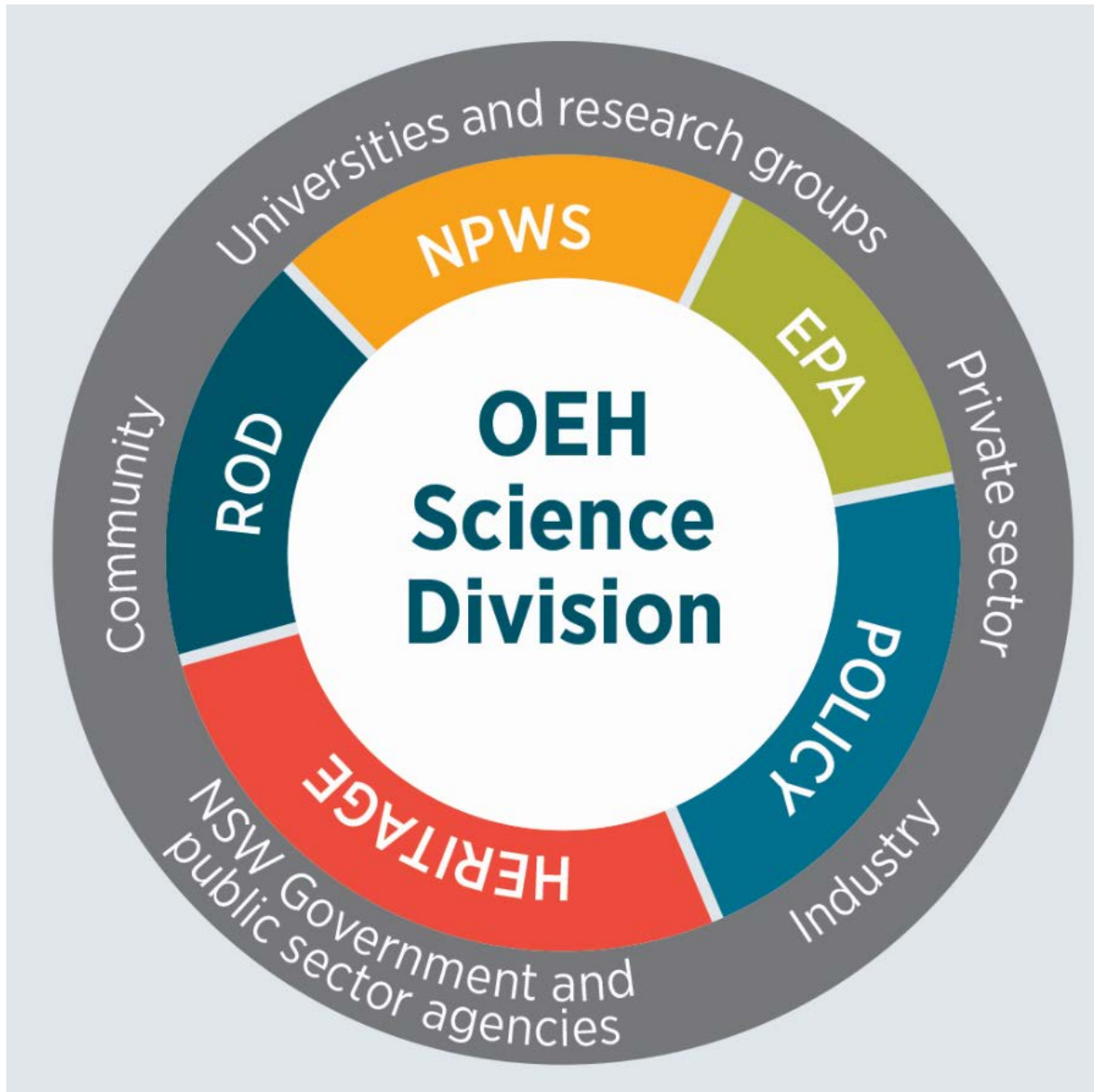


# The challenges of government adopting science

Key enabling factors for research to inform policy:

- **Relationships**: long term relationships with the government department or agency
- Partnering with department staff to answer the **right question**
- Understanding the **different ways** science is sourced and used
- Maintaining **excellence** in the science we deliver
- Deliver products asked for **on time** and in an **accessible way**





# Knowledge Strategy Annual Cycle





# Research Partnerships Strategy 2017–2020

Working together to achieve our knowledge needs

## Our vision

OEH will have harmonious, high-quality collaborative research partnerships filling our knowledge needs.



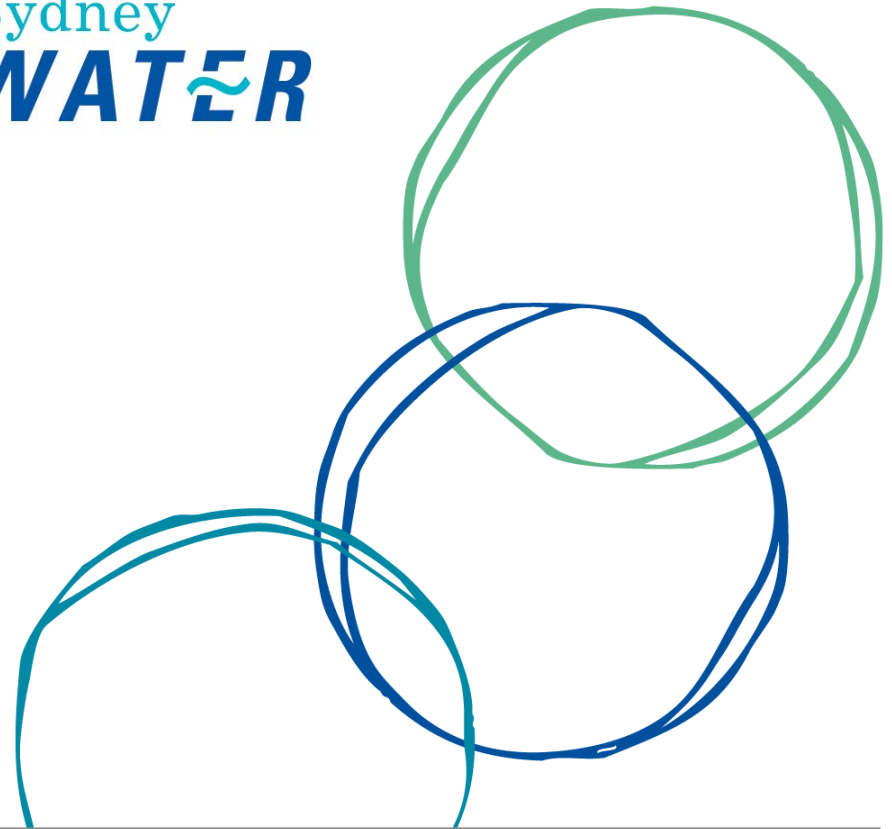
## NSW partnership programs with the LCL CRC

- Beneficial reuse of biosolids
- Cooling Western Sydney
- BASIX Monitoring Program
- Low carbon retrofits in social and community housing
- National Social Media Conversation on Energy Efficient Housing
- Energy Efficiency Decision-Making Research Node

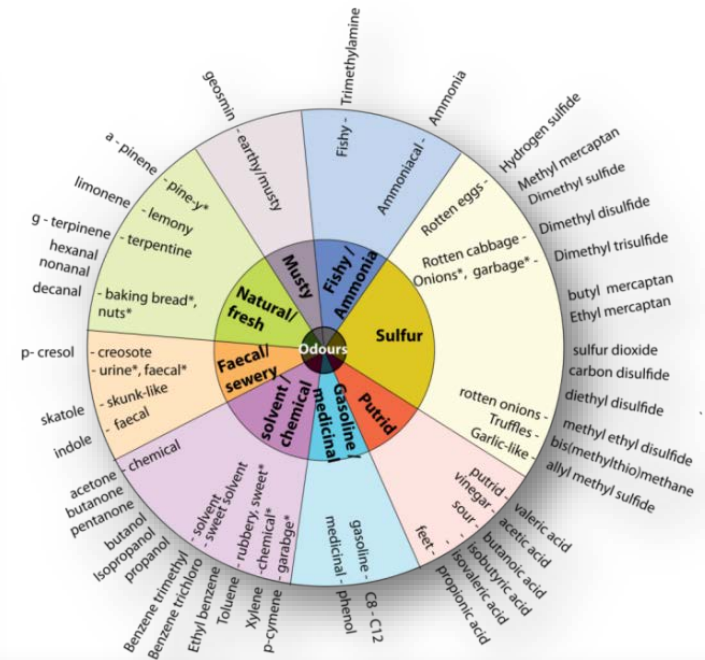




# Beneficial reuse of solids from Wastewater Treatment Operations



# Beneficial Reuse of Biosolids





## Beneficial Reuse of Biosolids

Savings of \$25K pa at Cronulla WWTP

Savings of \$150K pa in transport cost

\$2.5 m pa for farmers in reduced fertilizer application

Reduced community odour complaints





# Strategic Study on the Cooling Potential and Impact of Water Based and other Urban Climate Mitigation Technologies in Western Sydney

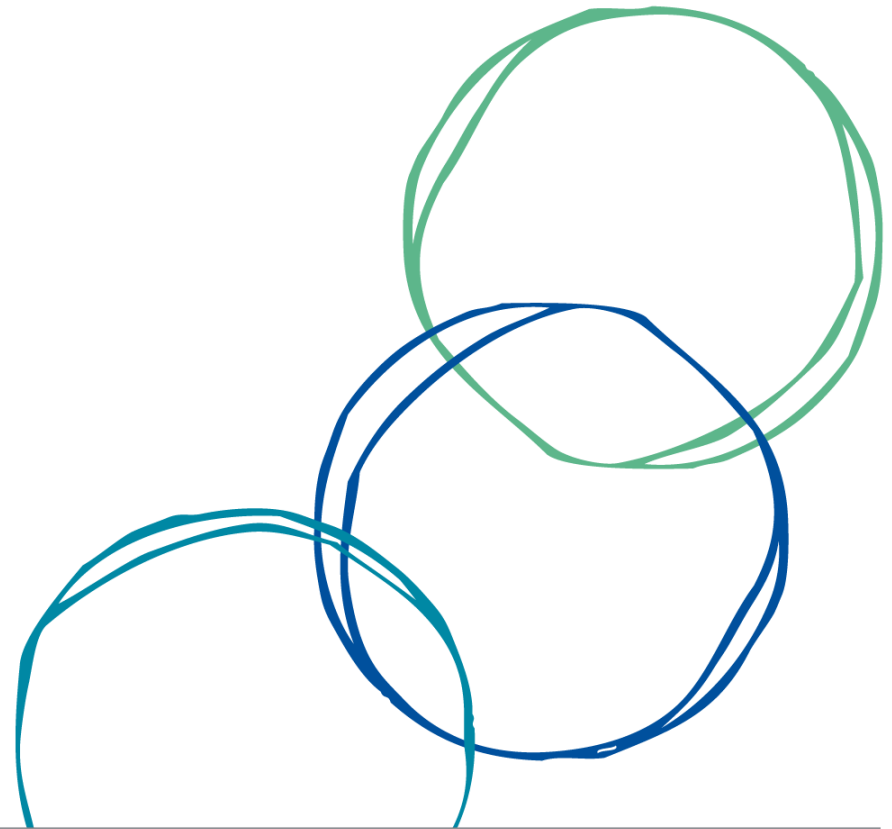


LOW CARBON LIVING  
CRC

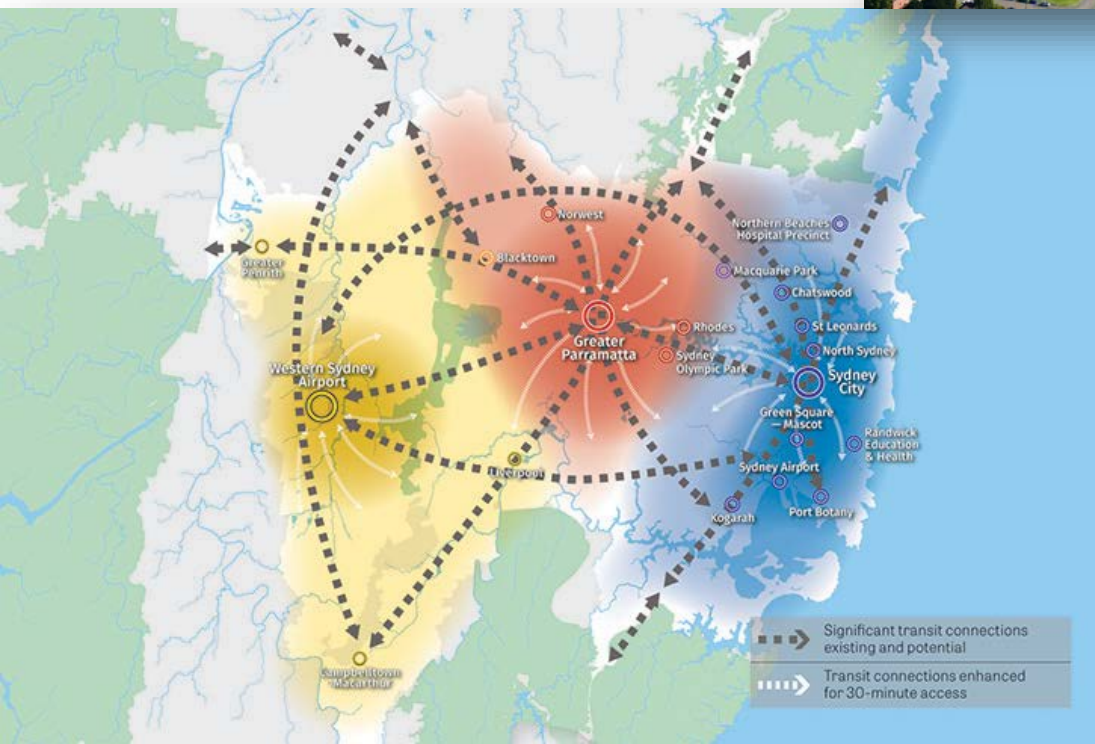
Sydney  
**WATER**



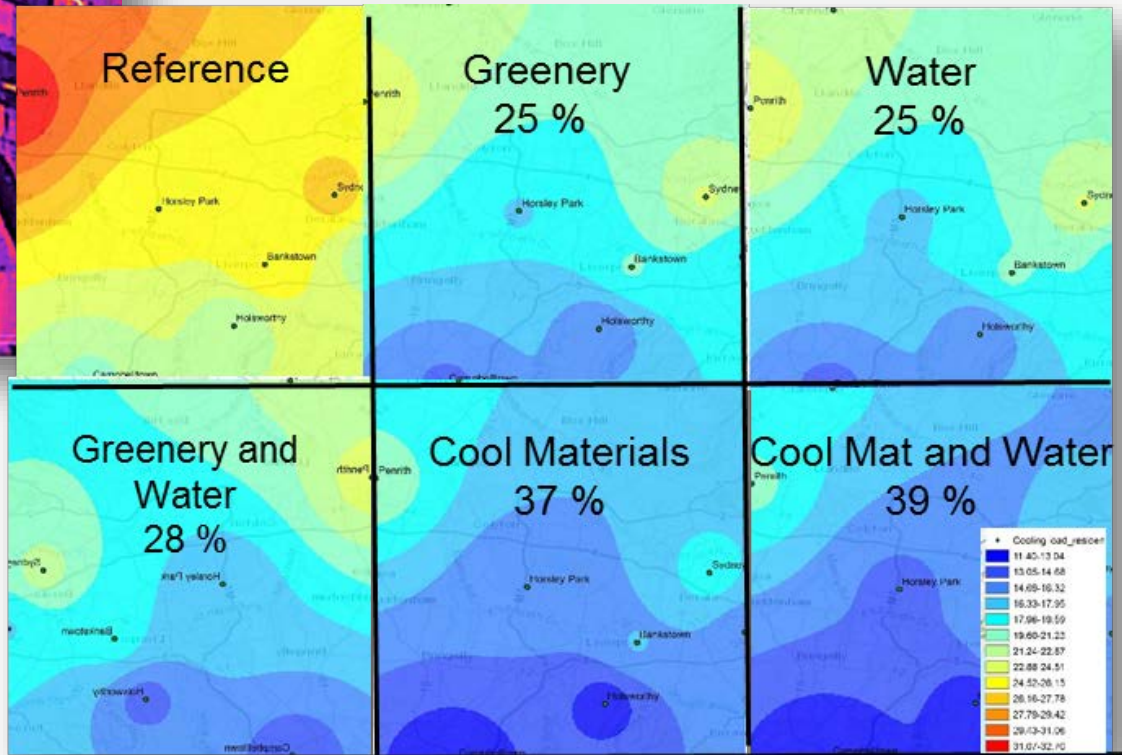
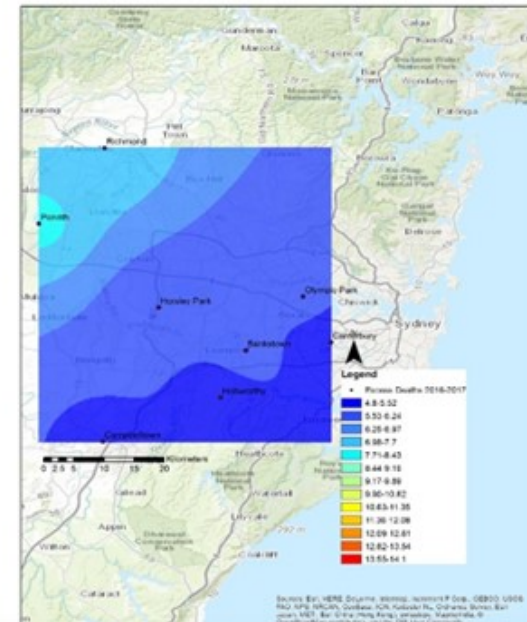
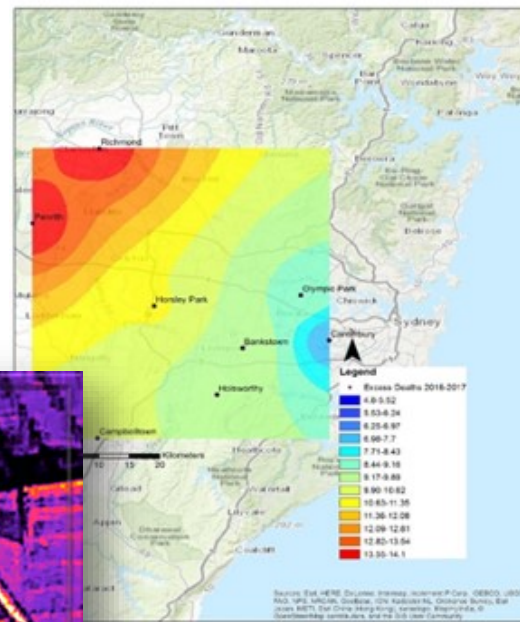
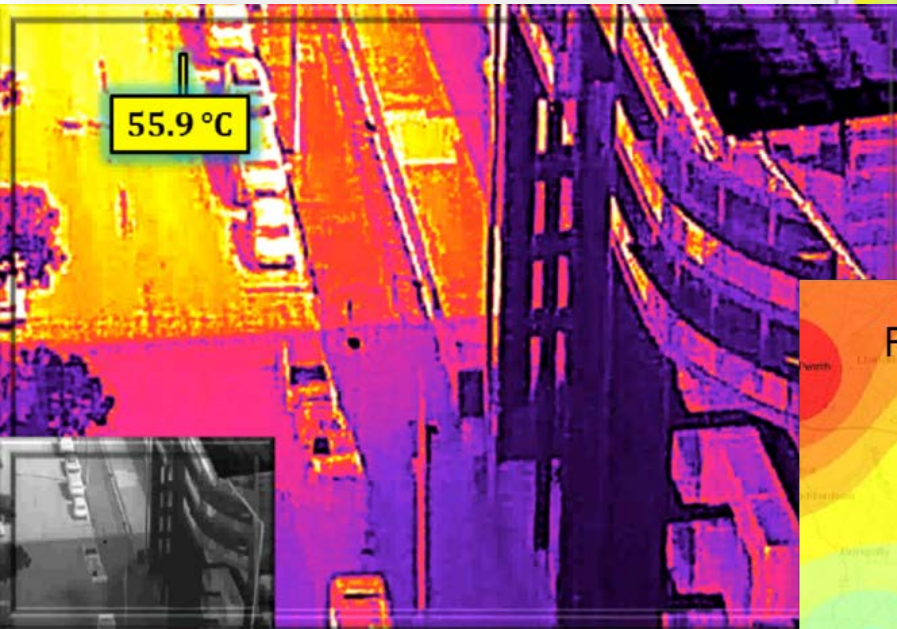
**UNSW**  
SYDNEY



# Cooling Western Sydney



# Cooling Western Sydney





# Participants in Validating and Improving the BASIX Energy Assessment Tool for Low Carbon Dwellings



LOW CARBON LIVING  
CRC



Planning &  
Environment



Office of  
Environment  
& Heritage



UNSW  
AUSTRALIA

CITY OF SYDNEY 

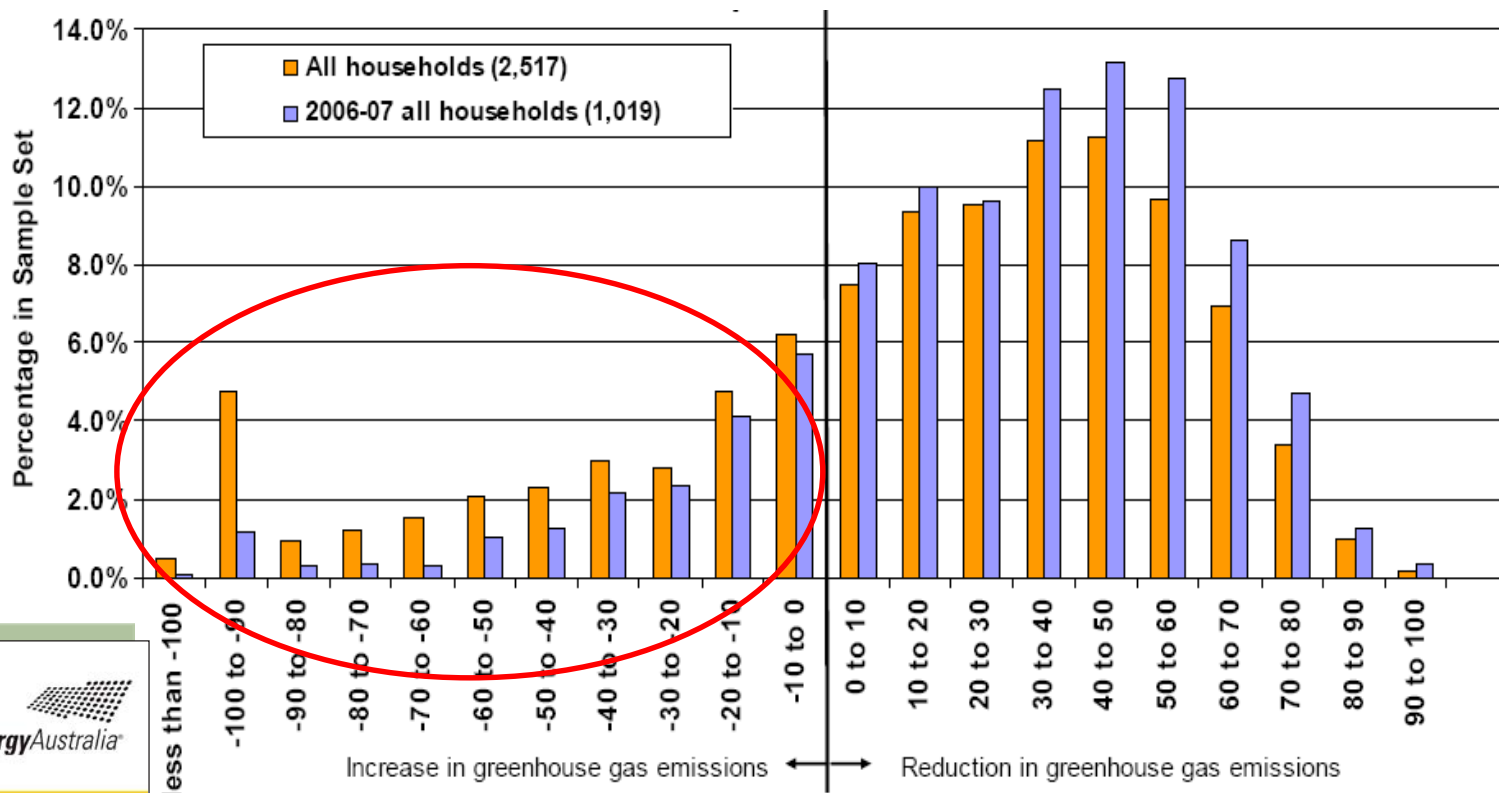


Australian Government

Department of the Environment and Energy



# BASIX Monitoring Program – previous work with energy utilities



Ranges of percentage reduction in greenhouse gas emissions compared to benchmark

EnergyAustralia

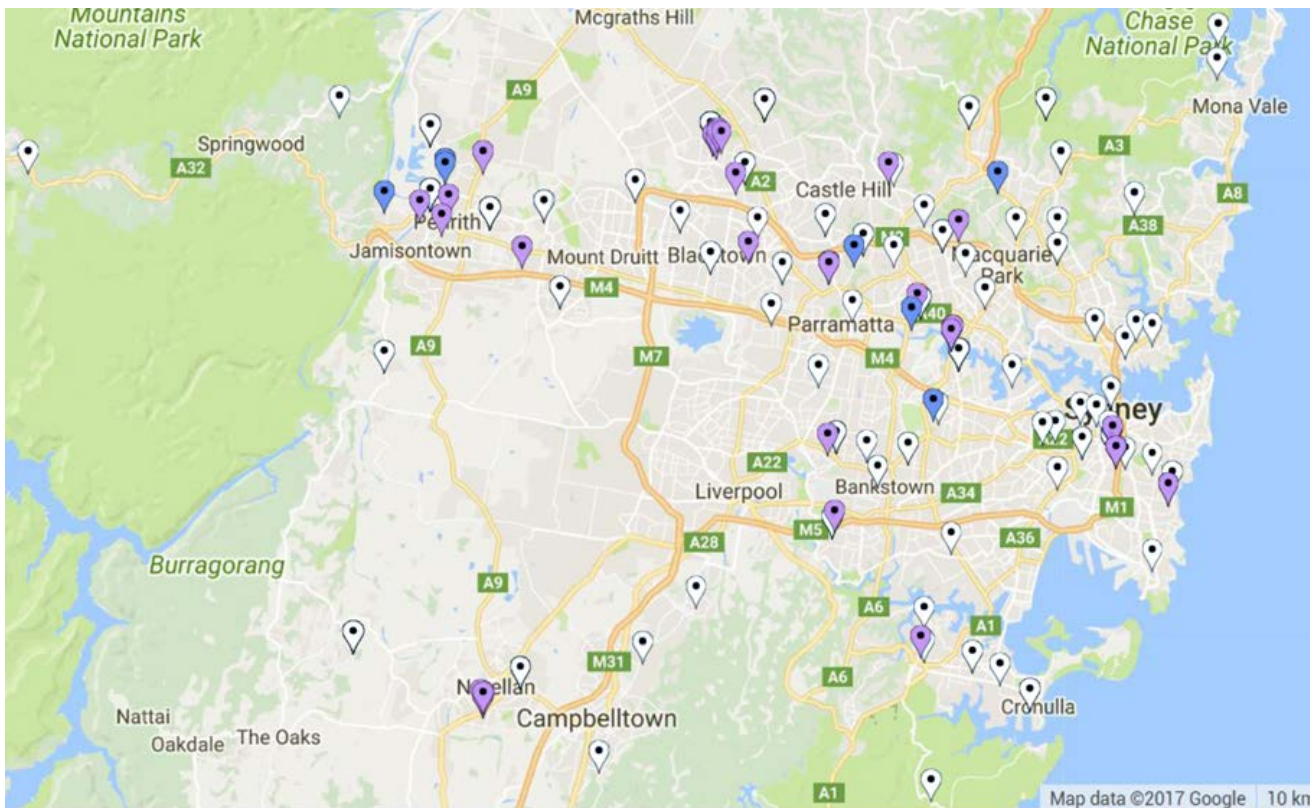
BASIX Monitoring Report  
Electricity Consumption for 2007-08 and 2008-09

June 2010

Prepared by EnergyAustralia for the NSW Department of Planning  
as part of the BASIX Energy Monitoring Project

## Project Phase 1

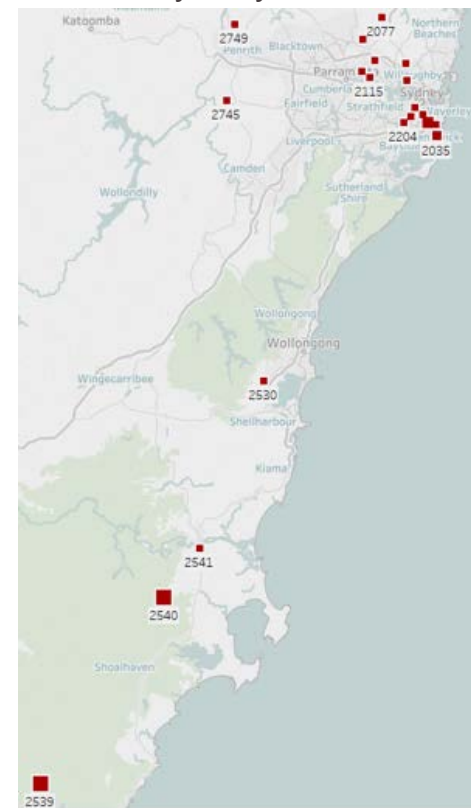
BASIX Affected Dwellings, Greater Sydney Area



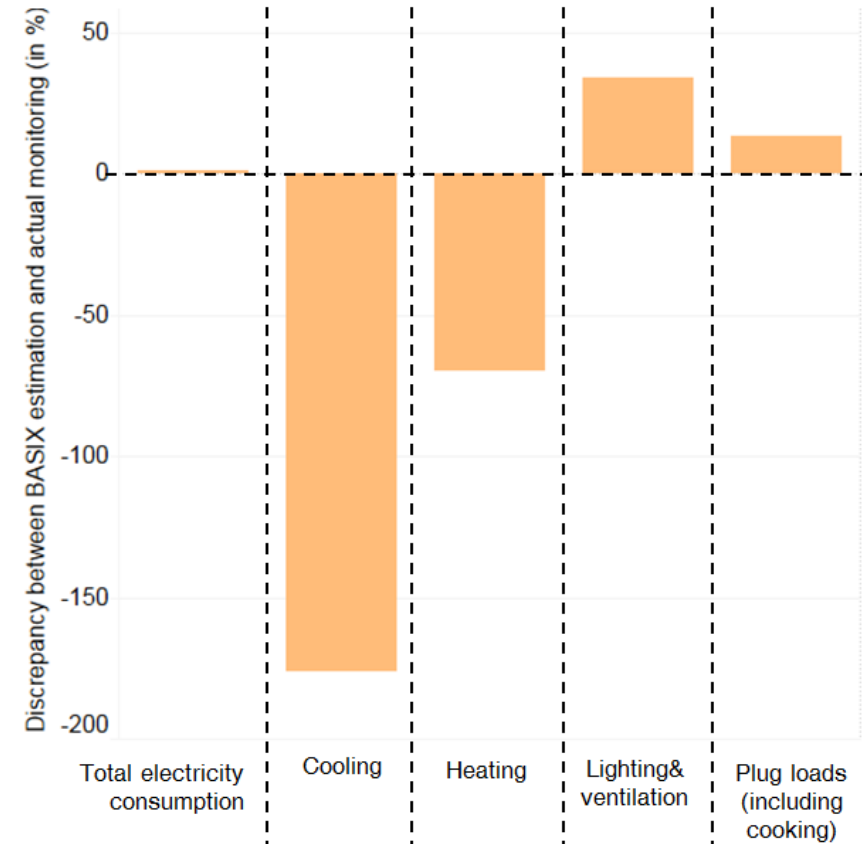
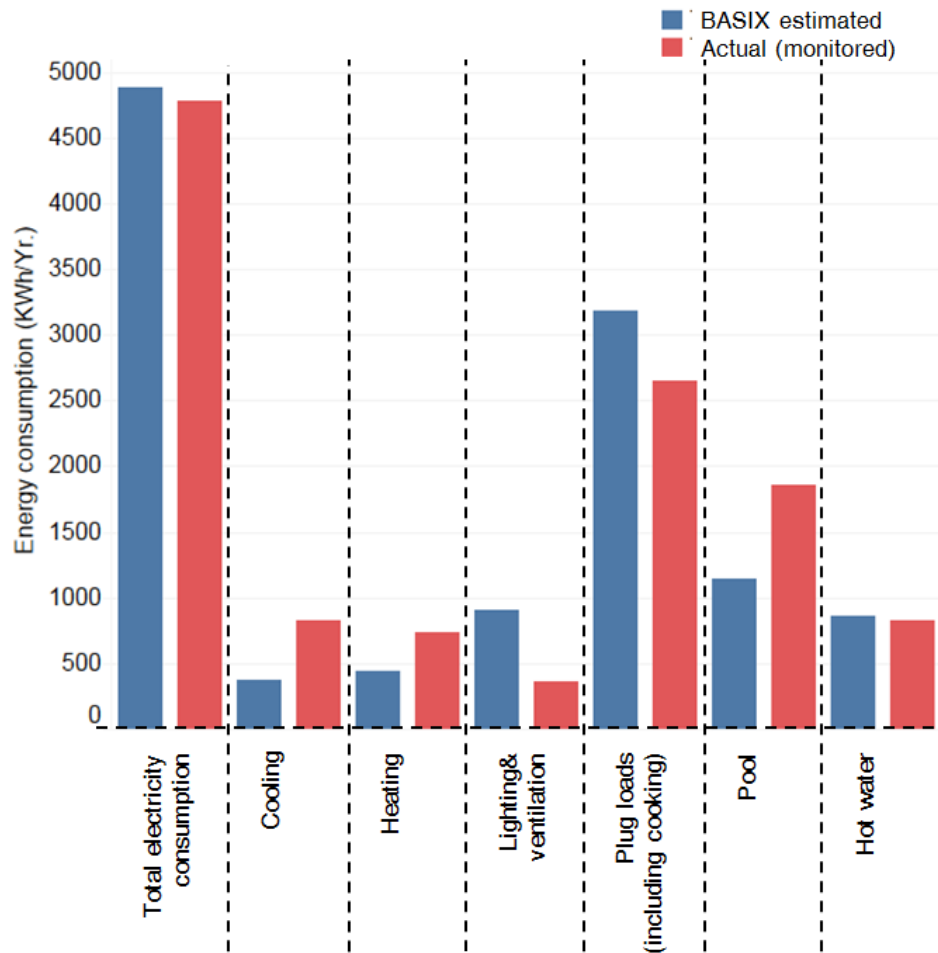
## Project Phase 2

Pre-BASIX dwellings & BASIX affected dwellings

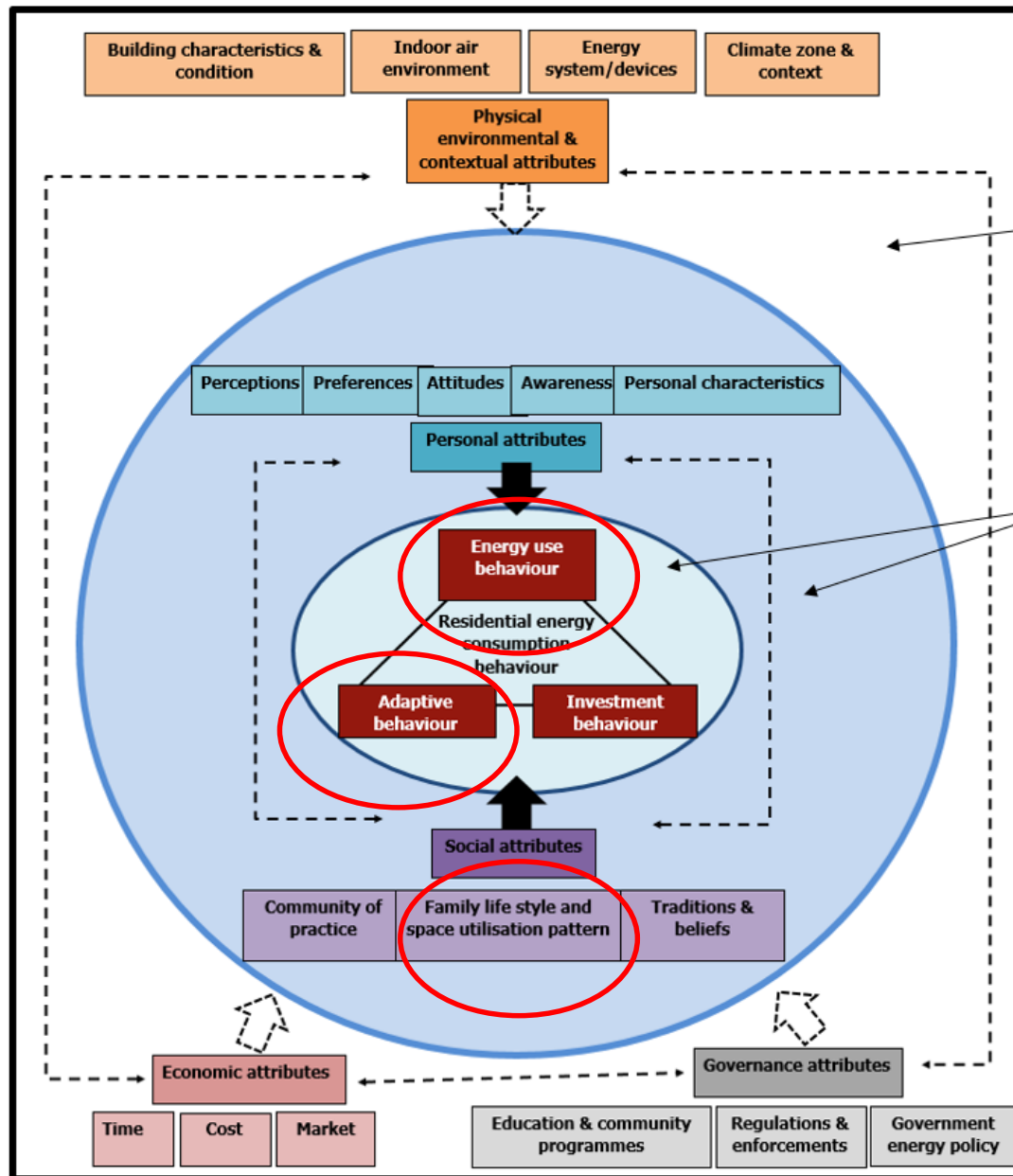
Greater Sydney & Shoalhaven



# Comparison of Energy Use between BASIX Estimation and Monitored Performance

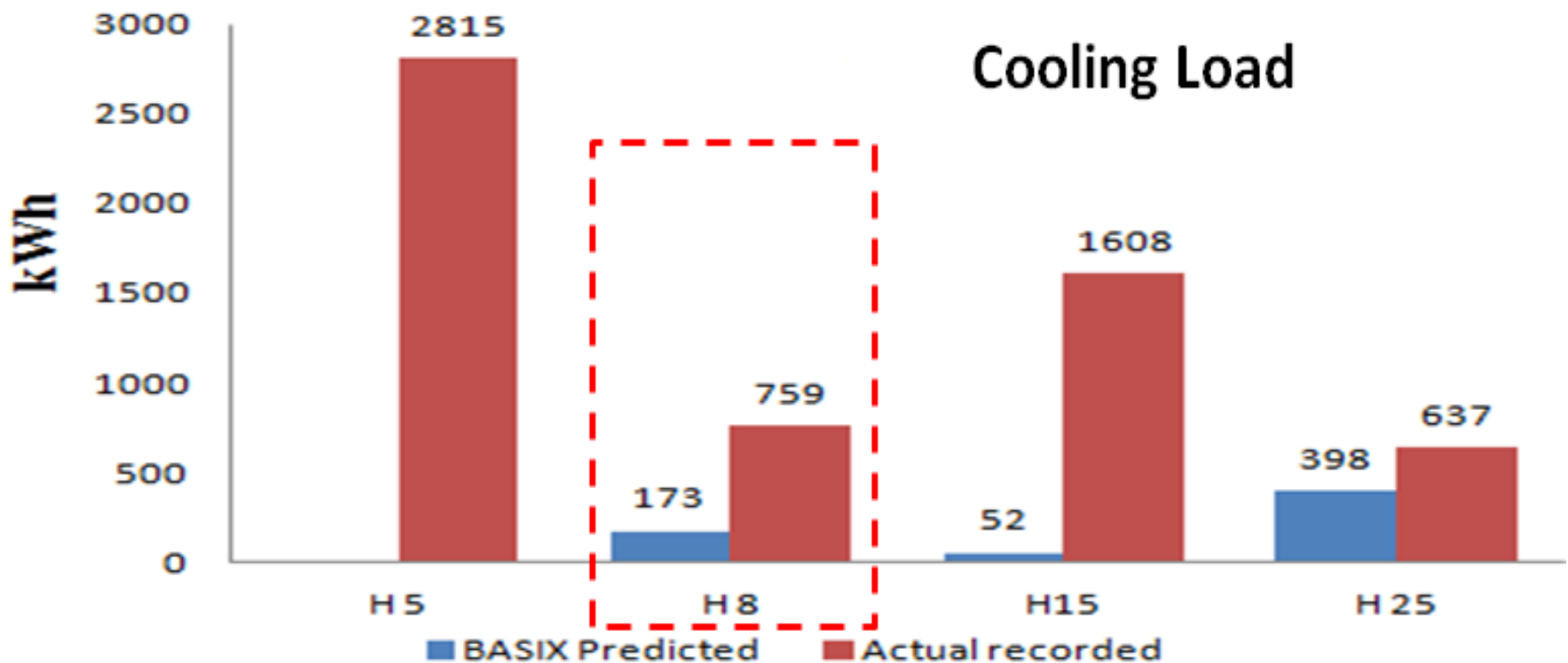


# Household Behaviour Analysis



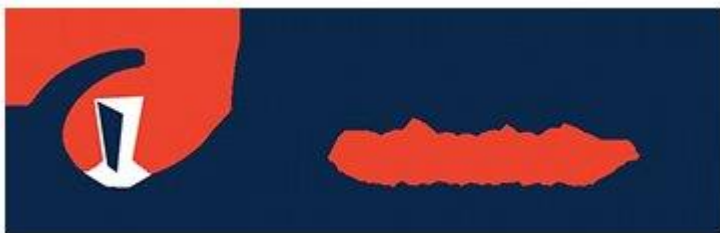
## Example: House ID #8

Dwelling ID	Number of occupants	Children	Elderly over 65	Home office	Single/double storied	Total floor area (m <sup>2</sup> )	Orientation	BASIX estimate kWh/yr.	Actual energy consumption kWh/yr.
8	4	2	0	yes	single	148	West facing Living: South	6603.83	7613





# Mainstreaming low carbon retrofits in social housing



# NSW Home Energy Action Plan

## HOME POWER SAVINGS PROGRAM DELIVERED

The **Home Power Savings Program** has delivered market leading support to **225,000** NSW low income households, helping them to reduce energy use and **spend less money** on their power bills.



**225,000**  
**LOW INCOME**  
**NSW HOMES**  
enjoying benefits

**59%**  
of participants live in  
**REGIONAL**  
**NSW** LOCAL  
GOVERNMENT AREAS

**30,000**  
**HOMES**  
where English is a  
second language

DELIVERING BILL SAVINGS OF  
**36 Million**  
EACH YEAR



**10%**  
**LESS POWER**  
**USE EVERY YEAR**  
and often more

Community support  
Over **200**  
**+ 100**  
LOCAL COMMUNITY CENTRES  
CENTRELINK OFFICES

**533** kWh/household  
**LESS POWER**  
EVERY YEAR

It all adds up

**120,000**  
**MEGAWATT**  
HOURS PER YEAR

**THOUSANDS**  
**OF HAPPY**  
**CLIENTS**

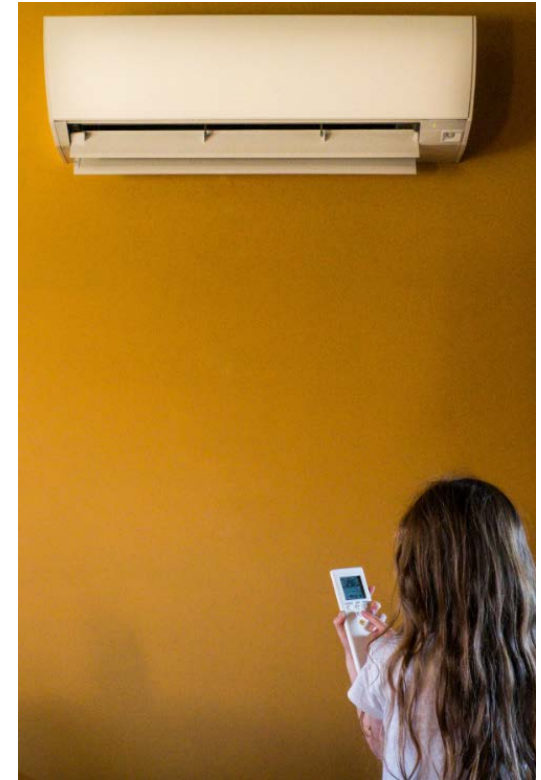
"When we leave the house each morning, the kids now switch off the TV and the power point – even my 3 year old does it".  
Rita, Liverpool

**DRIVING DOWN**  
THE COST OF LIVING

- It assists vulnerable households to access high-cost, high-return energy efficient appliances and home improvements
- HEAP works in partnership with community housing providers

# Mainstreaming Low Carbon Retrofits in Social Housing

- Provision of hard evidence for the evaluation of interventions
- New decision-support resources and tools for potential partners
- Evidence on health and other co-benefits of energy efficiency upgrades will enhance the net community benefit
- Reduced burden on government for social and health services with improved low income household wellbeing.





## Participants in Driving a National Social Media Conversation on Energy Efficient Housing (Build 4Life)



### A big idea built on solid ground

build4life is a big idea developed by leading Australian corporations, government bodies and specialist organisations with a specific interest in encouraging Australians to build better, healthier, more environmentally sustainable homes.

- Office of Environment and Heritage NSW
- CRC Low Carbon Living
- CSIRO
- KPMG
- Bluescope Steel
- Brookfield Multiplex
- Collabforge
- CSR Building Products
- Frasers Property Australia
- Green Building Council of Australia
- Lendlease
- Nine Entertainment Co.
- The Shannon Company

Any business that becomes a part of build4life will be part of something big – national, well planned, well organised and focused on success.

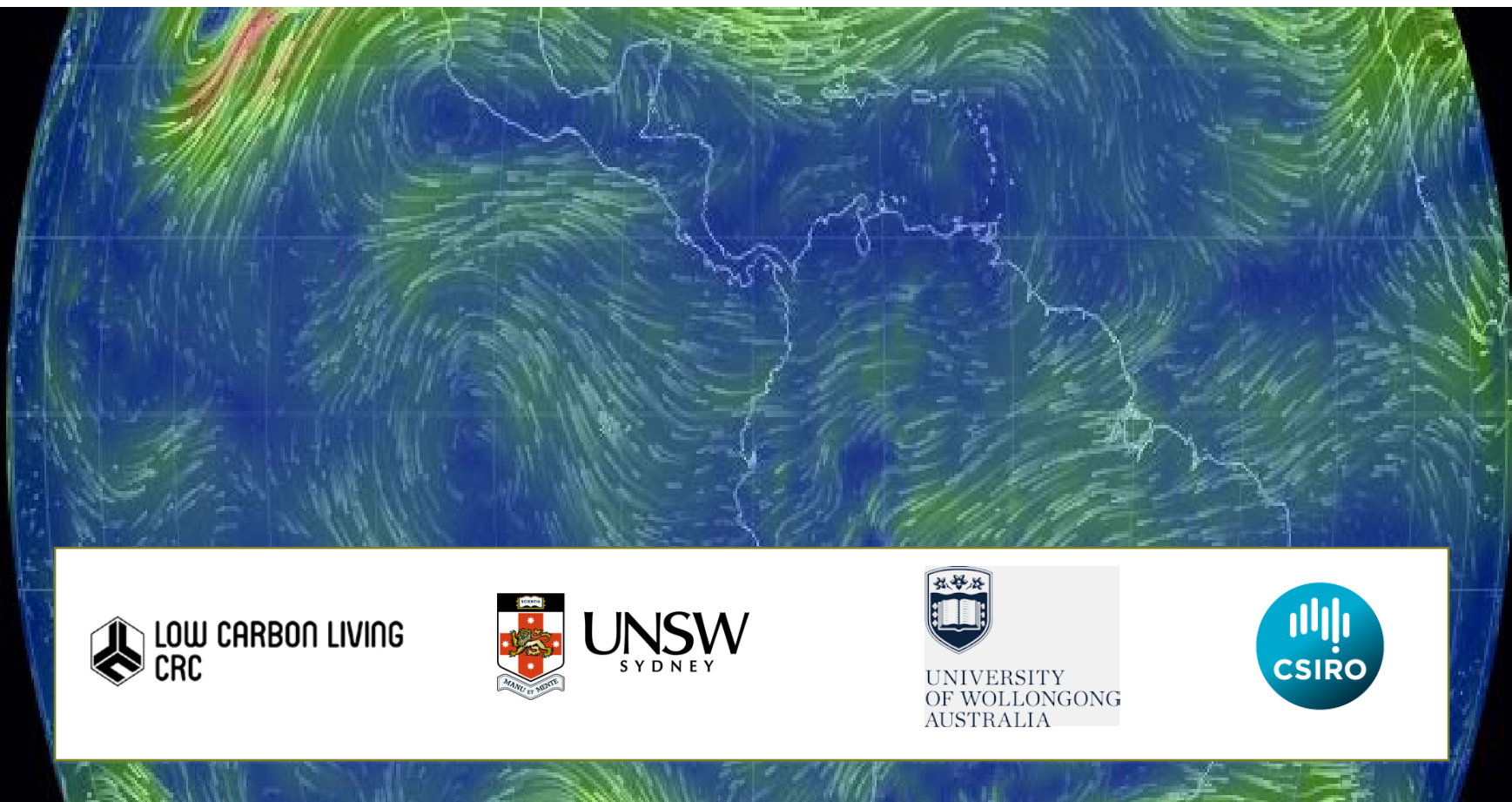
# Driving a National Social Media Conversation on Energy Efficient Housing



## Build4life Newcastle pilot



## Energy Efficiency Decision Making Node – the first node of the Energy Efficiency Research Hub



LOW CARBON LIVING  
CRC



UNSW  
SYDNEY



UNIVERSITY  
OF WOLLONGONG  
AUSTRALIA



# Energy Efficiency Decision Making Node

- **Project 1:** Estimating potential responses to Government interventions for zero-emission vehicles amongst vehicle suppliers and fleet managers
- **Project 2:** Energy Efficiency Decision Making in the NSW Social Housing Sector



## NSW Government partnering with the Low Carbon Living CRC





# A life cycle approach to lowering carbon in the built environment: a European case study

Dr. Sven Lundie

University of Hamburg, School of Business, Economics and Social Science  
UNSW Sydney, School of Civil and Environmental Engineering  
DFH – Deutsche Fertighaus Holding, Innovation and Sustainability



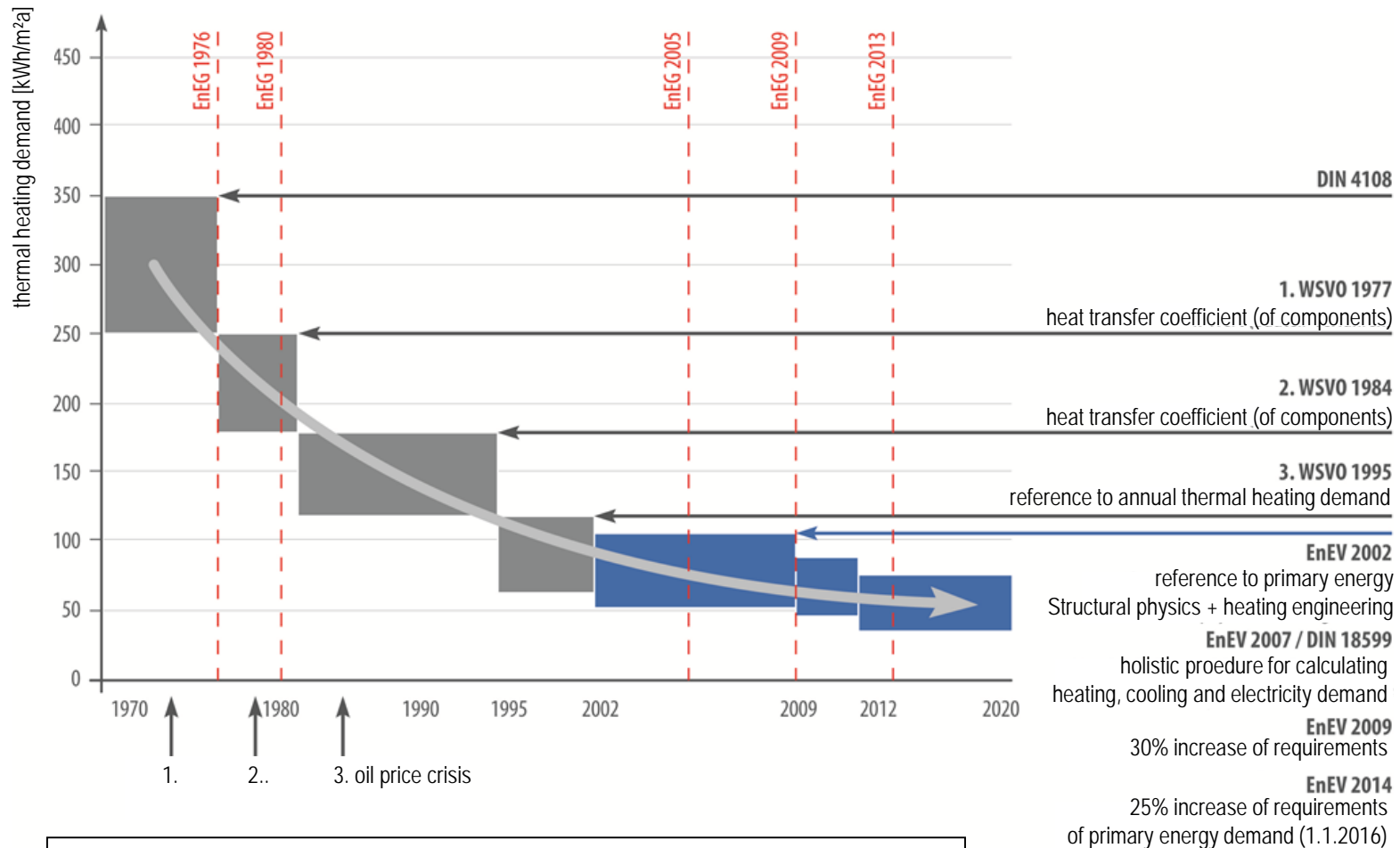
# Agenda

- **Energy laws**
- Sustainability Initiatives
- A business case – Deutsche Fertighaus Holding
- Conclusions

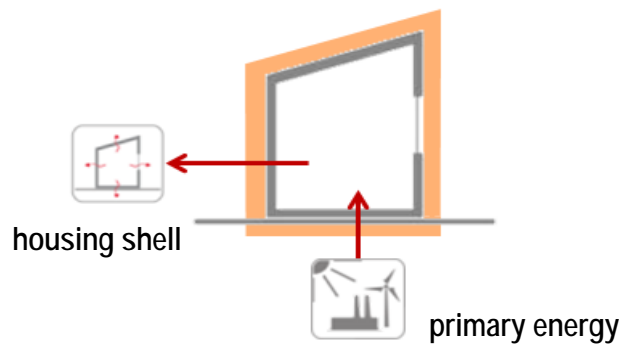




# Development of Annual Thermal Heating Demand



**How far can we actually go with reducing the demand?  
Is this the right focus?**



**There is a clear shift from consumer to ´prosumer´**



# Agenda

- Energy laws
- **Sustainability Initiatives**
- A business case - Deutsche Fertighaus Holding
- Conclusions



# Promising Initiatives in the building and construction sector



...

# DGNB –German Sustainable Building Council

- DGNB offers various **benchmarks** and **criteria for sustainability**, such as
  - different **types of usage** (living, office, hotel, industrial usage, ...)
  - **life cycle approach**, including planing, building, use and after use
  - **regional characteristics**
- DGNB system is **performance-oriented** with a focus on humans & environment in 6 dimensions, i.e.
  - Environmental, economic and socio-cultural and functional quality
  - Technical, process and site quality
- **Facts** about the DGNB
  - >2.100 DGNB certified houses globally
  - ~2.700 experts globally
  - ~1.200 member organisations





# DGNB –German Sustainable Building Council

- DGNB is currently developing an **update of the assessment criteria** with a new, intensified focus on

- the **human being**
- **circular economy**
- **aesthetics and cultural aspects**
- **EU conformity**
- **Innovation**



- DGNB is aligning with the **UN Sustainable Development Goals** with the objective of

- Linking with a globally accepted framework
- supporting SDGs with certified buildings and
- promoting climate protection



- **Shortcomings**

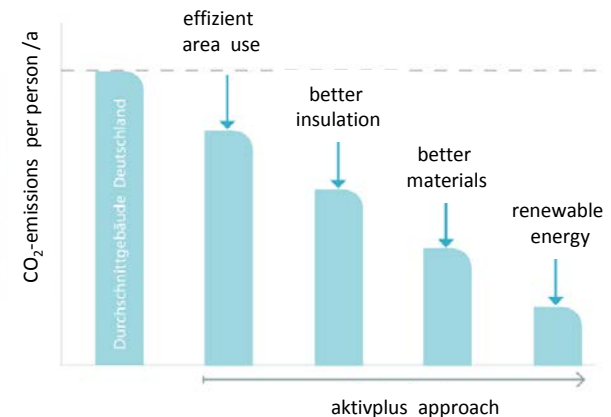
- DGNB is currently not really performance-oriented
- energy efficiency & climate issues are not addressed in an effective manner



as part of the **global active plus alliance**

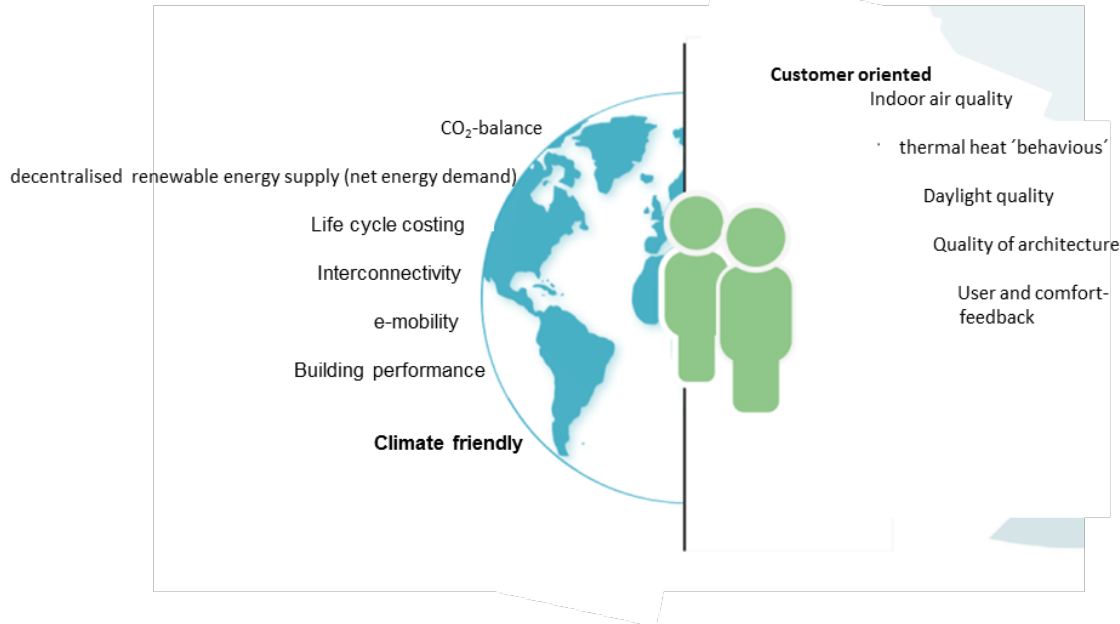
- **aktivplus** is a non-for profit initiative established by **planers** and **scientists** to **facilitate climate-neutral** and **convenient buildings** under special consideration of **CO<sub>2</sub>** and **Life Cycle Assessment** – in line with carbon reduction target of 80% by 2050
- The **aktivplus standard** is open for any technology and product that supports its objectives
- The **energy and carbon balance** consider
  - construction materials
  - thermal and electrical heating
  - household electricity demand
  - drinking water
  - renewable energy generation
  - End of Life

➔ the **entire life cycle**

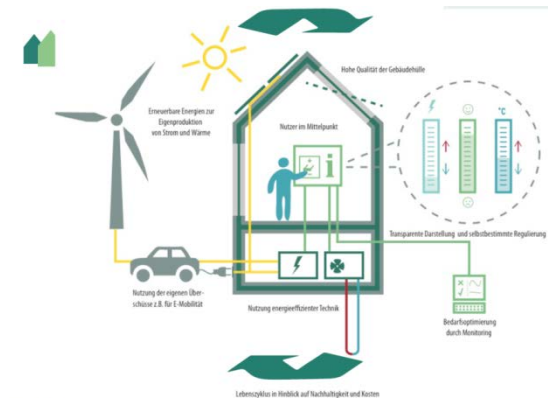




## additional benefits and principles



**aktivplus pays particular attention to the 2° C target, monitoring and facilitating innovation**





# Agenda

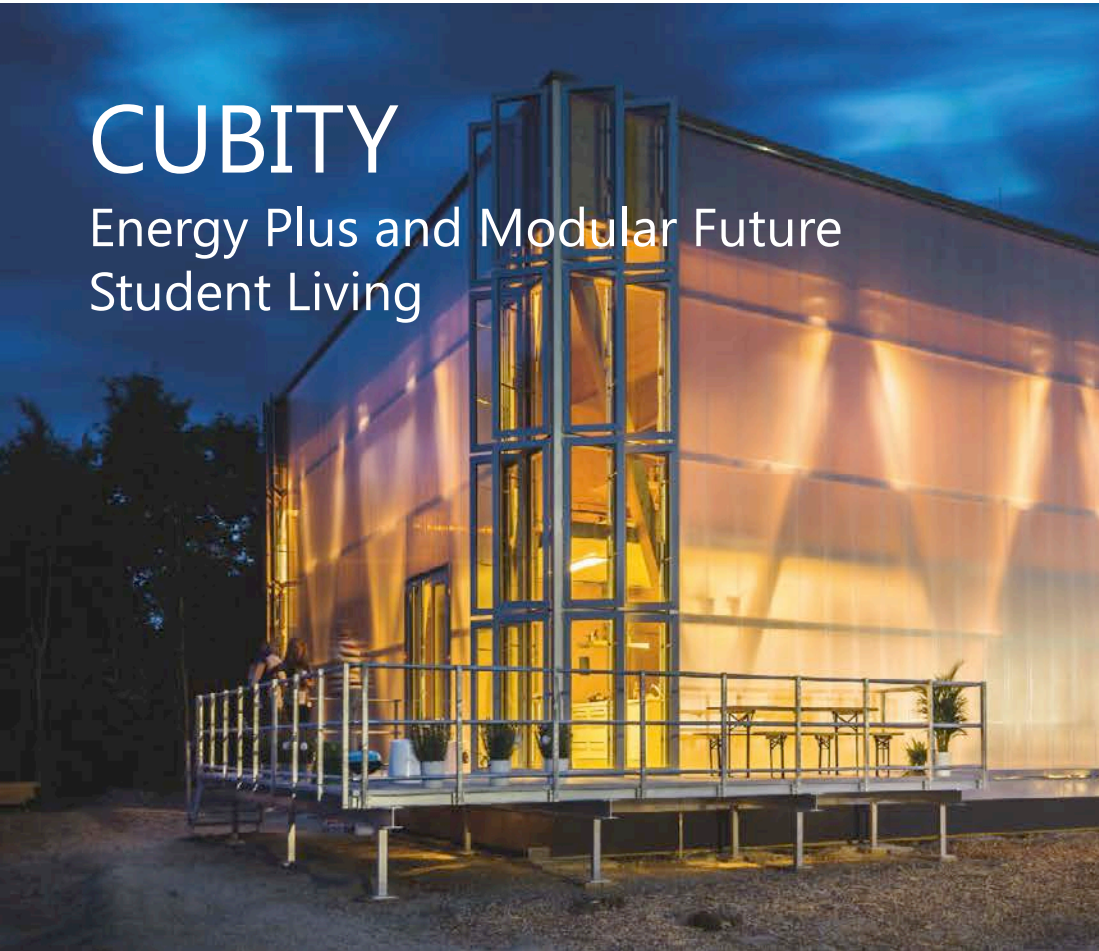
- Energy laws
- Sustainability Initiatives
- **A business case - Deutsche Fertighaus Holding**
- Conclusions



# Who is actually the DFH?

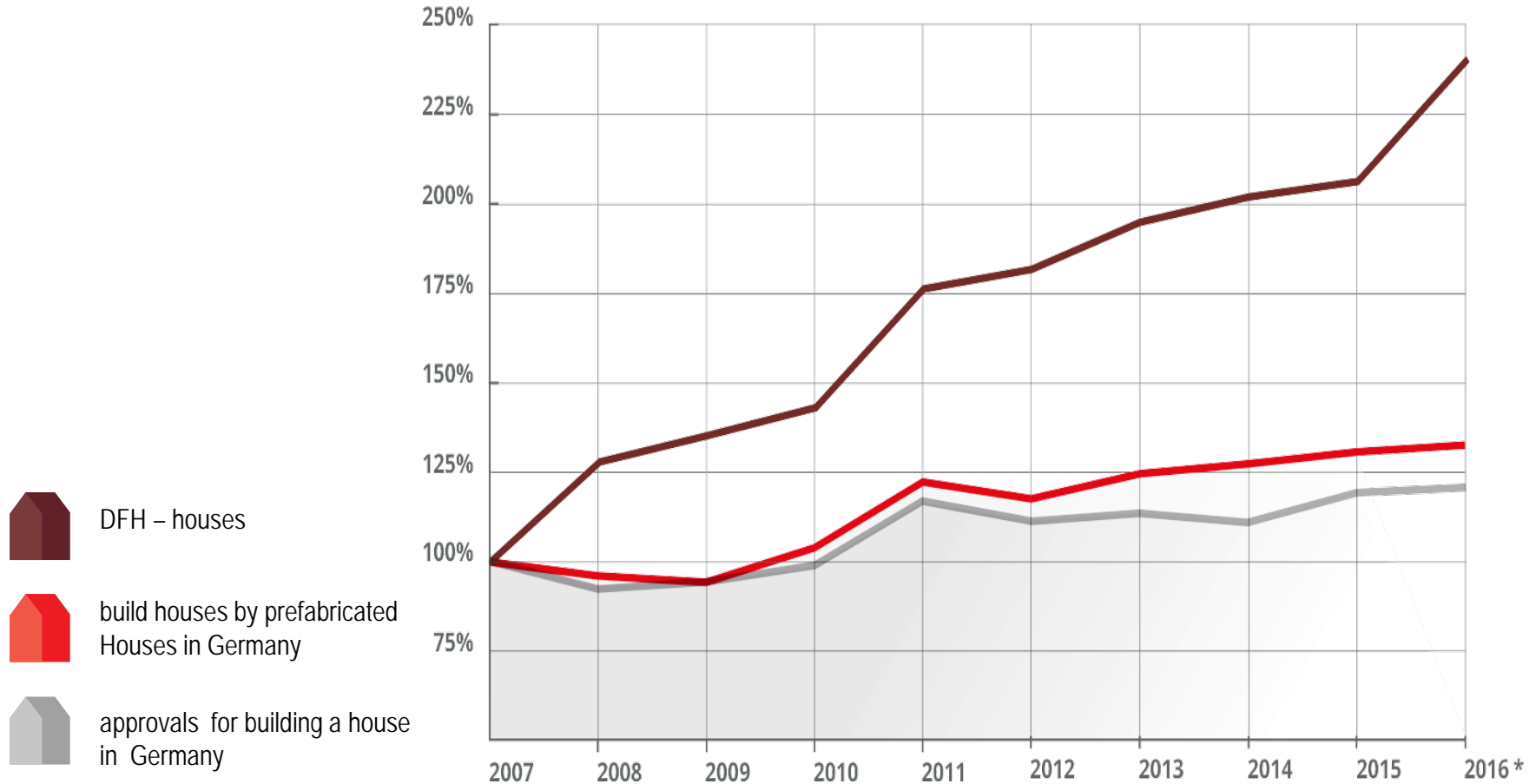
## CUBITY

Energy Plus and Modular Future  
Student Living





## DFH history – strong growth in comparison with the sector





## Four strong brands

**massahaus.**  
Entdecke dich neu ■■

**allkauf**   
DAS HAUS ZUM LEBEN.

**OKAL**  
zuhaus MIT  
SYSTEM

**MEIN  
STEIN  
HAUS**   
Massive Qualität.

Ausbauhaus mit Eigenleistung

Ausbauhaus mit Ausbaupaketen

Schlüsselfertiges Bauen

Fertighaus in Massivbauweise





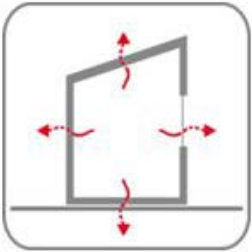
# Sustainability at DFH

- we are focussing on the **value to our customers**
- therefore we have been pushing the certifications **DGNB scheme**
  - 2016: 675 DFH houses certified
  - 2017: 656 (by 14 Nov 2017)
  - 2018: >1.000 (forecast)
  - DGNB certificates: 54% platinum and 46 gold (in 2016)
- In the future we will **broaden our activities** by
  - automated **LCA** and **LCC of every DFH house** based on financial input data
  - focussing on additional **customer issues**, such as **healthy living**, *and*
  - alignment of our **products** with the **2° degree target** by
    - applying suitable Science-Based Target Methods (SBTM, e.g. CBCM or C-Fact) to quantify the remaining carbon budget on a
      - national / sectoral level
      - company level and
      - DFH product level (= houses)



# How to build and operate houses that are in line with the 2° target?

- **Energy saving laws** build the **basis** (Energieeinsparverordnung) plus ..



- **better insulation** – including mandatory triple glazing?



**and/or**

- more efficient home automation (heating, ventilation and air conditioning)?

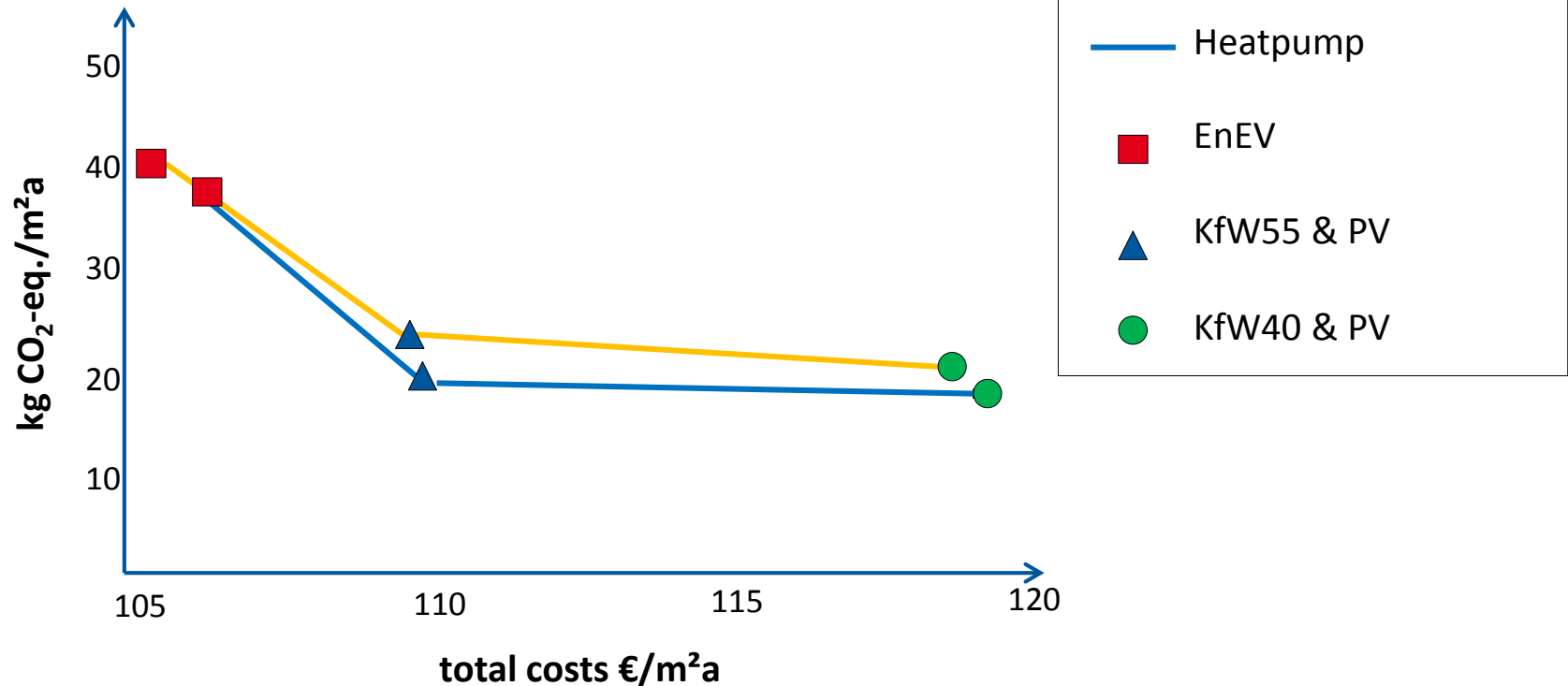


**and/or**

- generation and use of decentralised renewable energies?



# What is the optimum to whom?



**Our approach:** From minimizing energy losses → to the **optimal combination** of minimizing energy losses and producing renewable energy decentralised at reasonable costs



# Trends in the private building sector – one example



**PV<sub>peak</sub>/energy production**

**Battery capacity**

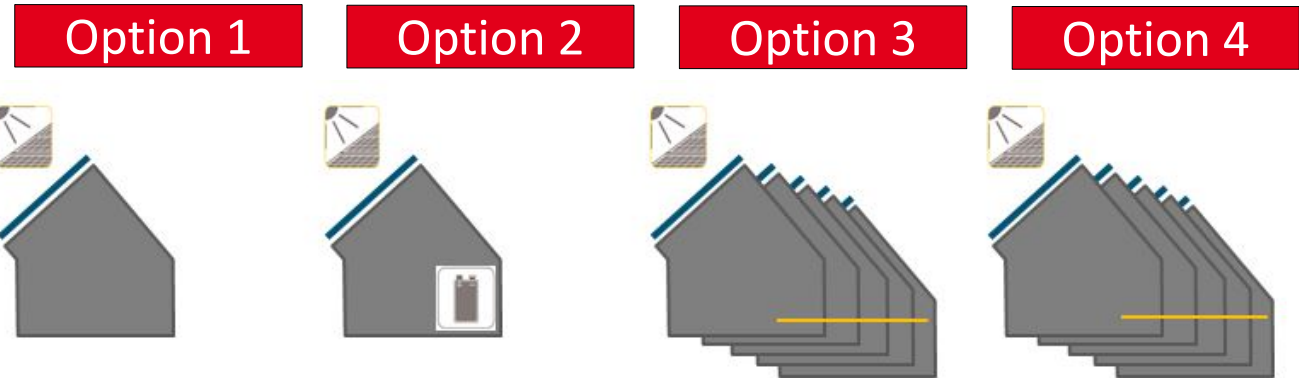
**Use of decentralised  
produced electricity**

**Solar capacity factor**

**Electricity demand**

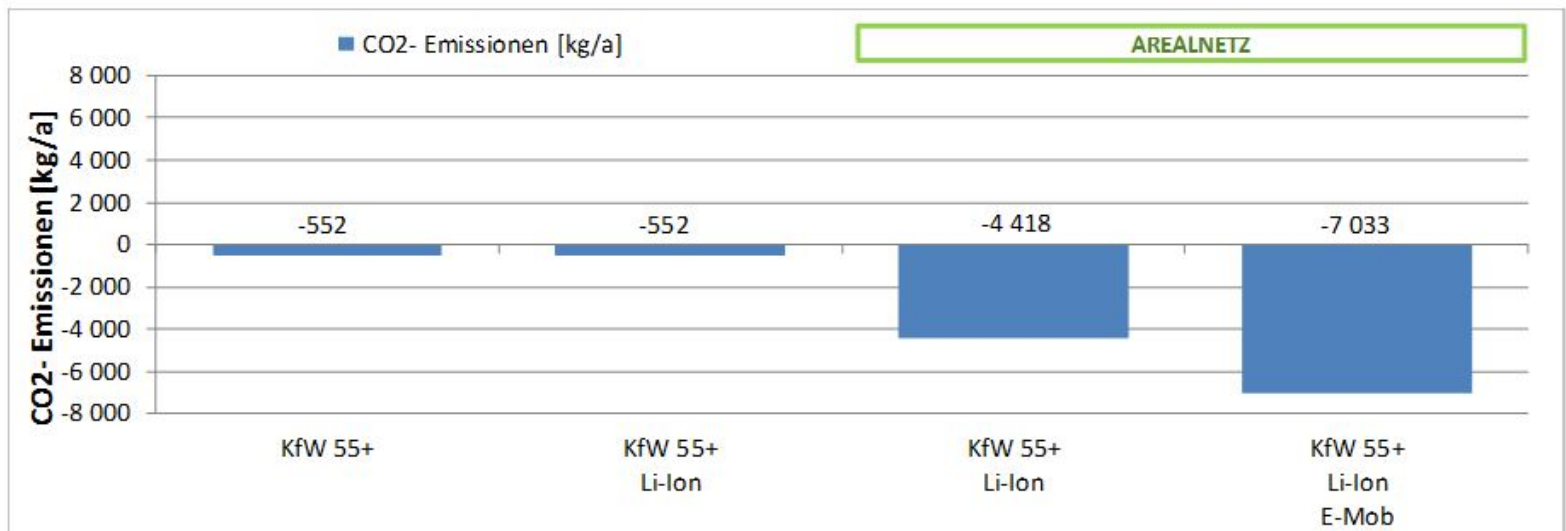
**Annual energy balance**

# CO<sub>2</sub> Balance



## Mobility

- 11.500km per household
- Consumption 6l/100km or 18kWh/100km





## Specific conclusions on the example

### ■ Environmental assessment

- All options have a **positive annual energy balance** (house and mobility)
- The solar capacity factor ranges from 40 - >55%
- PV makes every option **CO<sub>2</sub> neutral/positive**
- **Connecting several houses** (electricity cluster) and **e-mobility optimizes** the energy and carbon **performance** significantly

### ■ Economic assessment

- **Connected houses with a central battery and e-mobility** (option 4) is currently **not viable**, i.e. the owner needs to pay more for these solutions

### ■ Legal/organisational aspects need to be sorted out in the case of connected homes (options 3&4), e.g.

- Special **approval** is **required** from the council and the energy provider
- A **business** needs to be **established** in order buy and sell power to the electricity provider



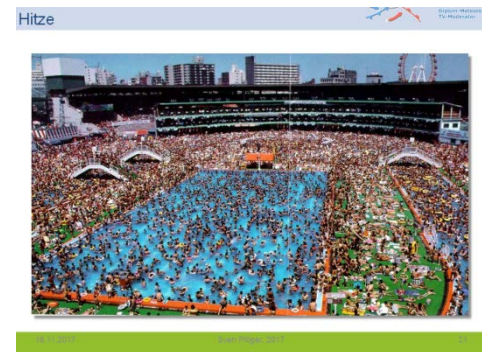
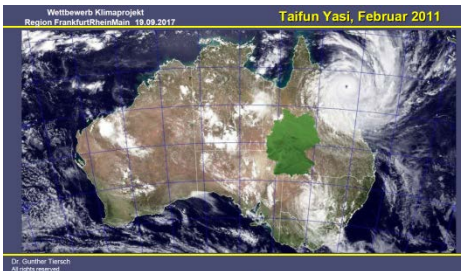
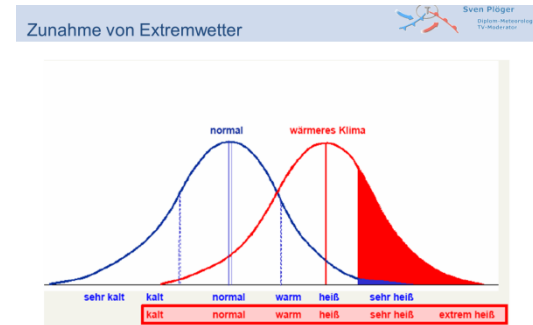
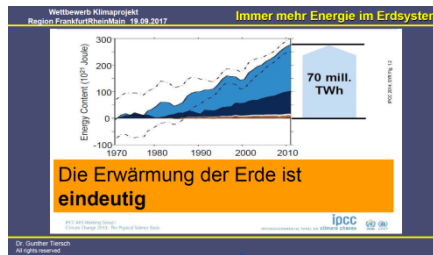
## General conclusions

- There will be a **shift** from **energy to carbon accounting**
- It is possible to **reduce the carbon impact** of new houses to a level that is **in line with the 2°C target** (but most of the buildings exist already)
- In the future there will be a shift
  - towards the **optimum** of
    - renewable energy decentralised produced,
    - energy efficiency and
    - Costs
  - **Energy clusters**
- **Monitoring is most important** – we need to provide evidence
- The **feed in tariff** is a crucial parameter for the economic viability
- Don't wait for legislation
- The solution has to be **attractive** (emotions!) and well thought through from an economic and environmental point of view



# Backup

# Climate Change (better title needed)

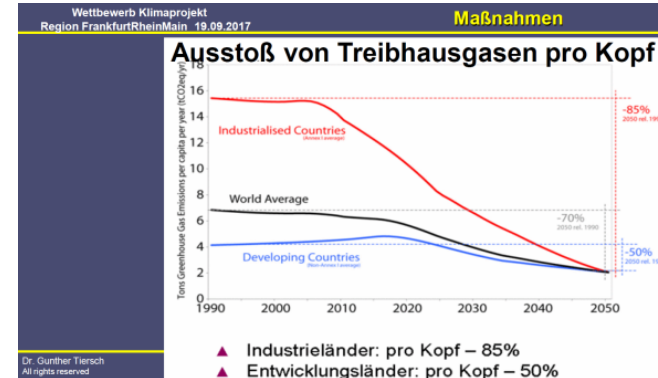


We still have got the choice, haven't we?



# Call for action (?)

- Carbon targets by 2050
  - Global
  - EU
  - Germany (baseline 1990)
    - by 2020 XX% <
    - by 2030
    - by 2050
- How? Tackling
  - Power supply side
    - away from **coal**
    - Towards **renewables** (and nuclear ??)
  - Demand side
    - Climate-neutral housing (currently 40% of the total energy demand)
    - Mobility (from combustion to e-/hydrogen mobility)
    - .... (UBA-Studie)



Buildings account for 36% of the energy consumption in the European Union. The sector is responsible for 36% of energy consumption and 36% of greenhouse gas emissions. Together with other sectors, the buildings sector must reduce the Union's greenhouse gas emissions. The Union would allow the United Nations Framework Convention on Climate Change (UNFCCC), and the Paris Agreement to maintain the global temperature rise to 1.5°C by 2100. The event of an increase in energy consumption and renewable sources, promoting security and in creating a sustainable development, in

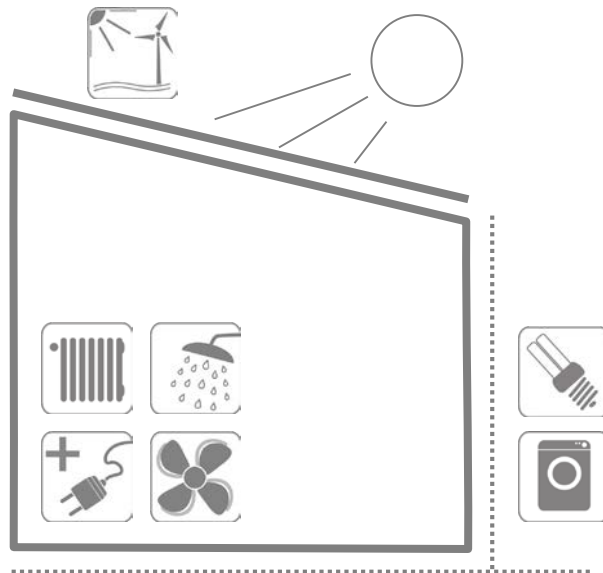


- Sources: to be checked
  - DGNB Handbook
  - UBA report
  - AktivPlus Handbuch

# Gebäudeenergiestandard

## Neubau EnEV 2016

### Bilanzraum



**Gebäudeenergiebedarf  
nach EnEV  
ohne Nutzerstrom!**

### Legende

-  Raumwärme
-  Warmwasser
-  Hilfsenergie
-  Lüftung
-  Beleuchtung
-  Haushaltsstrom
-  Erneuerbare Energie

### Anforderung

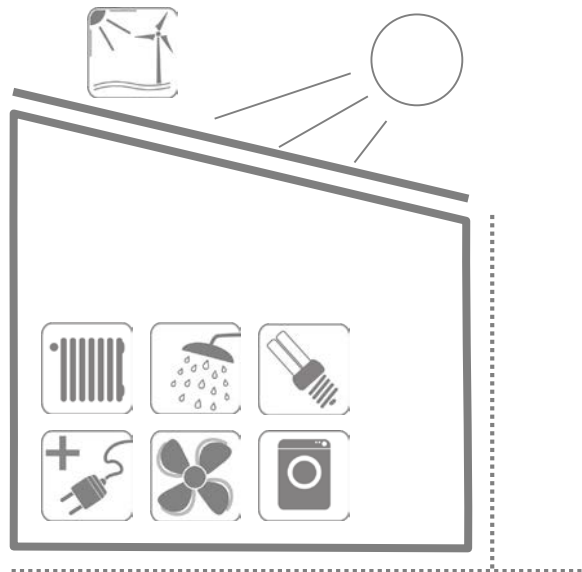
**Neubau nach EnEV 2014 (mit Verschärfung ab 01.01.2016)**

**Jahres-Primärenergiebedarf und HT<sup>+</sup>  
des Referenzgebäudes werden eingehalten.**

# Gebäudeenergiestandard

## Effizienzhaus Plus nach BMUB

Bilanzraum



Gebäudeenergiebedarf  
nach EnEV  
+ Nutzerstrom

Legende

-  Raumwärme
-  Warmwasser
-  Hilfsenergie
-  Lüftung
-  Beleuchtung
-  Haushaltsstrom
-  Erneuerbare Energie

Anforderung

Effizienzhaus Plus

End- und Primärenergiebedarf

< 0

## Pecha Kucha

Adriana Sanchez Gomez, University of NSW

Aaron Davis, University of South Australia

Catherine Kain, University of South Australia

Carlos Bartesaghi Koc, University of NSW

Christine Eon, Curtin University

Robert Enker, Curtin University



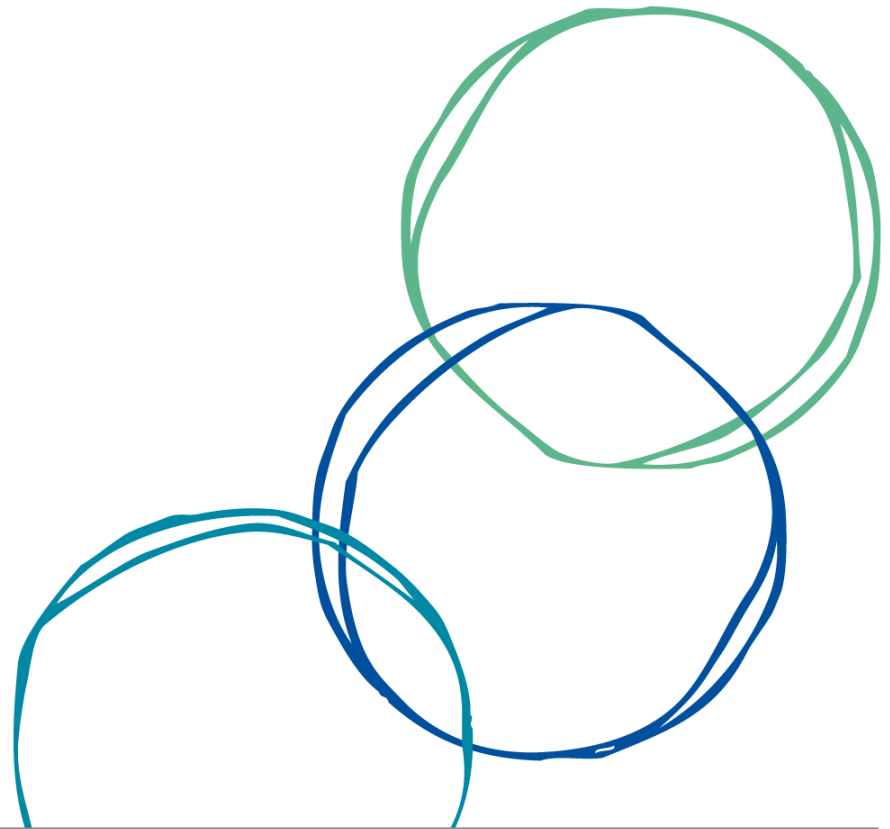
# Long-term Urban Resilience



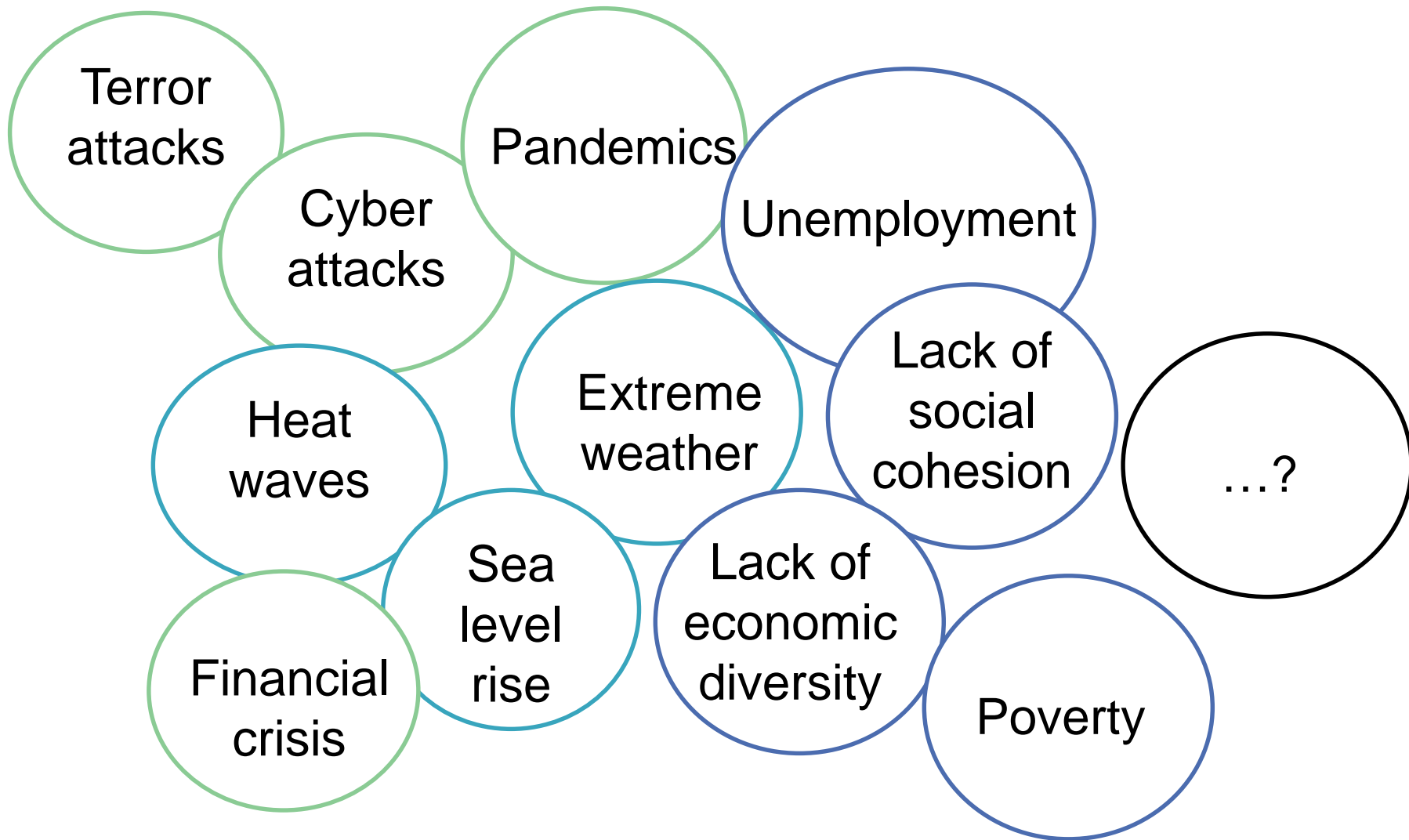
## A Policy Framework

Adriana X Sanchez

23 November 2017



# Urban Vulnerabilities



Drag picture to placeholder or click icon to add

Drag picture to placeholder or click icon to add

Reference: City of Sydney, 2016, Resilient Sydney – City Context report



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CRC

# The New Resilience Paradigm

*What we know now is that anything can happen.... So if we can get working models of multi-agency response... then we'll deal with whatever is thrown at us*

Superintendent Karen McCarthy, Commander EBLAC,  
NSW Police

*The resilience mindset goes beyond what the catalyst incident is and goes to the root-causes*

Michael Berkowitz, President of 100RC

# Research Question, Aim and Knowledge Gap

## Research Aim:

To develop a better understanding about *practical approaches* to *long-term resilience* building policy development and implementation at the *metropolitan scale across city networks* that share a common understanding of urban resilience building and strive towards it.

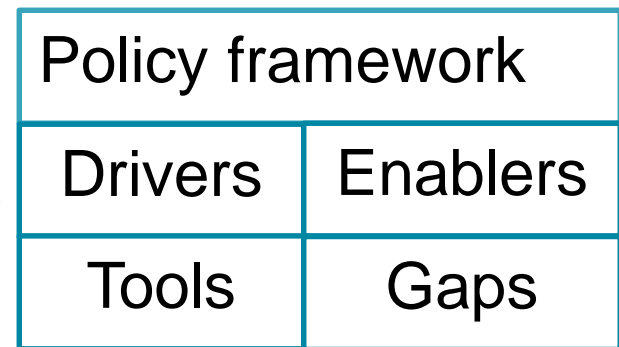
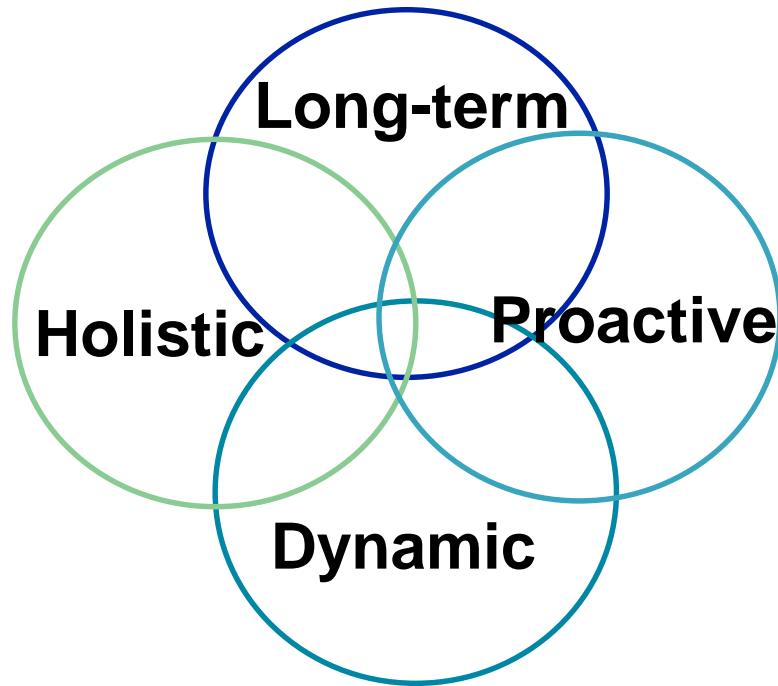
## Research Question:

How can urban policy approaches to long-term resilience building at the metropolitan scale cope with and address long-standing challenges shaped by their context and intrinsic need to deliver effective action over long time horizons?

## Knowledge Gap:

Lack of understanding about urban resilience policy contextual elements that hinder or enable its effectiveness over the long-term.

# The Research



# Learning from the others: Lens Framework

Language  
and scope

Multi-level/actor  
network

Interactions

Integration

Governance

Incentives for  
creative  
opportunism

Relevance

**Long-term  
Resilience  
Policy**

Financial  
sustainability

Life-cycle  
perspective

Budget  
coordination

Monitoring

Private  
investment



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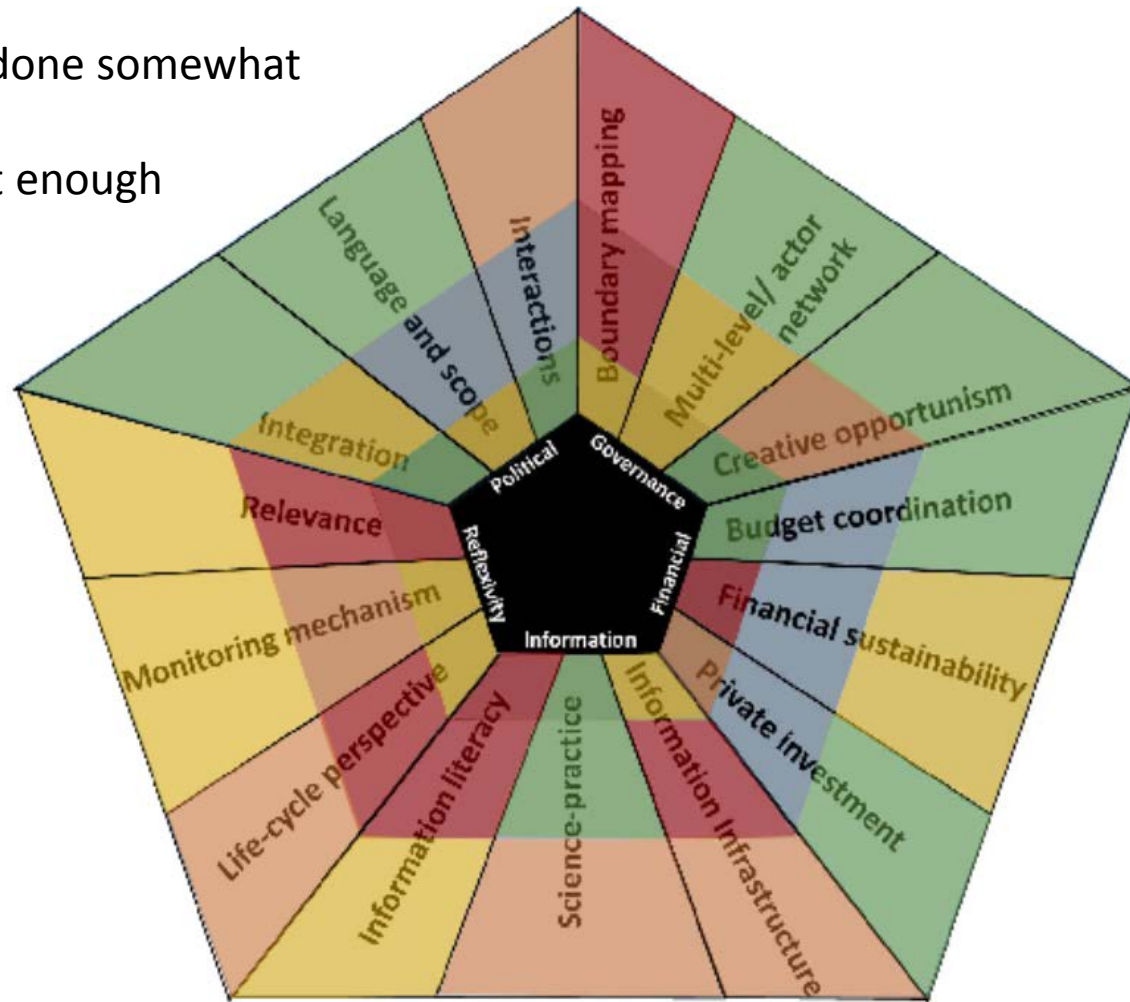
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# Applying the framework to case studies

- ▲ Never done it
- ▲ Doing it in theory
- ▲ Happening in foci/done somewhat
- ▲ Business as usual
- ▲ Does not apply/not enough information



# Thank you

To find out more, contact:

[CRC for Low Carbon Living Ltd](#)  
[www.lowcarbonlivingcrc.com.au](http://www.lowcarbonlivingcrc.com.au)

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

Twitter: @CRC\_LCL  
[info@lowcarbonlivingcrc.com.au](mailto:info@lowcarbonlivingcrc.com.au)  
P: +61 2 9385 5402  
F: +61 2 9385 5530

Extra contact details if required:

Adriana X Sanchez

PhD Candidate

[a.sanchezgomez@unsw.edu.au](mailto:a.sanchezgomez@unsw.edu.au)

# The Value Proposition of Low Carbon Higher-Density Housing Development:

a Property Developer's perspective



LOW CARBON LIVING  
CRC

Catherine Kain

PhD candidate

Supervisors:

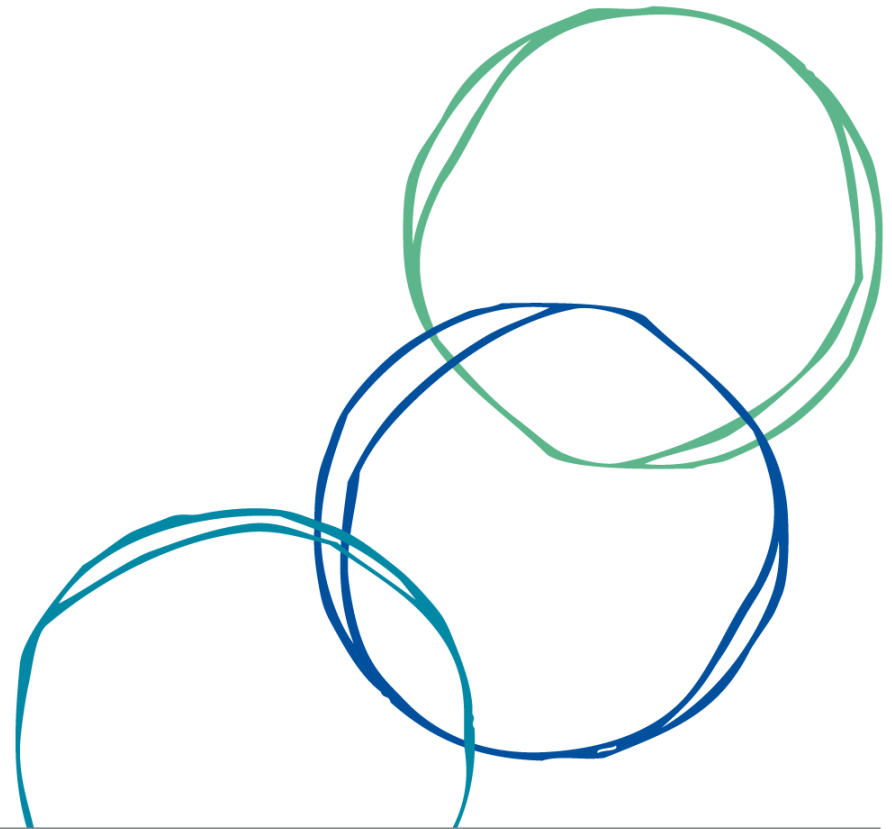
Dr. Kathryn Davidson

Dr. Stephen Berry

23 November 2017

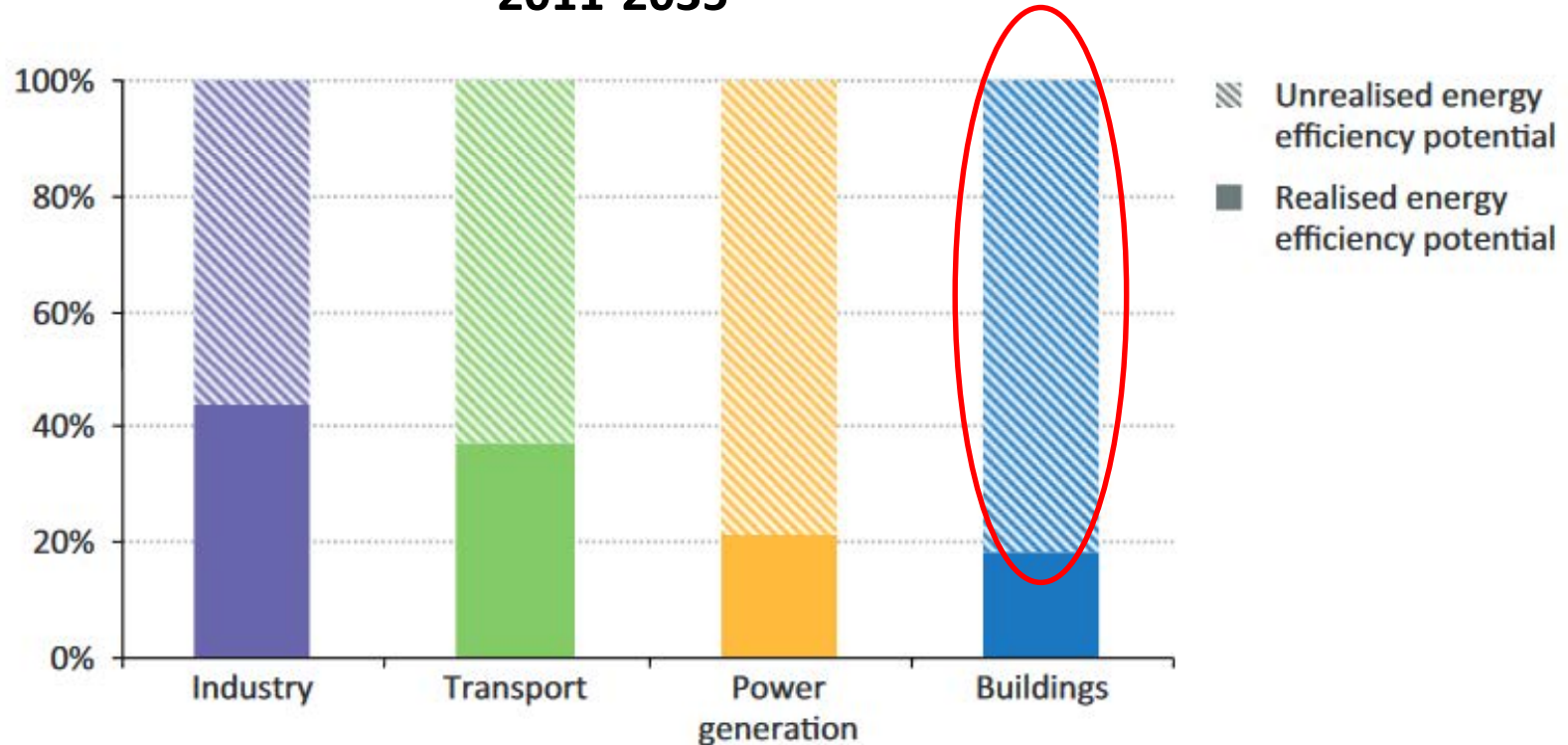


University of  
South Australia



# Value Proposition of Low Carbon Higher-Density Housing

## Utilised long-term energy efficiency economic potential 2011-2035



(Source: IEA *World Energy Outlook 2012*, p.291)

# Value Proposition of Low Carbon Higher-Density Housing

## Residential Property Developer

- Profit maximising entity
- Strategic capital investment decision making

(Brealey, Myers & Allen 2014; Cooremans 2012)

## Value Proposition

- The value a firm offers its market
- Value equates to *perceived benefits less costs*
- Perception affects effects brand / image and competitive advantage

(Kotler & Armstrong 2012; Porter 1980)

# Value Proposition of Low Carbon Higher-Density Housing

## Key questions

Is there a competitive advantage for the developer to adopt higher than minimum building code standards?

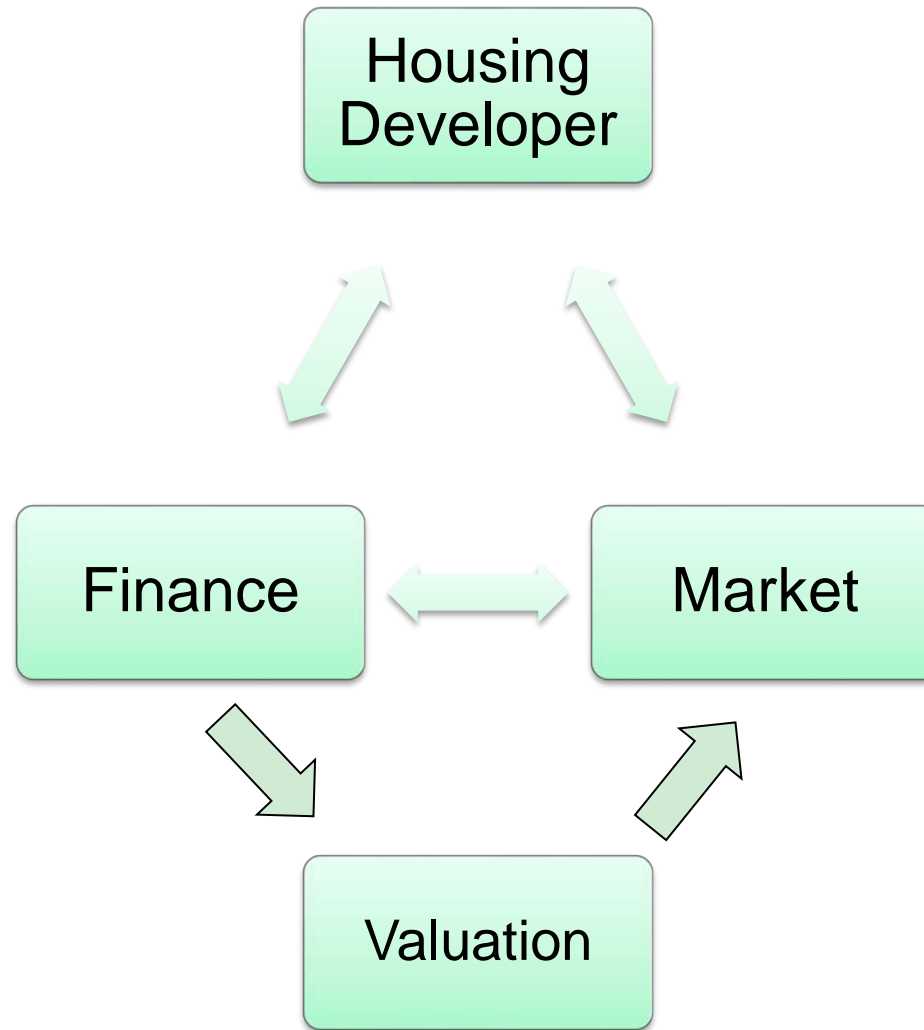
Can strategic capital investment decision making assist in greater energy efficiency adoption?

# Value Proposition of Low Carbon Higher-Density Housing

Business...is about creating **value** for the groups that support the business (Freeman et al 2010; p. 26)

- Expert panel focus groups
- Questionnaire to key stakeholder groups
- Quantitative analysis
- Interviews

# Value Proposition of Low Carbon Higher-Density Housing



# Value Proposition of Low Carbon Higher-Density Housing

## Results to date

- Market does not pay for environmental initiatives
- Legislation needs to enforce environmental change
- Education is imperative to enable the market to adequately price sustainable development

# Thank you

## To find out more, contact

CRC for Low Carbon Living Ltd

Room 202-207, Level 2,  
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UNSW Sydney NSW 2052 Australia

E: [info@lowcarbonlivingcrc.com.au](mailto:info@lowcarbonlivingcrc.com.au)

P: +61 2 9385 5402

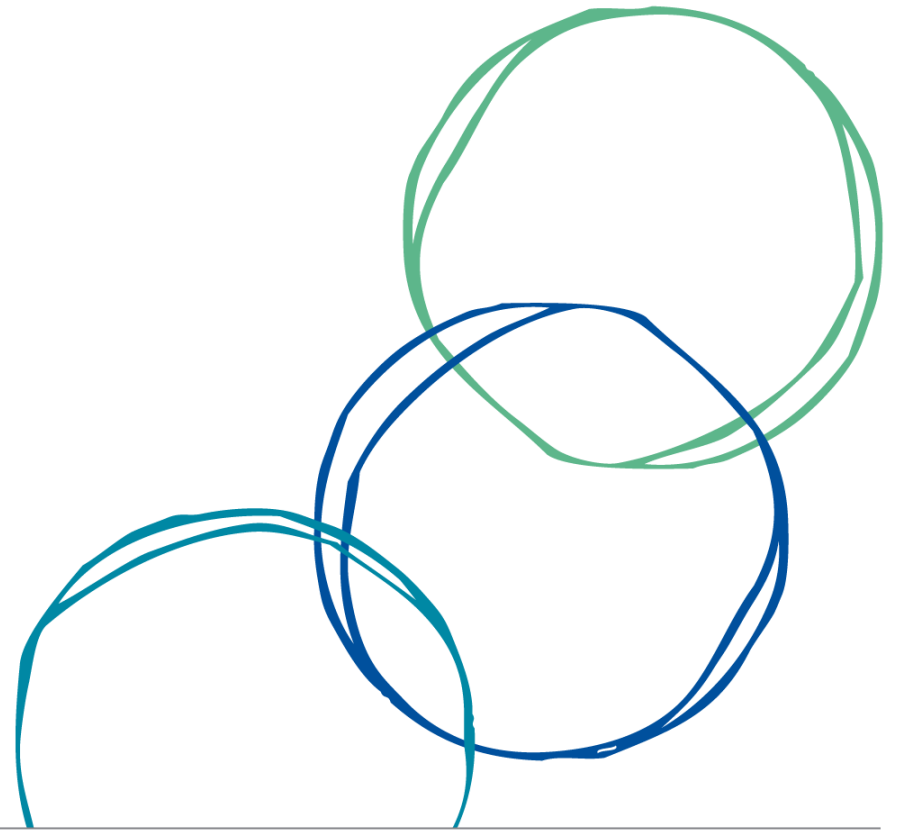
F: +61 2 9385 5530

Twitter: @CRC\_LCL

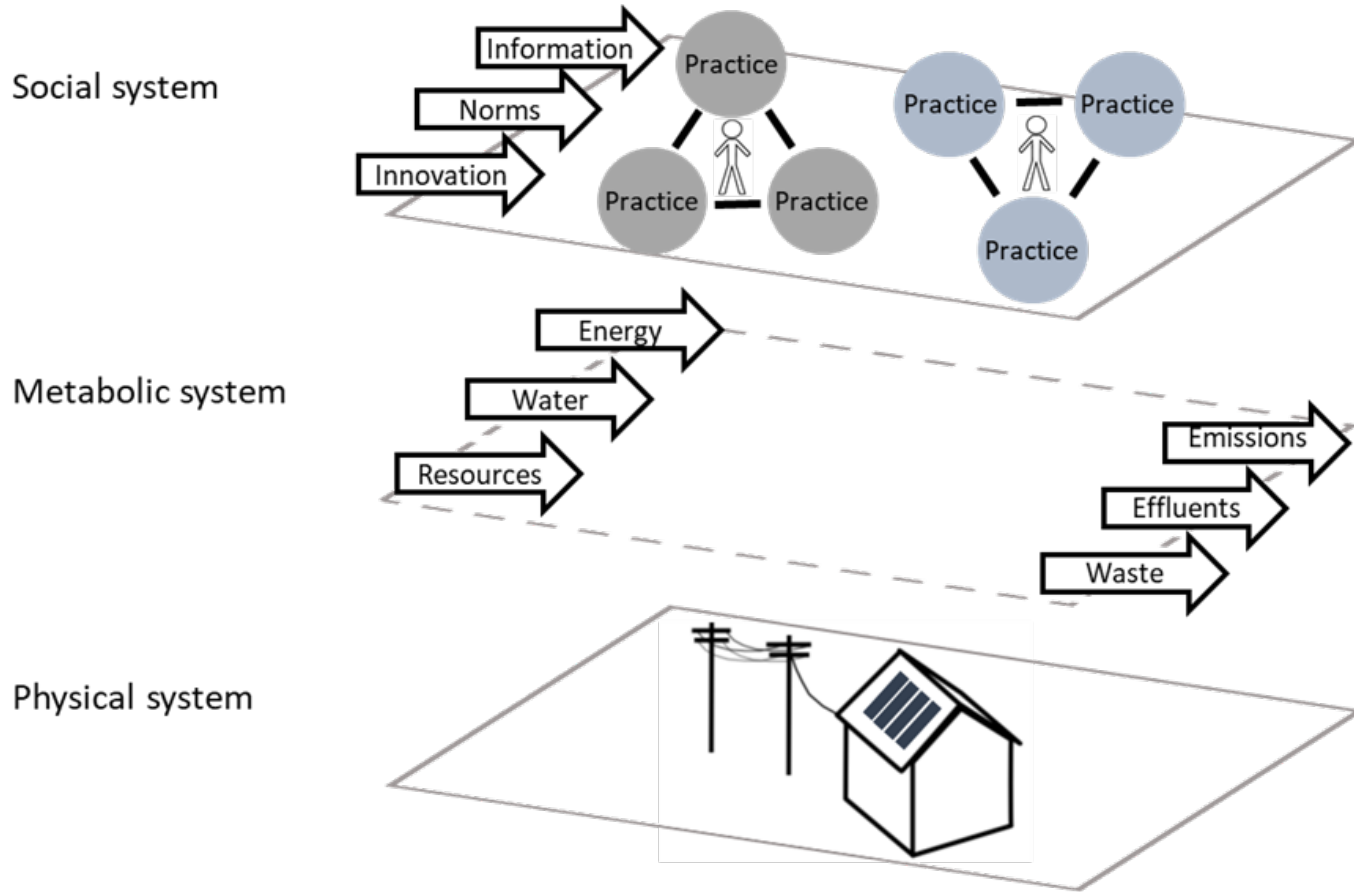
# The Home System of Practice

Christine Eon

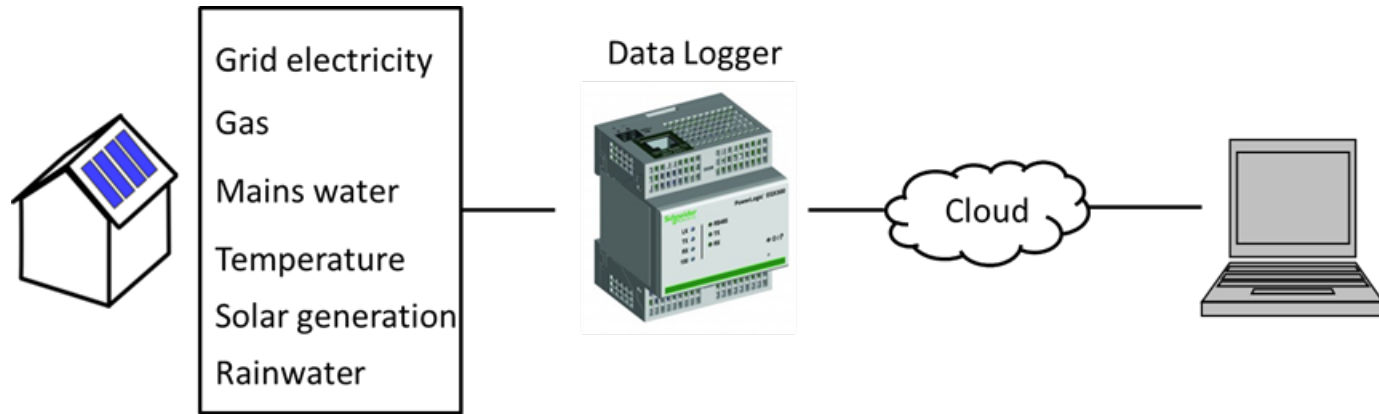
23 November 2017



# Research background



# The 10 Home Living Labs



# Results

## Water



4 homes reduced showers by ~ **59 s**



2 homes reduced water used in garden hand watering:

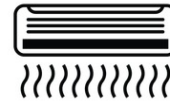
- plants became established
- application of mulch



Correction of watering days and times  
Frequent adjustment of the watering volumes:

- Irrigation outlets closed to already established plants
- Change of irrigation system following audits

## Energy

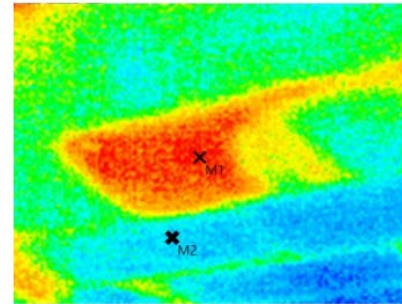


Reduction of thermostat on heating system



Automation:

- Dishwasher
- Pool pump
- Standby power

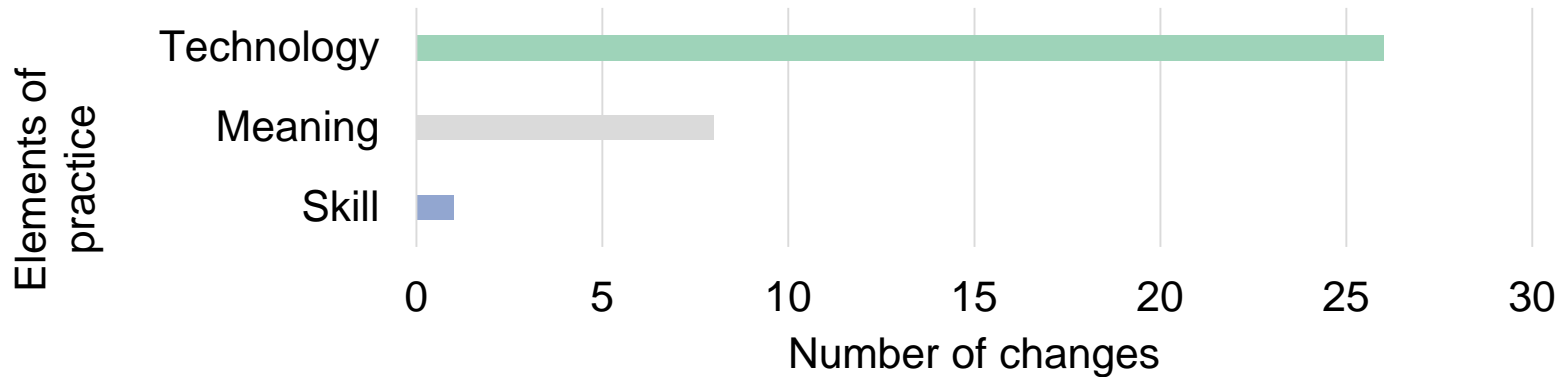


M1: 26°C, M2: 23.3°C



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CRC

# Results



*“ If change is difficult we don’t do them”*

*“I’m always working and then I relax and I guess I don’t feel like I have energy to study things like that.”*

*“ It is incessant to go and turn lights off”*

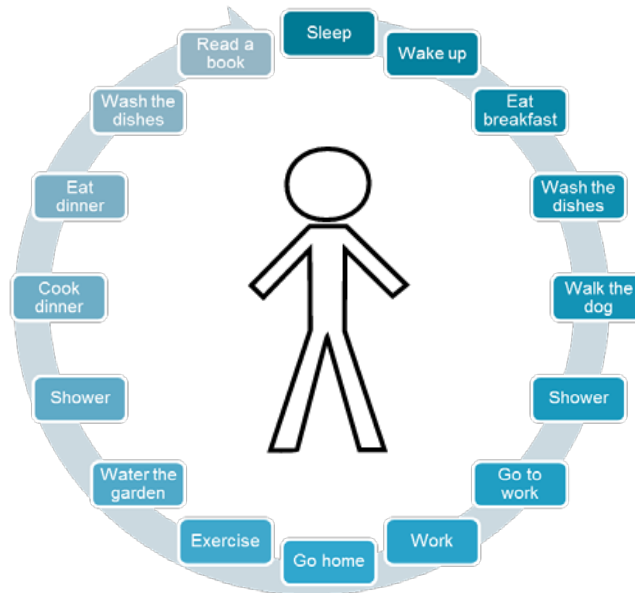
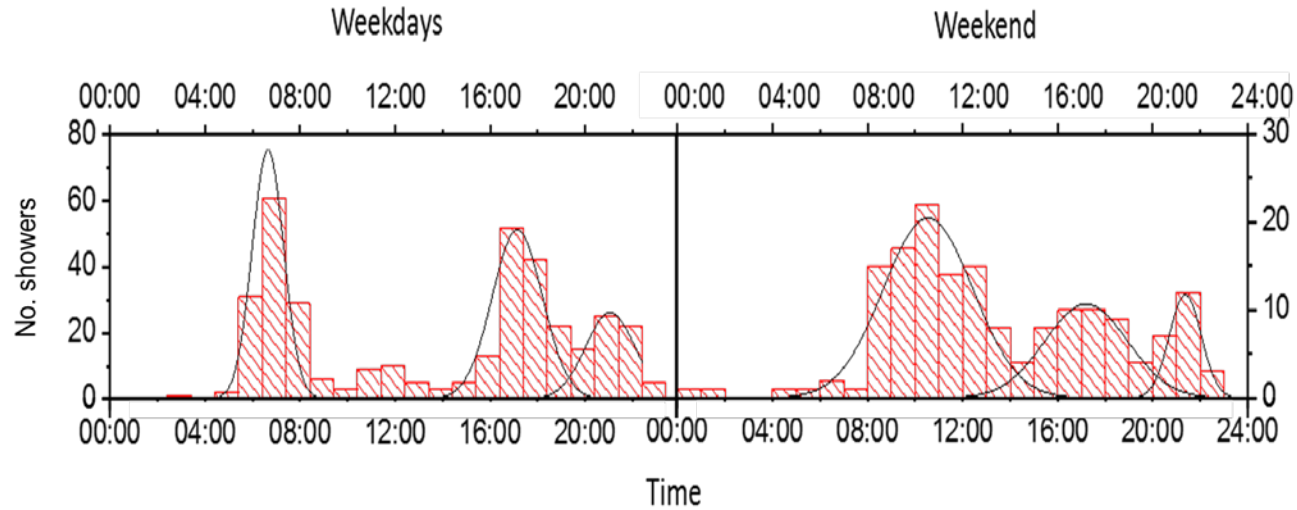
*“When I was working at home I’d look at it in the morning when I was sitting down as a procrastination tool”*

*“I usually forget to turn everything off, but the others [activities] I’m a bit more involved with day to day. I’m doing dishes, I’m washing clothes...”*

*“Because the results being emailed were so good, we didn’t feel the need to [look at the website]...”*

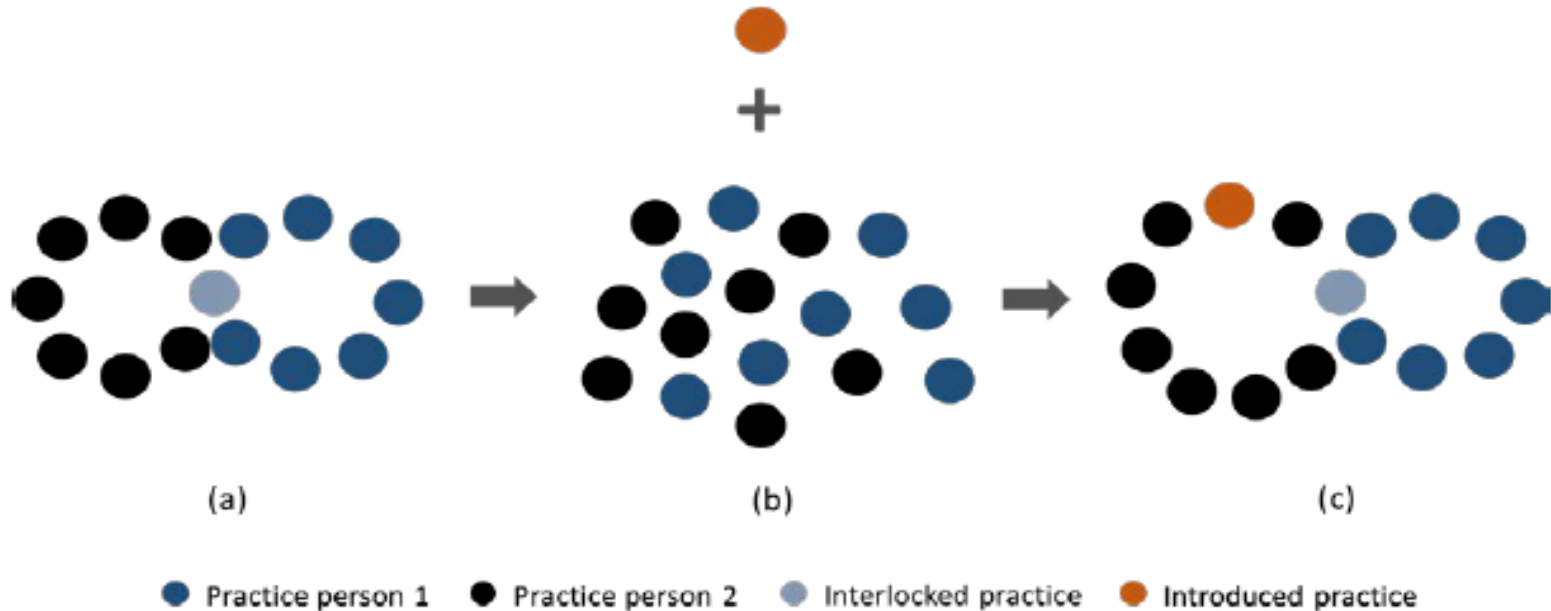


# Results



# Conclusions & impacts

## The Home System of Practice



Automation can **enable** change without disturbing the system of practice

# Thank you

## To find out more, contact

Christine Eon

Curtin University Sustainability Policy Institute  
Bentley Campus WA

E: [Christine.eon@curtin.edu.au](mailto:Christine.eon@curtin.edu.au)

P: +61 8 9266 9026

M: +61 4 6644 7551

# RP1021 Project Presentation: Building Regulation as a Policy Instrument for the transition to a Low Carbon Economy

Robert Enker

23 November 2017



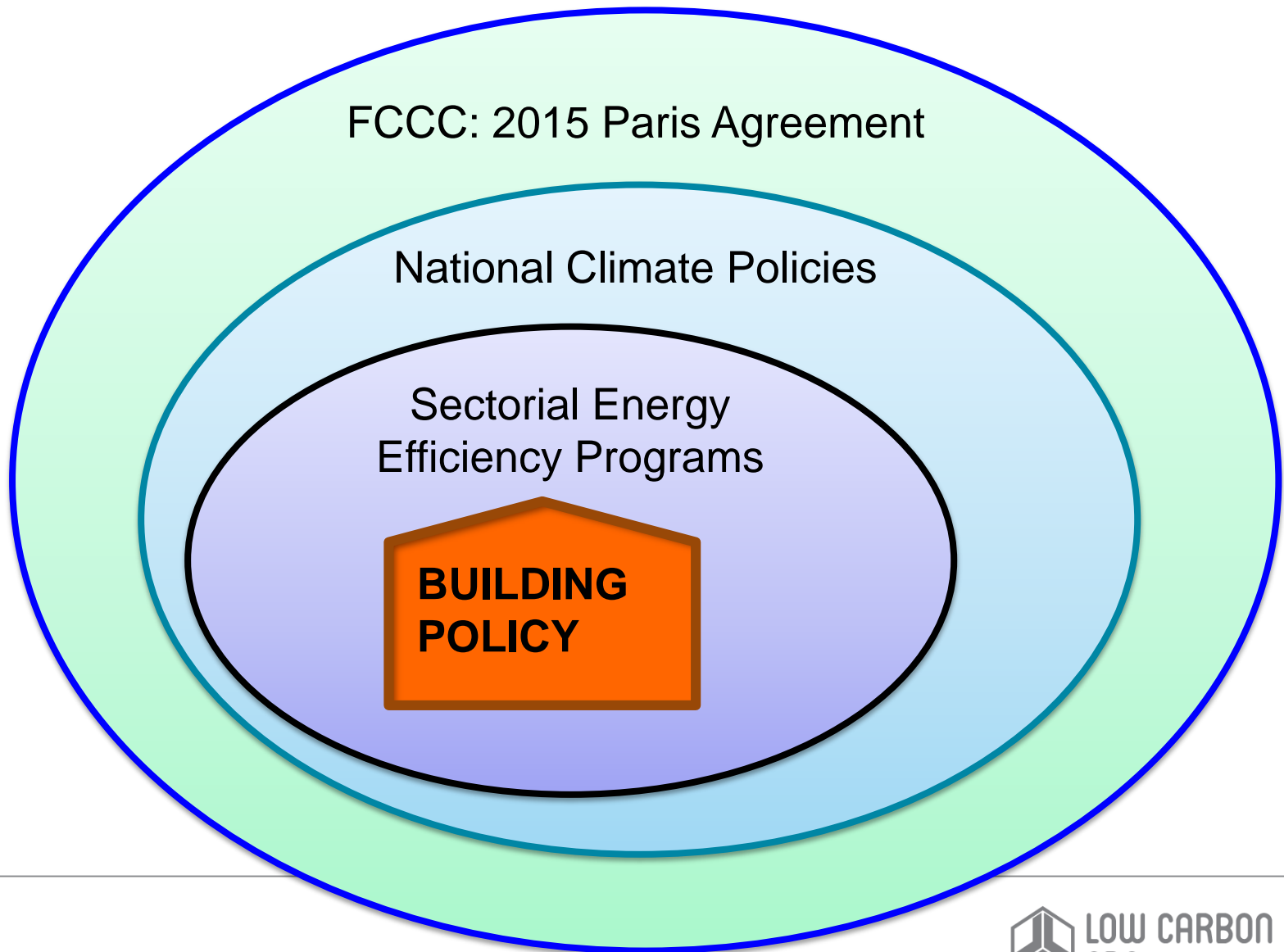
# PhD by publication - structure



# Research Questions

- ① Does **regulatory intervention** for building energy efficiency have a **negative impact** on housing affordability?
- ② Are **economic instruments** as effective as other government policy interventions [viz **building standards**] for successful policy implementation?
- ③ How do Australian building energy standards measure up when **benchmarked** against World's Best Practice?
- ④ How does **consumer choice** operate in the property market when examined from the perspective of **Behavioural Economics**?

# Building energy policy hierarchy



# Market intervention options

- a) Financial incentives and/or penalties [eg ETS]
- b) Regulations: buildings, services, appliances
- c) Information campaigns [eg building performance disclosure]
- d) Industry capacity building & cultural change

**Key point**: it's not about (a) **or** (b) **or** (c): **comprehensive, multi-faceted** strategy is crucial

# Benchmarking Australia's Building Code

Gap analysis using framework from **Global Building Performance Network**:

- ① No forward **trajectory**
- ② Visionary **Zero Emissions** target?
- ③ **Sporadic** revision cycles
- ④ Limited inclusion of **energy uses**
- ⑤ Problematic **enforcement** procedures
- ⑥ Lack of **policy complementarity**

# Benefits of Regulatory Intervention

- Effective greenhouse abatement
- \$\$\$ savings on building operating costs
- Improved building comfort & health benefits & climatic resilience
- Macro scale economic benefits
- Enhanced energy system security
- Property resale values increased
- Housing market development unimpeded

# 5 Star housing standard case study - cost trajectory

Year	Efficiency upgrade cost	Context for costing	Percentage cost increase on [base]
2002	<b>\$1100 - \$3300</b>	Base case Vic housing stock: 5-Star target	0.7 – 1.9% [\$160,000] Victorian analysis
2005	<b>\$1500</b>	5-Star outcome: actual builders' costs	0.4% [\$230,000] Victorian analysis
2005	<b>\$653</b>	Stringency increase: 2-4 Stars	National projection
2006	\$400	Stringency increase: 4-5-Stars	National projection
	<b>\$1053</b>	Total for transition 2-5 Stars	National projection
2013	<b>-\$5000 cost reduction</b>	Optimize base case design to maintain 5-Star outcome	CSIRO study

# Addressing buildings' global eco-footprint is a no-brainer!

To find out more, contact

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](mailto:info@lowcarbonlivingcrc.com.au)

P: +61 2 9385 5402

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Twitter: @CRC\_LCL



## Thank you



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# Panel presentation

## Mainstreaming high performance housing



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Dr Josh Byrne, Curtin University

Josh's House: Mainstreaming zero carbon homes

Dr Kevin Yee, NSW Department of Planning and Environment

Making residential sustainable using BASIX

Professor Paul Cooper, University of Wollongong

Working with what you've got: retro-fitting existing housing stock

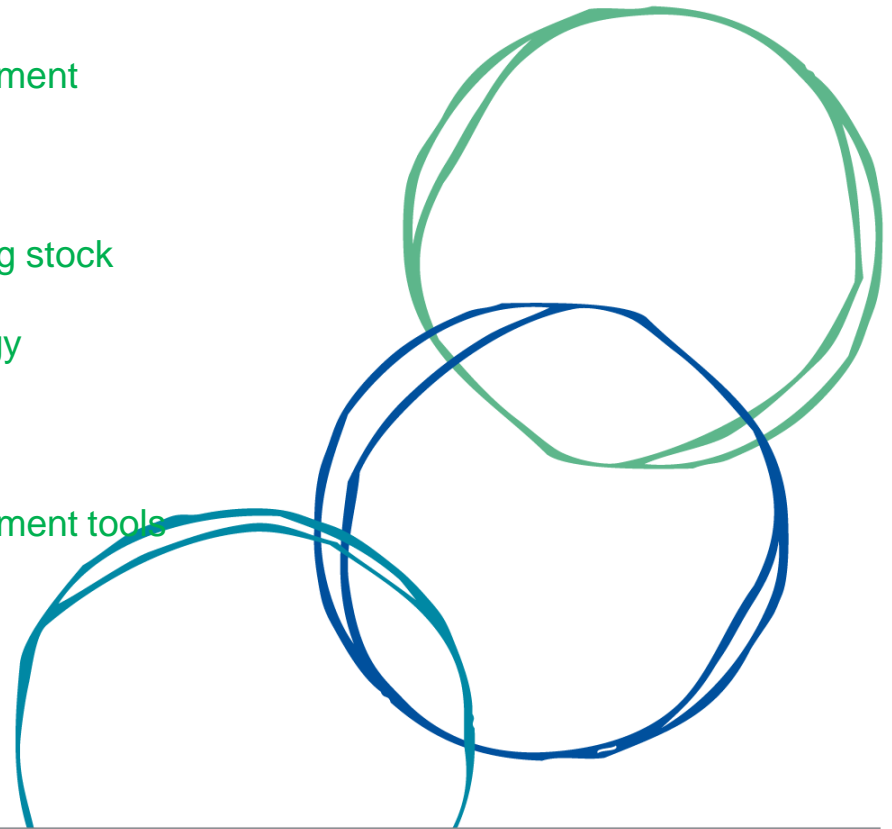
Jodie Pipkorn, Department of the Environment and Energy

Mainstreaming low carbon homes: a policy perspective

Professor Wasim Saman, University of South Australia

The Next-Gen Tool: whole of house, user friendly assessment tools

Facilitator: Dr Stephen White



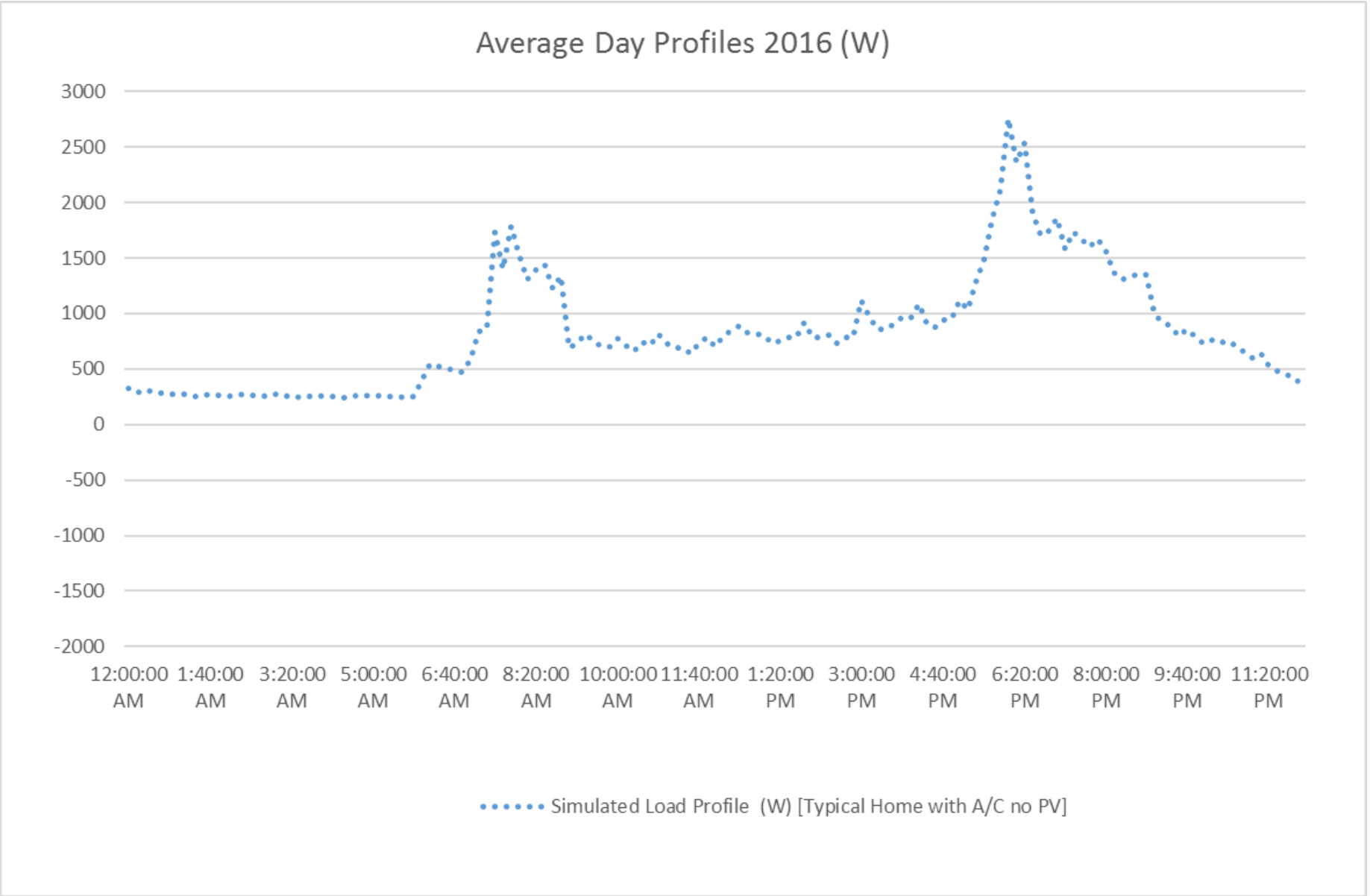
# Mainstreaming High Performance Housing Josh's House & Beyond

Dr Josh Byrne

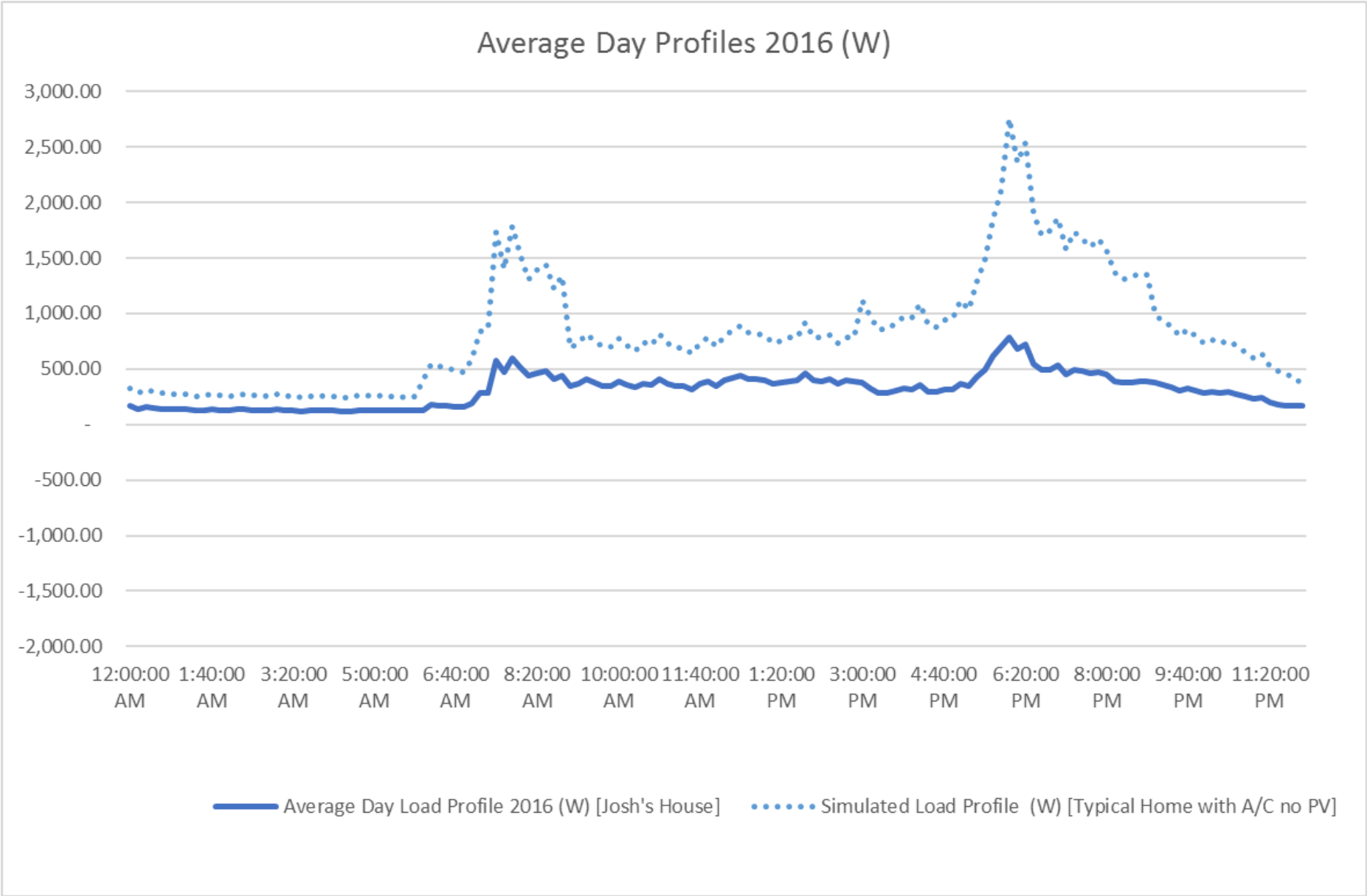




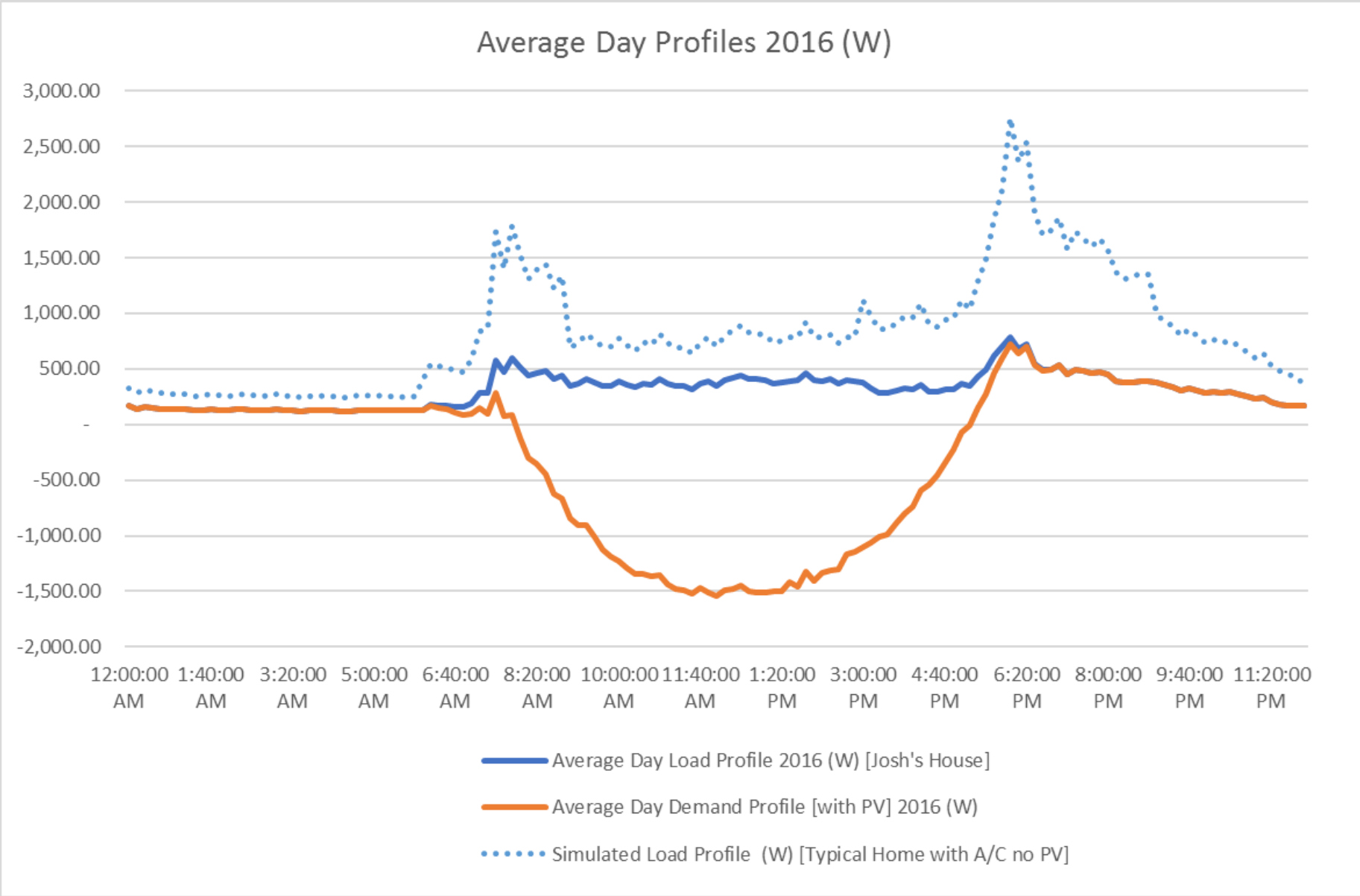
# Electricity Use Profile: Typical House



# Electricity Use Profile: High Performance House

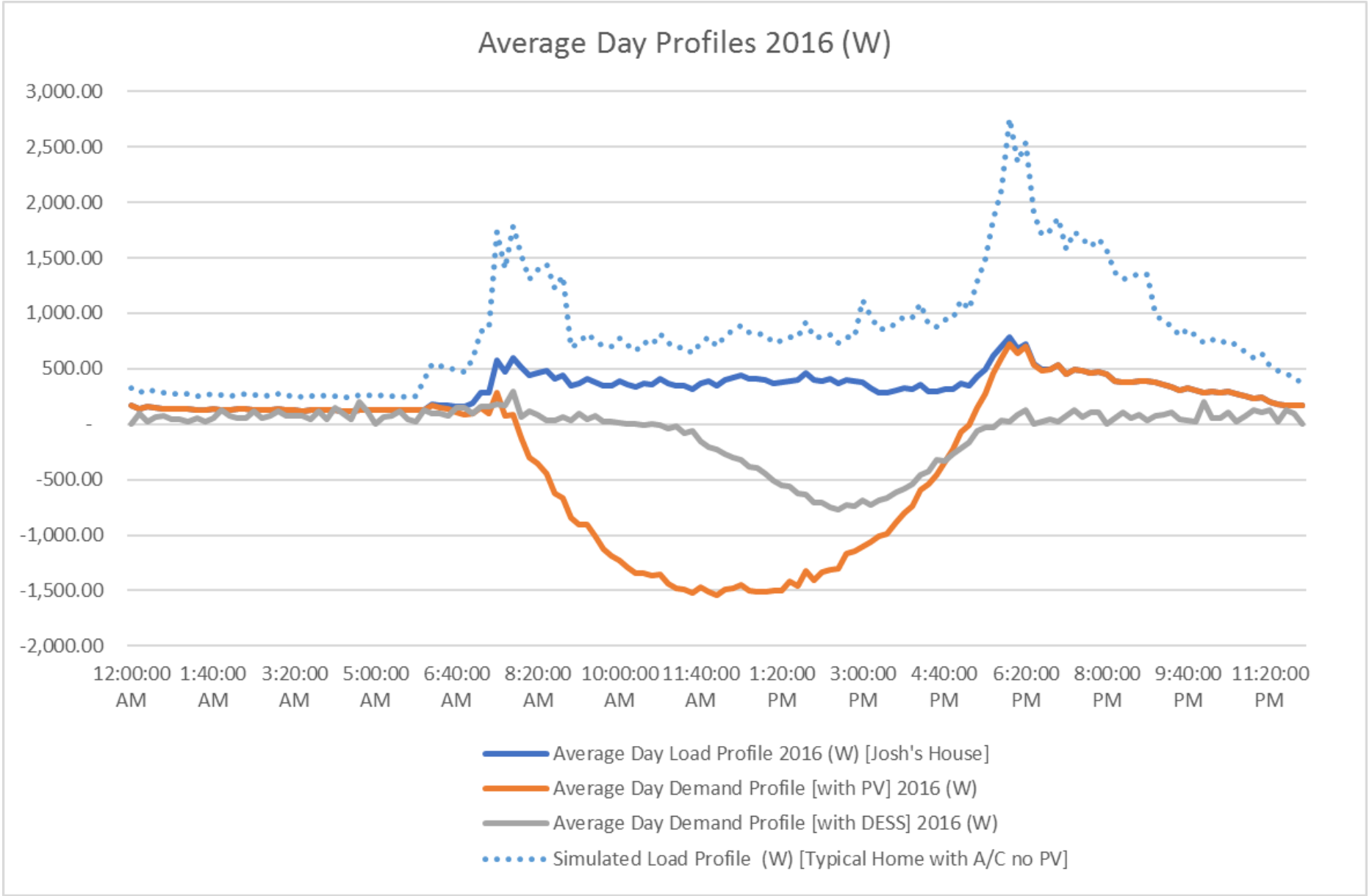


# Electricity Use Profile: High Performance House + Solar



# Electricity Use Profile:

## High Performance House + Solar + Battery



# Communications & Community Engagement

</

# CRCLCL RP3009: High Performance Housing



# Entrenched Industry Perceptions

- Energy efficient homes are expensive and impact affordability.
- The market is not interested.



# Next Steps

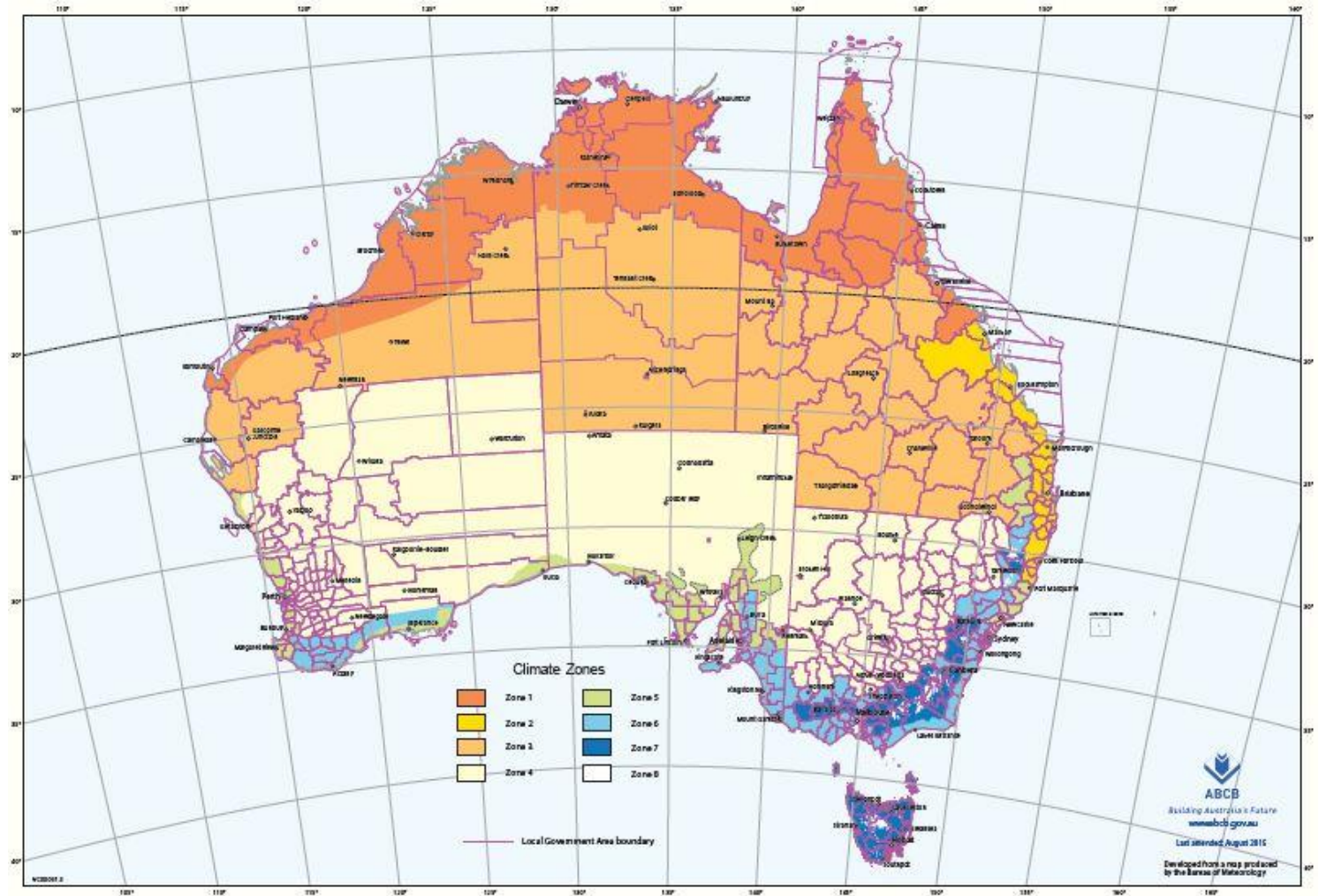
Building  
industry  
engagement

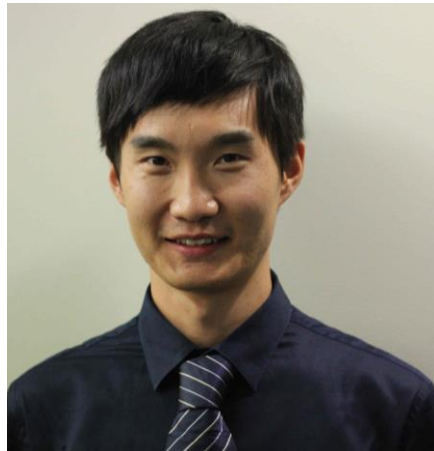
Design  
options  
analysis

Construction

Market  
perception

Dissemination





# Making residential sustainable using BASIX

November 2017



Planning &  
Environment

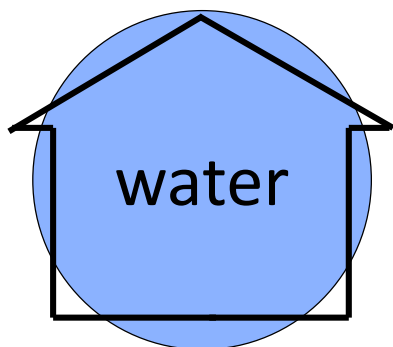


# The BASIX story so far...

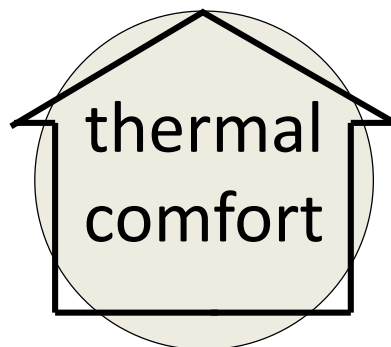
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- **Building Sustainability Index - BASIX**

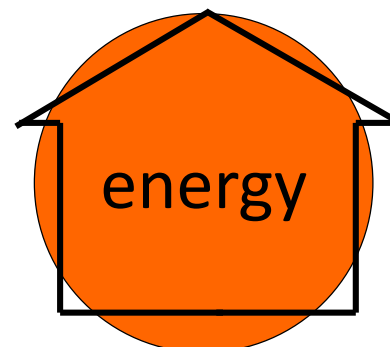
An online assessment tool to implement **minimum sustainability targets** for all new houses, home units and renovations<sup>1</sup> in NSW.



Up to **40%**



**pass**

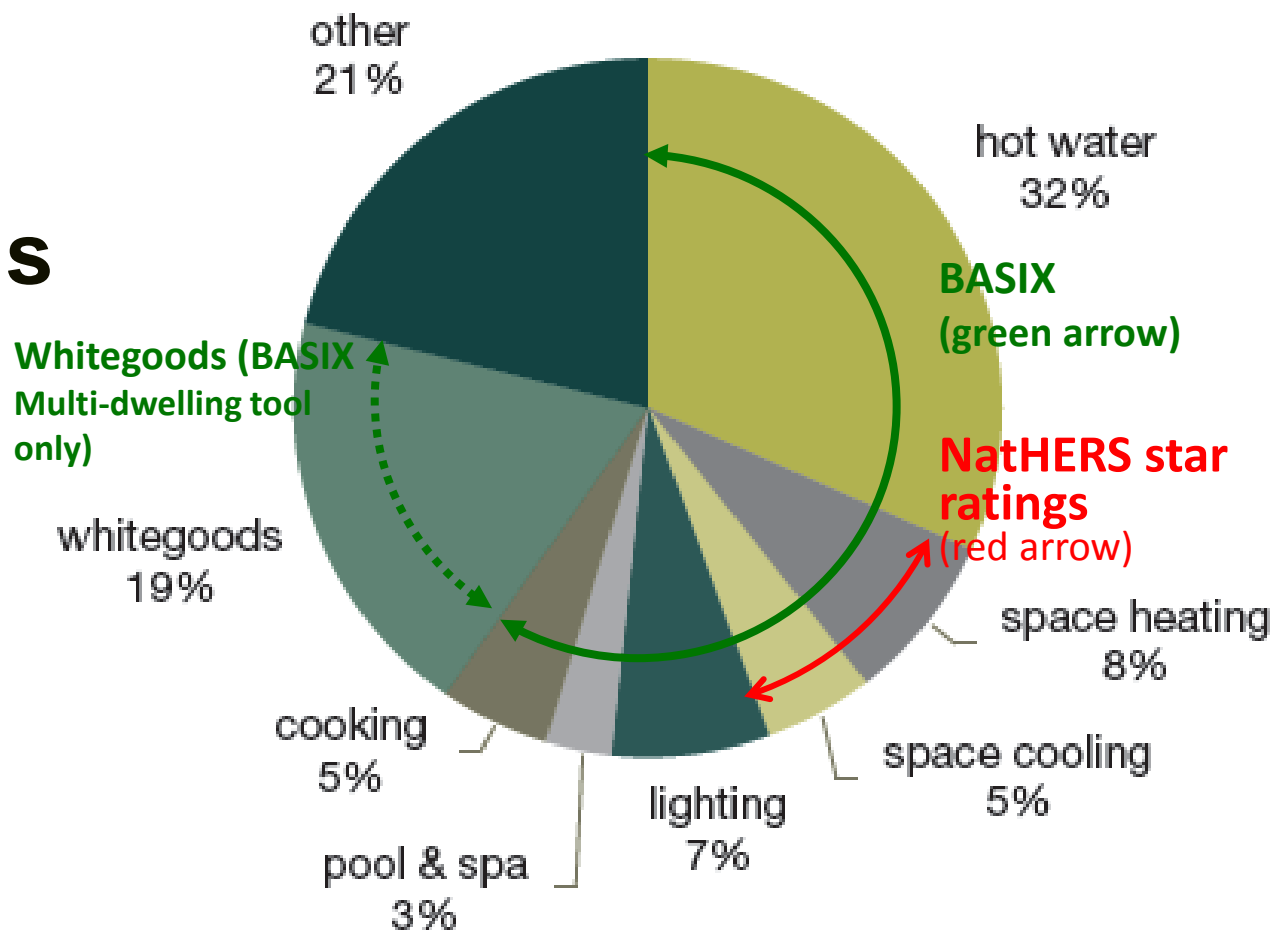


Up to **50%**

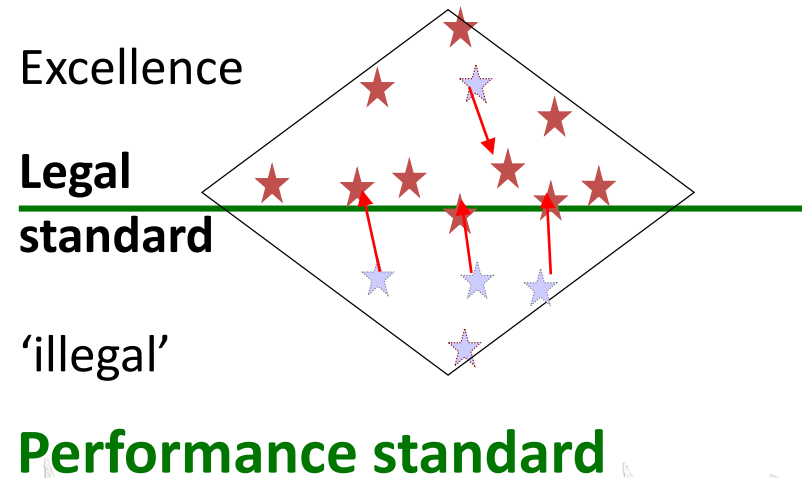
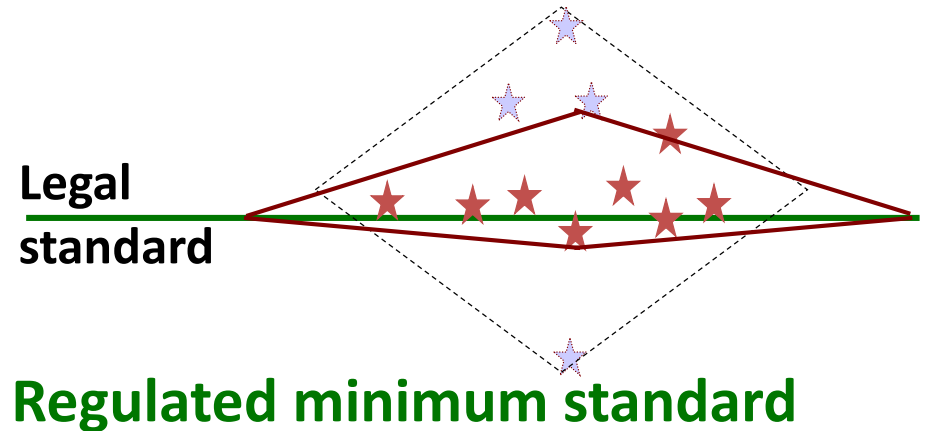
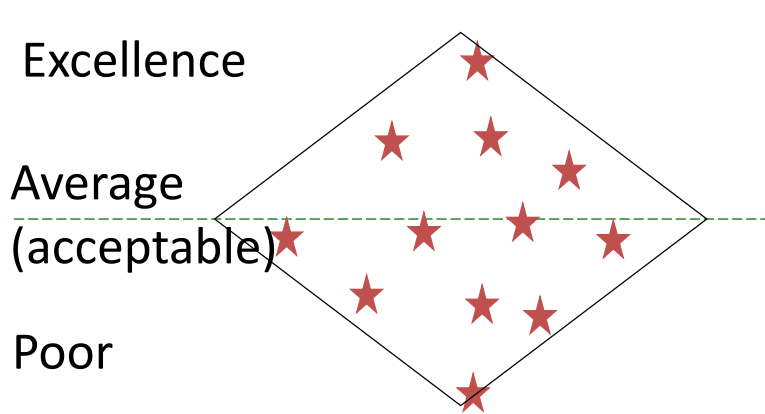
<sup>1</sup> over \$50,000

# BASIX – whole of house

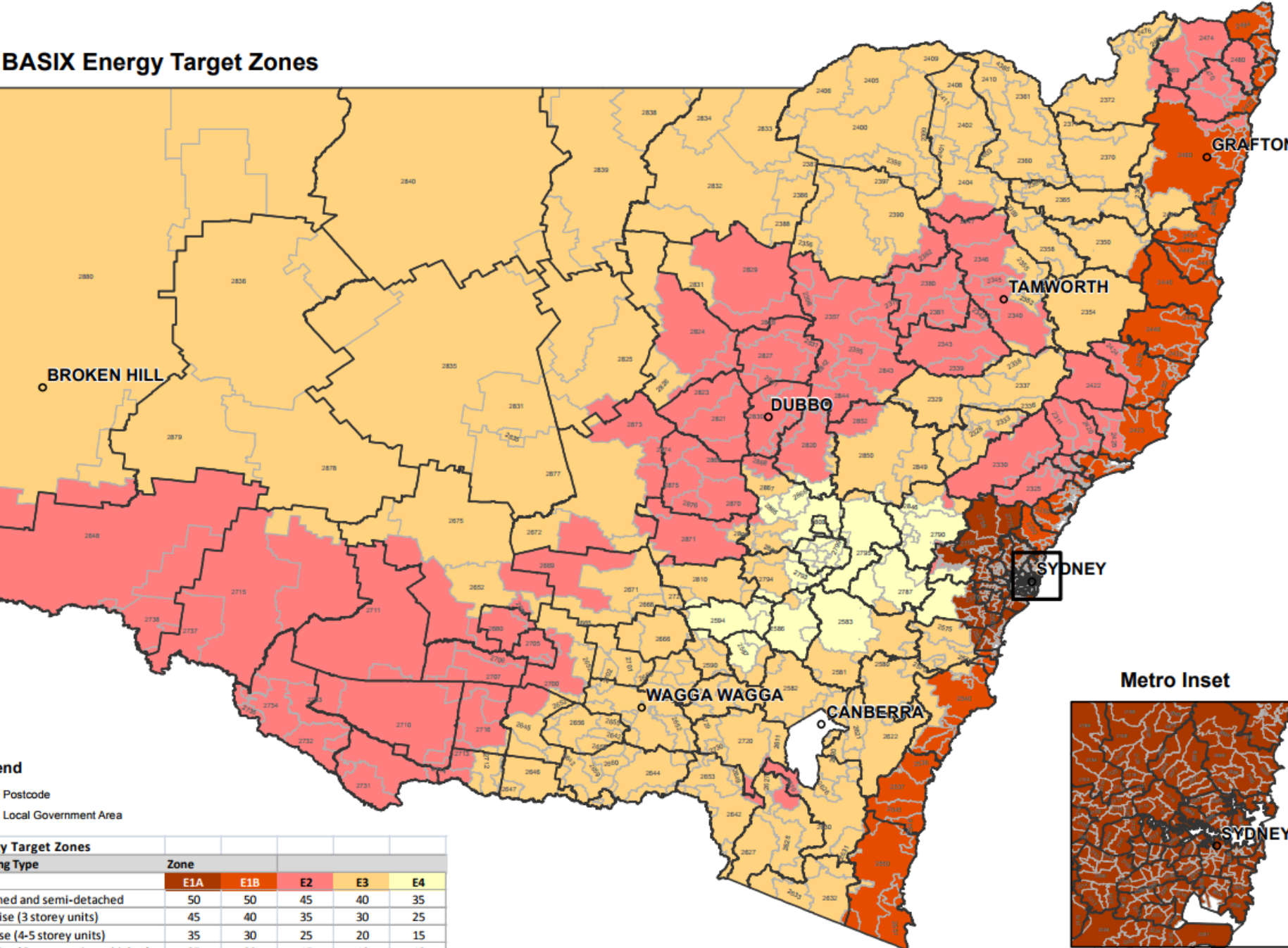
## Domestic Greenhouse Gas Emissions (BASIX Benchmark)



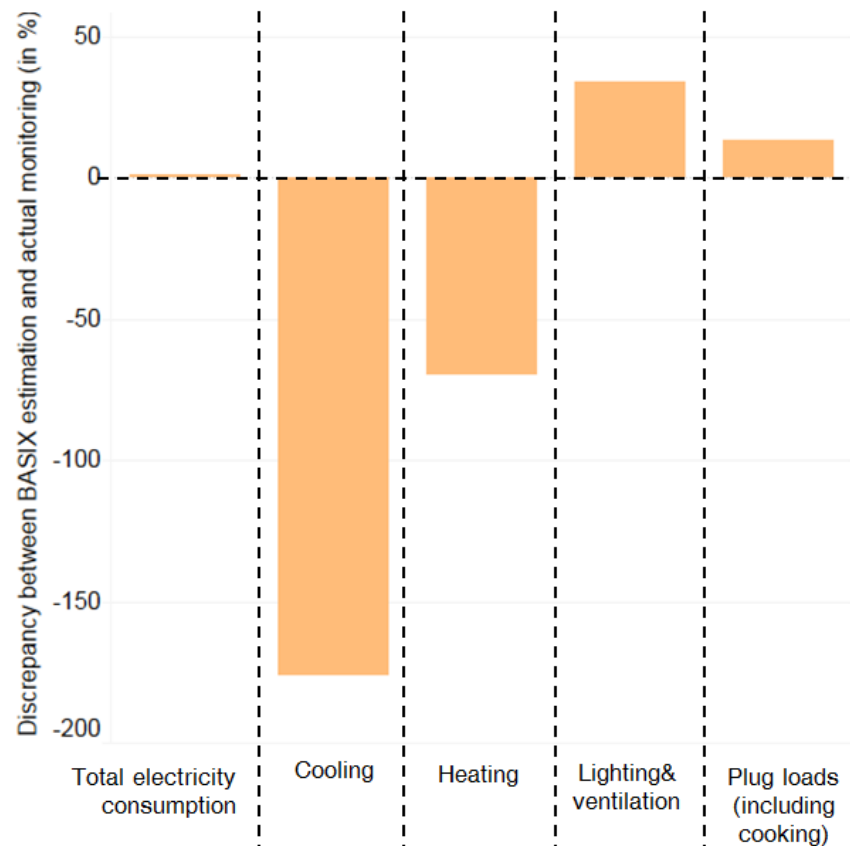
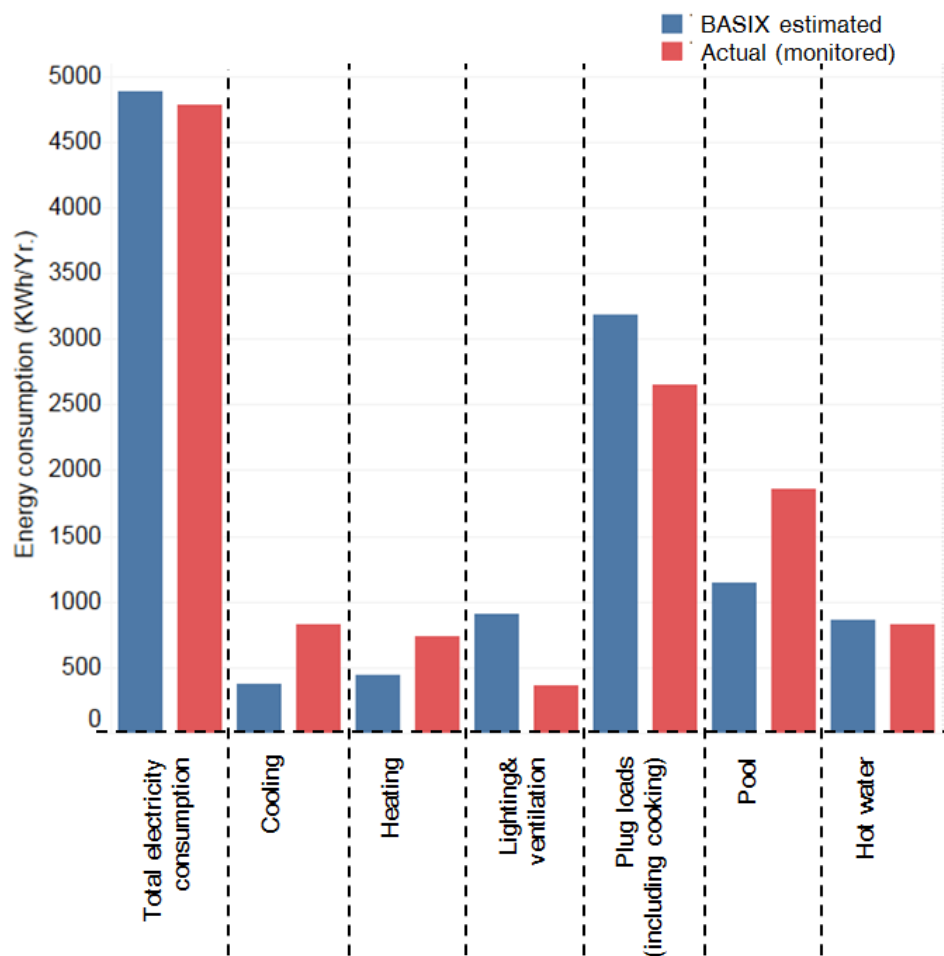
# BASIX – performance standard



# BASIX Energy Target Zones

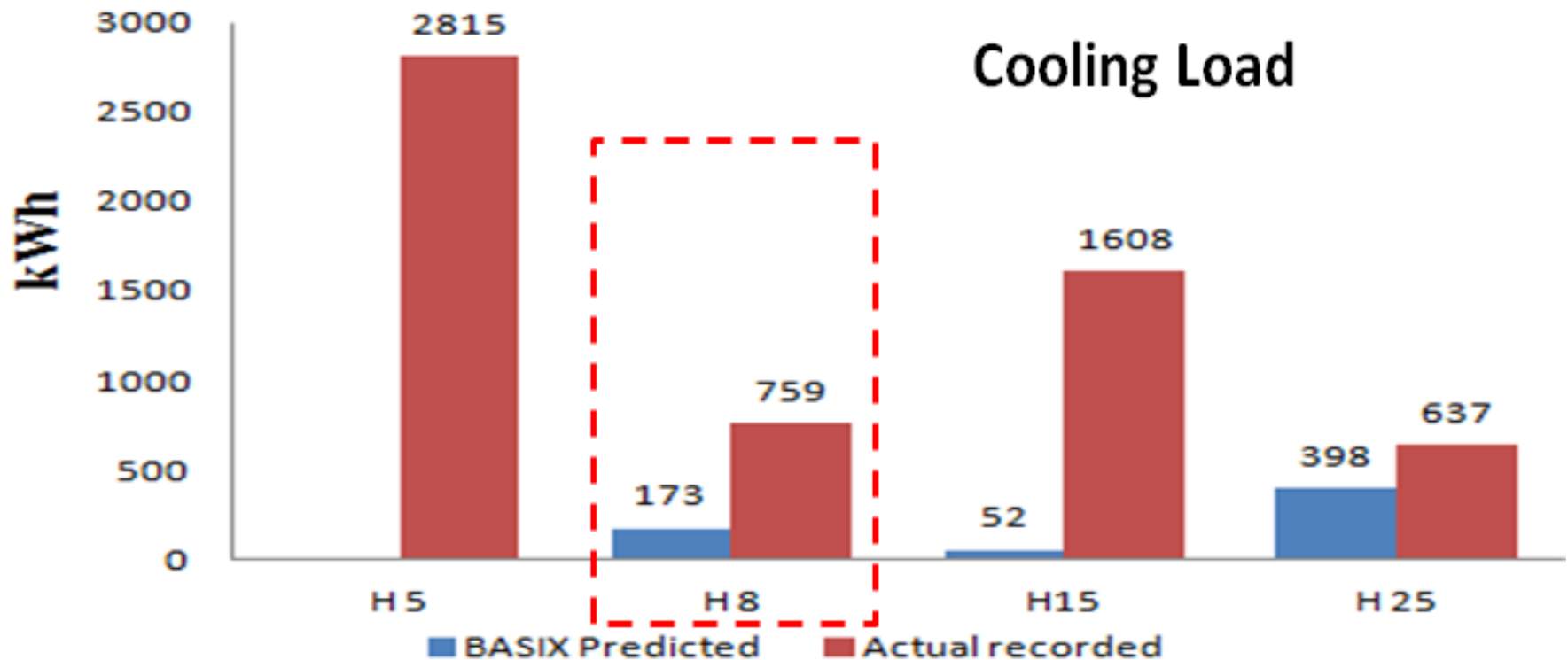


# CRC BASIX project – in-depth monitoring of BASIX affected houses



# Example: House ID #8

Dwelling ID	Number of occupants	Children	Elderly over 65	Home office	Single/double storied	Total floor area (m <sup>2</sup> )	Orientation	BASIX estimate kWh/yr.	Actual energy consumption kWh/yr.
8	4	2	0	yes	single	148	West facing Living: South	6603.83	7613



# Building Management System

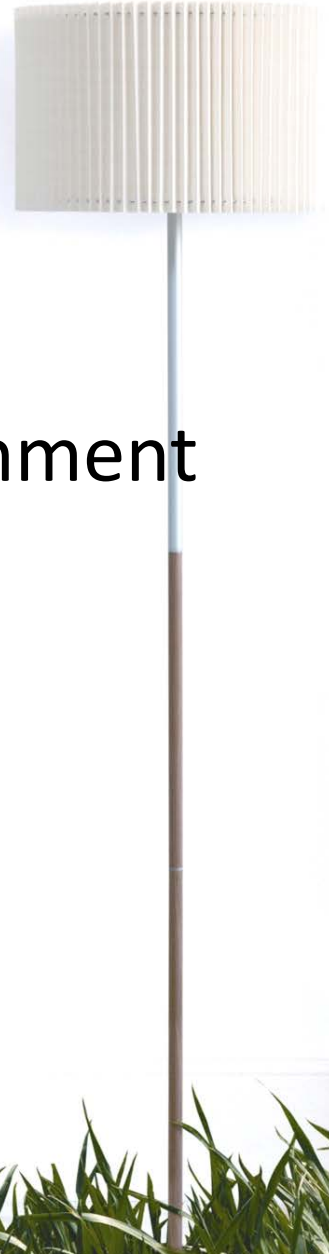
---



- Commercial buildings already incorporate sophisticated building management systems
- Bespoke technology for the residential sector
- Increasing number of phone apps to help manage home energy use.

# Contact

---



Dr Kevin Yee

NSW Department of Planning & Environment

Email: [basix@planning.nsw.gov.au](mailto:basix@planning.nsw.gov.au)

Web: [www.basix.nsw.gov.au](http://www.basix.nsw.gov.au)



# Working with what you've got: retro-fitting existing housing stock



LOW CARBON LIVING  
CRC

**Prof Paul Cooper**

Director

Sustainable Buildings Research Centre (SBRC)

University of Wollongong, NSW



---

23<sup>rd</sup> November 2017

# Agenda

- Background
- Existing Stock and Typologies
- Owner-occupier sector retrofits
- Low income housing
  - RP3044 Mainstreaming Low Carbon Retrofits in Community and Social Housing
- Deep and net-zero energy retrofits

# Retrofitting homes

- Key Sectors (different drivers for each):
  - Owner-occupier
  - Private rental
  - Social Housing (public and community)
- Approaches:
  - Technology centred
  - Property and/or household centred
- Key Challenges
  - Every home is different
  - Every family and occupant is different
  - Every retrofit can or should be different to match needs and desires
- Depth of retrofit
  - Alterations and Additions (alts and adds)
  - Whole of house (shallow or deep retrofit)
  - Appliances, PV, services etc (air conditioning)



# Existing building stock – what is it?

- Very poor data on the characteristics of existing Australian building stock
- Few major studies carried out e.g.
  - RMIT VIC
  - UOW OEH Housing NSW Stock Mapping project.
- Housing Typology definitions can help in simplifying the large range of building types and appropriate retrofits

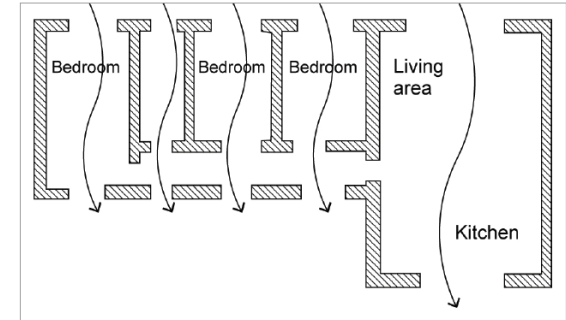


# Owner-occupier homes

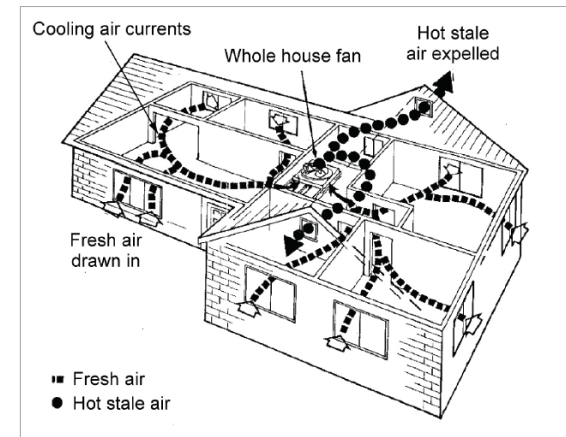
- Some great info available<sup>1</sup> – but is it used?
- Better energy efficiency not generally the primary objective
- Household rarely take a holistic approach:
  - Engage trades often in semi-random sequence
  - Lack of specialists in energy efficient renos
- No definitive LCA of knock-down vs. rebuild choice
- Low income owner-occupier households can't afford to upgrade and can't afford not to!  
(Ave Australian household energy bill >\$2,000/year)

## Ventilation, air movement and draughts

- Improve cross ventilation by:
  - retrofitting fully openable, breeze catching windows and doors
  - creating new openings in non-loadbearing walls and above doors
  - moving doors to improve breeze paths
  - designing landscaping planting, outbuildings or fences to direct breezes through the home
  - removing planting that blocks breeze access, unless needed as a windbreak.



Allow cross ventilation by prevailing breezes on summer afternoons.



<sup>1</sup> Chris Reardon, 2013, Your Home: Renovations and additions.

# NSW Housing Typologies Project (UOW&OEH)

## example information sheet

### OLDER DETACHED, BRICK VENEER

#### Description

Double fronted Brick Veneer house, predominately constructed circa 1960 -1970. Brick veneer detached dwellings were prevalent from the 1950's onwards. This house type is distinguished from newer detached, brick veneer homes on the basis of floor area and floor plan. The Housing Commission of New South Wales built a large number of these house types in the 1960's and 1970's. May represent Contemporary, Post-War Austerity, Public Housing, and Double/Triple Fronted architectural styles from Table 1.

#### House Form

Mostly three bedrooms, approximately 90 to 100 m<sup>2</sup> floor area, generally single storey, although examples of two-storeys dwelling exist. Many examples of this typology are likely to have been renovated and extended.

#### Example House

NSW Department of Housing BV3718 (Thomas & Prasad 1997). Example floorplan and elevations included in Appendix B.



Source: realestate.com.au

#### Main construction type/materials

#### Other variants/sub-typologies

**Walls:** Brick Veneer external walls, timber stud framed with plasterboard internal.

No

**Floors:** Suspended timber floor, enclosed subfloor.

Concrete Slab-on-ground

**Roof:** Timber framed, tiled roof. Plasterboard, standard height (2.47 m) ceiling. Likely to have some insulation.

Also metal sheeting.

**Glazing:** Single glazed, timber or aluminium window frames, WWR ratio for the example building is 16%

Likely to be substantial variation.

#### Upgrade potential, methods and materials

**Insulation:** Likely to have no insulation in walls and floor, and limited insulation in the ceiling.

Potential for top-up insulation in roof (or installation if uninsulated). Top-up insulation for a similar housing type has been estimated at approximately \$17.50/m<sup>2</sup> (Sustainability Victoria 2014), and to reduce heating energy requirement by an average of 8% for NSW (Thomas & Prasad 1997). These values are likely to vary significantly based on specific house designs, climate, contractors and market conditions.

Uninsulated brick veneer walls can cause discomfort in summer. Pump-in insulation (e.g. polystyrene balls or mineral fibre) can be used to retrofit insulation to these walls, or insulation can be added if the cladding/lining is removed during renovations.

Underfloor insulation can improve comfort, but need a minimum height of 400 mm, and preferably greater than 600 mm, for access to install. Thomas & Prasad (1997) predicted 10% reduction in heating energy through insulation of suspended floors.

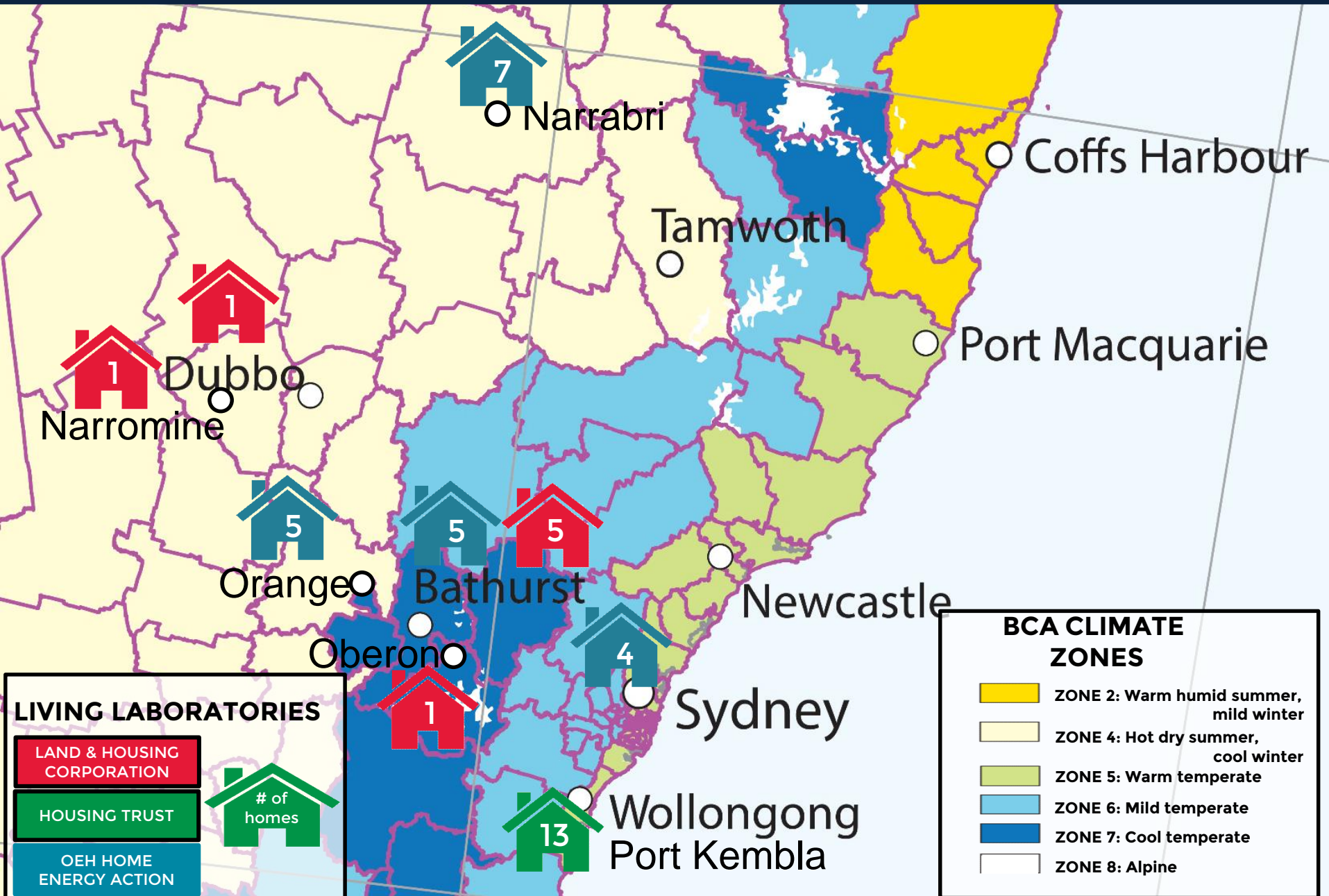
**Air tightness:** Air-tightness of this typology is likely to vary widely, and is highly dependent on build quality. Suspended floors represent a common pathway for air leakage (Ambrose & Syme 2015), and uninsulated suspended floors may benefit from sealing.

**Shading:** External shading of wall and glazing can significantly reduce summer heat gain and reduce overheating, and is more effective than internal shading at preventing solar gains entering a dwelling. External fixed (vertical screens or timber battens) or adjustable (awning blinds or roller shutters) vertical shading to west and east facing facades, and adjustable shading to the north can effectively reduce solar heat gains.

# RP3044 Mainstreaming Low Carbon Retrofits in Community/Social Housing

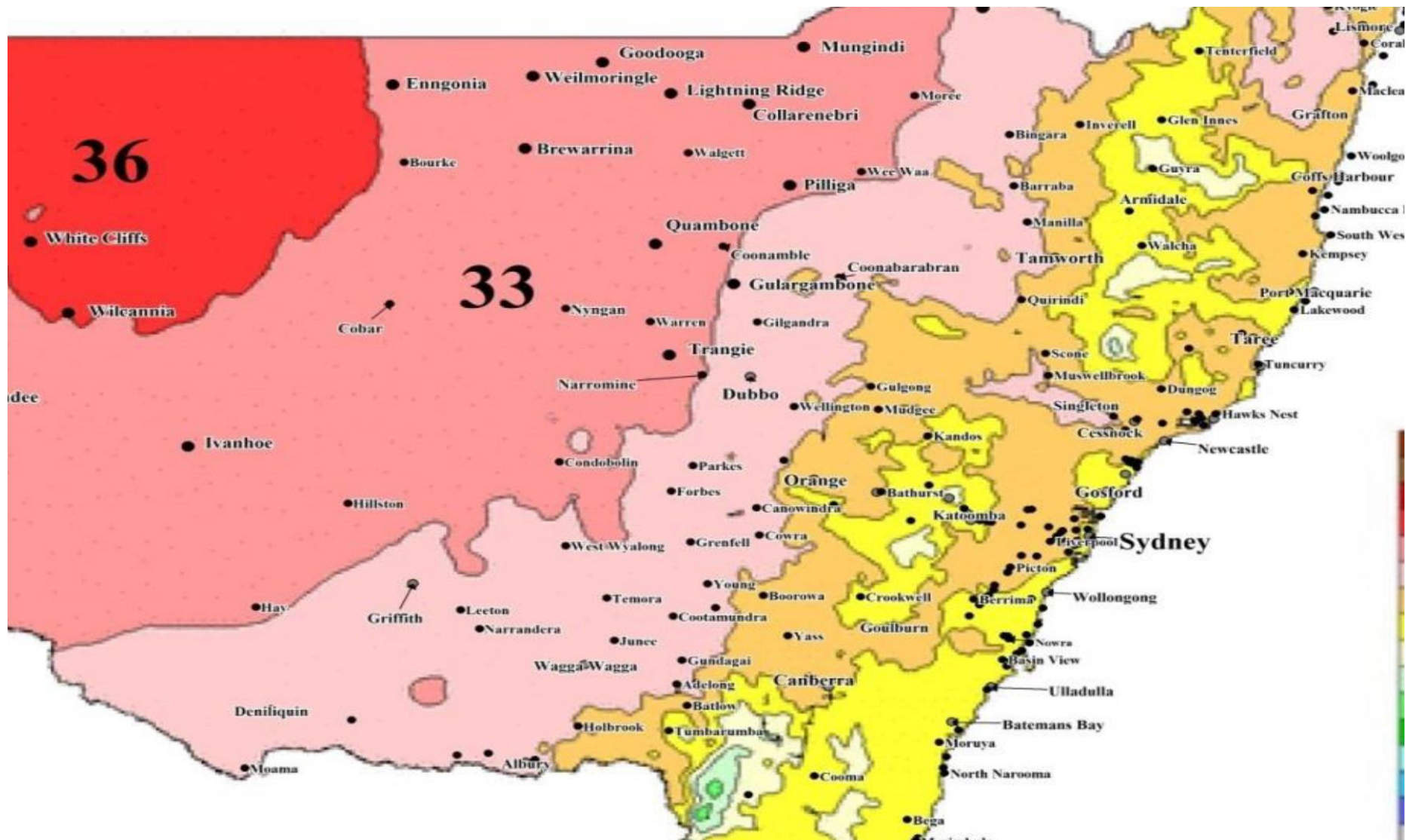
- Activity 1: Assemble the business case for low carbon retrofits in Social Housing:
  - Identify current performance benchmarks, and building upgrading and maintenance processes.
  - Literature review of direct and co-benefits from low carbon retrofits, focused on low income occupants.
- Activity 2: Co-design and development of retrofit decision support tools and resources for social housing providers, e.g.
  - Portfolio assessment and prioritisation of buildings for retrofit intervention;
  - Individual building characterisation and assessment;
  - Retrofit assessment and budget allocation processes; and
  - Cost/benefit analysis.
- Activity 3: Living Laboratory energy and environmental monitoring and evaluation
  - Monitoring of conditions in multiple three Social Housing living laboratories around NSW

# CRC LCL RP3044: MAINSTREAMING LOW CARBON RETROFITS IN SOCIAL HOUSING LIVING LABORATORIES



# LIVING LABORATORIES LOCATIONS

Living Laboratory	Location	Number of homes	Retrofits
1: Sustainable Port Kembla	Port Kembla	13	TBC – likely to include: <ul style="list-style-type: none"><li>• Ceiling fans</li><li>• External and internal shading</li><li>• Skylight replacements</li><li>• Internal zoning</li></ul>
2: OEH Home Energy Action	Bathurst, Orange, Narrabri, Parramatta.	21	<ul style="list-style-type: none"><li>• Solar PV</li><li>• Insulation</li><li>• Draught-proofing</li><li>• LED Lighting</li><li>• HP HWS</li><li>• RCAC</li></ul>
3: LAHC Cladding Upgrades	Bathurst, Dubbo, Narromine	8	Wall insulation



Aboriginal Housing Office  
Air Conditioning Guidelines  
12 March 2017

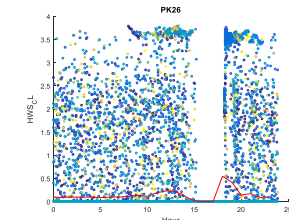
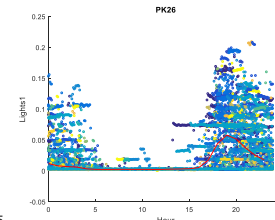
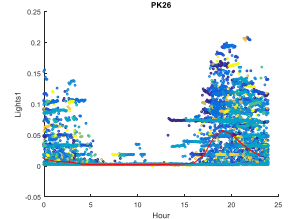
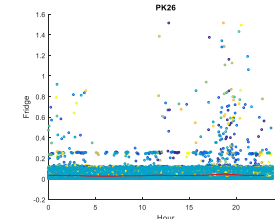
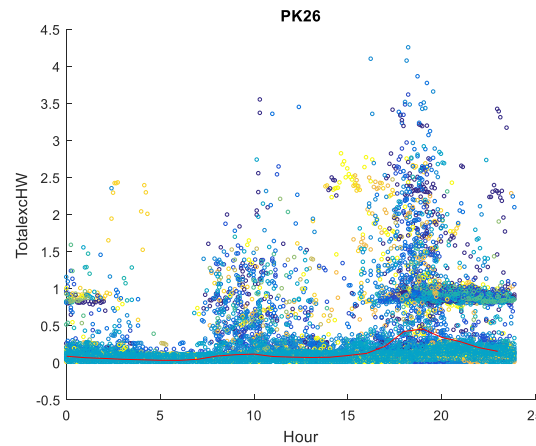
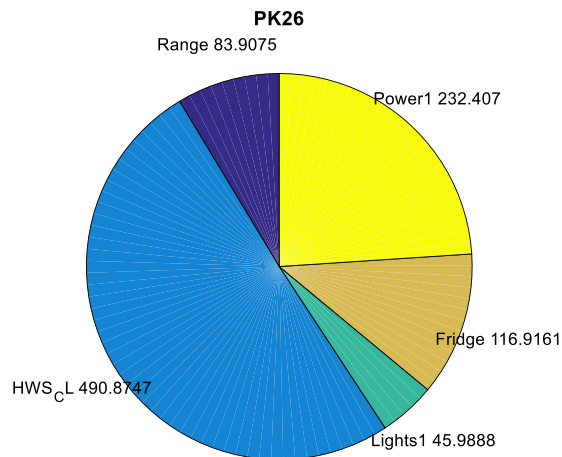
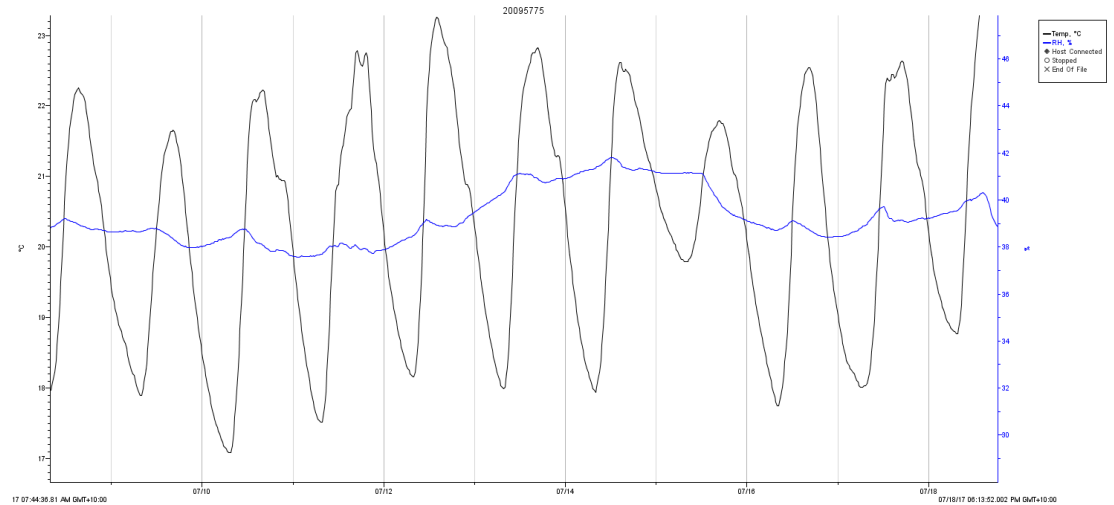
# RP3044 fieldwork team



# Monitoring

Homes are being monitored for:

1. Energy consumption, total and 5 sub-circuits at 1 min interval.
2. Temperature and humidity in main living area at 20 min interval
3. Temperature and humidity in 3 other rooms at hourly interval



# What are the problems?

## 1. Window rattlers + Poor Air-tightness = huge bills



# What are the problems

## 2. Poor insulation, old appliances, mould, etc, etc



LOW CARBON LIVING  
CRC

# Deep retrofits: often spoken of, but rarely done!



# Net-zero energy 21<sup>st</sup> century

## Team UOW Solar Decathlon House

*You can stay  
in it!*



# Key points

- Retrofitting existing housing is a major challenge
- Typologies can help in simplifying choice and process
- Much to be done to develop a low carbon residential retrofit eco-system
- Without good retrofits, low income people trapped in a no-choice situation of either:
  - Significant discomfort or health impacts
  - Huge electricity bills

# Thank you

To find out more, contact

CRC for Low Carbon Living Ltd

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Tyree Energy Technologies Building  
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Australian Government

Department of the Environment and Energy

# Mainstreaming low carbon homes - a policy perspective

Jodie Pipkorn



# Overview

1. Outline of current policies / initiatives
2. Challenges for current and future policies / initiatives
3. Opportunities for future policies / initiatives

# 1. Current policies / initiatives

- National Energy Productivity Plan
  - Building Standards & Labelling (5, 31, 32 + NatHERS)
  - Information Resources (3, 4, 22 + Your Home)
  - Appliance Standards and Labelling (30)
  - Financing (11)
  - Smart metering and metering reform (23)



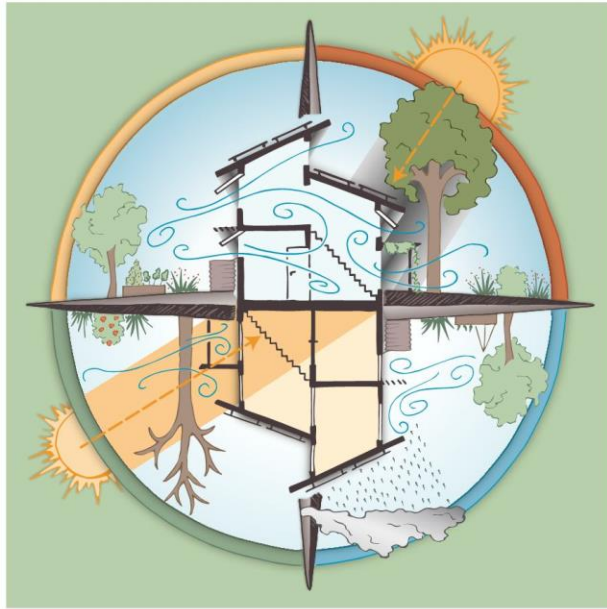
[www.nathers.gov.au](http://www.nathers.gov.au)



[www.yourhome.gov.au/house-designs](http://www.yourhome.gov.au/house-designs)

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Nationwide House Energy Rating Scheme and  
Design for Place free 7 star house plans are  
supporting better buildings



environment.gov.au

Australian Government **Your Energy Savings**

Home Energy Water Waste Travel Rebates Guides Translations Take action Your stories

**Your Energy Savings provides information about saving energy, saving money and available government assistance.**

- [Getting started - energy](#)
- [Understand your energy bill](#)
- [Electricity and gas market offers](#)

**Spring**  
Simple actions to help you prepare your house and garden for the hot summer months ahead.

**Energy-saving guide for Northern Australia**  
Save energy and stay comfortable in hot arid and tropical climates.

**Rebates**  
You may be eligible for assistance for home improvements that save energy

**Take action**  
[Buy a fuel-efficient vehicle](#)  
[Buy energy-efficient appliances](#)  
[Buy energy-efficient outdoor](#)

**Guides**  
[At work—what can I do?](#)  
[At work—what can we do?](#)  
[At home](#)

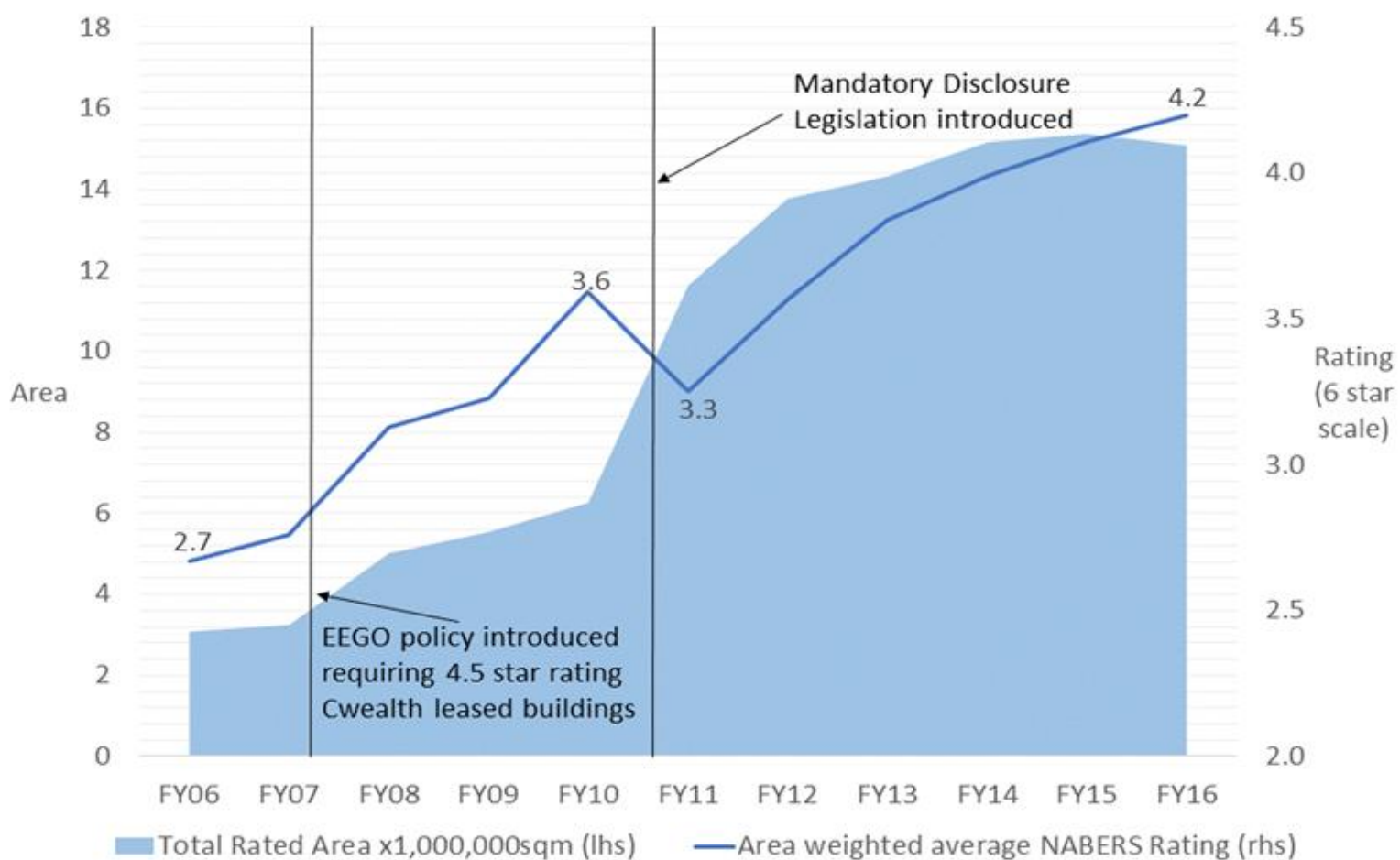
Information resources are supporting better buildings and behaviours

[www.yourhome.gov.au](http://www.yourhome.gov.au)

[www.yourenergysavings.gov.au](http://www.yourenergysavings.gov.au)

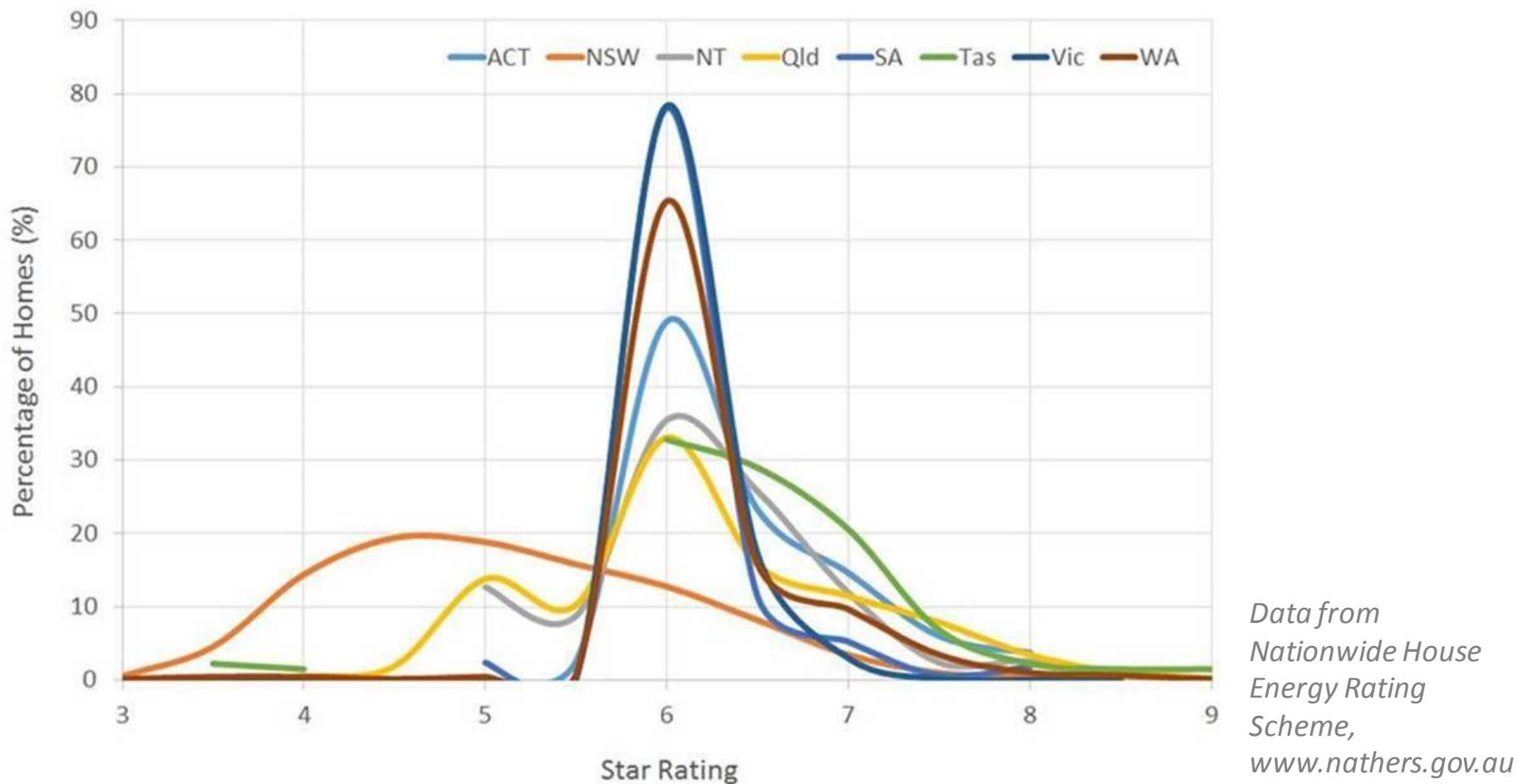
## **Challenges for current + future policies**

- Responsibility / evidence
- Compliance / culture
- Energy security / peak load



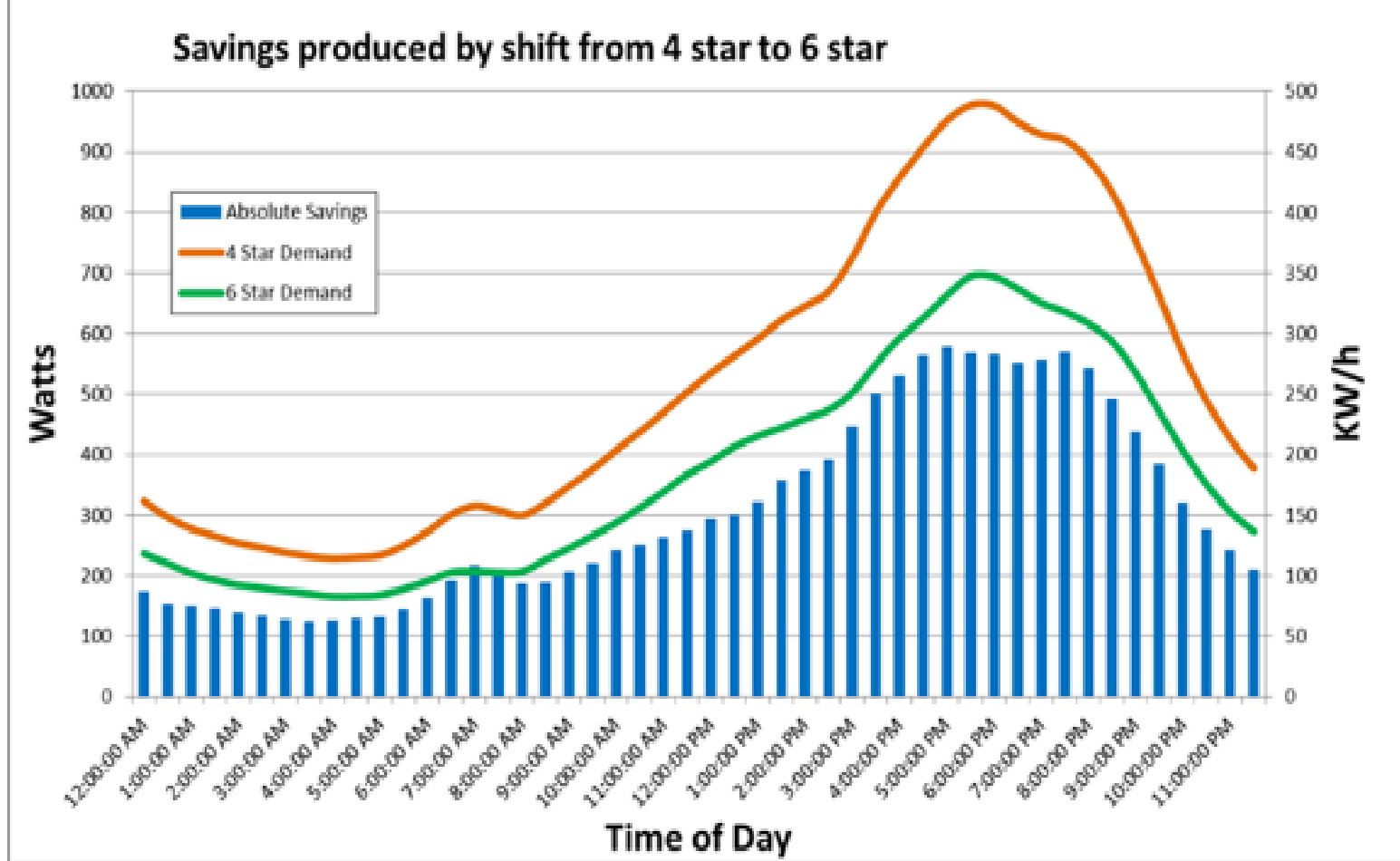
Commercial Building Disclosure (labelling) is improving demand for better buildings...

...but this is not in place for homes



Minimum building standards are improving  
the performance of buildings...

...but the majority of buildings are minimum



Better buildings can reduce peak loads...

...but depending on their design could make peak loads worse



- Designed for volume housing market
  - Occupied and monitored for just over 12 months
  - Used approximately double the energy
  - 50% increase in number of occupants
  - Higher number of appliances
- 

We can design better buildings like the AusZEH (Aust. Zero Emission House)...

...but they may not operate as intended

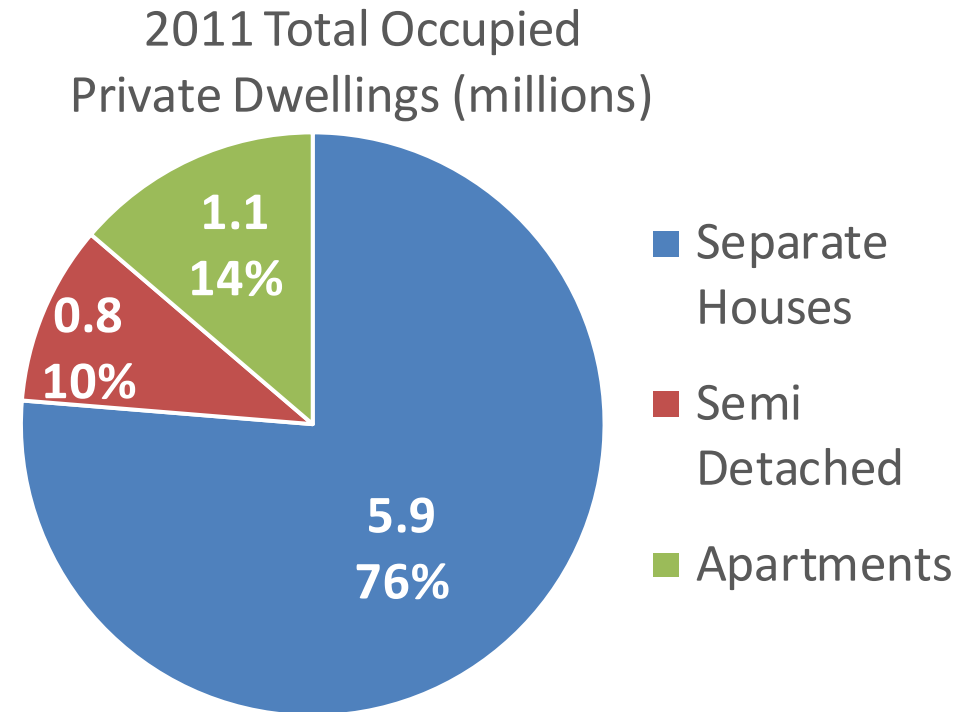
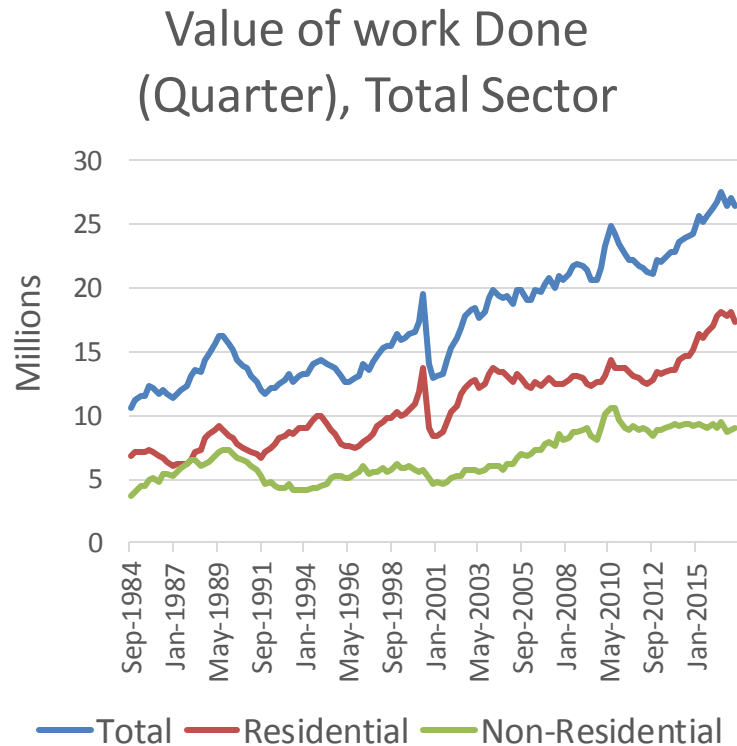
## **Opportunities for future policies / initiatives**

- Trajectory to Low Energy Homes
- Strategy for Your Home and NEPP 32
- Others...

## **NEPP 31.2 – Trajectory to Low Energy Homes**

- Australian Governments are developing a Trajectory for Low Energy Homes with a Whole-of-House approach for verifying compliance.
- The proposed Trajectory and changes to the National Construction Code in 2022 will be provided to the COAG Energy Council for consideration in December 2018.
- The first workshop for this project will be held on Tuesday 5 December 2017.

## Building types in Australia

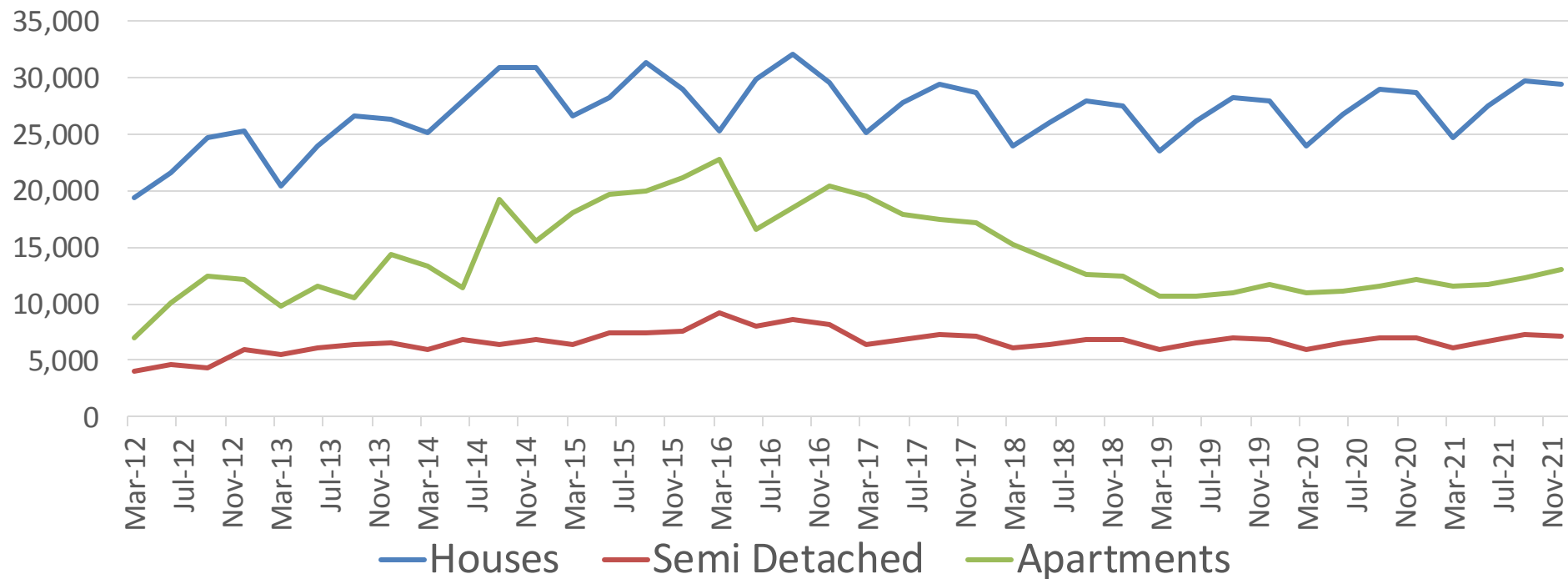


*Data from Australian Bureau of Statistics*

California has set a zero energy building requirement for detached houses...  
...much of the Australian stock is detached

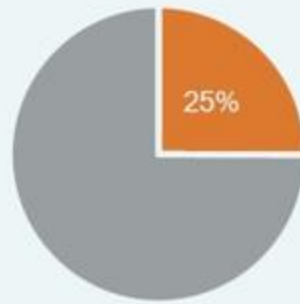
# Quarterly Private Dwelling Construction 2011 - 2021

*Data from Housing Industry Association*

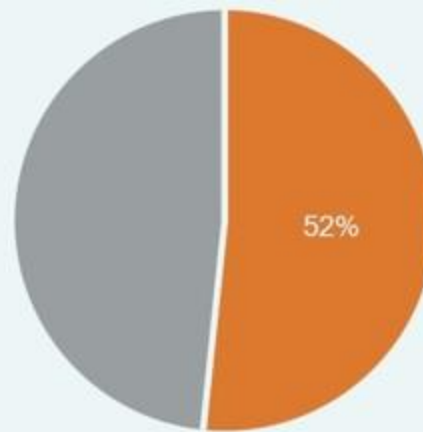


The number of new detached houses  
are expected to continue  
into the future

Residential:

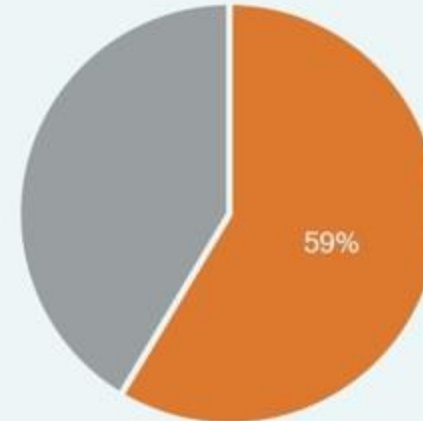
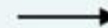
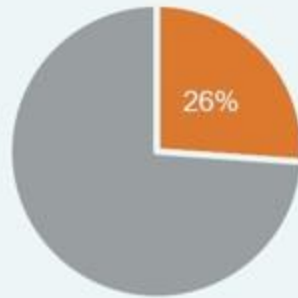


2030



2050

Commercial:



*Image from 'Building Code  
Energy Performance  
Trajectory Project July 2017  
Issues Paper' – ASBEC and  
Climate Works*

■ Built before 2019   ■ Built after 2019

Many buildings built now  
will still be here in 2050



---

Passivhaus and solar passive design with  
on-site renewable energy and batteries...  
...needs no winter heating in Canberra

# Questions

1. What is the target/end point and types of buildings/systems that we should be aiming for?
2. What is the role for Government vs industry vs other organisations vs consumers?
3. How can solutions support energy security and affordability?

**[www.environment.gov.au](http://www.environment.gov.au)**

**[www.yourhome.gov.au](http://www.yourhome.gov.au)**

**[www.yourenergysavings.gov.au](http://www.yourenergysavings.gov.au)**

**[www.nathers.gov.au](http://www.nathers.gov.au)**

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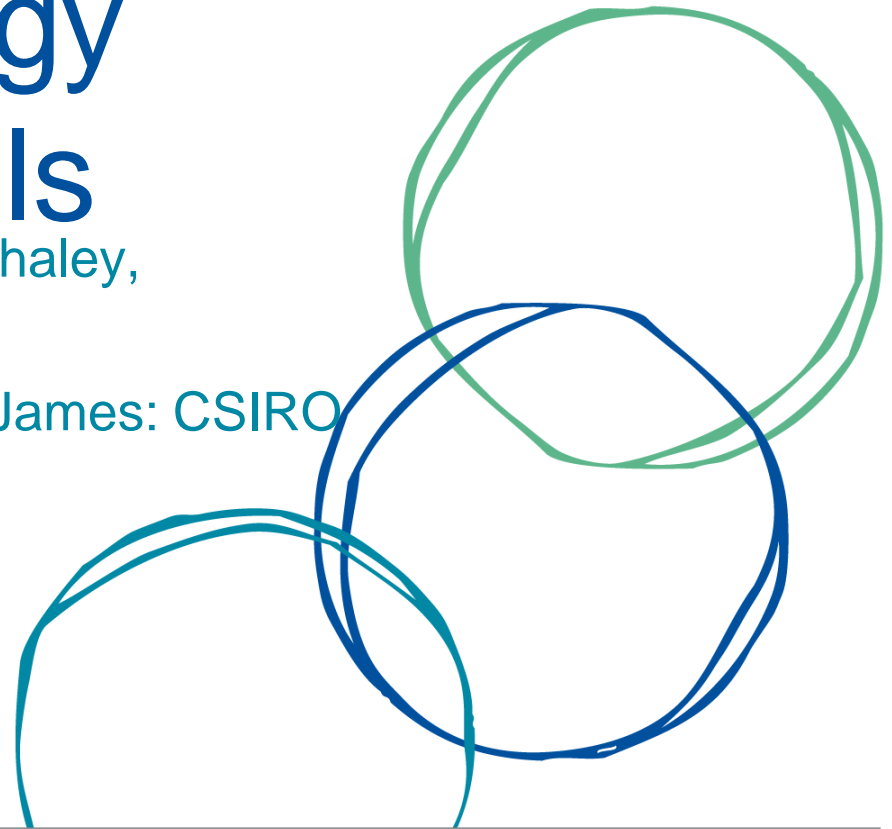
**[Jodie.Pipkorn@environment.gov.au](mailto:Jodie.Pipkorn@environment.gov.au)**

# Informing the Next Generation Residential Energy Assessment Tools

Wasim Saman, Stephen Berry, David Whaley,

Lyrian Daniel, Lachlan Mudge: UniSA

Michael Ambrose, Dong Chen, Melissa James: CSIRO

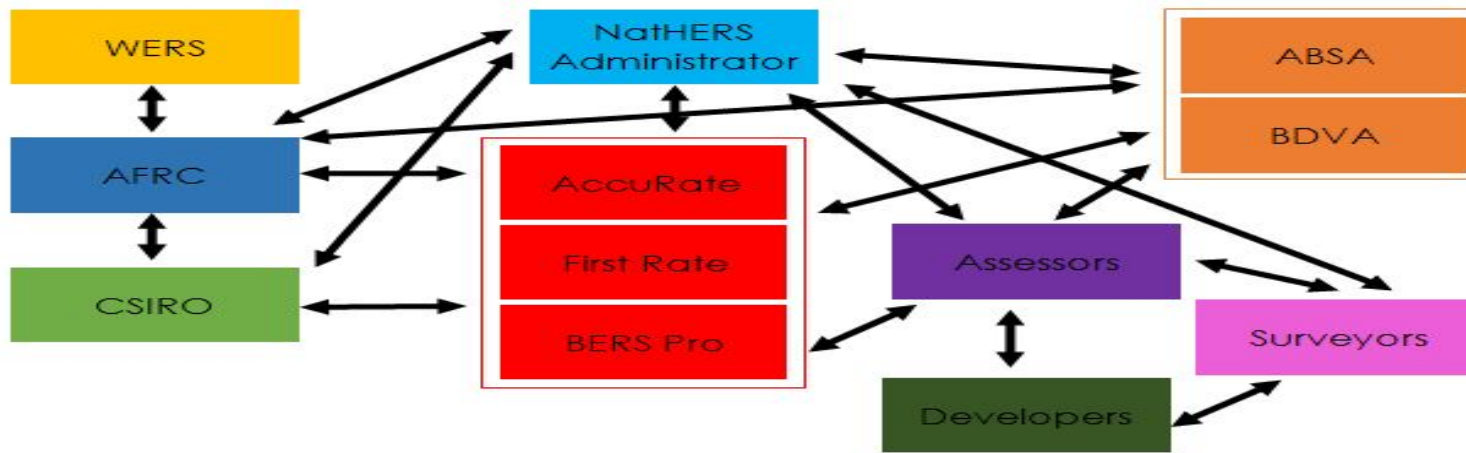
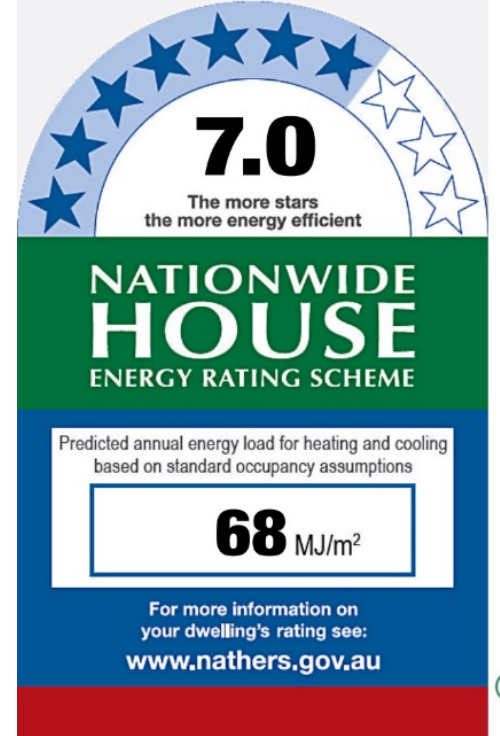


UniSA

Barbara Hardy  
Institute

# Australian Housing Energy Regulations

- Cover building envelope only
- 2003 = 4 Star
- 2006 = 5 Star
- 2010 = 6 Star + Lighting + Water Heating
- No development in the last 7 years
- Current activities by Administrator, ABCB, ASBEC CRCLCL and State Governments



# Next generation Rating Tools Project

Project Duration 2 years

## Project Participants:

University of South Australia

CSIRO

Department of Environment and Energy

SA Government

ASBEC

Energy Inspection

CSR Building Products

## Project Stakeholders:

State and Territory Governments

Local Governments

Australian Building Codes Board

BlueScope Steel

Australian Building sustainability Association

Australian Window Association

Australian Institute of Architects

Housing Industry association

Property Council

Energy Consumers Australia

1

# Project Objectives

- To review and update assumptions for contemporary lifestyles using available evidence base in all Australian climates.
- To incorporate a comfort metric and economic outputs.
- To broaden the scope of rating software to include all major domestic energy end-uses.
- To incorporate solar energy, energy storage technologies, and other demand management technologies.
- To incorporate advanced construction and mechanical ventilation systems
- To improve usability through the development of CAD interoperability.
- To investigate the suitability for assessing mandatory and best practice performance standards.
- To Investigate compliance issues



# Project Activities

## Milestone A – Review NatHERS assumptions/settings

### A.1 Building envelope/ heating and cooling load using new RMY climatic files:

Heating and cooling thermostat settings, infiltration, ventilation, zoning, thermal mass, roof, wall and subfloor models, thermal bridging, shading, window types, aperture opening and covering, internal loads (appliances, cooking, lighting, occupants), impact of size of house floor area.

Activities:

### A.2 Other energy components included in whole of house evaluation:

Heating, cooling and ventilation systems, hot water systems, lighting, cooking, dishwasher, other loads, rooftop PV generation, storage.

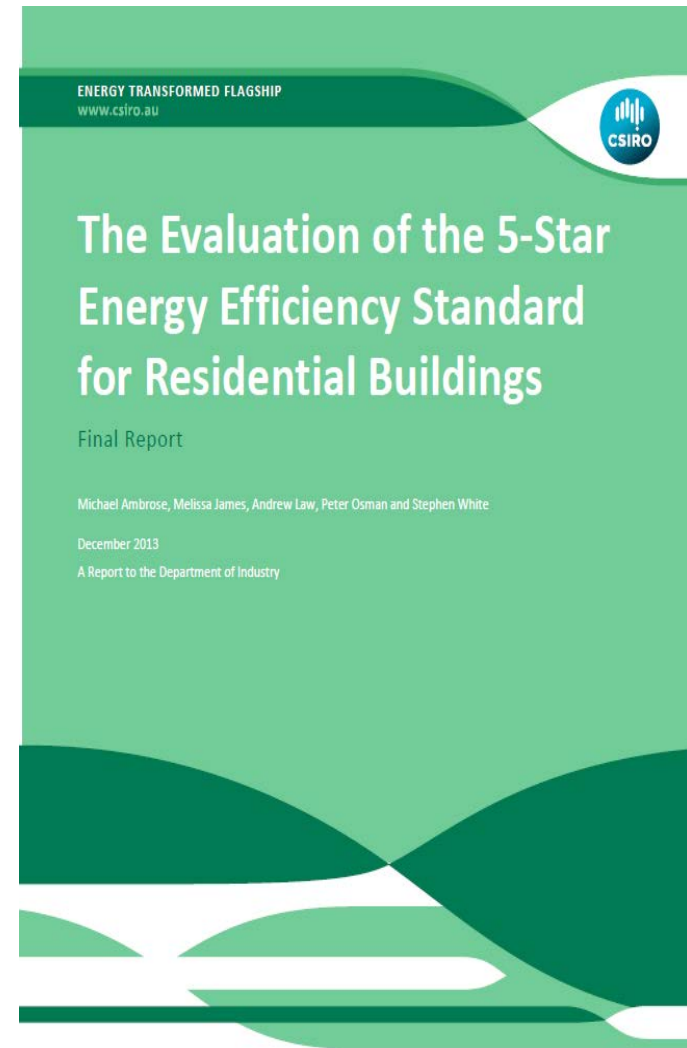
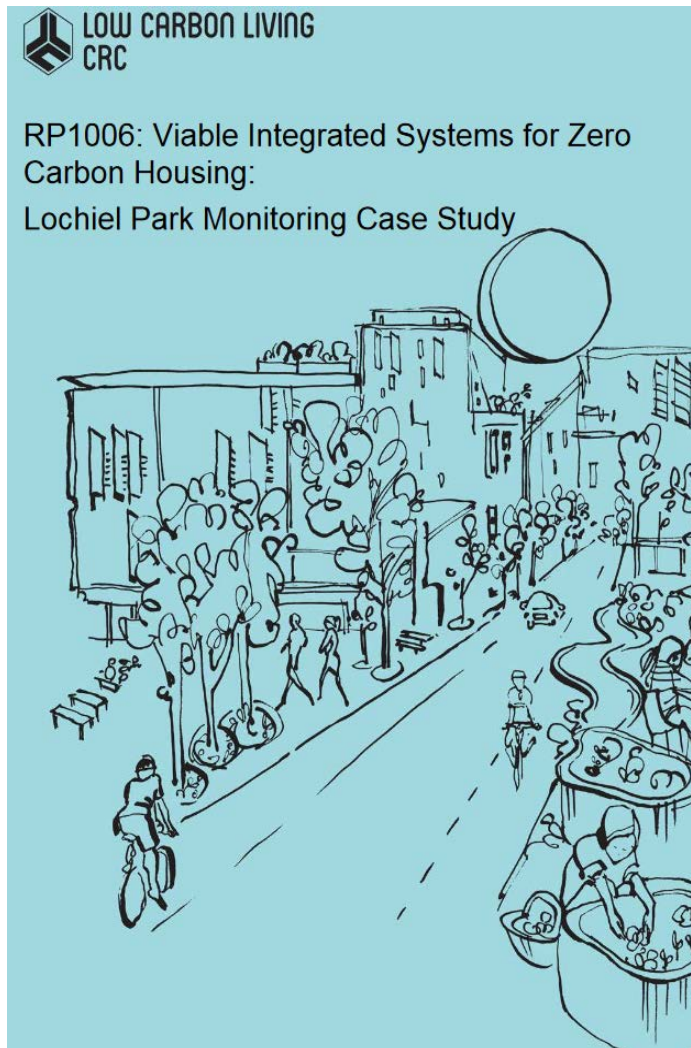
## Milestone B – Cooling model

## Milestone C – Develop design tool: Being carried out by CSIRO/Energy inspection

## Milestone D – Compliance and metrics

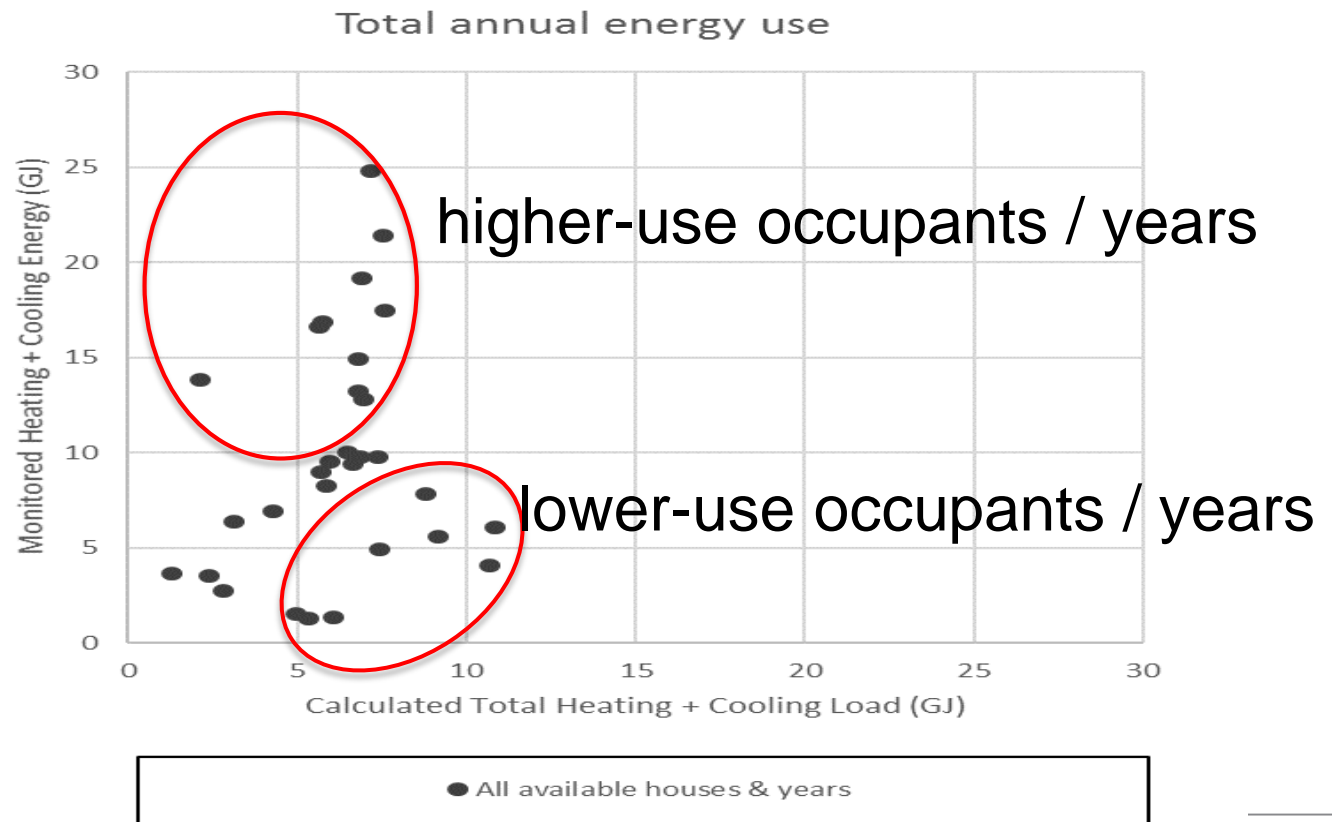
## Milestone E – Dissemination and integration

# Available Evidence



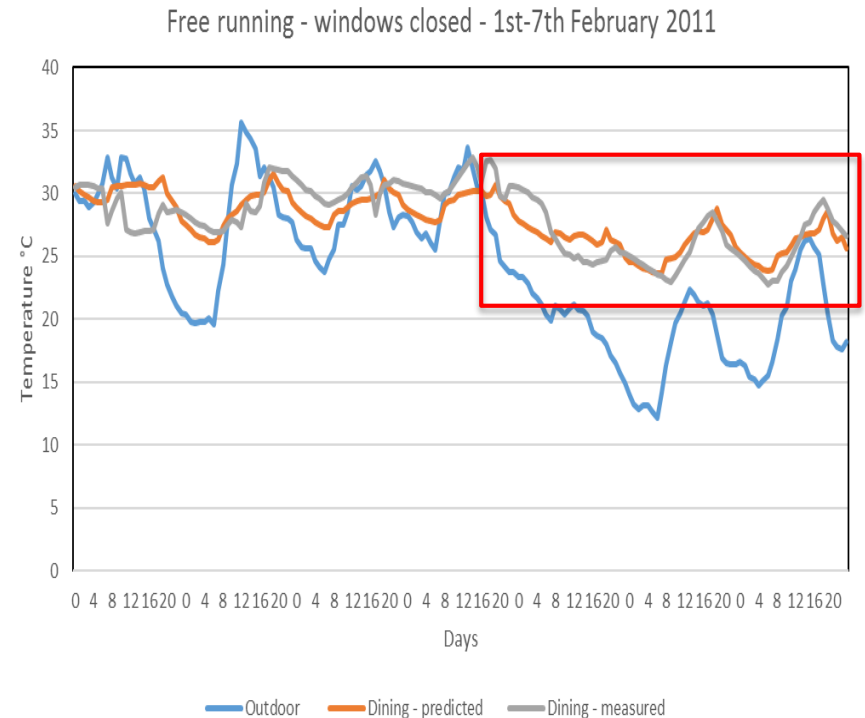
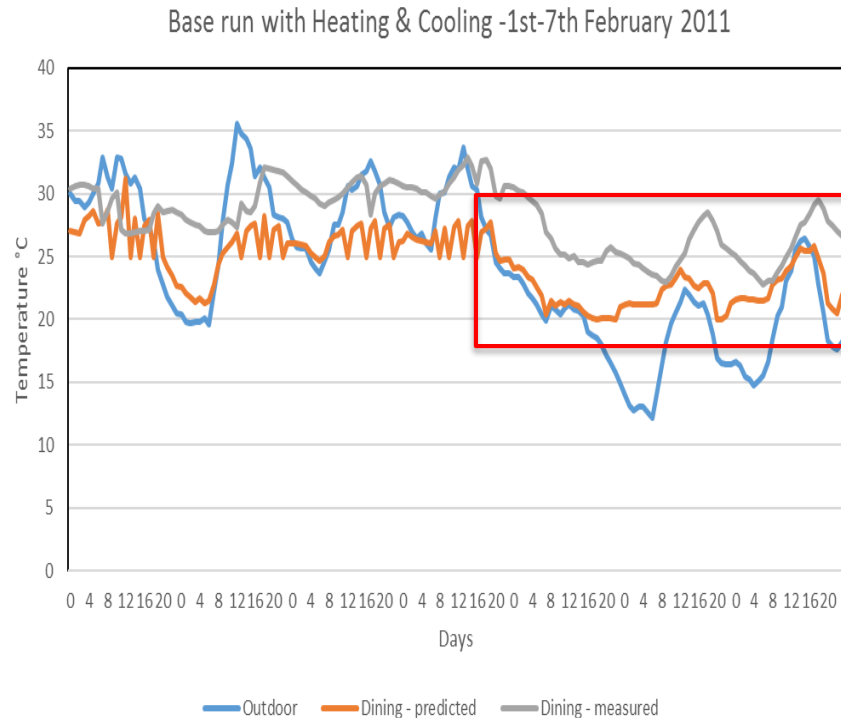
# Results

## Measured annual vs. predicted annual energy use



# Results

## Window opening behaviour



## Impact of opening & closing windows in hot weather

# Thank You

More details:

[wasim.saman@unisa.edu.au](mailto:wasim.saman@unisa.edu.au)

[www.lowcarbonlivingcrc.com.a](http://www.lowcarbonlivingcrc.com.au)

[u](#)