Electrification of Homes and Transport: Challenges and Opportunities

Energy Consumers Australia
Board Stakeholder Forum

14 September 2022

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Agenda

5:00 - 5:05pm	**Welcome from CEO** **Acknowledgement of Country**	**Lynne Gallagher, Energy Consumers Australia**
5:05 – 5:10pm	Introduction	Prof Neil Horrocks, University of Queensland
5:10 – 5:25pm	Queensland's Zero Emission Vehicle Strategy and the Electric Superhighway	Dr Liam Byrnes, Department of Energy and Public Works
5:25 – 5:40pm	Carseldine Village Living Laboratory research around fully electrified and efficient homes	Associate Professor Wendy Miller, Queensland University of Technology
5:40 – 5:55pm	Challenges and opportunities around the electrification of our homes and transport for Australian households and small business	Lynne Gallagher, Energy Consumers Australia
5:55 – 6:10pm	Panel Discussion	**Moderator** Prof Neil Horrocks **Panel** • Dr Liam Byrnes • Assoc. Prof. Wendy Miller • Lynne Gallagher
6:10 – 6:15pm	Closing remarks	Prof Neil Horrocks

Electrification of Homes and Transport: Challenges and Opportunities

Professor Neil Horrocks
University of Queensland

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Electrification of Homes and Transport: Challenges and Opportunities

Dr Liam Byrnes
Department of Energy and Public Works

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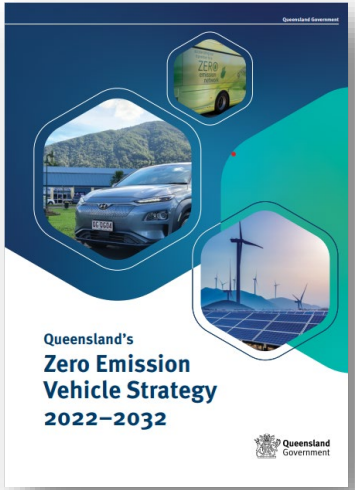
Electrification of Transport

Queensland Government

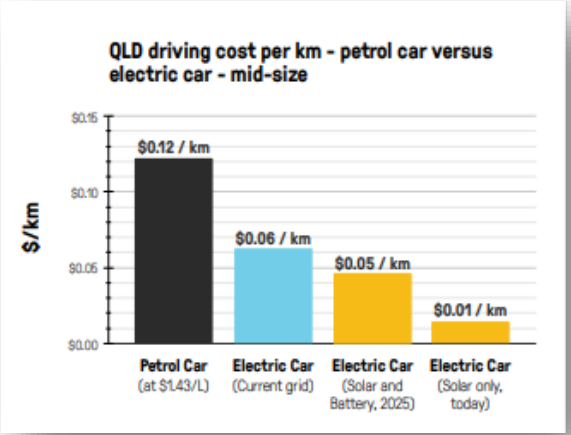
Vision

A cleaner, greener, integrated transport and energy network that encourages zero emission transport solutions and contributes to Queensland's net zero emissions future.



Drivers

- Social: health, skills uplift
- Economic: energy bills, keeping money in Australia
- Environmental: reduced emissions

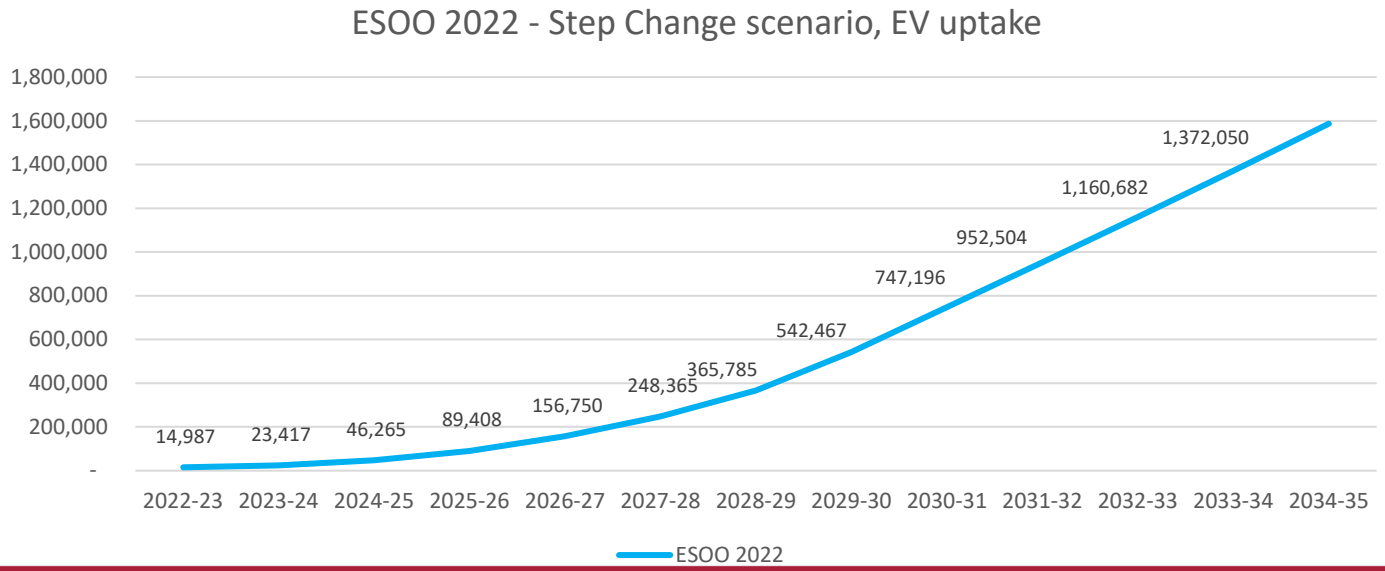


Rewiring Greater Brisbane, Rewiring Australia (May 2022)

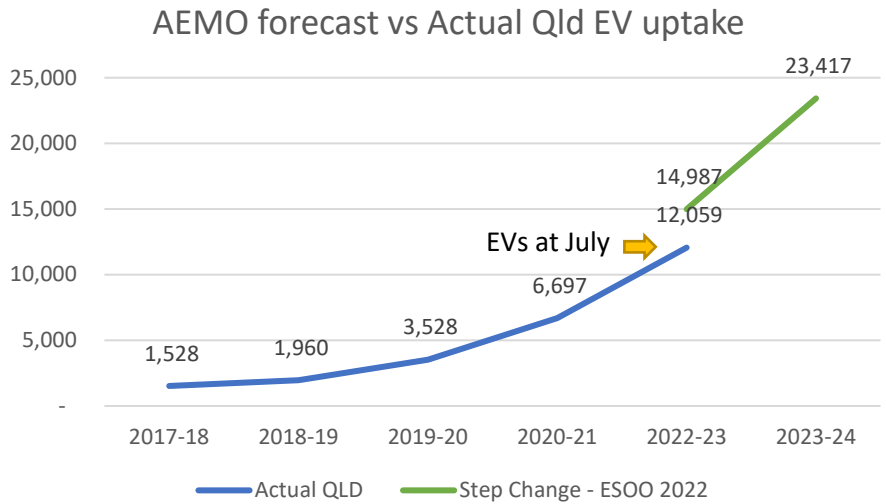
Priorities

1. Encouraging cleaner, greener transport modes
2. Building ZEV manufacturing and supply chain capability
3. **Facilitating supportive ZEV infrastructure**
4. **Driving towards renewables and smart charging**
5. Partnerships, innovation and advocacy

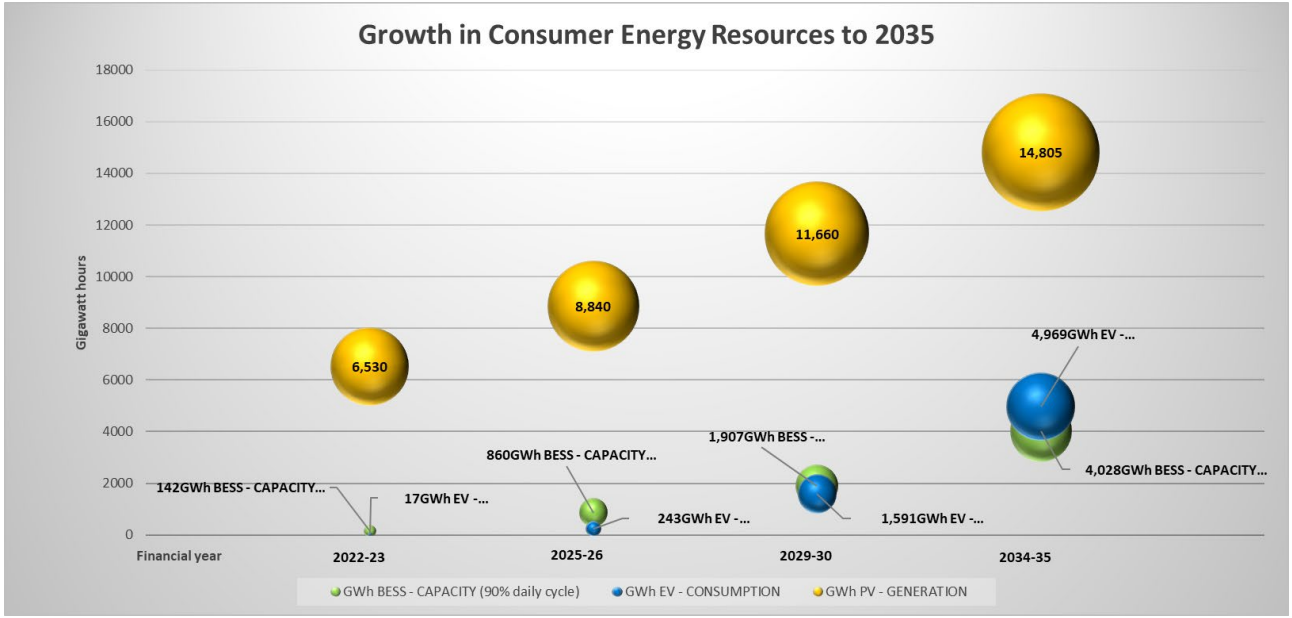
EV uptake – AEMO/CSIRO forecast



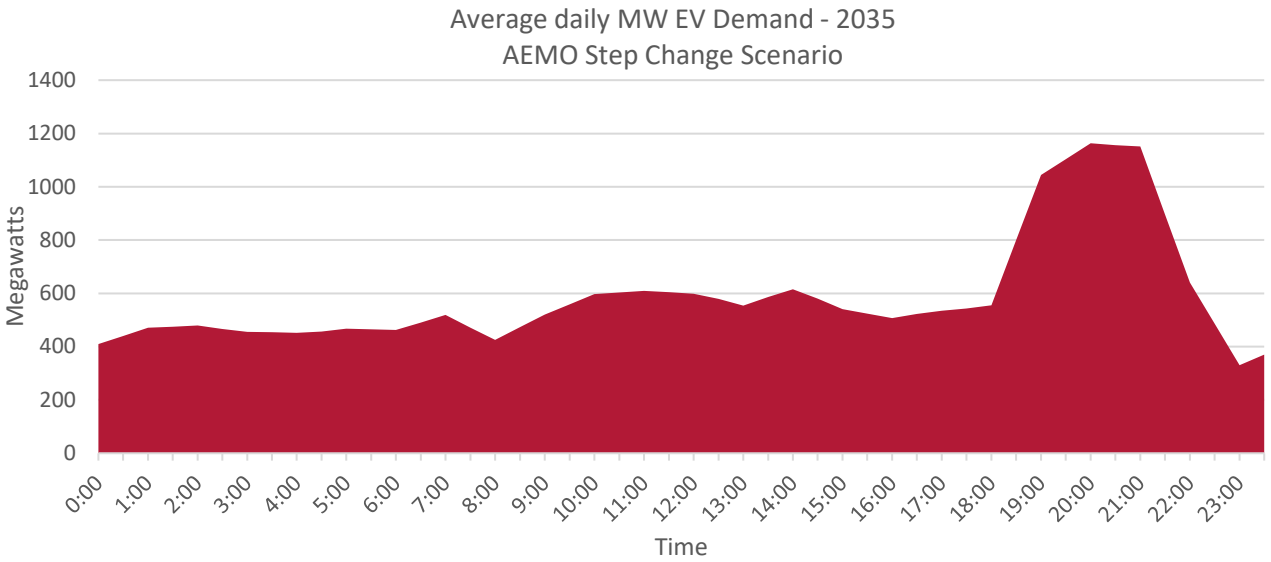
QLD EV uptake and projections



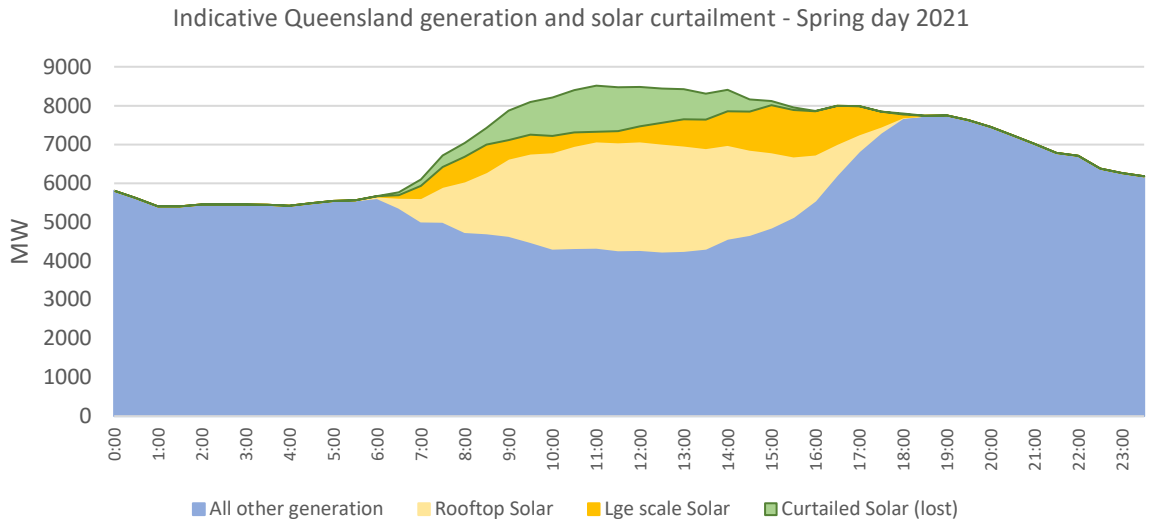
Relative impact of CER



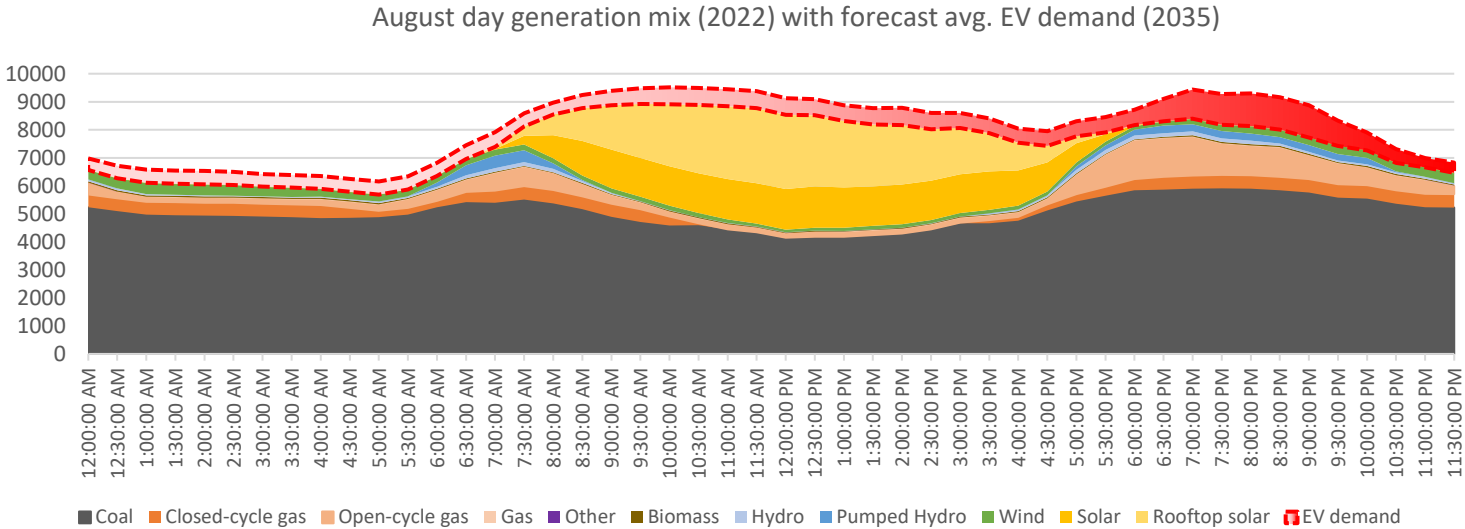
Future Demand



Renewable generation curtailed due to lack of demand



Generation mix – 9 August



Queensland Energy Plan

Actions to position the state as a leader in integrating decentralised energy sources and ZEVs into our electricity grid, including measures aimed at:

- building codes adjustment
- tariffs reform
- network upgrades and charging infrastructure

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Ass. Prof. Wendy Miller
Queensland University of Technology

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Carseldine Village
(Living Lab – Research Project)

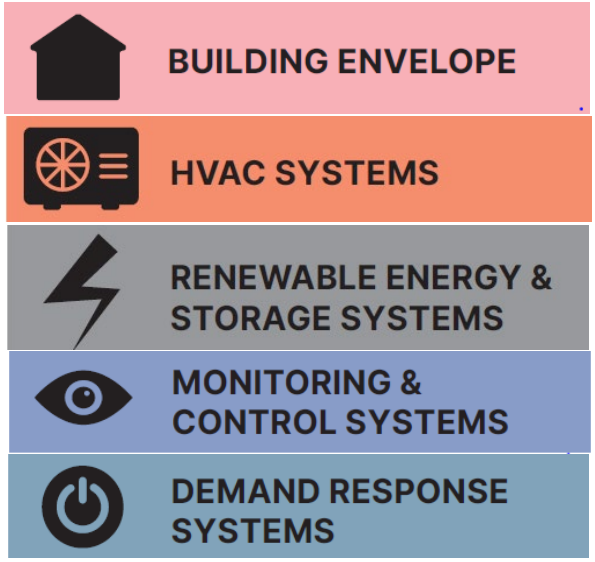
carseldinevillage.com.au

Queensland Government

*Stage 1 and 2 plan indicative only. See carseldinevillage.com.au for further information.

Carseldine Village Overview

- 5 Star Green Star – Communities rating
- Design intent – future proofed terrace homes
  - Freehold
  - Affordable sustainable living
  - Reduced cost of living
  - Enhanced energy efficiency and comfort (climate resilient)
  - Solar power and battery storage
  - Liveable Housing Australia certification
- Energy goal - net zero energy emissions
- Energy approach - holistic
  - orchestration of builders, appliance providers, electricity network, owners



Carseldine Terrace Homes standard inclusions =/> proposed 2022 NCC

- 7+ NatHERS rating
- 3.5 kWp rooftop solar (PV)
- 10.3 kWh battery storage
- Heat pump hot water system
- Demand responsive air conditioners
- Electric vehicle circuit

- Optional: Home Energy Management System (HEMS)

RACE for 2030 CRC (renewable, affordable, clean energy)

- Renewable, Affordable and Clean Energy for 2030
- An industry led collaborative research centre established in 2020 with $68.5M of Commonwealth funding + partner funding
- Aim: “to accelerate the transition to “RACE” by 2030 through innovation focused on energy end users and the networks that supply them”
- Vision: “A flourishing low carbon Australia, where energy research improves quality of life and boosts energy productivity”

RACE For everyone

Accelerating the customer-centred energy transition via fore-sighting, stakeholder engagement with the innovation ecosystem, capacity building, training and education.

RACE for NETWORKS:

Optimising Australia’s electricity grid through customer distributed energy resources and network integration.

RACE for HOMES:

Developing and applying new energy technologies and solutions to lower costs and improve comfort for households.

RACE for BUSINESS:

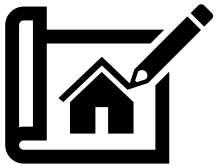
Boosting business energy productivity and cutting costs via digitalisation, electrification and value chain optimisation.

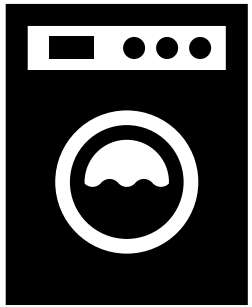
- Less shedding of household PV
- Less energy waste
- Lower energy costs
- Reducing emissions to less than 20 mega tonnes 2030

- Increasing demand flexibility = increasing renewable penetration while increasing reliability
- Increased energy productivity during economic growth
- Increased electrification

CV Living Lab Goals

- Build on QUT's Living Lab experience
- Provide independent quantitative and qualitative data analysis relevant to RACE for HOMES themes
  - *Solar Pre-cooling*
    - Communications, pricing, standards, engagement
  - *Thermal Inertia*
    - Enhancing home thermal efficiency
  - *Smart inverters – Appliances*
    - Using home energy technologies for grid support
  - *Rewarding Flexible Demand*
    - User-friendly cost-reflective tariffs and incentives
  - *Smart Algorithms*
    - For optimising home energy supply and use





Research Project Approach

- Project manager – Associate Professor Vaughan Coffey
- Project sub-teams
  - Building Performance / Stakeholder Influence - QUT
  - Energy Industry Impact - QUT
  - Behavioural Science (households) - QUT
  - Precooling - UNSW
- Industry Stakeholder Group
  - QUT/UNSW; Economic Development Queensland; Energy Queensland; Powerlink; Department of Energy Resources Minerals; Department of Environment and Science; Thompson Sustainable Homes; Vantage Homes QLD; Evergen, Major AC Manufacturer
- Industry Reference Group
  - Energy Consumers Association
  - Master Builders QLD

RQ 1: to what extent is solar pre-cooling as a DR strategy dependent on occupant needs and perceptions, and technology/network engagement mechanisms?

Building performance / stakeholder influence

- Quantify NatHERS rating as built, airtightness, specific heat capacity

Energy industry impact

- Evaluate technical feasibility of consumer lead solar precooling (HEMS, AC provider, EQ) – Ripple control and AS4755.2

Behavioural science

- Ascertain occupant needs and perceptions

Precooling

- Use HEMS data to characterise solar PC options for each home
- Develop a ‘standard’ or ‘approach’ for solar PC

RQ2: How does house design and construction impact on thermal inertia and thermal leakage, commercial viability, occupant comfort levels, and space cooling/heating demand and flexibility over the life of the building?

- Building performance / stakeholder impact
  - Quantify performance of house (air leakage, BERS/AccuRATE; CSIRO Whole-of-House; indoor T & RH conditions; stakeholder interactions) & compare with NCC 2022
- Energy industry impact
  - Analyse house performance at a circuit level
  - Energy system analysis (PV, batteries, net consumption, energy flow in|out|through)
- Precooling
  - Use HEMS, BOM and site weather station data to develop and test software tool for estimating thermal rating of a home

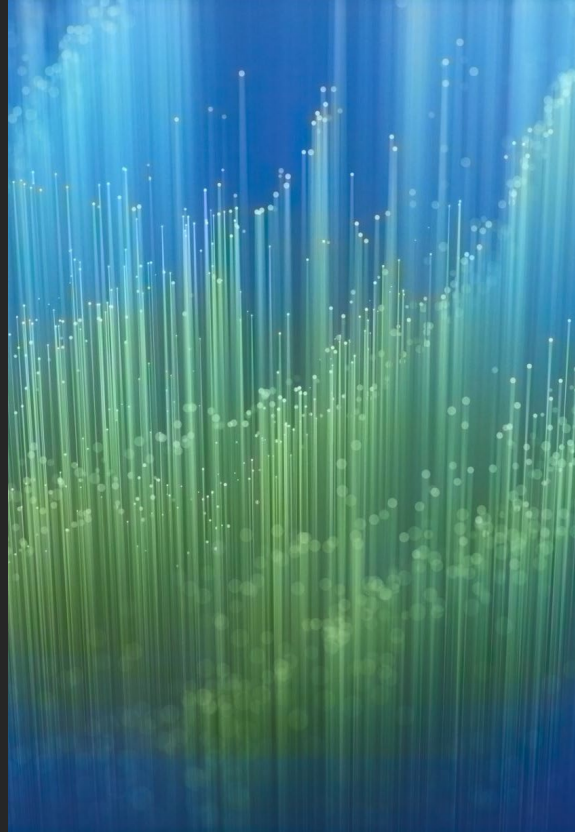
RQ3: to what extent do technologies (PV, inverter, battery, AC, HWS, EV, HEMS) enable participation in DR?

Building performance / stakeholder influence

- Stakeholder circle / influence (households, developer, builders, EQ, technology providers)

Energy industry impact

- Analyse DR program technical outputs for
  - households (energy use profile, peak demand, self-utilisation of solar, load shifting)
  - HEMS provider (effectiveness / reliability)
  - Networks (peak and minimum demand etc)



RQ4: What are the non-technical factors related to successful DR?

Building performance / stakeholder influence

- Interview builders / developer

Energy industry impact

- Interview network (EQ and Powerlink) re objectives, assumptions
- Evaluate implications for cost-reflective tariffs (with / without behaviour change)

Behavioural science

- Survey households (willingness to participate; attitudes towards rewards; way in which rewards are given)

RQ5: How effective is the HEMS technology for participating households, broader housing stock, networks and technology providers?

Building performance / stakeholder influence

- Interview developer/builders: commercial viability, marketing benefits, challenges

Energy industry impact

- Interview HEMS & AC providers, re API usefulness, control algorithms, applicability of API control to non-residential EMS, market diffusion

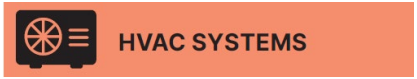
Behavioural science

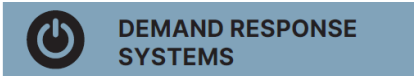
- Household survey (HEMS useability, satisfaction, engagement ...)

Precooling

- Analysis of value propositions to networks and the energy market/industry overall, due to the change in HH consumption behaviours resulting from different types of HEMS control
  - reduction in peak demand and peak solar export, net load ramping, voltage regulation management
- Compare HH level control versus village level control (e.g. VPPs)

Where are we up to?





Homes under construction and appliances installed:

- **PV, HPHW, BESS**
- **Wifi AC**

Airtightness tests prior to occupancy

X homes completed and residents moved in

- **HEMS operational**

Monitoring equipment being rolled out

- **HOBO CT clamps on circuits**
- **Indoor sensors (T, RH)**
- **Weather station**

Building simulation commencing

Occupant surveys and stakeholder interviews soon (ethics approved)

Further opportunities

- This research program doesn't cover
  - Longitudinal energy behaviours, impacts
  - Tariff reform / innovation
  - EV intent, usage patterns, impacts
  - Resilience – ratings, communication, effectiveness
  - Issues of disclosure & expectations for/of future occupants
  - Lessons that could be applied to existing estates re electrification / resilience
- For more information
  - AsPro Vaughan Coffey (Project manager) v.coffey@qut.edu.au
  - AsPro Wendy Miller w2.miller@qut.edu.au

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Lynne Gallagher
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Questions?

Raise your hand or use the Slido Q&A tab:

Thank you for coming!

Enjoy the networking refreshments