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Energy efficiency housing in South Australia – A gap analysis between the expected and actual benefits

Christy Chan^a, Tony Ma^{b*}

^aUniversity of South Australia, North Terrace, Adelaide, SA5000, Australia

^bUniversity of South Australia, North Terrace, Adelaide, SA5000, Australia

Abstract

In Australia, the trend of being energy efficient within modern multi-storey buildings has been more popular in recent years. However, lack of attention has been given to the residential housing in terms of the perceived benefits and actual performance. This research is to investigate the gap between the original expectation and the occupants' satisfaction in residential energy efficient dwellings. It also aims to analyze the relationship between the satisfaction level and both the initial as well as the ongoing cost of energy efficient dwellings in South Australia. Finally, it determines whether the initial cost is proportional to the financial savings.

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1. Introduction

The concept of sustainable development has been advocated since late 1980s and the idea of building green in order to respond to the call of achieving sustainable development was first brought up in the “Architects’ Chicago Declaration” during the International Union of Architects Congress in 1993 [1]. The Green Building Council Australia (GBCA) was found in the year of 2002 in order to response the need of encouraging and promoting the green building practices across the country as a not-for-profit organisation. There are many research articles which focused on investigating the benefits and barriers of commercial green building design and construction since then [2, 3, 4, 5]. However, less attention has been given to the residential sector. Limited investigations have been conducted to look

* Tony Ma. Tel.: +618 8302 2238; fax: +618 8302 2252.

E-mail address: tony.ma@unisa.edu.au

into the residential housing especially in South Australia regarding to the perceived benefits and actual performance. In fact, both ‘residential and commercial buildings in Australia are responsible for 23 per cent of the nation’s greenhouse gas emissions’ [6]. Hence, there is a need to investigate the current development of green building practices in terms of the perceived benefits and actual performance in the residential sector.

1.1. Why do we need green building?

Global warming which is mainly caused by the greenhouse gas (GHG) emissions has brought up the public’s attention in recent years. Extreme weather condition as a major side effect of global warming has been accounted for huge financial cost in Australia. The Parliament of Australia 2013 has found that total financial estimated cost of extreme weather events in Australia ranging from approximately 900 million dollars to 4 billion dollars annually. Furthermore, ‘climate change can significantly impact on the total energy consumption and GHG emissions of residential buildings [7]. In 2005-2006, the residential building sector in Australia contributed around 13 per cent of the total national GHG emissions [8], and the energy demand is anticipated to keep rising due to ‘... the projected population growth, the trend of smaller family sizes, and the desire for more comfortable indoor environment and larger houses ...’ [9]. Hence, there is an urgent need to be green in order to mitigate and adapt the climate changing climate.

1.2. Benefits and barriers

Building green architectures is a way to respond to the climate issues. The most significant advantage that is brought by green building is to reduce the overall energy consumption and cost as well as to enhance the occupants’ satisfaction through the incorporation of building design, materials selection and construction delivery [9]. Ries et al. [10] further proved that green building can bring positive impact on the occupants’ health and productivity, indoor environmental quality and consumption level of energy resource. However, there are barriers that need to be considered when promoting green buildings. A Swedish paper which focused on investigating the cost of going green has shown that the overall cost can be a concern. Although the difference of total investment cost between residential green building and conventional housing is said to be less than 10 per cent, the cost of design, materials and labour for the green ones tend to be approximately 10 per cent higher than the conventional ones [11]. When there are design variations or market fluctuation, all costs will increase and hence the residential green building will become less affordable. While the saving of operation cost in green building can be up to 20 per cent - 40 per cent, ‘... achieving the estimated energy efficiency may require more system adjustment than usual’ [11], and this has posed a challenge as in balancing the system. Occupants may be frustrated by the above benefit issues. The installation of an appropriate individual metering system for data collection within each household has posted another significant expense to the cost. To sum up, there are uncertainties that lie in the calculation of the total cost.

Occupants’ behaviour and understandings directly contribute to the level of energy consumption, which is also the actual performance of the green building. Gill et al. [12] commented that ‘whilst behavioral change is a major untapped route for energy savings, the varying knowledge, attitudes, and abilities of occupants presented a fundamental barrier to its implementation and optimization’. When occupants’ behaviour is not ready to adapt the green practice, it is less likely to achieve the target of reducing the energy consumption.

2. Green Buildings in South Australia

South Australia has promptly responded to the trend of being green in building development. In 2002, Premier Mike Rann announced the launch of Lochiel Park Green Village and stated that the project will become the nation’s model [13]. The project is delivered by the Urban Renewal Authority URA (formerly Land Management Corporation), and it is to exemplify the objective of ‘Attaining Sustainability’ in the South Australia’s Strategic Plan (Campbelltown City Council). The project will undergo a 9-year long monitoring program to analyse real time data of all energy consumption in the households throughout the period [13]. There are other upcoming green residential projects including the redevelopment of Tonsley and Bowden which were announced by the Renewal SA in 2013. Both of the projects will be assessed against the Green Star rating scheme which is monitored by the GBCA [6].

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