

International Conference for
**Sustainable Design of the
Built Environment**
SDBE 2017

Proceedings



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Harmonising energy use behaviour of British Asian households towards sustainable housing

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Abstract

Recent studies show that actual energy demand from low carbon new-build homes can be up to 40% above expectations and energy savings from thermal upgrades are often under predicted. The inefficient behaviour of its occupants is identified as a contributing factor of this “performance gap”. This behaviour is also believed to be significantly correlated to the households’ socio-economic characteristics. While building simulation has made significant progress, the representation of occupants and their behaviour needs further work.

This research investigates the energy use behaviour of a specific demographic and ethnic group, the British Asian households. A large-scale housing survey is used to gather self-reported information about the British Asian households’ energy use behaviour, for instance, heating patterns, appliances use, ventilation behaviour, as well as other socio-economic characteristics. Data collected will be analysed and transformed into energy models, which includes Space heating behaviour models, electrical appliances and lighting use models, Ventilation behaviour models, and architectural archetypes that represent behaviour patterns for different demographic groups. The outcome of this research demonstrates how social perception and economic aspirations limit the acceptability of sustainable design and construction strategies.

This research involves active community participation and engagement; a major part of the dissemination will aim at communicating the research findings to the British Asian households, which will have a direct impact of energy reduction by informed behaviour choice. Further, this research will define the low carbon housing strategies and improved energy use predictions for the British Asian households.

Keywords: Energy behaviour, British Asian, Sustainable housing

Introduction

The UK has committed to achieve 80% reduction in CO₂ emissions by 2050 against the 1990 baseline (DECC and Treasury, 2015). Among other sectors, it is critical to focus on domestic sector, as it contributes about 27% emission. Though government legislation addresses the mitigation strategies by setting stricter regulations for the new build, it is very difficult to upgrade the existing housing stock. Due to the very slow replacement cycles and long physical lifetimes, attention must also be placed upon the existing housing stock, which is expected to make up at least 70% of the UK’s total housing by 2050 (SDC, 2006). Among the factors affecting the energy consumption, Occupants behaviour plays a pivotal role. However, the lack of understanding of the households’ behaviour has led for assumptions which mostly predict higher energy saving compare to the actual saving. On the contrary, evidences point out the under prediction energy saving from thermal upgrades (Tahir and Walker, 2013).

There is a difference between the occupants’ behavior and assumptions at different stages and it is attributed as prime reason for the performance gap (de Wilde, 2014). There is considerable research to demonstrate the predicted and measured energy consumption and relate it to performance gap (Khoury et al., 2017, Menezes et al.,

2012). For instance, de Wilde (2014) in a review of the core reasons behind the performance gap and the implications thereof has identified three types of performance gap; predictions vs. measurement, machine learning vs. measurement, and prediction vs. displayed energy performance. However, there is limited research to explore the correlation of performance gap to the households' socio-economic characteristics. While building simulation has made significant progress, the representation of occupants and their behaviour needs further work.

Lack of knowledge and household behavior has been identified as main reason for the gap between the energy reduction prediction to actual savings despite of awareness of the climate change and increasingly stringent regulations (Pan and Garmston, 2012). Building users were considered as passive recipients of thermal stimuli to maintain the thermal balance reflecting the Fanger's model (Fanger, 1972). Recent studies have linked occupants' thermal experiences and expectations to the indoor conditions and to the climatic condition (Berry et al., 2014) and researchers have argued for understanding households' expectations and satisfying their desire for thermal comfort as one of the key drivers to reduce energy use (Berry et al., 2014).

In the domain of sustainable housing, both a qualitative approach and quantitative strategies are essential to the understanding of social and cultural dynamics as well as to measure and benchmark performance. Most of the process, from the beginning, including the Club of Rome, has relayed heavily on quantitative mathematical methods (Danilov-Danil'yan et al., 2009). Most of the studies evaluating performance of the energy efficient homes or refurbishment design process are quantitative and measure empirical data and most of the qualitative factors like, individual comfort variation, occupants' energy behavior is generalised (Thomas and Duffy, 2013, Konstantinou and Knaack, 2013).

Until recently, house-building targets and neighborhood planning lacked clear strategy to understand households energy behavior while developing sustainable communities (Power, 2008). Many energy efficient initiatives including net zero energy homes have been adopted as a financially viable, energy reduction models (Berry and Davidson, 2015). However, households, their expectations and its impact on energy usage are hardly considered in these models. The hierarchical approach to reduce energy consumption in buildings includes building envelop, energy efficient equipment and renewable power. However, none of these approaches acknowledge the behavior of households and its influence on operation of buildings while reducing the energy consumption (Maslesa et al., 2013).

The implication of behaviour pattern is further complicated when energy reduction run contrary to the prevailing practices or encouraged logical solutions. For instance, the average temperature maintained in the UK household is around 18⁰ C in winter (Waters, 2017). All the energy prediction is calculated based on this fact; whereas, expatriates from the tropical countries prefer to keep their homes warm and at 21.4⁰ C (Satish, 2017). The difference in internal temperature of the average UK households to that of British Asians is significant as every degree of higher internal temperature will increase the household energy consumption by 10 percent (Trust, 2017). British Asians, also referred as South Asians in the United Kingdom, Asian British people or Asian Britons, are persons of Asian

descent who reside in the United Kingdom (Smith, 2004) and they constitute about 5 percent of the UK population (White, 2012) and hence their behaviour pattern would have huge impact on the energy consumption.

For British Asians, though it appears to be way higher compare to UK average, it is perceived as a positive move to not bring down the temperature drastically and align themselves in reducing energy. In this context, this paper explores the behaviour pattern of the British Asian households, their socio-economic characteristics and its impact on the energy behaviour.

Methodology

This research builds on the previous research and aims to test the energy use behaviour of a specific demographic and ethnic group, the British Asian households in the UK and compare with that of the Indian homeowners and a large-scale, city wide, socio-technical survey conducted as part of the EnerGAware project (Jones et al., 2016, EnerGAware, 2017). This work builds on the extensive research conducted in India, wherein the homeowners' aspirations are mapped to the energy demand the ongoing research on social housing in Plymouth on the other.

This research targets the British Asians and the questionnaire forms are delivered to British Asians. The contact list of British Asians is developed through snowball sampling or chain-referral sampling and by approaching various cultural and community organisations and societies. The survey questionnaire is carefully developed to overlap with the EnerGAware project and the field works carried out in India. A small- scale housing survey was distributed to gather self-reported information about the British Asian households' energy use behaviour, as well as other socio-economic characteristics. chosen Survey questionnaires were collected from 40 households, who are British Asians living in Plymouth, the UK. Questionnaires are collected from homeowners settled in the UK from different Asian ethnic background. While distributing the questionnaires among owner-occupiers, special care was taken to ensure that different neighborhoods were represented. This included the city central area, neighborhoods around Derriford hospital and neighbourhoods in the villages near Plymouth. The social, economic and educational background of the respondents are mapped to similar representation of respondents in India. A wide spectrum of respondent occupations was collected and special attention was paid to reflect the different age group and domicility of the households.

The outcome of the questionnaire survey triangulated with the literature studies and the surveys conducted in India on one hand and the survey outcome of the EnerGAware project on the other. More than 200 homeowners were surveyed in a South Indian city, Mysore and the same questionnaire with modification to reflect the climatic and socio-cultural conditions is used as part of this questionnaire. Similar questions to relatively similar demographic has enabled to compare the survey outcomes. On the similar lines, part of the questionnaire of the EnerGAware project is used to compare the feedback of respondents of British households and British Asian households. Respondents have reflected various energy related issues including household preferences, ventilation, energy

related habits and energy consumption. This paper focuses on two key issues, socio-economic preferences and energy behaviour, for further analysis and discussion.

Fieldwork Analysis and Discussion

There is a convincing relation between the social-cultural practices and energy consumption behavior of the homeowners. Previous research has established a strong correlation between the homeowners' aspirations and its impact on sustainable housing in India (Satish and Brennan, 2015).

Socio-economic preferences

Although a growing population seeks to accommodate valid aspirations to achieve higher levels of prosperity, it is still imperative to reduce carbon emissions. Whilst a low carbon society for developed nations can be defined as "inventing low carbon technology and reducing carbon dioxide emission by the middle of 20th century" (Skea and Nishioka, 2008), for developing nations, the achievement of low carbon communities must go hand in hand with achieving wider development goals . Furthermore, while acknowledging the role of technology, an emphasis has to be placed on the importance of lifestyle and social change (Skea and Nishioka, 2008). In this context two surveys conducted in different economic background, are compared to examine the socio-cultural preferences of households.

The traditional housing typology was reflective of the social and cultural values of the homeowners. In the revised model, households' aspirations and their reflections were examined by asking them about their expectations of the house in terms of appearance. When asked about 'what their house represent', Asian homeowners tend to give highest priority to the appearance of their home and more than a third of the respondents wanted their house to reflect the wealth of their family. Contrary to this, none of the British Asians responded felt that their house should reflect the wealth of their family. Similarly, more than 23 percent of the Asian homeowners want their home to reflect the status of their family. Whereas, less than 10 percent of British Asians believe it is important in the UK (Figure 1).

The distinctiveness of the new class structure has rested on a range of representational practices centred around particular characteristics of consumption, style and social distinction (Fernandes, 2000b). These have their ramification on the spatial reorganisation of neighborhoods within cities and small towns. In this reorganisation, households have developed new suburban aesthetic identities and lifestyles that seek to change the visual signs of public spaces (Fernandes, 2000b). As scholars like Fernandes have argued, expression of the economic mobility and demonstration of newfound wealth is a key dimension of the homeowners in emerging world (Fernandes, 2000a, Fernandes, 2006). Whereas, living in a relatively established residential suburbs, with known and established history of the property value, British Asians won't find it a requirement to express their wealth outside.

Migrated households tend to give importance to the social and cultural values and are conscious of the cultural background as a mechanism to develop the family cultural values and explore socio-cultural activities (Castles, 2000). Nearly third of the respondents in the UK felt that their home should reflect the cultural taste of the family and 35 percent responded wanted their home to reflect the character of the family. Contrary to this, Asians do not consider it as important to reflect the cultural taste and very few homeowners, less than 3 percent wanted their home to show the cultural taste of the family (Figure 1).

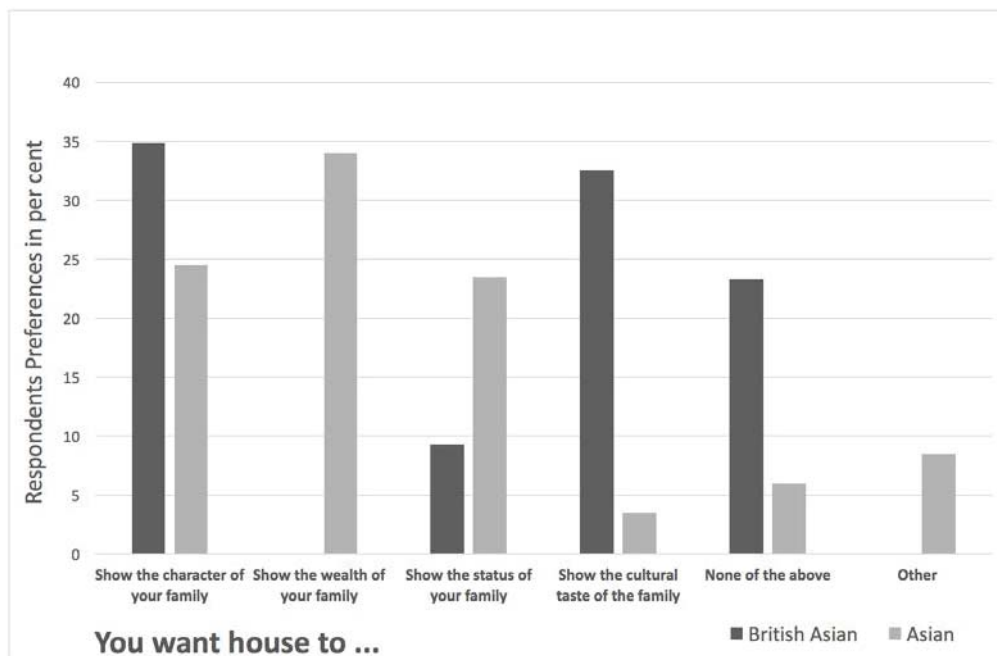


Figure 1. Respondents preferences for their home appearance.

Homeowners values would have a direct bearing on the selection process and preferences during the home construction or selection process. This is evident from the survey; wherein both Asians and British Asians have expressed nearly similar preferences when they were asked as what they would prefer to compromise in case of constraints. Although the preferences are similar in case of finishing material, furniture and area of space, they differ considerably in case of number of rooms and appearance.

In case of constraints, the British Asians give importance to area or size of the spaces they use and they are willing to compromise on number of rooms and appearance. Nearly 25 percent of the British Asians are ready to compromise on number of rooms and appearance, whereas in case of Asians, less than 10 percent would prefer to compromise on the appearance (Figure 2). Notable difference in preferences is that of equipment and appearance. More than 13 percent of the Asian homeowners are ready to compromise on equipment whereas British Asians consider this is a vital element of their house and none are ready to compromise on this (Figure 2). The reasons could well include the equipment required due to climatic conditions, like, water heater, and refrigerator.

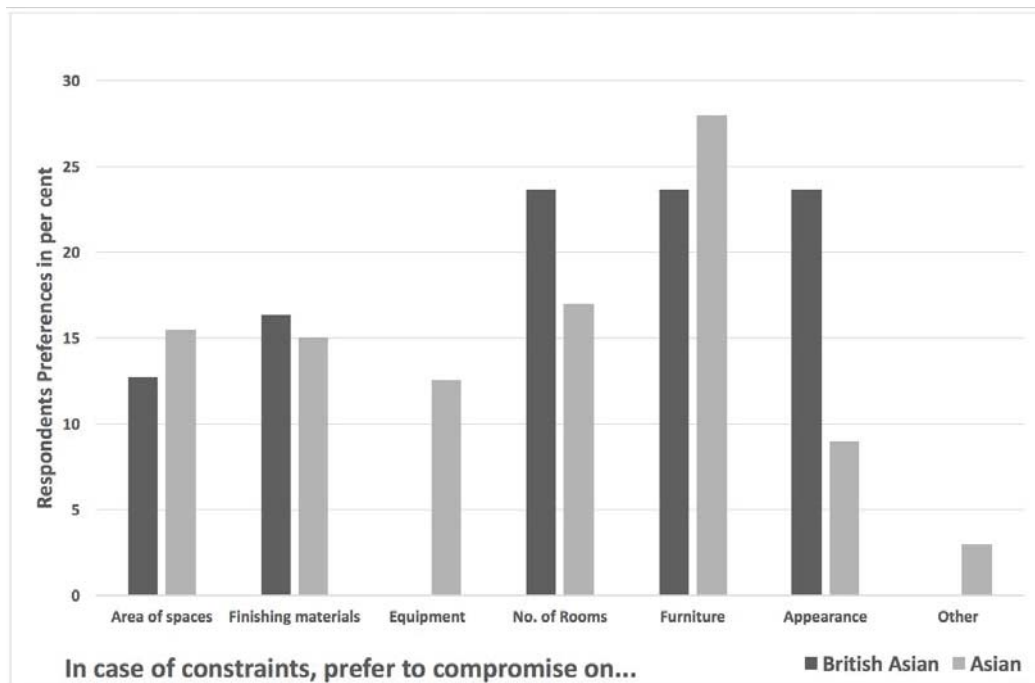


Figure 2. Respondents priorities in case of constraints.

One of the elements which reflect the cultural beliefs over the scientific or rational understanding is 'preferences for Vastu'. The original understanding of Vastu in the ancient India was developed in its entire system of building technology with the understanding of the climatology (Patra, 2009, Kannan and Jani, 2010). British Asian respondents include Asians from Pakistan, Bangladesh and Sri Lanka and in some of these places Vastu practices are not prevalent now. In spite, more than 30 percent would like to follow Vastu while selecting or building their home in the UK (Figure 3). in the context of the climate and geographical condition, understating of Vastu in the context of Indian sub-continent is not same as in the UK with limited clarity/research in this regard. The underpinning factor is that, Vastu followed as a belief in India has been carried on and adopted more in the social and cultural context in the UK. This is evident as nearly same percent of respondents likely to prefer vastu in both India and the UK, in spite of the education background of the households in the UK. This study clearly demonstrates the correlation between the beliefs and resultant value system and its impact on households' choices.

Comparative study of Asian and British Asian households' aspirations demonstrates a consistence in the preference for cultural values. This comparative study also demonstrates, how households tend to carry the cultural values and recreate them in the migrated place.

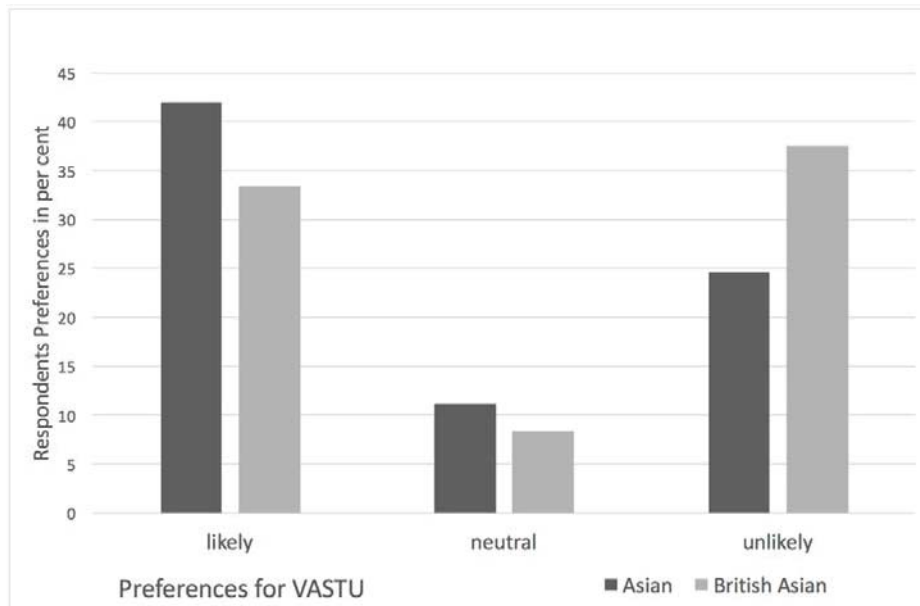


Figure 3. Respondents belief in Vastu.

Energy Behaviour:

One of the key difference for British Asians born and raised in Asia would be to acclimatise to the UK climate and hence understand the difference in the energy consumption in the homes. This section analyses the energy behaviour of the British Asians in Plymouth and compare with the similar survey of British (White British) household conducted by the EnerGAware project (EnerGAware, 2017).

To understand the awareness of energy consumption of the households, they were asked 'whether they understand how their home uses energy': More than 45 percent of the British households tend to or strongly agree that they don't understand the energy usage in their home. Whereas, about only 25 percent of the British Asians households expressed that they are ignorant of their energy behaviour (Figure 4). Their view is more pronounced where more than a third of British Asians understand their energy usage, whereas only 4 percent of British households strongly disagree that they don't understand their energy consumption pattern (Figure 4).

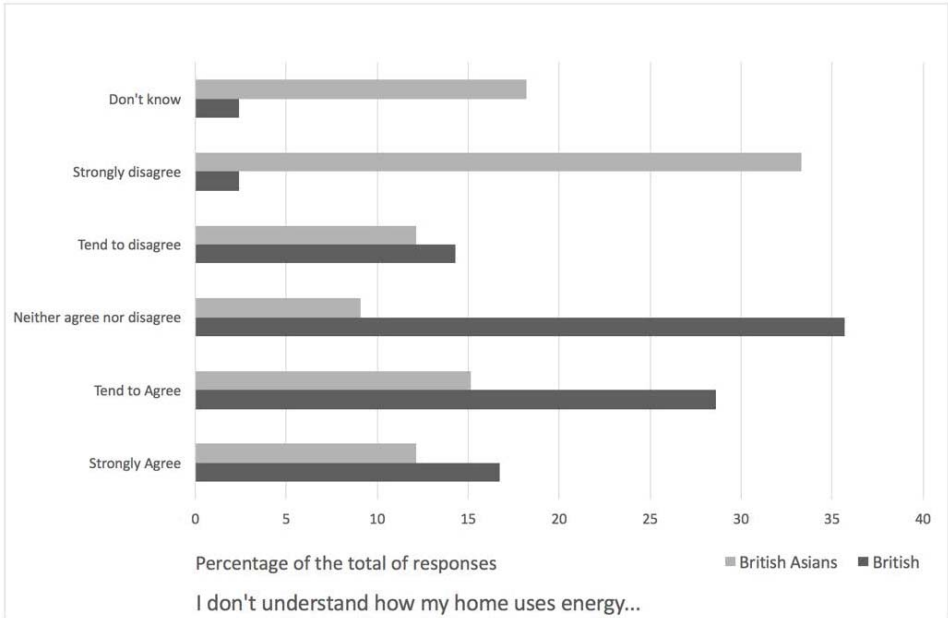


Figure 4. Respondents understanding of energy usage.

Influence of cultural and social values are evident as British Asians have a better understanding of their activities and energy use in spite of migrating from a tropical country and not lived in the similar climatic condition throughout their life, albeit second generation British Asian households.

Contrary to their differences in understanding of the energy consumption, nearly same percent of British and British Asian households expressed that they have control over how much energy consumed in their homes. Only difference is that nearly 10 percent of the British Asians are not aware their energy consumption, whereas less than 3 percent British household don't have control over the energy consumption (Figure 5). Understanding of the energy consumption and its impact on British Asians further reinforces the impact social values on households' preferences.

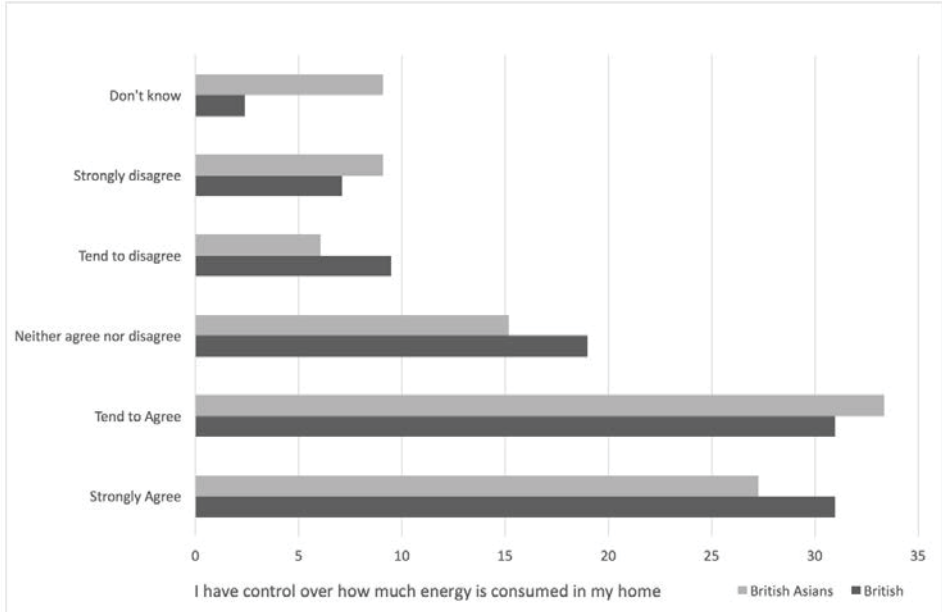


Figure 5. Respondents understanding of energy consumption.

Another aspect which connects homeowners' practices to their social and cultural background is their empathy towards sustainable world (Satish, 2013, Deepika, 2008). When asked about their intention to save energy, more than 85 percent of British Asians said that they often think about saving energy, whereas only about 75 percent British household think of saving energy (Figure 6).

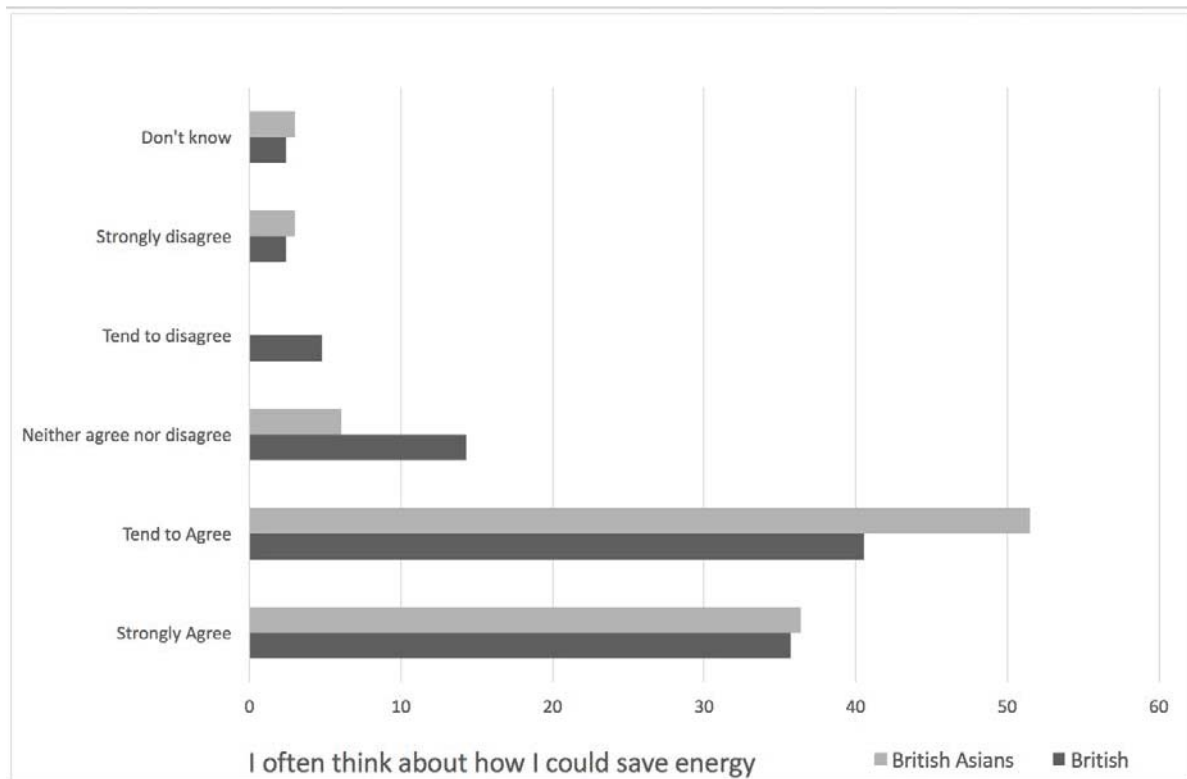


Figure 6. Respondents willingness to save energy.

Finally, both British and British Asian households believe that they will not be able to save any more energy. Lack of clarity, and uncertainty is evident in British Asians, as nearly 30 percent neither agree or disagree. lack of awareness and information are key reasons for more than 15 percent British households to say that they don't know whether they can save any more energy (Figure 7).

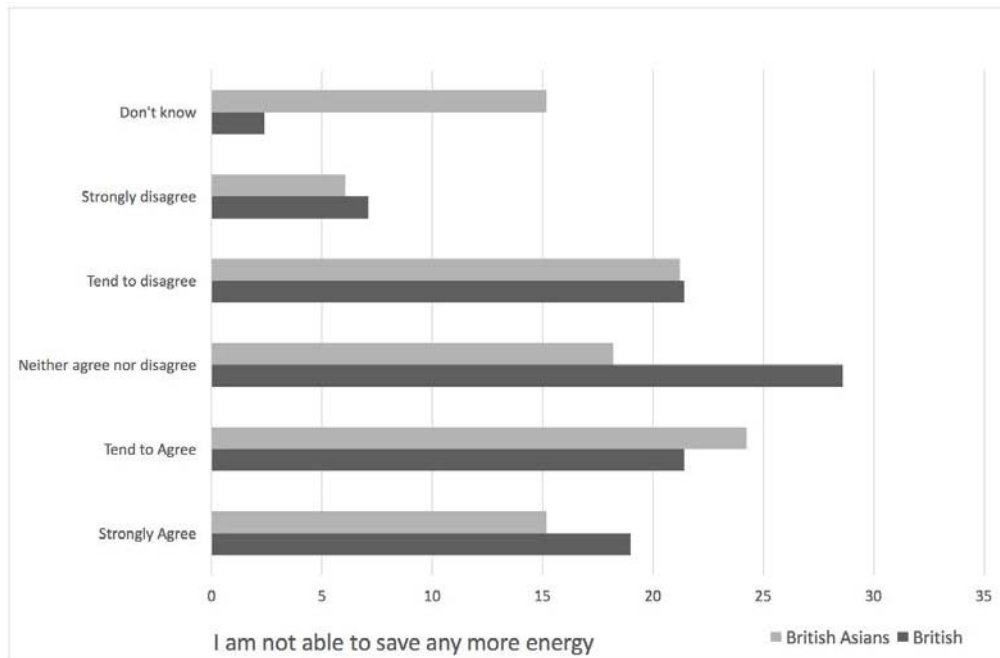


Figure 7. Respondents ability to save energy.

Conclusion

While acknowledging the role of policy guideline, emphasis needs to be given to the importance of lifestyle and social change. This research focus on the sustainable built environment as social and cultural phenomena that can allow insights in the effective formulation of localised and relevant low carbon strategies and thus provide bottom up tool to implement the policies and targets set by the professional bodies and the UK government.

The study in this paper, using a literature review and survey fieldwork, has highlighted the similarity and differences in the perception and socio-cultural value system of British and British Asian households. From the outcome of the questionnaire survey, this paper examined two key aspects of Socio-economic preferences and energy behaviour.

The particular points are as follows:

1. Social perception and economic aspirations limit the acceptability of sustainable design and construction strategies. Questionnaire survey both in India and the survey conducted in Plymouth, the UK, clearly demonstrate that it is crucial to align household's aspirations in the process of developing sustainable housing strategies.
2. Difference in behaviour pattern in regulated and unregulated economy: there is a striking difference between the behaviour pattern of respondents in India and the UK. For instance, most of the sustainable features adopted by households in India were voluntary, whereas households in the UK had engaged in the features promoted by the policy or government in the UK.

3. Some consistence in the preferences for cultural values: one of the key findings is that social and cultural values scaffold the decision making process and households tend to emulate those preferences in migrated places, in spite of its inappropriateness; for instance, Vastu.

The research has shown that there is a direct correlation between the social and cultural values and energy behavior of households. Further examination of specific aspects like ventilation, heating would provide greater insight into the extent of impact of behavior on energy consumption and would go a long way in reducing the carbon emission and develop sustainable communities for the future.

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