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Low-carbon homes, thermal comfort and household practices: Uplifting the energy-efficiency discourse

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Abstract

Reducing carbon emissions within the residential sector plays an important role in meeting carbon reduction targets. Low-carbon homes or homes with very high-energy efficiency ratings aim to decrease residential carbon emissions by reducing overall energy demand and increasing reliance on low-carbon energy sources. Numerous assessment and rating tools are available to motivate investment in low-carbon homes. However, the demand for low-carbon products and homes has been lower than anticipated. This study explored householders' notions of home comfort and energy efficiency, as well as construction specialists' perceptions about the market for low-carbon products and homes to investigate how such a market could be enhanced. The study collected data through four phases. Phase 1 and 2 explored householders' views through focus groups (n=107) and a household telephone survey (n=866). Phase 3 explored construction specialists' views through an online specialist survey (n=492) and phase 4 included an online experimental study (n=2008) to test message frames promoting low-carbon homes to potential home buyers. Overall, telephone survey participants expressed high levels of interest in energy efficient homes and homes with lower running costs. Phase 1 and 2 data also showed that the notion of home energy efficiency constructed by householders is heavily based on technological aspects, such as energy efficient appliances and/or renewable energy sources, which are closely related to the economic (i.e. saving energy costs) or environmental (i.e. reducing carbon emissions) benefits of energy efficiency. However, the same data indicated that energy efficient features such as airflow and ventilation, appropriate indoor temperatures and natural light are closely related to householders' notion of home comfort, suggesting that the market for energy efficient homes could be enhanced by making the link between energy efficiency and home comfort more evident. This concept was tested through a message framing survey, which confirmed that messages embedded with the notion of energy efficiency in the context of home comfort were more effective in increasing the perceived benefits of low-carbon homes than standard messages that simply listed energy features. Implications of these findings for enhancing the uptake of low-carbon homes are discussed.

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1. Introduction

It is well known that reducing carbon emissions within the residential sector plays an important part in meeting carbon reduction targets [1]. Low-carbon homes[†] can help decrease residential energy demand by achieving thermal comfort through passive heating and/or cooling and through energy efficient technology such as energy efficient appliances and lighting. Low carbon homes aim to improve the reliance on low-carbon energy sources through the installation of solar hot water heaters and solar PV panels for electricity generation. However, despite numerous assessment and rating tools available to householders and construction specialists to motivate investment in low-carbon homes, the demand for low-carbon products and homes in Australia is still low [2].

Improving thermal comfort is one of the main drivers of home renovations [3]. Thermal comfort can be achieved by low-energy (e.g. natural ventilation and/or fans) or high-energy (e.g. air-conditioning) demand solutions, however the use of high-energy demand heating and cooling systems is among the largest contributors to residential energy consumption, accounting for around 40% of energy consumption in Australian households [4]. In addition, high-energy demand cooling and heating systems not only increase overall residential demand but also peak demand, thus impacting grid infrastructure and consequently forcing energy costs upward [5]. Despite the negative impact of high-demand energy systems on both carbon emissions and energy costs, Australian householders are increasingly resorting to high-energy demand solutions to achieve thermal comfort. For example, the proportion of Australian households with a cooler in use (either a refrigerated air conditioner or an evaporative cooler) increased from 59% in 2005 to 73% in 2011 [6]. While the adoption of high-energy consumption technologies such as air-conditioners provides a straightforward solution in homes that have low thermal efficiency, it both escalates and normalises high-energy consumption [5]. Therefore, improvement of homes' thermal efficiency through solutions that facilitate the reliance on low-energy solutions (with lower energy demand and operational costs) is an important step towards reducing residential energy consumption.

To further understand households' perceptions of low-carbon homes and products, we conducted a multi-phase study to explore householders' notions of home comfort and energy efficiency, as well as construction specialists' perceptions about the market for low-carbon products and homes, with a view towards better understanding how this market could be enhanced. The aim of this paper is to present a summary of the main findings of the overall study, starting with the methodology used in each phase of the study followed by a summary of the main results for each phase. Detailed findings for each phase are available in the study reports [7-11]. This paper concludes with a discussion of overall findings.

2. Methodology

As shown in Table 1, this study employed a multi-stage and multi-method approach, employing both qualitative and quantitative data collection methods to investigate how Australian householders and construction specialists perceive low-carbon homes. Using a combination of focus groups, surveys (online and telephone) and an online survey-experiment, the study was able to explore and validate the range of views unveiled. A total of 3,473 participants were sampled across Australia between September 2014 and October 2015. To gather the views of different consumer groups, the study engaged home renters, homeowners and home investors to investigate

[†] In order to adopt a common language in the discussion of low energy residential development, the term 'low-carbon homes' is used throughout this paper to refer to homes with very high energy-efficiency ratings that aim to decrease residential carbon emissions by decreasing overall energy demand and increasing the reliance on low-carbon energy sources.

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