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A study on eco-friendly and energy efficient techniques available in market

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Abstract

The study was conducted in Udaipur city in phase-Exploration of Technologies. The sample selected for comprised of 15 authorized dealers who were dealing in various eco-friendly and energy efficient techniques. The result shows that in all there were 11 eco-friendly and energy efficient technologies viz. bricks (Concrete blocks, hollow block bricks, glass bricks and fly ash bricks), windows (glazed windows, artificial wood paneled windows, panned windows and super windows), doors (PVC, MDF and artificial wood panel), floors (Tiles, marbles, artificial wood flooring and cork), roofs (Terracotta roof and fiber kelu) and paints (Exterior and interior) in building materials and solar water heater, rainwater harvesting system, water treatment plant, Vermi-composting and solar lights in technologies were available in market of Udaipur city. 100 percent respondents were using different types of eco-friendly bricks, windows, doors, flooring, roof and paints.

Keywords: eco-friendly and energy efficient, eco-friendly and energy efficient technologies, eco-friendly and energy efficient building materials etc.

Introduction

India is the second most populous country in the world. The current population of India according to the national census is around 1.22 billion. The population growth rate of India is estimated at around 1.58%, which is on the higher side of the average population growth rate of the world. As the population increases, the need of the people also grows. Providing housing is one of the major challenges faced today by the government of India. Along with this the climatic changes which take place due to this surge in population can be mitigated to some extent by sustainable development which should be tackled at the grass root level (Anonymous, 2012) ^[1].

Methodology

Methodological step, which was followed to achieve the objectives set for the present investigation, are presented under the following phases:

Exploration of technologies

To collect the specifications regarding existing EFEEBM&BT, the sample of dealers were drawn from the market of Udaipur city. An interview schedule was developed, to collect the information regarding existence of eco-friendly and energy efficient building technologies, their names, types, specifications and their total price etc. The interview schedule was used to collect information regarding, eco-friendly & energy efficient building material and technologies for residential building available in the market of Udaipur city.

The developed pro-forma to collect required information was used by the investigator. Researcher personally visited and interviewed each selected authorized dealer at their shop to collect the required information. During visit, the researcher also made certain observations and authenticated the given information.

Results and Discussion

Various eco-friendly and energy efficient technologies for sustainable residential buildings were available in the market of Udaipur. The data so collected is presented under the following table:

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Table 2: Distribution of authorized dealers as per the availability of different EFEEBM & BT for sustainable residential buildings N=15

S. No	Name of building elements	Type & Name of EF &EE building material	percentage of authorized dealers	Remarks
1.	Walls Bricks	Concrete blocks	6.7	These were not sold in the market at the specific shops or showrooms. They were casted at the construction site by the builders.
		Hollow block bricks	6.7	
		Glass bricks	6.7	
		Fly ash bricks	13.4	
2.	Windows	Glazed windows	6.7	
		Wood panelled	66.7	
		Panned windows	6.7	
		Super windows	6.7	
3.	Doors	PVC	60	
		MDF	13.3	
		Artificial Wood panelled doors	66.7	
4.	Floors	Tiles :Ceramic tiles/ Vitrified tiles	66.7	
		Marble	60	
		Wooden laminates	53.3	
		Linoleum/vinyl flooring	53.3	
		Cork	53.3	
5.	Roofs	Green roof	Nil	Generally the landscape designer plans the greenery at roof
		Cool roof	Nil	
		Terracotta roof	40	
		Fibre Kulu roof	6.7	
6.	Finishes/ paints	Interior paints	73.3	
		Exterior paints	73.4	
S. No	Name of EF &EE building technologies		% of authorized dealers	Remarks
1.	Solar water heater		26.7	
2.	Rain water harvesting		26.7	
3.	Water treatment plant		13.3	
4.	Vermi-composting		Nil	The structure is created at house.
5.	Solar lights		26.7	

*Table contains multiple responses

Table 3: Specifications of available eco-friendly and energy efficient bricks

Concrete blocks	Rectangular, square, hexagonal, octagonal, different shapes in interlocking tile style	<ul style="list-style-type: none"> High strength Light weight Dimensional accuracy Use of waste concrete Quick processing of work Easy Maintenance Affordable, Varied size <ul style="list-style-type: none"> Availability Eco-friendly Durable 	<ul style="list-style-type: none"> 3-5/8"X2-1/4"X7-5/8" 3-5/8"X2-3/4"X7-5/8" 3-5/8"X3-5/4"X7-5/8" 3-5/8"X2-1/4"X11-5/8" 3-5/8"X3-5/4"X11-5/8" 	Grey	Depends on size and ratio of masonry used	No
Hollow block bricks	Rectangular	<ul style="list-style-type: none"> Dimensional accuracy Light weight Quick processing of work Higher strength/weight ratio <ul style="list-style-type: none"> Aesthetic Cost saving Thermal comfort Energy saving Maintenance Affordability Durable 	7"X2"X6.5"	Grey	Depends on size and ratio of masonry used	No
Glass bricks	Square glass block	<ul style="list-style-type: none"> Functional Expressive Multipurpose Beauty 	190mm X190mm X 75mm	<ul style="list-style-type: none"> Transparent, Multi-colour, Yellow, pink, Skyblue. 	Rs. 140 each piece	No

		<ul style="list-style-type: none"> • Proper lighting • Durability • Affordability • Easily available • Energy saving • Eco-friendly 				
Fly ash bricks	Rectangular	<ul style="list-style-type: none"> • Dimensional accuracy • High compressive strength • High tolerance level • Fire & vermin resistance • Different sizes • Appearance • Moisture resistance • Thermal properties <ul style="list-style-type: none"> • Durability • Affordability • Easily available • Energy saving • Eco-friendly 	9”X3”X3”	Grey	Rs. 25 each piece	No

The comprehensive data gathered in table 4.1.6 illustrates that various kind of eco-friendly and energy efficient bricks with various size and shapes were available in Udaipur market. Primary bricks available were concrete bricks, hollow bricks, glass bricks and fly ash bricks. Concrete brick and hollow bricks were made by the builder or architect itself so it may vary from one builder to another. It may also be developed through moulds and machine in different sizes and also in

bulk. Solid and concrete bricks were available in different sizes 3-5/8”X2-1/4”X7-5/8”, 3-5/8”X2-3/4”X7-5/8”, 3-5/8”X3-5/4”X7-5/8”, 3-5/8”X2-1/4”X11-5/8”, 3-5/8”X3-5/4”X11-5/8” where as glass bricks and fly ash bricks were of definite size. Only glass bricks were of different colours, other bricks were of grey colour only. There is no guarantee/warranty given by the dealer for any kind of brick.

Table 4: Specifications of available eco-friendly and energy efficient flooring materials

S. No.	Flooring	Brand	Characteristics	Dimension	Colour	Price in INR	Guarantee/warranty
1.	Tiles :Ceramic tiles/Vitrified tiles	Somany floor and wall tiles ISO 9001 & ISO 14001)	Low Water absorbency, Tougher and rigid, Scratch resistant, Grouts, Comfortable feel, Durable, Affordable, Easily available, Eco-friendly,	8mmX 8mm	Cream, burgundy, almond, yellow, olive green, tusk, terracotta, china blue, mango yellow, tobacco, blood red, black, lapis, tomato red, magenta	Price varies according to type, size, cut, colour design, graphics, finish, trade mark texture etc	No
		Vitro Crystals	Low Water absorbency, Tougher and rigid, Scratch resistant, Grouts, Comfortable feel, Durable, Affordable, Easily available, Eco-friendly.	450mmX300mm, 350mmX250mm 300mmX200mm 200mmX200mm	Prismline series, plain colors, murano, torino, nature, plain color, atlantis, bohemia, helios, Sydney, pastel, mystic, cuboids	Price varies according to type, size, cut, colour design, graphics, finish, trade mark texture etc	No
		Greviti	Colors, Sizes, Designs, Water absorbency, Tougher and rigid, Scratch resistant, Grouts, Comfortable feel, Durable, Affordable, Easily available, Eco-friendly, low maintenance.	450mmX300mm, 350mmX250mm 300mmX200mm 200mmX200mm	Bologia beige light, bologia dark, bologia pink light, bologia pink dark, bologia verde light bologia verde dark, bottochino brown light, bottochino brown dark, bottochino grey light, duna beige light, duna beige dark, jatoba cheery light and dark	Price varies according to type, size, cut, colour design, graphics, finish, trade mark texture etc	No
		Leonardo ceramica 1502	Colors, Sizes, Designs, Water absorbency, Tougher and rigid, Scratch resistant, Grouts, Comfortable feel, Durable, Affordable, Easily available, Eco-friendly, Maintenance	450mmX300mm, 350mmX250mm 300mmX200mm 200mmX200mm	Crema, ivory, white, 1001 cream, 1003 green grey, 1005 beige brown, 1006 grey, 1006 grey royal, 1006 ivory, 1010 beige, 1010 beige royal, 1510 black gold, 1510 lapis gold, 1510 silver	Price varies according to type, size, cut, colour design, graphics, finish, trade mark texture etc	No
2.	Marble	Rajnagar white marble	Strength, Different sizes, Dimensional accuracy, Maintenance, Affordability, Availability, Aesthetic, Eco-friendly	As per requirement available @ per sqft)	White	Approx. Rs 22-25 per sq ft. Varies according to thickness,	No

					colour, grain, area, polish etc.)	
	Makrana	Strength, Different sizes, Dimensional accuracy, Maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sqft)		Approx. Rs 150-1500-2000) per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No
	Banswara	Strength, Different sizes, Dimensional accuracy, Maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sqft)		Approx. Rs 50-150 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No
	Ambaji	Strength, Different sizes, Dimensional accuracy, Maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sqft)		Approx. Rs 50-500 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No
	Kesariyajji	Strength, Different sizes, Dimensional accuracy, Maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sqft)	Green	Approx. Rs 30-75 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No
Pink				Approx. Rs 20-50 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No	
	Jaiselmer	Strength, Different sizes, Dimensional accuracy, Maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sqft)	Yellow	Approx. Rs 30-60 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No
Panther				Approx. Rs 100-150 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No	
	Dharyawat	Strength, Different sizes, Dimensional accuracy, Maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sqft)	Black	Approx. Rs 100-150 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No
	Bidasar	Strength, Different sizes, Dimensional accuracy, Maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sq ft)	Green	Approx. Rs 140-160 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No
		Strength, Different sizes, Dimensional accuracy, low maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sqft)	Golden	Approx. Rs 120-140 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No

			Strength, Different sizes, Dimensional accuracy, low maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sqft)	Brown	Approx. Rs120-140 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No
		Katni	Strength, Different sizes, Dimensional accuracy, low maintenance, Affordability, Availability, Aesthetic, Eco-friendly.	As per requirement available @ per sqft)	Batch colour	Approx. Rs 50 per sq ft. Varies according to thickness, colour, grain, area, polish etc.)	No
3.	Wooden laminates	Artificial wood laminate	Stain resistant, Abrasion resistant, Cleaning, Affordability, Durability, Elegant look, Easy to fix, Economical, Easily availability, Eco-friendly.	As per requirement available @ per sqft)	Brown, natural wood shades	Varies according to thickness, colour, natural grain, area, polish etc.)	No
		Bamboo laminate		As per requirement available @ per sqft)	Brown, light green and natural wood shades	Varies according to thickness, colour, natural grain, area, polish etc.)	No

Data in the above table 4. contains eco-friendly and energy efficient flooring materials available in the market of Udaipur city. There were broadly three categories of flooring materials viz ceramic tiles, marbles and wooden laminates. Tiles were of different brands such as somany floor and wall tiles, vitro crystals, greviti and Leonardo ceramica 1502 with varied dimension size) and prizes. There were countless numbers of colours available in different brands, but no manufacturer provides guarantee or warrantee of these tiles.

Marble flooring were of various types based on their origin area were available. Most of the marble were transported from different areas of Rajasthan State, so somewhere it adds with the cost of marbles. Various types name as per their origin) were Rajnagar, Makrana, Banswara, Ambaji, Kesariyaji, Jaiselmer, Dharyawat, Bidasar and Katni. These types were available in their specific colour or shades like Rajnagar, Makrana, Banswara and Ambaji marble were available in white colour, Kesariyaji marble in green and pink colour, Jaiselmer marble were available in yellow and panther shades, Dharyawat marble in black shades, bidasar in shades of green, golden and brown separately. Price of each marble piece depends on its sizesquare feet area) and increases as the size increase, price ranges from Rs 20 to 2000/ Square feet.

Wooden laminates were available in artificial wood and bamboo wood laminates type with its various attributes such as stain resistant, abrasion resistant, cleaning, affordability, durability, elegant look, easy to fix, economical, easily availability and eco-friendly. They were generally available in brown or natural wood colour with varied price range. Price increases as the thickness of laminating material increases.

Summary conclusion

The results have shown that collectively there were 11 eco-friendly and energy efficient techniques were available in market of Udaipur city. There were eco-friendly and energy efficient bricks, windows, doors, floor, roofs and paints in eco-friendly and energy efficient building materials and solar water heater, rainwater harvesting system, vermin-composting and solar lights in eco-friendly and energy efficient technologies were found in Udaipur market. In category of bricks, five types of eco-friendly and energy efficient bricks

were found in the market these were: solid blocks bricks, concrete blocks bricks, hollow block bricks, glass bricks and fly ash bricks. Three types of eco-friendly and energy efficient windows found were glazed windows, artificial wood paneled, panned windows and super windows.

Thus it can be concluded that many EFEE techniques are upcoming in the market. Architects, builder and home owner are getting aware of these techniques, their merits and sustainable character tics. Few house owners have adopted many EFEE techniques in their houses and are extremely satisfied with various respectively. The developed model of house was also one of the effective method to promote and encourage prospective house owners to adopt these techniques and make their buildings sustainable.

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