

MAKING EXISTING HOMES GREEN AND ENERGY EFFICIENT: CASE STUDY OF STUDIO APARTMENTS IN DELHI AND NCR

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Abstract: The study was conducted to explore Interior Products to make Existing homes Energy Efficient in 2012 and access the awareness level regarding energy efficient interior products amongst interior designer and occupants. It was also conducted to make people aware about the implementation of energy efficient interior products and framing guidelines that will help people in implementing and making their existing homes as energy efficient. 15 designer and 35 occupants of studio apartments were interviewed to gain insight into the awareness level regarding energy efficient features and products that can be implemented in an existing home.

The results showed that most of the occupants (73%) and almost all (93%) the designers were aware about the energy efficiency concept but they were not aware about the practices that can be done to conserve energy. Most of the designers believe that the concept of energy efficient features will be highly successful in Delhi if implemented properly as it is the need to conserve energy for present as well as for future.

Both the designers and occupants are ready to spend more on energy efficient features being implemented provided it saves their energy and money.

Keywords: Energy Efficiency, Green Building, Studio Apartments, Sustainability, Energy Conservation.

INTRODUCTION

Sustainable building (also known as Green Construction or Green Buildings) refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from sitting to design, construction, operation, maintenance, renovation, and demolition. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.

World Bank emphasizes (<http://www.worldenergyoutlook.org/> accessed on 4 December 2007) that energy security based on energy efficiency is one of the major concerns of developing countries for sound energy management. The fundamental goal of energy management and conservation is to produce goods and services at the maximum energy efficiency, least cost and least adverse environmental impact. Good energy management can lead to reduction in pollution particularly the carbon-di-oxide levels (CADET, 1995).

Considering the vast potential of energy savings and benefits of energy efficiency, the Government of India enacted the Energy Conservation Act, 2001 (retrieved from www.Delhi.transco.gov.in on 21 August 2007). The Act provides for the legal framework, institutional arrangement and a regulatory mechanism at the central and state level to embark upon energy efficiency drive in the country.

Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by: (a) Efficiently using energy, water, and other resources (b) Protecting occupant health and improving employee productivity (c) Reducing waste, pollution and environmental degradation (http://en.wikipedia.org/wiki/Green_building, 2011)

Green homes are beneficial like energy and water saving, reduced waste, improved indoor environmental quality, greater employee productivity, and reduced employee health cost. It helps to save energy and enables efficient use of resources. (H.Kats, 2003)

Energy saving features help in lowering operation costs, and reducing electrical energy and water consumption. In addition, it also benefits the environment by lowering the amount of carbon

dioxide emitted into the atmosphere, principal cause of global warming (Adalberto, 2009).

The present study entitled "Energy Efficient Interior Products to Make Existing Homes as Energy Efficient Homes- An Exploratory Study" was an endeavor to understand the various energy efficient features that can be implemented in an existing home to make it energy efficient and also the implementation of these energy efficient features into existing home. An attempt was made to gain insight into the awareness levels of interior designers and occupants regarding energy efficient features. The study was conducted with the following objectives in mind: (a) To study the awareness level of designers and occupants towards energy efficient practices. (b) To study how the energy efficient features can be implemented in an existing home to make it a green home. (c) To frame guidelines to make people aware regarding the implementation of energy efficient features.

The awareness levels of designers and occupants were analyzed on the basis of their knowledge about energy efficient devices, lighting management, water management, waste management and other miscellaneous energy efficient construction material.

METHODOLOGY

The study was carried out with 15 interior designers who have designed residential and commercial buildings and 35 occupants of studio apartments. They were selected randomly as per their availability. The research comprised of **questionnaire-cum-interview** schedule for the awareness levels of interior designers and occupants. **Observation method** was used to see the various energy efficient features already existing in their homes.

The data obtained through questionnaire-cum-interview was coded, frequencies of responses against their codes were tabulated in the excel format, the percentages calculated and analyzed. The frequencies and percentages computes were represented through tables and graphs.

RESULTS AND DISCUSSIONS

Profile of interior designers

Majority of the designers were in the age group of 23 to 46years. They generally have designed interior of residential buildings in North Delhi. Almost all of them resided in North Delhi and some were from South Delhi as well.

Awareness about energy efficient practices among interior designers

Majority of the designers (93%) were aware about the term "energy efficiency". They believe that saving energy and using energy efficient devices is the key

to implement energy efficient features in any building. Some designers even think that using environment friendly techniques is also an energy efficient practice. This indicates that almost every designer was aware about the energy efficient feature that can be implemented in an existing home to make it energy efficient but they were not much aware about the implementation of these features and also the awareness level of the occupants.

Designers have also seen the advertisements regarding energy efficient practices through newspapers, conferences and seminars but many of them haven't seen any advertisement. They believe that people should be made more aware about energy efficiency through helping in implementing small practices in their daily life which will help to save energy. Also, people should be made aware that they should not only save energy but they should also use it judiciously.

Majority of the designers (73%) have incorporated terrace gardening as an energy efficient feature in the buildings designed by them. They were aware about the other features like solar panels, rain water harvesting but they haven't implemented them in their buildings. This indicates that the knowledge level regarding energy efficiency was good but the implementation knowledge was less. Most of them even considered fly ash to be most energy efficient construction material but again it hasn't been used in construction of any of the building.

Lighting management

It is the most important energy efficient feature required in a building. Most energy is consumed by the lighting equipment. Majority of designers (67%) believe that there is no psychological difference between usage of tube lights and CFLs. They think that CFLs are long lasting and are more energy efficient. Also, tube lights consumes more energy per watt. Some designers even think tube lights are more illuminating as compared to CFLs. Almost all the designers believe that CFL is the most energy efficient lighting equipment but due to psychological aspect, the acceptance is less. They are even aware about T8, T12 but they haven't implemented them anywhere. They also think that windows do not play any role in saving energy. but some designers believe that windows help in regulating the indoor air of room which further reduce the usage of fans, coolers and HVACs.

Most of the designers are aware about the energy star labeled devices and mostly refrigerators have been incorporated in the buildings designed by them.

Water management

It is a very necessary concept of energy efficiency. There is a great need to conserve water for the present and the future generations. Majority of the designers (86%) have incorporated dual flush system as a technique of saving water in the buildings designed by them. Some designers believe that people are not ready to accept the other water conserving techniques as they might not be aware about the benefits. Also, it is psychologically that people don't accept the change easily. Most of the waste water is either utilized for gardening purpose or for cleaning up of washrooms. This saves a lot of water and it is a small practice that can be implemented in daily life. Majority of designers (53%) believe that drip less taps help in saving a lot of water but they haven't implemented them in any of the buildings. They also said even foamed taps help in saving water. Designers also believe that rain water should not be wasted and it should be reused for cleaning purpose or for other household work to reduce the usage of tap water and minimize water loss. Usage of rain water also depends on the awareness of occupants as again it is a small practice that can be done in daily life.

Waste management

It is of major concern as waste management is not much practiced in India and it leads to many diseases if not managed properly. Also utilizing waste paper and saving paper also come under waste management. Majority of the designers (93%) are not aware about any waste management technique and they haven't incorporated any waste management technique in their buildings. This might be due to the fact that they are not aware about any techniques and also waste management is not given much focus in India. Almost all the designers do save paper by some or the other method. They use newspaper as rough paper and use e-mails instead of using paper. This helps in saving a lot of paper and every person should implement it in their life. Many people print on both sides of paper to prevent unnecessary loss of paper.

Other energy efficient practices

They will include awareness regarding wood substitutes, low volatile organic compound paints, energy efficient glass, etc. 100% of the designers are aware that wood is banned in India and they are also aware about the various substitutes of wood. As due to cutting of wood there is a lot of deforestation so government has banned the usage of wood in India. Majority of the designer (67%) are aware about plywood as a major wood substitute that can be used

in furniture and other items. Other wood substitutes can be fiber board, particle board, bamboo, etc. 53% designers are aware about energy efficient glass that do not allow the heat to come inside and only allows daylight to enter but they haven't implemented it in any of the buildings. Very few designers i.e., 47% designers are not aware about wood substitutes may be due to the fact that they are not much advertised.

Majority of the designers are aware about modular furniture which is a new and upcoming concept in India. It saves a lot of space and avoids wastage of material. 40% of the designers have used display racks as modular furniture in the buildings they have designed. Modular kitchens are a newer and very practical concept nowadays but only 75 designers have incorporated in their design features.

Low VOC paints

Majority of the designers (80%) are aware about low volatile organic compound (VOC) paints but they haven't incorporated it anywhere. This is because people are not aware about its benefits and they are not ready to accept it. Designers are also aware that low VOC paints are advisable for health as they do not harm the environment and the health of occupants.

Indoor Air Quality

93% designers believe that indoor air quality can be maintained by using exhaust fans and it is mostly used in bathrooms and kitchen as in these places it is mostly required to regulate the air. Coolers, fans and HVACs can also be used to maintain the indoor environmental quality.

Majority of designers believe that the concept of energy efficiency is very much successful in Delhi as it is the need of today and it helps in saving resources as well as it leads to cost cutting. The initial cost can be high but it is long lasting and it will pay back in few years. People are getting conscious regarding the usage of energy efficient products but they are not aware how to implement these in existing homes. All the designers are ready to spend more on energy efficient features like electrical devices, waste management, lighting management and material and finishes and to implement these features.

Profile of the occupants of studio apartments

The occupants selected were residing in studio apartments. They were of the age group of 23-45 years. Most of them were professionals and some were housewives. On an average there were 2 to 4 people living in a studio apartment.

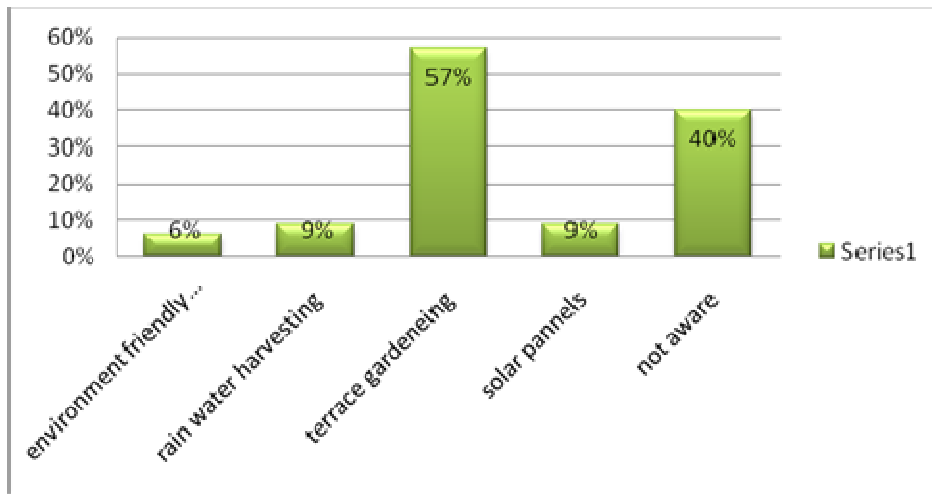


Figure 1: Energy efficient features used in the building

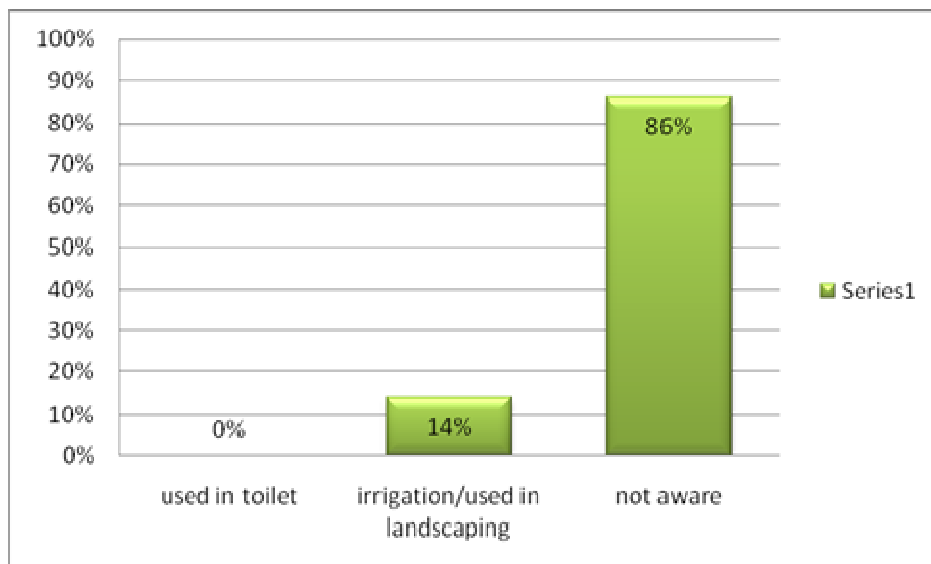


Figure 2: Utilization of waste water

Awareness about energy efficient practices among occupants of studio apartments

Majority of the people i.e., 100% people are aware about energy efficient devices. They know what energy efficiency is but they don't know small things that can help in saving energy in their homes. People were also aware about using solar energy but they don't know how to use it. Every 1 was aware about energy efficiency in their own context. Most of the people are aware about energy efficiency but they haven't seen any advertisement regarding energy efficiency. 26% people have seen advertisements but they were not completely aware about energy efficiency. 57% people said that terrace gardening is an energy efficient feature that has been used in the building. 9% people have heard about solar panels but it is not implemented in their homes. Cement is the major construction material that has been used in the building. Other construction material that has been used in the building is aluminium, brick, steel and gypsum. They were aware about flyash but it hasn't been used in the building. There were multiple responses regarding the construction material used as more than one construction material has been used in different materials.

Lighting management

It is of prime focus and has been of major concern as it utilizes the maximum energy of all the energy efficient features. 49% people believe that tubelights should be used instead of CFLs as it gives more illumination and is less in cost but they are not aware that tubelights consumes more energy than CFL. 17% people said tubelight and CFLs are same thing and they do not make any difference which shows that people are not aware about the benefits of CFL. 89% people say that sometimes there is not proper daylight and they have to switch on lights. This may be due to the fact that windows are not properly placed for receiving proper daylight. They also feel that in some places the windows are not appropriately placed for daylight and wind.

Water management

It is a major concern of today and it can be managed by following small practices daily. 100% people are aware about water management but they don't follow any method to save water. This may be due to the fact that they are not aware about the various water management techniques that can be implemented. 83% people said that dual flush systems have been used in their buildings as a method of water conservation. Many of the people were not even aware about any water conservation measure that has been implemented in their building. They were also aware about using the rain water but nobody has implemented this is their daily routine. Most of the

people were not aware about the utilization of waste water. 14% people use waste water for irrigation or for cleaning of washrooms. Most of the people said that rain water should be recycled but they don't know how to recycle rain water.

Waste management

It is not practiced much but it should be brought into lime light and people should be made aware about it. Most of the people i.e., 94% people were not aware about any waste management technique that is being used in the building. They didn't know which techniques are called waste management techniques. 52% people said that it is the duty of sweeper to come and collect the waste from their house as they don't have the time to go and throw it. 48% people said that they go and throw the waste themselves as the sweepers don't come on a daily basis. Majority of the respondents are aware about the segregated bins and that they are placed in their societies. 46% respondents even said that waste management staff of society takes efforts to clean the society dustbins on regular basis. In some societies it is not cleared on regular basis and so it remains unattended for several days creating health and sanitation issues. Most of the people are aware about saving paper and they do not waste it. Most of them print on both sides of sheet and use e-mails instead of writing on paper.

Other energy efficient features

They include material used in making furniture, in flooring, in doors, etc. Plywood is mostly used in making furniture as said by most of the people. They are aware that wood is banned in India and that is why wood substitutes are now being used. Mostly occupants said that wood and its substitutes have been used in the construction of door and some said aluminum door with glass has been used.

Low VOC paints

Majority of respondents are not aware about low volatile organic compound paints and that they don't know whether these paints have been used in the building or not. Majority of people are aware that paints are harmful for health but they are not aware about eco-friendly paints and its benefits.

Indoor Air Quality

97% occupants believed that indoor air quality can be maintained by exhaust fans. Only 49% occupants believe that indoor air quality can also be maintained by HVACs. Mostly people said that windows are kept open for ventilation and it sometimes depend on the outside environment. Windows are mostly kept open in winter season as it increases heat level in the room.

51% respondents are not aware about energy efficiency labeling on device (star rating concept) and that their willingness to incorporate power saving device even if the initial cost were higher while 63% respondents said that resident welfare association is not taking any efforts to increase awareness regarding energy efficiency implementation and they should make efforts to aware people about the implementation aspect.

CONCLUSION

Designers have suggested certain ways in which energy efficiency of an existing building can be improved. Most of them said that people have to be made aware regarding the usage of energy efficient devices and they should be made ready to spend more on energy efficient devices. Government should also make efforts in spreading awareness through more seminars and conferences at local level as well. Energy auditing can be done to make people aware that how much energy they are consuming and by implementing these features they are cutting on lot of unnecessary wastage. Energy efficient techniques like energy efficient glass, dual flush system, waste water utilization etc. should be done to improve the energy efficiency of a building.

Guidelines to create Awareness regarding the Implementation of Energy Efficient Interior Products

(a) Windows on the north or east side should have sheer curtains so that daylight can come inside and not the heat. (b) Windows on the south and west should be properly shielded on outside by canopies and inside by curtains. (c) Toilets should have big ventilators so that in daytime more natural light can be utilized. (d) People living on top floor should have terrace gardens as it reduces the temperature to around 3 degree Celsius or potted plants can be kept to withstand heat. (e) A small herbal kitchen garden should be made in front of the kitchen window. (f) Heat retardant paints should be used on the external wall that helps to reduce the temperature in the room. (g) Floor carpets should be avoided as it produces heat and increase the temperature in the room. (h) Wooden flooring is considered to be good. (i) Energy star labeled devices should be used as they are energy efficient. (j) Cleaning of tube lights should be regularly done. (k) Garbage should be thrown in segregated bins bio-degradable and non-biodegradable. (l) Rain water harvesting should be a compulsory practice to increase the ground water level. (m) Proper cross ventilation should be there for air circulation. (n) CFLs T6, T8 should be used for saving lights and switched off when not in use.

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