www.ThePharmaJournal.com

The Pharma Innovation

Harleen Kaur
M.Sc. Student, Punjab
Agricultural University, Punjab,
India

Dr. Harsharan Kaur Gill
Professor, Punjab
Agricultural University, Punjab,
India

Dr. Narienderjit Kaur
Extension Specialist, Punjab
Agricultural University, Punjab,
India

Adoption level of modern families in green homes norms in the modern houses

Harleen Kaur, Dr. Harsharan Kaur Gill and Dr. Narienderjit Kaur

Abstract
The present study was undertaken to know the adoption level of modern families about in green home norms in the modern houses, their adoption level of green home norms related to site selection and planning, water efficiency, energy efficiency, building materials and indoor air. The study was conducted in three smart cities of Punjab *viz*: Amritsar, Jalandhar and Ludhiana. One hundred and fifty houses, fifty from each city built after 2015 were selected from posh localities. Data were collected through structured schedule. Result revealed that all respondents did not adopt rain harvesting and efficient landscape design for enhancing water use efficiency. Eighty six percent respondents did not adopt renewable energy systems. Ninety, 86 and 93.33 per cent respondents did not dispose of building material waste properly, used recycled material and had on-site waste treatment for organic waste respectively.

Keywords: Green home, adoption level, green home norms, modern houses

Introduction
Environmental adoption is the practice to save or protect our environment. Day by day is being degrading because of overconsumption of natural resources. There are many organizations and schemes which helps to protect our environment but it is our responsibility to adopt it individually and keep our homes "green". A green home needs to address all aspects of environmental concerns related to the site, water and energy efficient practices, choice of the materials and good indoor air quality related aspects. Some of the sustainable building designs have distinct features i.e. green homes include wall and roof insulation, devices and practices regarding shading the house, use of reclaimed and recycled materials, low volatile organic compounds paints, on-site and off-site waste water treatment, vermin-composting, roof and non-roof water harvesting, installation of the energy & water sub-metering and energy efficient appliances etc. Some easily implementable practices like installation of solar panels**,** star rated appliances which are more efficient than standard appliances, shift from conventional to high efficiency water heaters and washing machines, low-flow showerheads, faucets and toilets, installation of the low-e glass windows. A green house also has enhanced asset value resulting in higher profits in their total value. Economic life cycle performance of a green house is optimum and it minimises health problems resulting from poor indoor air quality.

Research methods works
The study was conducted in three smart cities of Punjab *viz*. Ludhiana, Jalandhar and Amritsar. B.R.S Nagar, Sarabha Nagar, Raj Guru Nagar, Dayal Nagar and Aggar Nagar Colony areas from Ludhiana were selected. Urban Estate-phase I, Urban Estate-phase II, Model Town, Dashmesh Nagar, Ashok Nagar and Joti Nagarareas were selected from Jalandhar. Dream city, Model Town, Holy City, New Amritsar and Ranjit Avenue localities were selected from Amritsar. Data were tabulated for systematic analysis. According to the objective appropriate tables were formulated for moving towards the conclusions. Statistical tool applied were: frequencies and percentage.

Research findings and Discussion
Level of adoption
Selection of an appropriate site for house construction is indispensable and fundamental to a green building. Consideration for level of ground, quality of underground water, proximity to civic amenities, appropriate outside configuration of the house, approval of building plan, soil erosion control measure, stockpiling fertile top soil for reusing in landscape, convenient design

Correspondence
Harleen Kaur
M.Sc. Student, Punjab
Agricultural University, Punjab,
India

for differently abled, basic facilities for construction workers etc. are valuable considerations at the time of selection of site for house construction which were studied and relevant data presented in table 1.

The perusal of data reveals that majority of respondents (93.33%) considered the level of the ground while selecting the site for the house construction partially meaning thereby that they thought about this aspect but were not much fixed about based on this consideration for their final decision. Similarly ninety three per cent of the respondents partially took care about the type of soil of the site of the house as they were concerned about raising a kitchen garden and develop aesthetic landscape. All the respondents were greatly concerned about the quality of underground water at their house construction site. A good number of respondents (52%) could not choose a site having close proximity to civic amenities in order to reduce the use of automobile in their endeavor to construct a green building due to non-availability of such sites at reasonable cost. Fourty two, twenty seven, fourteen & fourty fourper cent respondents were found resorting to online shopping for fast moving consumer goods, payment of utility bills, banking services & booking of various services respectively in order to curtail the use of automobile and save their time and botheration also, hence making their contribution towards green thought. About sixty per cent respondents' houses had a regular outside configuration thus contributing towards better thermal control conditions inside the building due to less exposure of external walls to the outside environment. This may be dueto concern of the architects of these houses about creating green buildings though majority of the house owners were not found aware about the fact of conserving electrical energy in cooling/ heating the rooms through appropriate outside building configuration. All the respondents got their house plans approved and also obtained occupancy certificates from the local civic bodies as it was mandatory in all the locations by their respective local bodies. All respondents managed the soil erosion in the pre-construction phase while eighty eight per cent respondents showed little concern in controlling the soil erosion during construction phase. All the respondents partially concern about the soil erosion in the post construction phase. Sixty per cent respondents partially stockpiled the top soil to be used in landscape later. Only six per cent respondents showed any concern in conserving the natural topography/vegetation while constructing their house. Majority of respondents (83.33%) did not pay any heed to offsetting heat island effect from the roof area as either they were not aware of the technologies of reducing heat island effect from roof area or there are a few viable technologies for the purpose or the high installation cost of these technologies is keeping them away. Comparatively a good per cent of respondents (84.67%) managed the heat island effect in non-roof area by way of planting trees, hedges, climbers, grass etc. around the building. About sixty six per cent respondents did not provide any parking facility for the visitors due to shortage of space. All of the respondents showed lack of interest in using electric vehicles running in the region. Somewhat differently abled person were found in the respondents' families however they showed scant concern for the visiting differently abled guests with fifty four per cent respondents having an easy access to the main entrance, thirteen per cent having non-slippery ramps, all respondents having adequate entrance door width for wheel chair users but not for other rooms and ninety two per cent having just partial adoption of uniformity in floor levels for the convenience for differently abled persons.. Better adoption of green home norms related to selection of site and planning in homes was found by respondents of Amritsar followed by Jalandhar and Ludhiana.

Table 1: Distribution of respondents according to their level of adoption of green home norms related to site selection and planning of house. (N=150)

Green home norms related to site selection and planning	Level of adoption											
	Ludhiana			Jalandhar			Amritsar			Overall		
	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)
Consideration for site selection Level of ground	4 (8.00)	46 (92.00)	0 (0.00)	3 (6.00)	47 (94.00)	0 (0.00)	3 (6.00)	47 (94.00)	0 (0.00)	10 (6.67)	140 (93.33)	0 (0.00)
Type of soil	3 (6.00)	47.00 (94.00)	0 (0.00)	2 (4.00)	48 (96.00)	0 (0.00)	4 (8.00)	46 (92.00)	0 (0.00)	10 (6.67)	140 (93.33)	0 (0.00)
Condition of underground water	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)
Proximity to civic amenities	0 (0.00)	13 (26.00)	37 (74.00)	0 (0.00)	19 (38.00)	31 (62.00)	4 (8.00)	36 (72.00)	10 (20.00)	4 (2.67)	68 (45.33)	78 (52.00)
Basic amenities accessible by safe convenient pedestrian pathways	0 (0.00)	3 (6.00)	47 (94.00)	4 (8.00)	7 (14.00)	39 (78.00)	20 (40.00)	30 (60.00)	0 (0.00)	24 (16.00)	40 (26.67)	86 (57.33)
Online shopping Fast moving consumer goods	0 (0.00)	17 (34.00)	33 (66.00)	0 (0.00)	19 (44.00)	31 (62.00)	0 (0.00)	27 (54.00)	23 (46.00)	0 (0.00)	63 (42.00)	87 (58.00)
Payment of utility Bills	3 (6.00)	13 (26.00)	34 (68.00)	1 (2.00)	14 (28.00)	35 (70.00)	3 (6.00)	14 (28.00)	33 (66.00)	7 (4.67)	41 (27.33)	102 (68.00)
Banking services	0 (0.00)	7 (14.00)	43 (86.00)	0 (0.00)	5 (10.00)	45 (90.00)	0 (0.00)	9 (18.00)	41 (82.00)	0 (0.00)	21 (14.00)	129 (86.00)
Booking of various services	1 (2.00)	20 (40.00)	29 (58.00)	1 (2.00)	26 (52.00)	23 (46.00)	2 (4.00)	24 (48.00)	24 (48.00)	4 (2.67)	66 (44.00)	80 (53.33)
Appropriate Outside configuration of house	0 (0.00)	26 (52.00)	24 (48.00)	2 (4.00)	32 (64.00)	16 (32.00)	3 (6.00)	30 (60.00)	17 (34.00)	5 (3.33)	90 (60.00)	55 (36.67)
Approval of building plan Obtaining occupancy certificate	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)	0 (0.00)
Soil erosion control measure Pre-construction	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)	0 (0.00)
During-construction	0	42	8	0	41	9	0 (0.00)	49	1	0	132	18

	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)
	(0.00)	(84.00)	(16.00)	(0.00)	(82.00)	(18.00)		(98.00)	(2.00)	(0.00)	(88.00)	(12.00)
Post occupancy	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)
Stock piling fertile top in landscape	0 (0.00)	25 (50.00)	25 (50.00)	0 (0.00)	29 (58.00)	21 (42.00)	4 (8.00)	36 (72.00)	10 (20.00)	4 (2.67)	90 (60.00)	56 (37.33)
Conserving natural topography or vegetation	0 (0.00)	3 (6.00)	47 (94.00)	0 (0.00)	4 (8.00)	46 (92.00)	0 (0.00)	3 (6.00)	47 (94.00)	0 (0.00)	10 (6.67)	140 (93.33)
Offsetting heat island effect (Non-roof area)	0 (0.00)	42 (84.00)	8 (16.00)	0 (0.00)	39 (78.00)	10 (20.00)	0 (0.00)	46 (92.00)	2 (4.00)	0 (0.00)	127 (84.67)	20 (13.33)
Offsetting heat island effect (Roof area)	0 (0.00)	7 (14.00)	43 (86.00)	0 (0.00)	4 (8.00)	46 (92.00)	0 (0.00)	9 (18.00)	41 (82.00)	0 (0.00)	25 (16.67)	125 (83.33)
Parking facilities for visitors	0 (0.00)	12 (24.00)	38 (76.00)	0 (0.00)	20 (40.00)	30 (60.00)	0 (0.00)	19 (38.00)	31 (62.00)	0 (0.00)	51 (34.00)	99 (66.00)
Electric charging facilities for vehicle	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Design for differently abled Easy to access to main entrance	29 (58.00)	21 (42.00)	0 (0.00)	34 (68.00)	16 (32.00)	0 (0.00)	19 (38.00)	31 (62.0)	0 (0.00)	82 (54.67)	68 (45.33)	0 (0.00)
Non-slippery ramps with handrails	4 (8.00)	5 (10.00)	41 (82.00)	2 (4.00)	7 (14.00)	41 (82.00)	5 (10.00)	8 (16.00)	37 (74.00)	11 (7.33)	20 (13.33)	119 (80.00)
Adequate width of doors	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)
Uniformity in Floor level	0 (0.00)	46 (92.00)	4 (8.00)	0 (0.00)	48 (96.00)	2 (4.00)	0 (0.00)	45 (90.00)	5 (10.00)	0 (0.00)	139 (92.67)	11 (7.33)
Basic facilities for construction workers	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)

(Figure in parentheses depicts percentage)

Level of adoption

Concern for enhancing water use efficiency in homes is one of the prime content of green home norms. Every single drop of water saved is important for the sustainability of our environment. The data related to level of adoption of practices related to water use efficiency in homes was collected and given in table 2.

Upon critical examination of data it is evident that almost all of respondents (99.33%) were not at all concerned about the need of conserving rain water either through roof top rain water harvesting system or capturing the rain water run-off by some other means since they were neither much aware of the importance to harvest rain water nor aware of rain water harvesting technologies and agencies to install them. The practice of saving water through installation of water use efficient plumbing fixtures i.e. by installing dual flush was adopted by 87.33% respondents. However the practice of saving water by installing faucets with a flow of eight liters per minute and bidet with a flow of eight liters per minute by 92 and 70.67 percent respondents respectively. Sixty three percent respondents did not install aerators on kitchen taps to shape water stream coming out of the tap to bring more efficiency in flow rate. All of the respondents showed scant interest for saving water in maintaining their landscape area as none of the respondents were found aware about the importance of planting drought resistant plant species whereas majority of respondents (91.33%) limited their turf area due to difficulties in maintaining grassy turf during summer due limited municipal water supply. None of the respondents were found adopting the practice of segregating turf and bedding area based on watering requirements since they were not sensitive to conserving water to that extent. Similarly no one was found having the facility of drip irrigation for irrigating lawns which may have high contributions in saving water as they were not facing any shortage of water due to their dependence on underground water source of their own. Fifty two percent respondents were found having the facility of sprinkling irrigation system for their lawns. None of the respondents were found adopting modern technologies like moisture sensor, water pressure regulating device or time based water controllers for conserving water for irritating landscape area as they neither heard of these technologies nor they were finding any pressing need to conserve water through these technologies. Swimming pools and fountains were not found in any of the respondents' homes. Eighteen per cent respondents were found washing their cars by adopting good water use practices. Better adoption of green home norms related to water efficiency in homes was found by respondents of Amritsar followed by Jalandhar and Ludhiana.

Table 2: Distribution of respondents according to their level of adoption of green home norms related to water use efficiency in their homes.

Water use efficiency	Level of adoption											
	Ludhiana			Jalandhar			Amritsar			Overall		
	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)
Provision of rainwater harvesting system	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	1 (2.00)	49 (98.00)	0 (0.00)	1 (0.67)	149 (99.33)
Fixtures Dual flush	44 (88.00)	6 (12.00)	0 (0.00)	46 (92.00)	4 (8.00)	0 (0.00)	41 (82.00)	9 (18.00)	0 (0.00)	131 (87.33)	19 (12.67)	0 (0.00)
Faucet (8 LPM)	4 (8.00)	46 (92.00)	0 (0.00)	8 (16.00)	42 (84.00)	0 (0.00)	10 (20.00)	40 (80.00)	0 (0.00)	22 (14.67)	128 (92.00)	0 (0.00)
Bidet (8 LPM)	13 (26.00)	37 (74.00)	0 (0.00)	13 (26.00)	37 (74.00)	0 (0.00)	18 (36.00)	32 (64.00)	0 (0.00)	44 (29.33)	106 (70.67)	0 (0.00)
Kitchen tap's aerators	6 (12.00)	11 (22.00)	33 (66.00)	1 (2.00)	13 (26.00)	36 (72.00)	8 (16.00)	16 (32.00)	26 (52.00)	15 (10.00)	40 (26.67)	95 (63.00)

Energy efficiency practices	Ludhiana Full F (%)	Ludhiana Partial F (%)	Ludhiana Not adopted F (%)	Jalandhar Full F (%)	Jalandhar Partial F (%)	Jalandhar Not adopted F (%)	Amritsar Full F (%)	Amritsar Partial F (%)	Amritsar Not adopted F (%)	Overall Full F (%)	Overall Partial F (%)	Overall Not adopted F (%)
Shower hea (10 LPM/8 LPM)	0 (0.00)	21 (42.00)	29 (58.00)	0 (0.00)	19(38.00)	31 (62.00)	0 (0.00)	25(50.00)	25 (50.00)	0 (0.00)	65(43.33)	85 (56.67)
Hand held spray (10LPM/8LPM)	0(0.00)	21 (42.00)	29(58.00)	0(0.00)	16.00 (32.00)	34.00 (68.00)	0 (0.00)	29 (58.00)	21.00 (42.00)	0 (0.00)	66 (44.00)	84 (56.00)
Landscape design Plant drought resistant Species	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Limit turf area	0 (0.00)	43 (86.00)	7 (14.00)	0 (0.00)	48 (96.00)	2 (4.00)	0 (0.00)	46 (92.00)	4 (8.00)	0 (0.00)	137 (91.33)	13 (8.67)
Efficient landscape of irrigation system Install central shut off valve	0 (0.00)	40 (80.00)	10 (20.00)	0 (0.00)	43 (86.00)	7 (14.00)	0 (0.00)	46 (92.00)	4 (8.00)	0 (0.00)	129 (86.00)	21 (14.00)
Segregate turf and bedding based on watering Needs 50% area drip – irrigated	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Installation of sprinkler irrigation system for turf	0 (0.00)	23 (46.00)	27 (54.00)	1 (2.00)	26 (52.00)	23 (46.00)	5 (10.00)	29 (58.00)	16 (32.00)	6 (4.00)	78 (52.00)	66 (44.00)
Use of pressure regulating device to maintain optimal pressure	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Install moisture sensors	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Install time/ based controller	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Efficient car washing Practices	0 (0.00)	9 (18.00)	41 (82.00)	0 (0.00)	11 (22.00)	39 (78.00)	0 (0.00)	17 (34.00)	33 (66.00)	0 (0.00)	27 (18.00)	123 (82.00)

(Figure in parentheses depicts percentage)

Level of adoption

Homes are the 2nd largest consumers of energy after industry world over. Small savings in energy consumption through careful planning and adoption of judicious practices helps to save a lot of energy. Here, the concern is to reduce the amount of energy consumption leading to green environment plus saving the pockets of consumers. So data were collected to check the adoption level of energy conserving practices by respondents in their homes and showed in table 3.

Upon critical examination of data it is evident that all of the respondents used CFC free household equipment like A.Cs and refrigerators but were not conscious for this norm in other household appliances. Majority of respondents (80.66%) were not at all concerned about the halon-free fire suppression systems. The practice of saving electricity through installation of star rated (BEE 5 rating) i.e. by installation of efficient fans was adopted by 27.33% respondents. However the practice of saving energy by installing 5 star air conditioner fully (20%)

and partially (80%) adopted by respondents, light fittings were adopted by fully (26.67%) and partially (73.33%) motors and pumps were adopted by 27.33 percent respondents respectively. Sixty percentages of respondents partially orientated theirs room. Majority of respondents (64%) selected light colors for their rooms but with the combination of the dark colors walls. All respondents partially adopted the proper management of the window treatment like appropriate selection and operation of window treatments. Majority of respondents did not adopted the sun shading of windows by growing plants (66.67%), efficient fenestration (85%). Only 12.67% and 16% respondents were found who adopt the solar water heater system and solar garden lights respectively. None of the respondents were found adopting solar generators. Better adoption of green home norms related to energy efficiency in homes was found by respondents of Amritsar followed by Jalandhar and Ludhiana.

Table 3: Distribution of respondents according to their level of adoption of green home norms related to energy efficiency in their homes (N=150)

Energy efficiency practices	Level of adoption											
	Ludhiana			Jalandhar			Amritsar			Overall		
	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)
Use CFC free household equipment	0 (0.00)	50 (100.00	0 (0.00)	0 (0.00)	50 (100.00	0 (0.00)	0 (0.00)	50 (100.00	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)
Halon-free Fire Suppression Systems	0 (0.00)	6 (12.00)	44 (88.00)	0 (0.00)	10 (20.00)	40 (80.00)	0 (0.00)	13 (26.00)	37 (74.00)	0 (0.00)	29 (19.33)	121 (80.66)
Installation of star rated appliances (BEE 5 rating) Fans	3 (6.00)	9 (18.00)	38 (76.00)	4 (8.00)	13 (26.00)	33 (66.00)	9 (18.00)	19 (38.00)	22 (44.00)	16 (10.67)	41 (27.33)	93 (62.00)
Air conditioners	14 (28.00)	36 (72.00)	0 (0.00)	11 (22.00)	39 (78.00)	0 (0.00)	17 (34.00)	33 (66.00)	0 (0.00)	30 (20.00)	120 (80.00)	0 (0.00)
Refrigerators	38 (76.00)	12 (24.00)	0 (0.00)	47 (94.00)	3 (6.00)	0 (0.00)	45 (90.00)	5 (10.00)	0 (0.00)	69 (46.00)	81 (54.00)	0 (0.00)
Light fittings	14 (28.00)	36 (72.00)	0 (0.00)	7 (14.00)	43 (86.00)	0 (0.00)	19 (38.00)	31 (62.00)	0 (0.00)	40 (26.67)	110 (73.33)	0 (0.00)
Motors and pumps	0 (0.00)	11 (22.00)	36 (72.00)	0 (0.00)	12 (24.00)	31 (62.00)	0 (0.00)	18 (36.00)	27 (54.00)	0 (0.00)	41 (27.33)	109 (72.67)
Building envelope Proper orientation of the room	3 (6.00)	29 (58.00)	18 (36.00)	1 (2.00)	30 (60.00)	19 (38.00)	5 (10.00)	32 (64.00)	13 (26.00)	9 (6.00)	91 (60.67)	50 (33.33)
Select light colours for the room's walls	8 (16.00)	36 (72.00)	6 (12.00)	8 (16.00)	31 (62.00)	11 (22.00)	12 (24.00)	29 (58.00)	9 (18.00)	28 (18.67)	96 (64.00)	26 (17.33)
Appropriate selection and operation of window treatments	2 (4.00)	5 (10.00)	43 (86.00)	0 (0.00)	10 (20.00)	40 (80.00)	4 (8.00)	10 (20.00)	36 (72.00)	6 (4.00)	25 (16.67)	119 (79.00)

Sun shading of windows by awnings etc.	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)
Sun shading of windows by growing plants	0 (0.00)	13 (26.00)	37 (74.00)	0 (0.00)	17 (34.00)	30 (60.00)	0 (0.00)	20 (40.00)	43 (86.00)	0 (0.00)	50 (33.33)	100 (66.66)
Efficient fenestration	0 (0.00)	6 (12.00)	44 (88.00)	0 (0.00)	5 (10.00)	45 (90.00)	0 (0.00)	11 (22.00)	39 (78.00)	0 (0.00)	22 (14.67)	128 (85.00)
Installation of on-site renewable energy systems Water heaters	0 (0.00)	5 (10.00)	45 (90.00)	0 (0.00)	6 (12.00)	44 (88.00)	0 (0.00)	8 (16.00)	42 (84.00)	0 (0.00)	19 (12.67)	131 (87.33)
Solar garden Lights	0 (0.00)	9 (38.00)	41 (82.00)	0 (0.00)	8 (16.00)	42 (84.00)	0 (0.00)	7 (14.00)	43 (86.00)	0 (0.00)	24 (16.00)	126 (84.00)

(Figure in parentheses depicts percentage)

Level of adoption

Sustainable building materials and resources help to reduce dependence on materials that have associated negative environmental impacts and help to maintain the building strength for life long period. The data related to use of environment friendly materials in the construction of the house were collected and presented in table 4.

The results showed that majority of respondents (90%) did not dispose of waste of building material in a segregated way and at an appropriate place due to non-availability of this disposal facility and lack of their interest in systematic disposal adopted. Fifty eight per cent respondents used building materials like bricks, sand etc. which were manufactured within 400 km distance. Fifty seven per cent respondents used fifty per cent wood based material by cost from rapidly renewable source like wooden ply board, wood

veneers, batton / particle boards etc. which are being manufactured locally from the local grown fast growing trees like poplar and eucalyptus. This may be due to the fact that original wood is very expensive or good quality wood products are available at affordable prices in the local market. No respondents used thirty per cent building material from the recycled content as such materials were either not available in the market or their quality was not up to the mark. Few (6.67%) of respondents did not create the facility for on site waste treatment system for handling fifty percent of organic or landscape waste of the building. Fifty one per cent of respondents used at least five passive or active green building materials, products and equipment (certified by IGBC). Better adoption of green home norms related to building resources and materials in homes was found by respondents of Amritsar followed by Jalandhar and Ludhiana.

Table 4: Distribution of respondents according to their level of adoption of green home norms for building materials and resources (N=150)

Energy efficiency practices	Level of adoption											
	Ludhiana			Jalandhar			Amritsar			Overall		
	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)
Dispose of waste of building material in a segregated way	0 (0.00)	3 (6.00)	47 (94.00)	0 (0.00)	5 (10.00)	45 (90.00)	0 (0.00)	7 (14.00)	43 (86.00)	0 (0.00)	15 (10.00)	135 (90.00)
20% of the total building material (by cost) is manufactured locally	0 (0.00)	25 (50.00)	25 (50.00)	0 (0.00)	29 (58.00)	21 (42.00)	0 (0.00)	34 (68.00)	16 (32.00)	0 (0.00)	88 (58.67)	62 (41.33)
50% of wood based material(by cost) is from rapidly renewable source	0 (0.00)	25 (50.00)	25 (50.00)	0 (0.00)	29 (58.00)	21 (42.00)	0 (0.00)	32 (64.00)	18 (36.00)	0 (0.00)	86 (57.33)	64 (42.67)
30% of total building material (by cost) has recycled content	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Facility of on-site waste treatment system for handling 50% of organic and landscape waste of the building	0 (0.00)	2 (4.00)	48 (96.00)	0 (0.00)	4 (8.00)	46 (92.00)	0 (0.00)	4 (8.00)	46 (92.00)	0 (0.00)	10 (6.67)	140 (93.33)
75% of the waste generated during construction is diverted from landfills for reuse or recycling	0 (0.00)	11 (22.00)	39 (78.00)	0 (0.00)	14 (28.00)	36 (72.00)	0 (0.00)	19 (38.00)	31 (62.00)	0 (0.00)	44 (29.33)	106 (70.67)
Used at least five passive or active green building materials, products and equipment (certified by IGBC)	0 (0.00)	21 (42.00)	29 (58.00)	0 (0.00)	26 (52.00)	24 (48.00)	0 (0.00)	30 (60.00)	20 (40.00)	0 (0.00)	77 (51.33)	73 (48.67)

(Figure in parentheses depicts percentage)

Level of adoption

The quality of the air inside of the house drastically effects on health and its really very important to have proper ventilated house. The data related to check the indoor air quality of the house presented in table 5.

The perusal of data reveals that cross ventilation in rooms was just partially adopted by all the respondents. All respondents had partially proper ventilated rooms in their house. Placement of doors and windows did not ensure adequate cross ventilation in the rooms basically because of lack of provision and lack of awareness of the respondents. Similarly 88.67 per cent respondents did not adopt the practice of having adequate operable windows to the exterior. Fourty per

cent respondents could not adopt the practice of having unobstructed space beyond windows for free flow of air due to lack of provision. None of the respondent adopted the practice of having separate smoking area because respondents were not much aware about the effects of passive smoking. Moreover smoking cigarettes was not very common among in respondent families. Carbon dioxide sensors were not found installed in any of the houses to have a constant check over the quality of indoor air. All respondents had no provision of separate smoking area, carbon dioxide sensors and adequate operable window area. Good adoption of green home norms related to indoor air quality in homes was found by respondents of Amritsar followed by Jalandhar and Ludhiana.

Table 5: Distribution of respondents according to their level of adoption of green home norms for indoor air quality (N=150)

Name of Practices	Level of adoption											
	Ludhiana			Jalandhar			Amritsar			Overall		
	Full F (%)	Partial F %	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)	Full F (%)	Partial F (%)	Not adopted F (%)
Provision of cross ventilation in rooms	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)
Adequate operable windows in each room to exterior	0 (0.00)	4 (8.00)	46 (92.00)	0 (0.00)	6 (12.00)	44 (88.00)	0 (0.00)	7 (14.00)	43 (86.00)	0 (0.00)	17 (11.33)	133 (88.67)
Unobstructed space beyond windows for free flow of air	0 (0.00)	32 (64.00)	18 (36.00)	0 (0.00)	30 (60.00)	20 (40.00)	0 (0.00)	27 (54.00)	23 (46.00)	0 (0.00)	89 (59.33)	61 (40.67)
Provision of separate smoking area	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Installation of carbon dioxide sensors	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Provision of adequate day lighting in regularly occupied areas	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)
Provision of adequate day lighting in non-regularly occupied areas	0 (0.00)	31 (62.00)	19 (38.00)	0 (0.00)	36 (72.00)	14 (28.00)	0 (0.00)	38 (76.00)	12 (24.00)	0 (0.00)	105 (70.00)	45 (30.00)
Provision of adequate outdoor view	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)	0 (0.00)
Occupants should have access to sky or fauna and flora around	0 (0.00)	11 (22.00)	39 (78.00)	0 (0.00)	12 (24.00)	38 (76.00)	0 (0.00)	17 (34.00)	33 (66.00)	0 (0.00)	40 (26.67)	110 (73.33)
Provision for minimizing exposure of occupants to hazardous Indoor	0 (0.00)	11 (22.00)	39 (78.00)	0 (0.00)	14 (28.00)	36 (72.00)	0 (0.00)	16 (32.00)	34 (68.00)	0 (0.00)	41 (27.33)	109 (72.67)
Use paints and coatings with low or no VOC content	7 (14.00)	0 (0.00)	43 (86.00)	10 (20.00)	0 (0.00)	40 (80.00)	23 (46.00)	0 (0.00)	27 (54.00)	40 (26.67)	0 (0.00)	110 (73.33)
Use of adhesives in interiors with permitted level of VOCs	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Installation of Green Label carpets only	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Composite wood and agr-fiber materials to be used for flooring paneling etc.	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	50 (100.00)	0 (0.00)	0 (0.00)	150 (100.00)
Salvaged wood based materials to be used	0 (0.00)	11 (22.00)	39 (78.00)	0 (0.00)	16 (32.00)	34 (68.00)	0 (0.00)	23 (46.00)	27 (54.00)	0 (0.00)	50 (33.33)	100 (66.67)
Facilities to enhance physical, emotional and spiritual wellbeing of occupants (gymnasium, yoga, meditation etc.)	0 (0.00)	9 (18.00)	41 (82.00)	0 (0.00)	11 (22.00)	39 (78.00)	0 (0.00)	19 (38.00)	31 (62.00)	0 (0.00)	39 (26.00)	111 (74.00)

(Figure in parentheses depicts percentage)

References
1. Ahmad T, Thaheem MJ, Anwar A. Developing a green-building design approach by selective use of systems and techniques. Archit Eng Des Manag 2016; 12:29-50.
2. Chiara B. Recent trends and challenges of energy efficient and sustainable buildings. Amer J Engg Appl Sci. 2014; 7:292-94.
3. Garas GL, Allam ME, Bakhoum ES. Sustainability analysis of conventional and eco-friendly materials: a step towards green buildings. ARPN J Engg Appl Sci. 2015; 10:2.
4. Hsieh MH. The application trend of smart sensing technology in home of building: an example of a green and smart building for the seniors citizens offered by Farglory Land Development. 2011; 1:1.
5. Liang HH, Chen CP, Hwang RL, Shih WM, Lo SC, Liao HY. Comparison of the conventional and green homes on variety of aspects of Indoor Environmental Quality. *Build Environ* 2014; 72:232-42.
6. Lin P, Huang Y. The influence factors on choice behavior regarding green products based on the theory of consumption values. Journal of Cleaner Production. 2012; 22(1):11-18. https://doi.org/10.1016/j.jclepro.2011.10.002
7. Radwan A, Issa M, Hill MS. Occupant satisfaction with indoor environmental quality in green buildings. Proc Healthy Build. 2006, 365-70.