

# RP3009 HIGH PERFORMANCE HOUSING: MONITORING, EVALUATING & COMMUNICATING THE JOURNEY

## TEN HOUSE LIVING LABORATORY STUDY

### Research Question

Since 2012 all new residential homes in Australia are required to achieve a minimum of 6-Stars under the Nationwide House Energy Rating Scheme (NatHERS) framework. However, recent studies have shown that high performance homes do not always perform accordingly. Factors believed to be influencing this are the limitation of NatHERS as a rating tool and the impact of occupant behaviour.

This research aims to answer the following questions:

1. What is the impact of occupant behaviour as distinct from design on the performance of single family dwellings?
2. Do currently available house assessment tools provide an accurate representation of operational house performance and house sustainability?

### Methodology

Ten households 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 old retrofitted homes, 6-Star homes and high performance homes (7 or more Stars) as described in Table 1.

Figure 1- Research Methodology

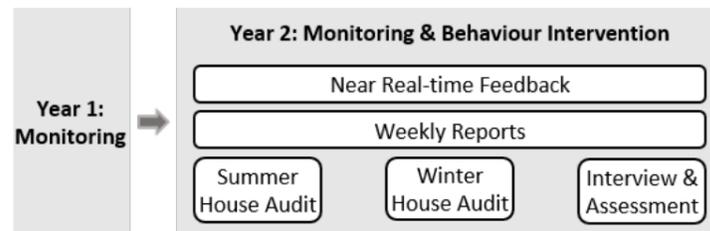


Table 1 – House Profiles

| Id | Class.   | Occ. | Area (m <sup>2</sup> ) | Gas | Elect. | Water | Temp. | PV | RW |
|----|----------|------|------------------------|-----|--------|-------|-------|----|----|
| C  | Retrofit | 4    | 106.65                 | X   | X      | X     | X     | X  | X  |
| E  | Retrofit | 2    | 106                    | X   | X      | X     | X     | X  | X  |
| F  | DTS      | 4    | 182.8                  | X   | X      | X     | X     | X  | X  |
| L  | 6 Stars  | 3    | 218.54                 | X   | X      | X     | X     |    |    |
| M  | 6 Stars  | 4    | 147.36                 | X   | X      | X     | X     | X  | X  |
| O  | 6 Stars  | 2    | 154.09                 | X   | X      | X     | X     | X  | X  |
| P  | 6 Stars  | 5    | 177.42                 | X   | X      | X     | X     | X  |    |
| G  | 7 Stars  | 3    | 185.71                 | X   | X      | X     | X     | X  | X  |
| B  | 8 Stars  | 4    | 177.46                 | X   | X      | X     | X     | X  | X  |
| H  | 8 Stars  | 4    | 238.04                 | X   | X      | X     | X     | X  | X  |

During the community engagement phase (Year 2), the householders' journey will be captured as part of the online Josh's House video series to communicate the findings to a national audience via [www.joshshouse.com.au](http://www.joshshouse.com.au) and associated social media activity.

Year 2 will start in December 2015.

### Results

The first ten months of data show that most of the energy consumption in Perth households happens during winter (Figure 2) and is related to

the utilisation of space heating, to the increased need for water heating and to the lower yields of photovoltaic electricity.

Whereas it is expected that high performance homes will use less energy than 6-Star homes or retrofitted homes, results thus far show that this is not always the case (Figure 3). In 2015 House G (7-Stars), for example, used more energy per occupant than two of the 6-Star homes (M and P), the two retrofitted homes and the Deemed-to-Satisfy (DTS) home. Similarly, House B (8.5-Stars) used comparable amounts of energy as the two retrofitted homes and a 6-Star house. Consumption also varied significantly between houses rated within the same NatHERS Star band.

Figure 2 – Energy consumption per occupant (Wh)

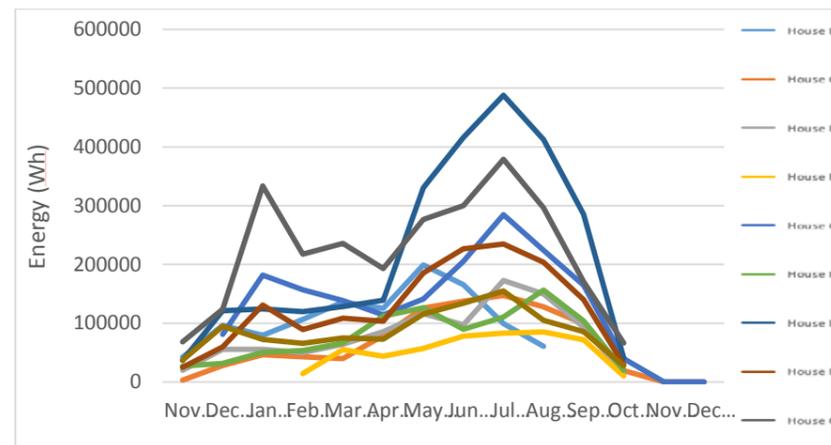


Figure 3 – Total energy consumption per household per occupant (Wh) in 2015

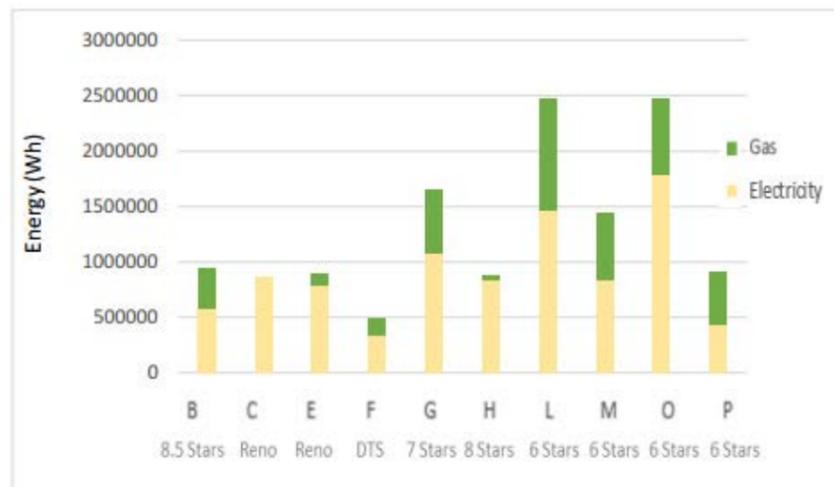
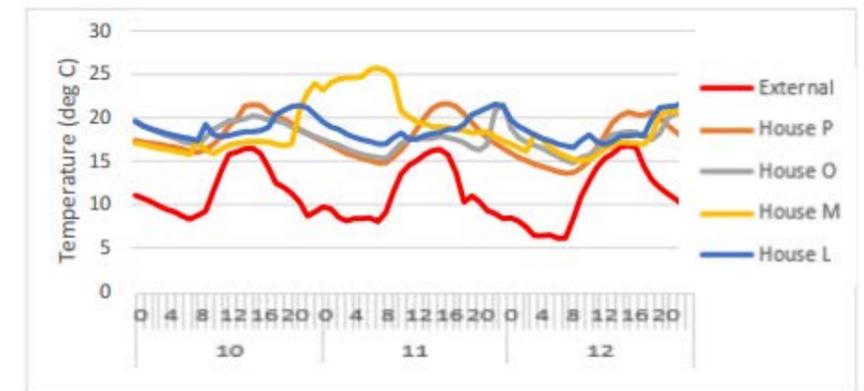


Figure 4 presents the internal temperature in all four 6-Star houses on some of the coldest days of 2015. While the temperature in some of these houses is similar at times of the day (e.g. P and O), the effects of behaviour on energy usage can be clearly seen. For example, House M sets the heater at 26°C, while Houses L and O set it at 21°C. House P in contrast does not seem to heat the house during this period.

Figure 4 – Internal and external temperature in winter (10, 11 and 12 July 2015)



### Conclusions

The first ten months of house monitoring have confirmed the assumptions that while house design has a large influence on house performance, behaviour also impacts significantly on energy usage. In the small sample being studied, one 6-Star house (M) consumed 1,6 times more energy than another (P). Both were built with similar materials, they both possess a PV, have similar habitable areas and occupancies, which leads to the assumption that behaviour is affecting house performance. Behaviour differences will be further investigated during Year 2 of the research project.

### 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 as distinct from design in the performance of houses.
- Industry - Inform best areas for leadership and opportunities for community engagement.
- Government – Inform policy and initiatives.

Appropriate behaviour is necessary for high performance homes to achieve optimal results.

### Further information

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

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