

TEN HOUSE LIVING LABORATORY STUDY

Research Question

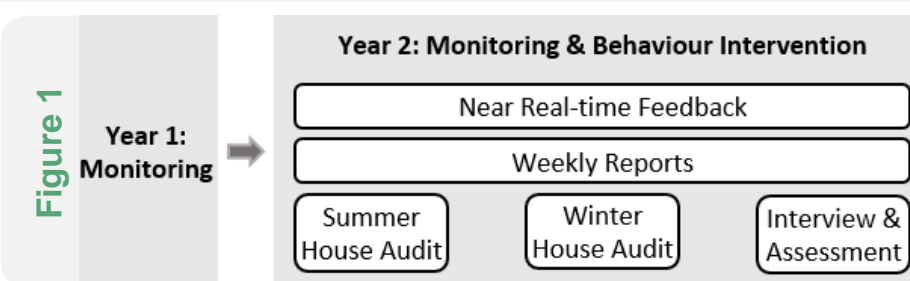
Recent research has found that low-emission buildings do not meet their full potential and the main reason for this discrepancy is related to occupancy. Inside the building, users interact with technologies and are influenced by everyday practice and subsequent behaviour.

This research aims to answer the following questions:

1. How do user practices and behaviours affect energy use at a home level?
2. Do currently available house assessment tools provide an accurate representation of operational house performance and house sustainability?

Methodology

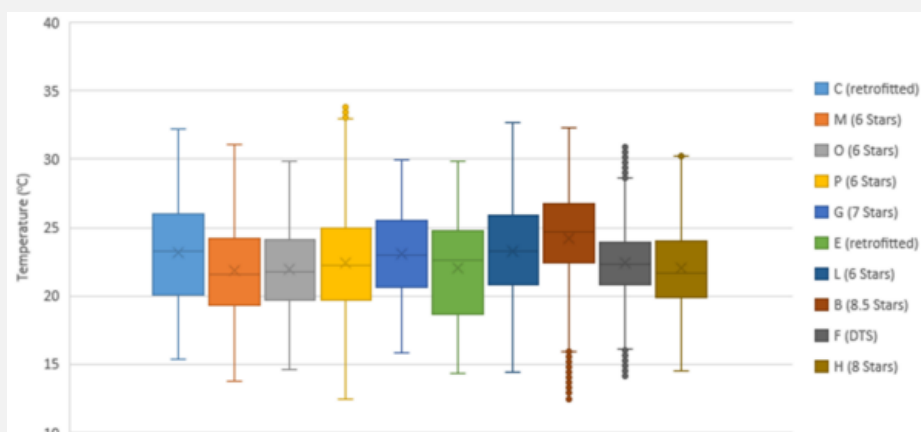
Ten Western Australian houses were established as embedded Living Labs and are being monitored (energy, water, temperature, PV) over a period of two years, subject to an educational intervention strategy at the start of Year 2 (Figure 1). These houses include a mix of design and occupancies and will enable the understanding of energy consumption associated with different housing typologies as well as provide better insights into occupants' behaviours and practices.



“Energy use is determined by technology, lifestyle, family structure, awareness, attitudes, comfort, habits and economic factors”

Results

Temperature distribution in the ten participant households during 2015

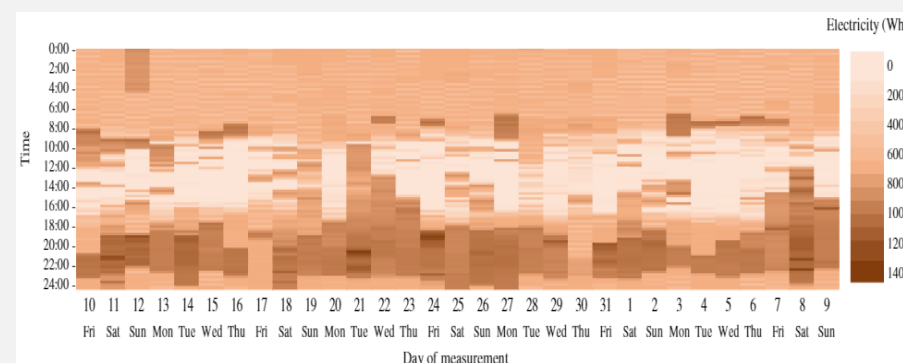


The wider the temperature distribution range, the higher the household occupants' discomfort in winter and summer. The whiskers, maximum, minimum and outlier temperatures relate to the need for heating and cooling in the households.

House P (6 Star) experiences a wide range of temperatures, reaching a minimum of 12°C in winter and a maximum of 34°C in summer. However, it is one of the lowest energy consumers in the study. House O (6 Star), on the other hand, has comparatively stable temperatures throughout the year but is one of the highest energy consumers in the study. We have found no apparent relationship between cooling or heating degree days and energy consumption in the houses.

House G – 7 Star house

Turning on the heater daily is a habit in this house and not necessarily related to thermal comfort.



“Personally I don't care (about greenhouse gas emissions) because I think we actually are focusing in the wrong area” (P1)

“If I use 10% less energy over 20 years would it supplement to my wallet? When you put it in that context it probably makes no difference, so...” (P1)

“I would probably say ditto in terms of the energy use (about having solar panels and a 7 Star house)” (P2)

“I still don't know that I fully understand the whole thing about the solar power and when you use it and that sort of thing” (P2)

House P – 6 Star house

House P keeps warm by putting on warm clothes. They turn the heater on only on very cold days and make the most of the PVs



“You could just walk around with a jumper on and a pair of jeans. It's not like you're sitting there going 'oh my God, I'm freezing cold'” (P1)

“We went electric (heater) purely because we knew we would put solar on the roof and then the intent was that you just put it on for a couple of hours during the day when you get the maximum from your panels” (P1)

“My parents were very economical [...] everything was literally... 'Shut the door, turn the light off, shut the fridge door'... so that part of it has stuck with me” (P1)

Conclusions

Lifestyle and comfort are factors influencing energy use. However, this study also revealed that habits, family structure, willingness to save money, environmental awareness, attitudes and the presence of renewable energy all impact on the frequency, timing and intensity of heating and cooling.

Anticipated impacts

This study will help develop a better understanding of what is required for an effective transition to a more sustainable housing future, benefiting the community in the following ways:

- Households - Improved awareness of available strategies for reducing home energy use and associated operational costs.
- Researchers - Better understanding of the impact of occupant behaviour and practices on house performance.
- Industry - Inform best areas for leadership and opportunities for community engagement
- Government – Inform policy and initiatives.

Further information

For further information about this project, please access the CRC LCL website: <http://lowcarbonlivingcrc.com.au/research>

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