

A Pragmatic Proposal for Award of Credits to Qualify as a Green Building in Developing Country

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Abstract—

Over the years there has been significant increase in the standard of living of the people around the globe due to rapid industrialization, and urbanization. However, these developments have also resulted in exploitation and overuse of natural resources, which are now hitting us back in the form of global warming, natural calamities and other tantamount effects. The word is slowly getting spread that we need to protect the environment so the quality of life for us and future generations does not deteriorate. To protect our Environment, the concept of Green Building has come in to picture which helps to reduce the pollution that is being produced from industries, automobiles, houses, pesticides, etc. However, lack of awareness on this technology, coupled with improper city planning, and complacency to provide support at the level of Government and local bodies has challenged for astute implementation of green technology. A Green Building is a sustainable building which is environmentally eco-friendly and resource efficient. Developed countries like USA, UK kick started to make people aware about this technology and provide aid for implementation through organizations like USGBC (United State Green Building Council), LEED (Leadership in Energy and Environment Design) and NAHB (National Authority of High Rise Buildings). In India, too, the task has been taken up through IGBC (Indian Green Building Council). The main aim of the Council is to reduce the pollution that emanates from houses and industries and seek for alternative renewable resources of energy for efficient use of building materials.

In this research the process of point system for award of IGBC credits has been studied in detail and it was observed that the system is too complex for adoption for low and middle income group of houses in developing country environments like India and Nepal. Thus there is a need to review and suggest an encouraging system of categorizing the houses as Green Houses in developing country environment. In this research different factors like area, type of design, materials used have been included to come up with new plans and assignments of credits in a way that they can be achieved relatively easily. Also components like landscape, parking facilities, energy performance, grey water management, management of irrigation systems, credits have also been factored in so that certification as green building is made easy for new and existing low and middle income groups/class of houses to promote sustainable development in the near future

Index Terms— Green Buildings, Environment, Accessible Credits, LEED and IGBC, Human Health, Sustainable Development

INTRODUCTION

Air, water, forests, and land are the main component of environment. All these components are polluted by human beings through misuse and overuse of these natural resources. Due to this many affects such as air pollution, water pollution, depletion of forests, soil erosion etc are seen which has made adverse effect in different components of environment. This is the reason why unexpected rain falls, cyclones, floods, sudden increase in temperature, earth quakes, polluted water, polluted air, decreased growth of trees are commonly occurring and are seen by all of us in our everyday life. Cutting of trees is also affecting the quality of air. Humans can live without water for some days but can't live without trees which enrich us with Oxygen even for a few minutes. Human beings have lately realized that if the environment is safe then they can live safely and healthy, which ultimately lead them for finding the solutions for protecting the environment by controlling the pollution with new ideas.

Though the environmental protection concept was started in 1970 it came into progress in the form of Green revolution in 1990 which raised the attention for the need for preservation of environment [19]. [1] Many developed countries like USA & UK have already

started Green building concept i.e. the building that beneficially utilize renewable sources like solar energy, wind energy and water from rain water harvesting, recycling grey water etc.[20] and enhance energy efficiency by innovative design, materials that we use in the building. Developing countries like India, Nepal, and Sri Lanka have started with Green Building Council(s) that include all the specifications that are required for the Green Building like soil parameters, energy parameters, day light and ventilation parameters, innovative design etc. Right now many developed and developing countries like USA, UK, India, Nepal, Bhutan, Sri Lanka, Japan, New Zealand etc. have instituted councils known as: USGBC, UKBC, IGBC, NGBC, BGBC, SGBC, JGBC, NGBC etc. for the preserving the environment. It is widely understood that five parameters e.g. water use, energy consumption, type of material, site selection and planning and innovative design play important role in deciding whether a building can be rated as a green building or not.

ONGOING TRENDS AND ITS IMPLEMENTATION EFFECTIVENESS:

Nowadays a green building is becoming most popular due to its effective energy conservation and eco-friendliness to the environment. The process of construction of a green building is same as construction of a normal building but the ideology is different from one another[21]. The green building concept was introduced by the United States Green Building Council (USGBC). This USGBC has developed leadership in energy and environmental design (LEED) for major construction and remodeling projects [2]. LEED gives the certification for Green building and also enumerates the steps to be followed during construction. However, LEEDS certification is mostly applicable for the major constructions like multistoried buildings, commercial buildings and remodeling buildings [3].

LEED has identified 18 criteria for the certification as a green building. Each building is assessed and points are awarded based on which a building is certified as being silver, gold, or platinum rated building[22].

IGBC and other Green Building Councils have developed their own rating system. Since ultimate aim of all the green building rating systems (USGBC, LEED, NAHB, IGBC, TERI, MNRE, IBEE, CII, and IPD) is to protect the environment from the pollution that comes from the residential buildings and industries by reducing the utilization of non-renewable sources like coal, crude oil etc., and increase the utilization of natural resources like solar energy, wind energy and renewable resources which can be reused like recyclable products which are eco-friendly to environment[14]. There are different organizations which are responsible for spreading the green concept worldwide like US Green Building Council (USGBC), which is a third party certification body, Bureau of Energy Efficiency (BEE), Indian Green Building Council and several other non-profitable government organizations[23]. Literature released through these organizations also confirms that green buildings are proven to be environmental friendly and result in reducing consumption of natural resources, pollution and waste and also improves the health of people [4]. Energy consumed by heating; ventilation and air conditioning (HVAC) and lighting systems utilize 60% of the electric power of the buildings, which challenges the green concept[15]. The level of utilization of such material need to be reduced and alternatives sought. These could simply be achieved by the use of photovoltaic solar cells [5] or reducing the consumption of lights through day lighting effects [6].

Different organizations also charge fee for award of green building certification. Figure 1 below shows about the registration charges of different countries. It should be emphasized that high registration charge often proves to be deterrent for people to go in for green building technology, as depicted in figure 2 below.

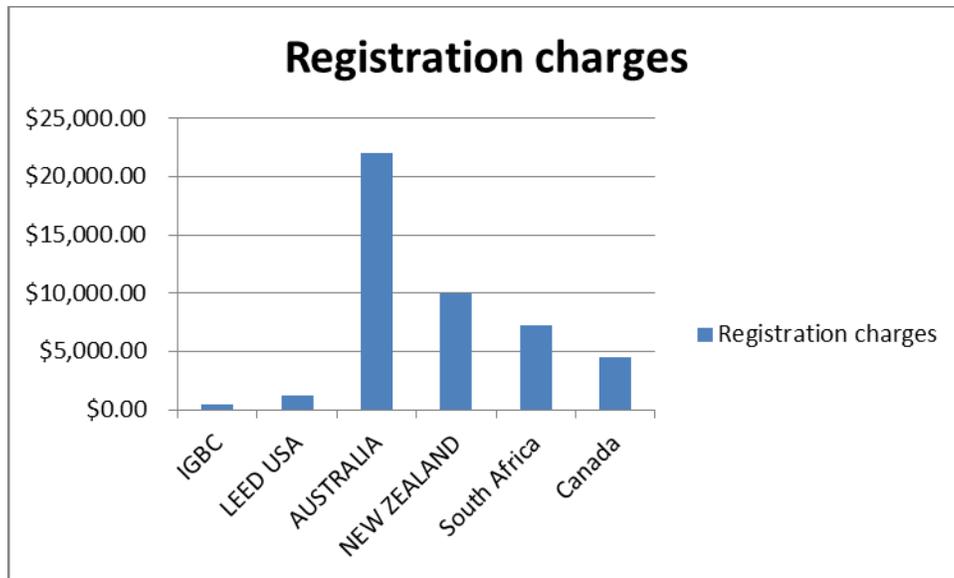


Fig-1 Comparison of Registration Charges among different Countries [7][8][9][10][11][12]

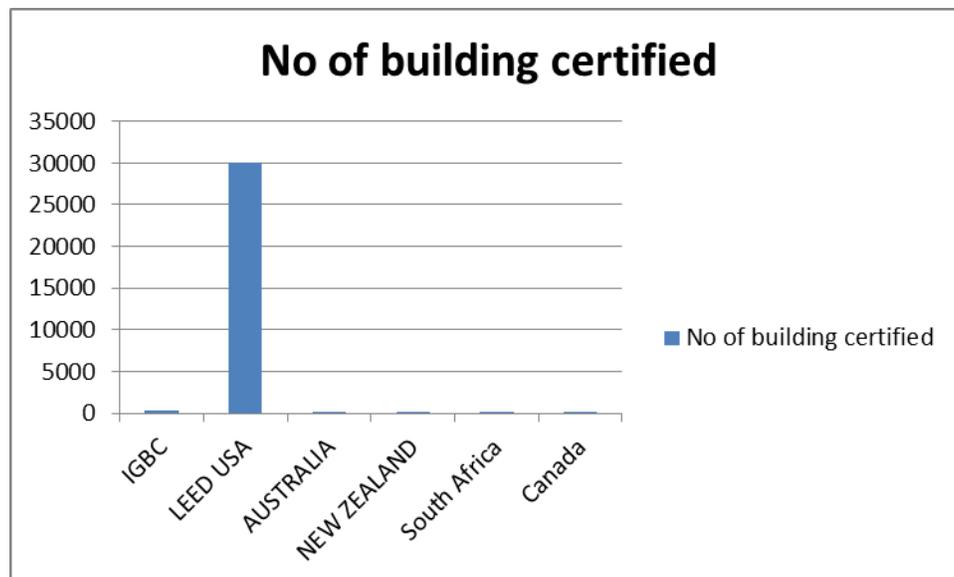


Fig - 2 Comparison of certified buildings among different Countries

The above figure shows the no of buildings that are certified as Green Buildings in Different Countries. This shows that awareness in the people and Government implementation is the main drawback in implementing the Green Building concept even in the developed world.

Table 1 below shows the IGBC credit criteria being currently used for awarding points for building to be branded as being green building or not [7].

IGBC Credits		Points available	
		Projects with interiors	Projects without interiors
Site selection and planning			
Mandatory requirement 1	Local regulations	Required	Required
Mandatory requirement 2	Soil erosion	Required	Required
Site credit 1.0	Basic Amenities	1	1
Site credit 2.0	Natural topography or landscape: 15%,25%	2	2
Site credit 3.0	Heat Island effect-Roof:50%,70%	2	2
Site credit 4.0	Parking facilities for visitors	1	1
Site credit 5.0	Electric charging facility for vehicles	1	1
Site credit 6.0	Design for differently abled	1	1
Site credit 7.0	Green home guidelines-Design & post Occupancy	NA	1
		8	9
Water Efficiency			
Mandatory requirement 1	Rainwater harvesting,50%	Required	Required
Mandatory requirement 2	Water efficient fixtures	Required	Required
Water credit1.0	Turf Design: 20%,40%	2	2
Water credit2.0	Drought tolerant species: 25%	1	1
Water credit3.0	Management of irrigation systems	2	2
Water credit4.0	Rainwater harvesting: 75%,95%	2	2
Water credit5.0	Grey water treatment:50%,75%,95%	3	3
Water credit6.0	Treated grey water for landscaping: 50%,75%,95%	3	3
Water credit7.0	Treated grey water for flushing: 50%,75%,95%	3	3
Water credit8.0	Water efficient fixtures:20%,30%	3	3
Water credit9.0	Water metering	1	1
		20	20
Energy efficiency			
Mandatory requirement 1	CFC free Equipment	Required	Required
Mandatory requirement 2	Minimum energy performance	Required	Required
Energy Credit 1.0	Energy performance	10	10
Energy Credit 2.0	Energy metering	1	1
Energy Credit 3.0	refrigerators	1	NA
Energy Credit 4.0	Solar water heating systems: 50%.75%,95%	3	3
Energy Credit 5.0	Captive power generation	1	1
Energy Credit 6.0	On-site renewable energy: 2.5%,5%,7.5%,10%	4	4
Energy Credit 7.0	Efficient luminaries & lighting power density:20%	1	1
Energy Credit 8.0	Energy saving measures in other appliances & equipment	1	1
		22	21
Materials			

Mandatory requirement 1	Separation of waste	Required	Required
Material credit 1.0	Waste deduction during construction: 75%	1	1
Material credit 2.0	Organic waste management, Post occupancy: 50%, 95%	2	2
Material credit 3.0	Material with recycled content: 10%, 20%	2	2
Material credit 4.0	Rapidly renewable materials: 2.5%, 5%	2	1
Material credit 5.0	Local materials: 50%, 75%	2	2
Material credit 6.0	Reuse of salvaged materials: 2.5%, 5%	2	2
Material credit 7.0	Certified wood based materials and furniture: 50%, 75%	2	2
		13	12
Indoor environmental quality			
Mandatory requirement 1	Tobacco smoke control	Required	Required
Mandatory requirement 2	Day lightning: 50%	Required	Required
Mandatory requirement 3	Fresh air ventilation	Required	Required
IEQ Credit 1.0	Exhaust systems	2	NA
IEQ Credit 2.0	Enhanced fresh air ventilation: 30%	2	2
IEQ Credit 3.0	Low VOC materials	2	2
IEQ Credit 4.0	Carpets: 5%	1	NA
IEQ Credit 5.0	Building flush out	1	NA
IEQ Credit 6.0	Day lightning : 75%, 85%, 95%	3	3
IEQ Credit 7.0	Cross ventilation	2	2
		13	9
Innovation and Design Process			
INN Credit 1.1	Innovation and Design Process	1	1
INN Credit 1.2	Innovation and Design Process	1	1
INN Credit 1.3	Innovation and Design Process	1	1
INN Credit 2.0	IGBC AP	1	1
		4	4
		80	75

Table-1 IGBC Credits for the certification of Green Building

LOCAL REGULATIONS:

This requirement can be achieved by every person irrespective of whether he/she belongs to low class, middle class and high class. But still low class and middle class people are lagging in this requirement due to reasons like:

- Awareness about the local regulations, many people don't realize the benefits of living in healthy environment, in house or outside.
- Municipality rules, implementation procedures and city planning are not clear enough to common masses, thereby providing no encouragement to potential users.

SOIL EROSION:

Soil Erosion is one of the parameters of consideration for the Green Building. The top soil on the empty site is most important that contains many important nutrients that cannot be achieved easily. This soil may be transported where ever it is required for cultivation etc. due to soil erosion and improper settlements the building may sink. This requirement can be met by every class of people but due to lack of awareness about the importance soil and its properties the implementation is lagging.

BASIC AMENITIES:

At least 5 of the following basic amenities like school, college, police station, hospital, post office, retail shops, bank, temple, restaurant, electrician, laundry etc. should be nearby their house with a maximum distance of 1 Km. While in most cases this can be achieved by all groups of houses, sometimes it cannot be achieved due to improper city planning.

NATURAL TOPOGRAPHY AND PARKING FACILITIES:

This can be achieved only when large areas of land are available. This requirement can be achieved only by high class people and apartments for low class and middle class people cannot achieve this requirement.

RAIN WATER HARVESTING:

This is the requirement which any type of house can implement very easily and can achieve this requirement. But to achieve this to 100% usage we should motivate the uneducated people and educate them about the advantages of rain water harvesting and its uses.

GREY WATER TREATMENT AND ITS USAGE:

This can be implemented only in large houses where the land area is more so, low class people and middle class people can't achieve this requirement.

Low class and middle class people can achieve this by a scientific technique where this water can be passed through the trees and sand filter and later on it can be used for flushing purpose.

ENERGY PERFORMANCE:

Energy performance such as renewable energy (solar, wind energy) and other energy efficient appliances and should be used and implemented. Scientists say that after 2050 there will be no energy from non-renewable Sources (coal, gas). So use of alternative energy i.e., renewable energy should be encouraged. So government should provide the devices working on renewable energy sources with some subsidy to low income people.

MATERIALS:

Material selection is the crucial part that influences our health and the environment indirectly. It affects the human in the form of gases and to environment in the form of time of decomposition in to the soil. So, everyone should know about the type of materials and their uses and disadvantages.

INDOOR ENVIRONMENTAL QUALITY:

The design of the house should encourage cross ventilation so that people who live in house can get fresh air and day light. Ventilation shall also drive away unwanted gases that are released by paints and other materials. This can be achieved by innovative design practices [18].

INNOVATIVE DESIGN:

This is the design where all the important parameters such as local Regulation, Soil Erosion, Water Efficiency, Energy Efficiency, Material Selection, and Indoor Environmental Quality are included in a building. If we design building based on innovative design principles then every house can be a green building.

DRAWBACKS OF THE IGBC CREDITS FOR IMPLEMENTATION:

- The parameters like local regulations, Soil Erosion, Basic Amenities, Rainwater Harvesting, Water Efficient Fixtures, Turf Design, Waste Deduction during Construction, Local Materials, Day Lightning, Fresh Air Ventilation, Low VOC Materials, Cross Ventilation, Innovation and Design Process etc. can be acquired by every class of people but low class people and middle class people cannot implement due to lack of awareness about their advantages.

- The parameters such as Natural Topography, Parking Facilities, Management of Irrigation Systems, Grey Water Treatment, Energy Performance, Solar Water Heating System, Captive Power Generation, Onsite Renewable Energy, Organic Waste Management, Carpets that are in the IGBC table cannot be acquired by the common people because they are very costly and also these are difficult to be implemented in houses of smaller areas.
- Awareness is one of the major drawbacks that is impeding the implementation of Green Building/Green Industries [16].
- Cost is another drawback where people are not showing interest to go for the Green Building. The minimum registration and certification fee is Rs 250000/- form very small independent house to medium independent house. Again they have to register the house in the municipality and pay the normal registration charges again. This is the reason why people are not going for Green Building.
- Lack of improper city planning.
- Awareness about the environment and their impacts that are being produced from industries and houses is lacking in all low and middle class people [17].

DISCUSSION

- We should bring awareness to all the low class and middle class people by conducting awareness programs wherein emphasis need to be given to educate about Green Building and its advantages and Environment protection.
- Green building course should be made mandatory at the school level. Training to children should be provided through small workshops and seminars.
- By considering the low class people and middle class people conditions like type of house, annual income and their requirements, it is suggested that special IGBC crediting system as shown in Table 2 below should be used for all the low class and middle class houses and by this we can make every house as a Green Building.
- For poor and middle class people who can't afford high technology there must be a provision made for providing free consultancy service for Green Building Designs and education.
- Government should help the poor people by giving bank loans, subsidies etc.

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		Projects with interiors	Projects without interiors
Site selection and planning			
Mandatory requirement 1	Local regulations	2	2
Mandatory requirement 2	Soil erosion	2	2
Site credit 1.0	Basic Amenities	1	1
Site credit 2.0	Natural topography or landscape: 15%,25%	Optional	Optional
Site credit 3.0	Heat Island effect-Roof:50%,70%	1	1
Site credit 4.0	Parking facilities for visitors	Optional	Optional
Site credit 5.0	Electric charging facility for vehicles	1	1
Site credit 6.0	Design for differently abled	1	1
Site credit 7.0	Green home guidelines-Design & post Occupancy	NA	1
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Water Efficiency			
Mandatory requirement 1	Rainwater harvesting,50%	4	4
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	50%,75%,95%		
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Energy Credit 1.0	Energy performance	10	10
Energy Credit 2.0	Energy metering	1	1
Energy Credit 3.0	refrigerators	1	NA
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Energy Credit 6.0	On-site renewable energy: 2.5%,5%,7.5%,10%	4	4
Energy Credit 7.0	Efficient luminaries & lighting power density:20%	1	1
Energy Credit 8.0	Energy saving measures in other appliances & equipment	1	1
		22	21
Materials			
Mandatory requirement 1	Separation of waste	2	2
Material credit 1.0	Waste deduction during construction: 75%	2	2
Material credit 2.0	Organic waste management, Post occupancy: 50%, 95%	Optional	Optional
Material credit 3.0	Material with recycled content:10%,20%	2	2
Material credit 4.0	Rapidly renewable materials: 2.5%,5%	2	1
Material credit 5.0	Local materials: 50%,75%	2	2
Material credit 6.0	Reuse of salvaged materials: 2.5%,5%	2	2
Material credit 7.0	Certified wood based materials and furniture: 50%, 75%	1	1
		13	12
Indoor environmental quality			
Mandatory requirement 1	Tobacco smoke control	1	1
Mandatory requirement 2	Day lightning: 50%	1	1
Mandatory requirement 3	Fresh air ventilation	1	1
IEQ Credit 1.0	Exhaust systems	1	NA
IEQ Credit 2.0	Enhanced fresh air ventilation: 30%	1	1
IEQ Credit 3.0	Low VOC materials	2	2
IEQ Credit 4.0	Carpets:5%	Optional	NA
IEQ Credit 5.0	Building flush out	1	NA
IEQ Credit 6.0	Day lightning :75%,85%, 95%	3	3
IEQ Credit 7.0	Cross ventilation	2	2
		13	11
Innovation and Design Process			
INN Credit 1.1	Innovation and Design Process	1	1
INN Credit 1.2	Innovation and Design Process	1	1
INN Credit 1.3	Innovation and Design Process	1	1
INN Credit 2.0	IGBC AP	1	1

	4	4
	80	75

Table-2 IGBC Credit System for low and middle class Houses

CONCLUSIONS

Community awareness programs should be conducted to educate people about the resources and energy and the need and advantages of using green building concept. All the polluting industries should be encouraged to implement green concept to reduce the pollution to save the environment. Government should encourage implementation of Green Building concept by providing opportunity for subsidies and/or free consultation. Government and Banks should help the poor and middle class people by giving loans and subsidies as they can't afford the high technology due to cost factors. This approach can be spread by updating the green concept course from the primary school level itself. Various program, conference and training workshops must be launched on a regular basis. Green building is a boon to the society where energy and water consumption can be reduced. It also results in enhanced productivity and better health and safety conditions for occupants.

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