

Cognitive Occupancy Appraisal for Sustainable Housing

Ar. Parul Bhyan, Bhavna Shrivastava, Nand kumar

Abstract: Concept of sustainable buildings is defined as use of various strategy and standards of working to intensify the quality of life of occupants, secure the environment of neighborhood by lessen the construction rate of consumption of natural resources. Conventional buildings are not much conveniently rated over energy efficient buildings as per indoor climate basis, whereas when studied furthered the users have different reviews. The quality occupancy when evaluated from varying results of users has various aspects. Inappropriate use of building may concerns in bad experience in conventional buildings by the users. New area for further research could be identified as required information for an operation and use is difficult for overall quality experience of the building. There is a shortage of research that takes into account of “Unawareness” or “inconveniences” of occupancy behavior with a survey defining the authentic gap in research. Research on use of energy efficient buildings is increasing, but there is still a scope to give more information and training in operation and use. This paper justifies occupancy evaluation with indoor climate, building operation, occupancy attitudes, and economic.

Keywords: Occupancy Evaluations, Energy Efficient Buildings, “Unawareness” or “inconveniences”

I. INTRODUCTION

Gradually, the building energy analysis is increasing to be significantly more sustainable in day to day life with increasing awareness among people. Sustainability comes in concern due to rapidly increasing climatic change in environment. Differently increasing climate change is willing to be the greatest threat and challenge for time ahead. Climate change increase use of air conditioning and use of other appliances for long duration of a day and simultaneously the operation and use comes in concern by occupational behavior. Construction and design being the most important factor in buildings for their energy use as consideration of sunlight in building during winters and shading during summers all can be managed by design of building. Inappropriate Ventilation in building also causes maximum usage of mechanical system which increases energy usage in building. The behavior of opening windows during summers is degrading with every passing year which should be evaluated. As well as the construction material plays an important role for energy use in building. Most of the energy is used in construction includes construction, operation, use and maintenance of building.

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Including huge amount of energy is used and wasted in HVAC, lighting, water heating and other appliances in residential buildings because of occupant behavior.

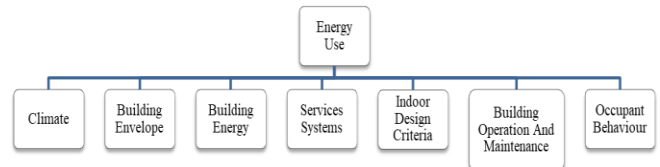


Figure 1 Six Parameters of Energy use in Buildings
Source: International Energy Agency - Energy in the Buildings and Communities Program (IEA-EBC) Annex 5

“Unawareness” or “inconveniences” are two major terms to be discussed in terms of energy consumption by occupants in residential building, it should be understood if the space is not used during day time opening windows can maintain the indoor climate. But majorly the mechanical system is being used which increase the energy load of building. “Unawareness” can be eliminated by discussing the benefits of sustainability for coming years or by presentations about how energy consumption is deploying our resources with time. whereas, “inconvenience” of opening windows because of outdoor pollutants and soothing mechanical ventilation even after high bills is major topic to be discussed .so significantly the energy consumption of all building(like residential) depends on its building envelope, construction age and detail, occupancy behavior, HVAC usage operation and age and building location’s climatic characteristics.

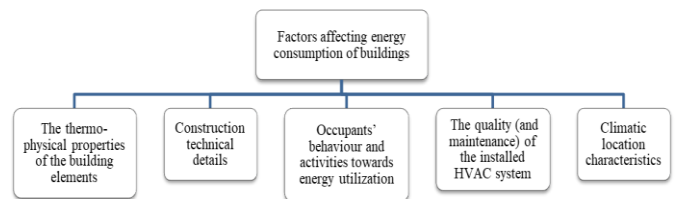


Figure 2 Factors affecting energy consumption of a building (Source: By author)

II. METHODOLOGY

The reliable research approach is based on comfort and to give more information and training in operation and use of energy by occupants in housing .a questionnaire survey is conducted to justify occupancy evaluation with indoor climate, building operation, occupancy attitudes, and economic conditions. The aim of survey is to analyze the frequency of parameters in a process.

To predict broad causes, by examining their individual components. To evaluate focus on the most significant problems or causes when there are many attributes.

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(Figure 3) illustrates the methodology used to understand parameters qualitatively.

In the first step of research, Understanding qualitative aspects of occupants behavior in residency aspect. For the purpose for achieving the associated attributes and variables focusing energy attributes linked with occupancy to focus on various related parameters. Reason for taking this method is refining variables and attribute is that, key attributes research area is huge.

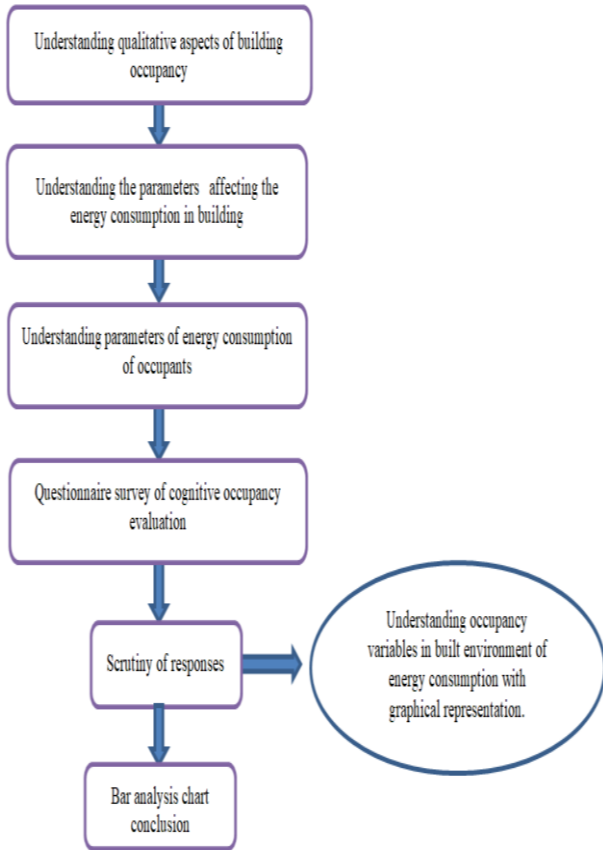


Figure 3 Methodological Framework Influencing Energy Operation of Occupants. (Source: By author)

III. ABOUT STUDY

Occupancy behaviour includes parameters that refer to the inter-activity with building environment in order to manage the indoor building system for health, and to maintain thermal, cooling and visual solace inside buildings. Whereas energy consumption in building includes various other factors like environmental design of building ,typology of building ,climatic characteristics of building etc.so combing both factories various parameters of occupation behaviour of energy consumption in building .the study comprises framework including four major sub factors indoor climate ,building operation, occupancy attitude and economic.

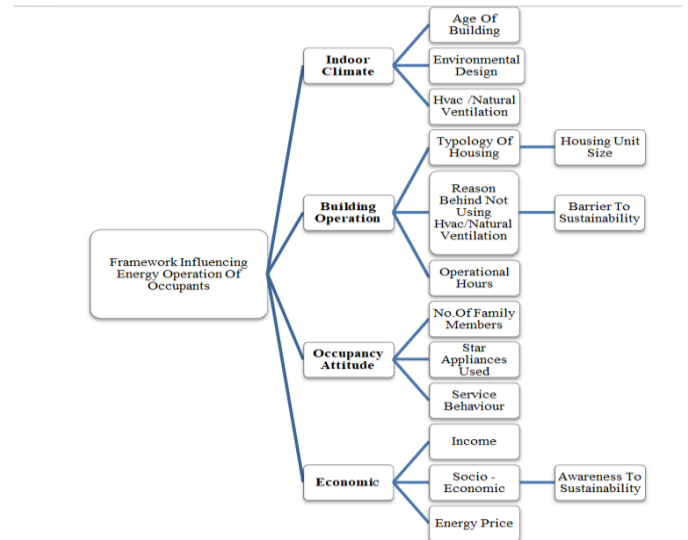


Figure 4 Framework influencing energy operations of occupants.(Source: By author)

IV. INDOOR CLIMATE:

The measurable physical, chemical and biological factors forge an indoor climate. Indoor climate of a building includes many various environments within the single climate as Thermal environment (heat, cold, and humidity), actinic environment (lighting and radiations) and Atmospheric environment (pollution and air quality). Indoor climate of housing depends on various other factors like, age of building, environmental design and type of ventilation used in building. These parameters symbolise the indoor quality of building as if the building is old construction more than 10 years and no maintenance measures are implied after construction the indoor air quality may get disturbed with dampness causes and others .secondly if the building was designed with some defined environmental design and because of occupancy attitudes it is not followed the building will not reciprocate the same with its age and use. Thirdly, and majorly the occupancy behaviour of using the type of ventilation in building these days maintains a rapid role for managing indoor air quality in concern of occupants.

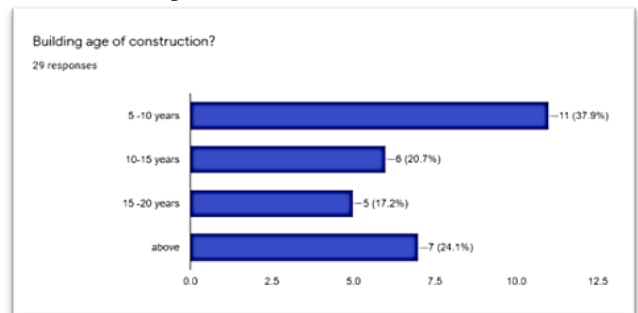


Figure 4 Building age group majorly used by respondents in questionnaire survey (Source: By author)

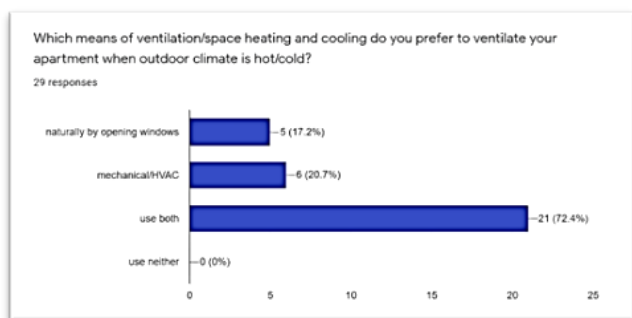


Figure 5 Preferable means of ventilation in housing by respondents in questionnaire survey (Source: By author)

A questionnaire survey was executed to summarize the occupation in housing in native place (composite climate) with which 29 responses were collected on short notice of research showing major (37.9%) housing occupants live in 5-10 years old constructions, 10-15 years old construction share 20.7%, 15-20 years old construction share 17.2% and above share 24.1% of old constructed housing. This depicts there are still old constructions under use with less sustainable facilities and awareness among the common occupants. Still, secondly, 20.7% of occupants majorly use mechanical/HVAC system for ventilation in the occupancy rapidly increasing their energy consumption in the building. And less "awareness" or "inconvenience" led to less use of opening windows ventilation as compared to mechanical system.

V. BUILDING OPERATION

Building operation is a term used to understand the use of building for less energy consumption and healthy atmosphere for occupants to live in a building. Housing occupancy evaluation includes its various sub factors showing typology of housing, housing unit size, occupancy behavior of using energy in household works.

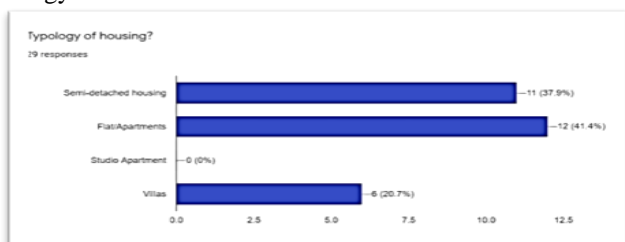


Figure 6 Typology of housing used by respondents in questionnaire survey (Source: By author)

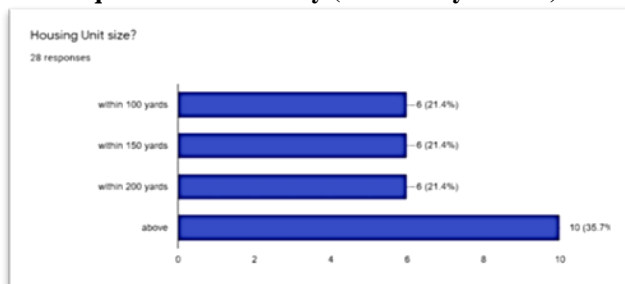


Figure 7 Preferable housing unit sizes by respondents in questionnaire survey (Source: By author)

The questionnaire survey was executed to summarize the occupation operation behavior of housing showing 29 responses out of which 41.4% share flat/apartments in

housing typology, 37.9% share semi-detached housing and 20.7% share villas. Showing need of sustainable housing for future awareness among people. Occupants operational behaviour of using appliances in housing majorly decide need of energy consumption in day to day life. Major parts of usage time is 5-6 hours sharing 37.9% and reason behind not using opening window operation for ventilation shares 48.3% with reason of thermal discomfort.

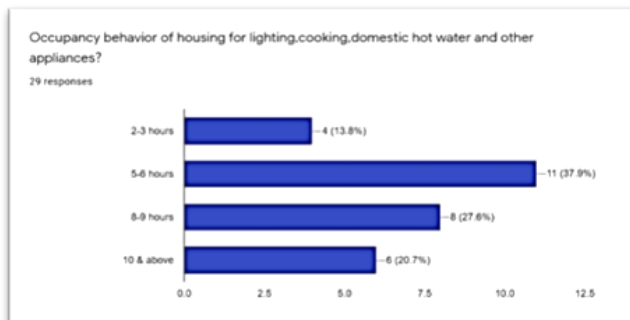


Figure 8 Use of appliances in housing by respondents in questionnaire survey (Source: By author)

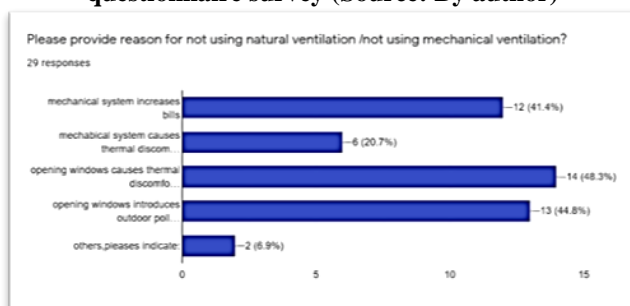


Figure 9 Reason for not-Preferable means of ventilation in housing by respondents in questionnaire survey (Source: By author)

VI. OCCUPANCY ATTITUDE

Occupancy attitude towards the energy consumption in a family shares the major role in energy saving by each family in housing community. Survey defines the awareness among people using 5-star appliances but still more the number of family members > more the unit size of housing > more the energy consumption.

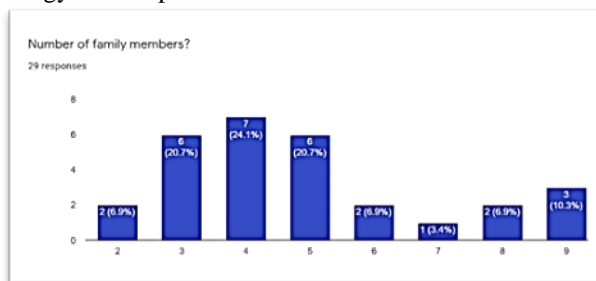


Figure 10 Number of family member per family in questionnaire survey (Source: By author)

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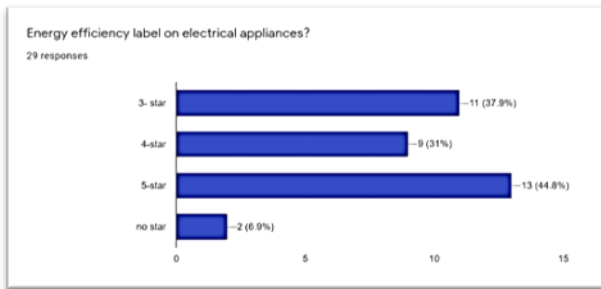


Figure 11 Preferable star –rated appliances use in housing by respondents in questionnaire survey (Source: By author)

So there are still barriers to sustainability in housing by occupancy attitudes so further surveyed the reasons behind shows, technical barriers due to space layout shares the major reason with 51.7%, secondly, comfort issues with 31%, lack of time with 27.6%, lack of convenience with 24.1%.

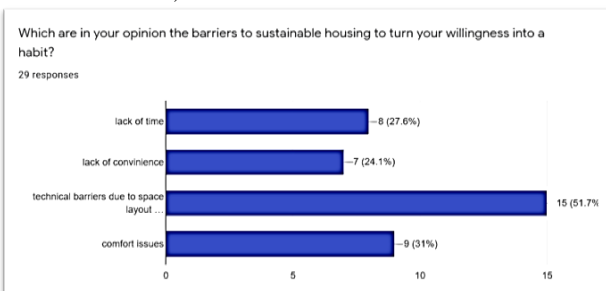


Figure 12 Reason for barrier to sustainable housing by respondents in questionnaire survey (Source: By author)

VII. ECONOMIC

As per sustainable housing concept more use of energy saving appliances will turn to economic efficiency of house hold income. And less energy consumption will led to energy efficacy as a whole of production.

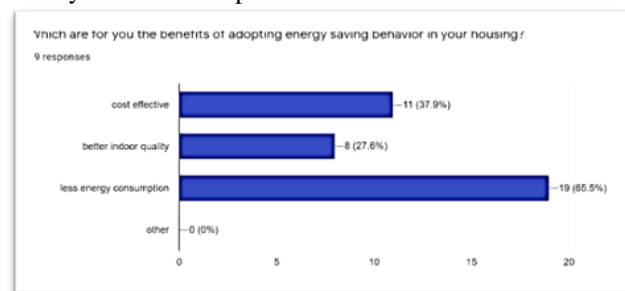


Figure 13 Occupancy attitudes behind energy efficiency behaviour in housing by respondents in questionnaire survey (Source: By author)

VIII. RESULTS

Occupancy evaluation in energy consumption is a considered research topic to address the need of climate changing challenges. Concerning the need, this study summarize the various interlinked factors (indoor climate, building operation, occupancy attitude and economic) and sub factors of framework of energy consumption occupant's behavior, with the impact of occupant's actions on the total energy consumption of buildings. Survey analysis that there are more "inconveniences" among people for taking sustainable housing as major concern over "unawareness" about

sustainability reasons are several in every account (less space layout ,opening windows for ventilation causing thermal discomfort) etc.

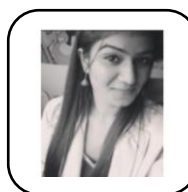
IX. CONCLUSION

There are end studies defining the impact of occupancy on energy consumption with need to reduce the gap between predicted and actual energy consumption of building. There are numerous active and passive energy behaviors of occupants (including: use of hot/cold water, solar shading and window openings etc.) which are not considered in initial or partial simulation tools. Thus, there is an inherent demand for energy researchers to improve the understanding of energy consumption of buildings by considering energy behavior of occupants. Furthermore, factors in a multi-disciplinary approach from a sociology, psychology, and engineering and design perspectives for future research can be evaluated with primary survey.

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