Techniques And Approach In The Design Of Green Building For LEED-EB

Prashant H. Kanade [1], Prof. Rahul Shinde[2]
[1, 2] Dept of Civil Engineering
[1, 2] RMD Sinhgad School of Engineering, Warje, Pune-411058, India

Abstract- *India will rank as the country with largest urban population in the world by 2021. Predicting this exponential growth it is necessary to conserve natural resources and save the mother earth. The way the world has used global natural resources in the past has placed a tremendous strain on the environment–depleting our natural resources, polluting the environment, warming the earth, raising sea levels, and endangering our biodiversity. Climate change has become the inevitable result of our past actions. This paper represents basic strategic techniques and approach in the design and thesis is representing the project strategic planning and its implementation of the techniques and approach in the design how to convert existing non-green building to green building by doing suitable changes to get LEED certification. Besides this, the focus of this paper will also be on the Important principles, Techniques and approach which are associated with the seven major elements of green building design categories for the LEED O+M: Existing Buildings | v4 check list which are: Sustainable Site Design; Water Conservation and Quality; Energy and Environment; Indoor Environmental Quality; Conservation of Materials and Resources; Innovation and design process and LEED Accredited Professional; Regional priority (RP). To create a green building design that can not only minimize the impact on the environment, but also remain practical, economical and comfortable for use, it is important to look into integrated green building techniques and approach in the design, in which the design team works hand-in-hand throughout the entire process, as well as consider each aspect of a building in an integrative and holistic manner. With this paper, we hope that the understanding of implementation of basic techniques and approach in the design how to convert the existing non-green building to a green building by making the suitable changes in the system process and the usability of the resources to new stakeholders, building owners, architects, engineering consultants, and all the parties in a building project*

Keywords- Green Building, LEED-EB.

I. INTRODUCTION

THIS paper presents an overview of green buildings techniques and approach for to understanding of implementation of basic techniques and approach in the design how to convert the existing non-green building to a green building by making the suitable changes in the system process of checklist and the usability of the resources. It discusses what makes buildings green and gives definitions of green building [2.6]. It discusses the Benefits of Sustainable Construction and the Application of Concepts of Sustainability to traditional buildings and explains common green building practices with respect to siting, energy efficiency, water efficiency, building materials, occupant health and well-being, and construction and demolition waste.

II. GREEN CONCEPT FOR THE LEED - EXISTING BUILDING

A green building is one whose construction and lifetime of operation assure the healthiest possible environment while representing the most efficient and least disruptive use of land, water, energy and resources. The optimum design solution is one that effectively emulates all of the natural systems and conditions of the pre-developed site – after development is complete. Buildings have the highest potential to reduce carbon emissions hence it gives a basic idea of how to convert the existing non-green building to a green building by making the suitable changes in the system process and the usability of the resources

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III. BENEFITS OF SUSTAINABLE CONSTRUCTION

Sustainability "creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations." The importance of sustainability lies in the "future" factors, which set a higher standard than those used to define green building.
Sustainable construction makes wise use of all the natural resources and a 50% reduction in energy use. Improves occupant health, comfort, productivity, reduces pollution and landfill waste that are not easily quantified. A sustainable building may cost more up front, but saves through lower operating costs over the life of the building. Building is designed as one system rather than a collection of stand-alone systems with the help of the integrated system approach.

IV. APPLICATION OF CONCEPTS OF SUSTAINABILITY

The 5th Assessment Report from the Intergovernmental Panel [15] on Climate Change (IPCC) has shown that buildings have the highest potential to reduce carbon emissions as shown in Fig.1. This is due to the large consumption of energy within buildings. With the use of the right design and green technologies, a considerable amount of both energy and economic savings can actually be achieved.

Building a green building is not just a matter of assembling a collection of the latest green technologies or materials. Rather, it is a process in which every element of the design is first optimized and then the impact and interrelationship of various different elements and systems within the building and site are re- valuated, integrated, and optimized as part of a whole building solution.

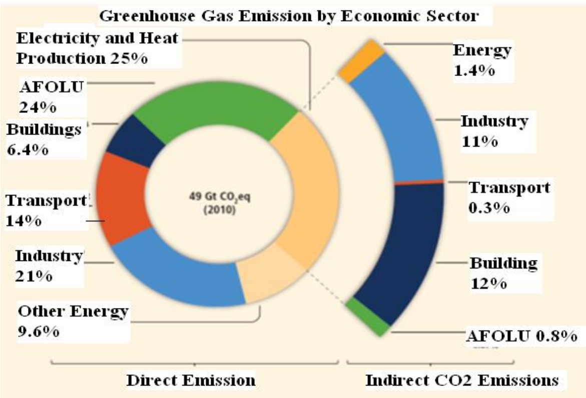

Fig. 1. Carbon Emissions

For example, interrelationships between the building site, site features, the path of the sun, and the location and orientation of the building and elements such as windows and external shading devices have a significant impact on the quality and effectiveness of natural day lighting.

TABLE I Key Differences

TRADITIONAL PLANNING AND DESIGN APPROACH	INTEGRATED GREEN BUILDING DESIGN APPROACH
Involvement of the project members is limited.	Project members are included right from start of project.
Project gets more intensive. Less time is spent at the early stages.	Project starts off intensively with time spent on meetings and discussions.
Decisions are made by stakeholders :owners, architects and contractors.	Decisions are made by the team by Brainstorming sessiomns and research.
A linear process is adopted	Whole system approach is adopted.
The focus is to reduce up-front capital cost.	Teams aims towards reducing long term operation and maintainance costs.
Systems are considered in isolation and offen result in over deigning.	Building performance is used to assess how each system affetcs one another.
Project members undertake limited responsibilities.	All team members share equal responsibilities.

So this paper will help to team to look into understanding of the techniques and approach in the green building design. Especially sustainable development has become a must, green Building Design has therefore become essential. This is reflected in the statutory requirement for all new developments and existing buildings undergoing major retrofitting works with a Gross Floor Area and more to achieve a minimum of LEED certified standard [7].

V. OVERVIEW OF THE SEVEN ELEMENTS OF GREEN BUILDING CATEGORIES IN PROJECT

Important principles, Techniques and approach which are associated with the seven major elements of green building design for the existing building which are: Sustainable Site Design; Water Conservation and Quality; Energy and Environment; Indoor Environmental Quality; Conservation of Materials and Resources; Innovation and design process and Regional priority (RP).

A. Sustainable Site Design

Minimize urban sprawl and needless destruction of valuable land, habitat and green space, which results from inefficient low-density development. Encourage higher density urban development, urban re-development and urban renewal, and brownfield development as a means to preserve valuable green space. Preserve key environmental assets through careful examination of each site. Engage in a design and construction process that minimizes site disturbance and which values, preserves and actually restores or regenerates valuable habitat, green space and associated eco-systems that are vital to sustaining life [11, 12].

Strategic Approaches and techniques:

- Make more efficient use of space in existing occupied buildings, renovate and re-use existing vacant buildings, sites, and associated infrastructure and consider re-development of brownfield sites. Design buildings and renovations to maximize future flexibility and reuse thereby expanding useful life.
- When new development is unavoidable, steer clear of sites that play a key role in the local or regional ecosystem. Identify and protect valuable greenfield and wetland sites from development.
- Recognize that allowing higher density development in urban areas helps to preserve green space and reduce urban sprawl. Invest time and energy in seeking variances and regulatory reform where needed.

- Evaluate each site in terms of the location and orientation of buildings and improvements in order to optimize the use of passive solar energy, natural day lighting, and natural breezes and ventilation.
- Make best use of existing mass transit systems and make buildings and sites pedestrian and bike friendly, including provisions for safe storage of bicycles. Develop programs and incentives that promote car-pooling including preferred parking for commuters who carpool. Consider making provisions for re-fueling or recharging alternative fuel vehicles.

B. Water Quality and Conservation

Preserve the existing natural water cycle and design site and building improvements such that they closely emulate the site's natural "pre-development" hydrological systems. Emphasis should be placed on retention of storm water and on-site infiltration and ground water recharge using methods that closely emulate natural systems [10]. Minimize the unnecessary and inefficient use of potable water on the site while maximizing the recycling and reuse of water, including harvested rainwater, storm water, and gray water.

Strategic Approaches and techniques:

- Recognize that the least costly, least time consuming and most environmentally preferable design for site and storm water management is often the one in which the design of buildings and site improvements respect the existing natural flows and features of the land, instead of designing the building and site improvements with total disregard for the site, which results in needless, extensive, disruptive, costly and time consuming excavation and earthmoving.
- Conduct a thorough site assessment and strategically locate buildings and site improvements so as to preserve key natural hydrological features. Special effort should be made to preserve areas of the site that serve as natural storm water retention and ground water infiltration and recharge systems. Preserve existing forest and mature vegetation that play a vital role in the natural water cycle by absorbing and disbursing up to 30% of a site's rainwater through evapo-transpiration.
- Minimize the building's footprint, site improvements and construction area, and minimize excavation, soil disturbance and compaction of existing topsoil as this soil in its natural uncompacted state serves a vital role in absorbing and storing up to 80% of natural rainfall until it can be absorbed by vegetation or enter the site's natural sub-surface ground water system.

C. *Energy and Environment*

Minimize adverse impacts on the environment (air, water, land, natural resources) through optimized building siting, optimized building design, material selection, and aggressive use of energy conservation measures. Resulting building performance should exceed minimum International Energy Code (IEC) compliance level by 30 to 40% or more [9]. Maximize the use of renewable energy and other low impact energy sources.

Strategic Approaches and techniques:

- Optimize passive solar orientation, building massing and use of external shading devices such that the design of the building minimizes undesirable solar gains during the summer months while maximizing desirable solar gains during winter months.
- Optimize building orientation, massing, shape, design, and interior colors and finishes in order to maximize the use of controlled natural day lighting which significantly reduces artificial lighting energy use thereby reducing the buildings internal cooling load and energy use. Consider the use of light shelf technology.
- Use high performance low-e glazing, which can result in significant year round energy savings. Consider insulated double glazing, triple glazing or double pane glazing with a suspended low-e film. Selective coatings offer optimal light transmittance while providing minimal solar gain and minimal heat transmission. Window frames, sashes and curtain wall systems should also be designed for optimum energy performance including the use of multiple thermal breaks to help reduce energy use.
- Optimize the value of exterior insulation and the overall thermal performance of the exterior envelope assembly. Consider advanced/high performance envelope building systems such as structural insulated panel systems (SIPS) and insulated concrete form systems (ICF's) that can be applied to light commercial and institutional buildings. SIPS and ICF's and other thermally "decoupled" envelope systems will offer the highest energy performance.

D. Indoor environmental Quality

Provide a healthy, comfortable and productive indoor environment for building occupants and visitors. Provide a building design, which affords the best possible conditions in terms of indoor air quality, ventilation, and thermal comfort, access to natural ventilation and day lighting, and effective control of the acoustical environment [7].

Strategic Approaches and techniques:

- Use building materials, adhesives, sealants, finishes and furnishings which do not contain, harbor, generate or release any particulate or gaseous contaminants including volatile organic compounds.
- Maximize the use of natural day lighting. Optimize solar orientation and design the building to maximize penetration of natural daylight into interior spaces. Provide shades or daylight controls where needed.
- Maximize the use of operable windows and natural ventilation. Provide dedicated engineered ventilation systems that operate independently of the buildings heating and cooling system. Ventilation systems should be capable of effectively removing or treating indoor contaminants while providing adequate amounts of fresh clean make-up air to all occupants and all regions of the building. Monitor indoor air conditions including temperature, humidity and carbon dioxide levels, so that building ventilation systems can respond when space conditions fall outside the optimum range.
- Provide a smoke free building. When smoking must be accommodated, provide completely dedicated smoking areas are physically isolated, have dedicated HVAC systems, and remain under negative pressure with respect to all adjoining spaces. Assure that air from smoking areas does not get distributed to other areas of the building does not re-enter the building through doors or vestibules, operable windows, or building fresh air intakes.. Locate outdoor smoking areas so that non-smokers do not have to pass through these areas when using primary building entrances or exits.

E. Materials and Resources

Minimize the use of non-renewable construction materials and other resources such as energy and water through efficient engineering, design, planning and construction and effective recycling of construction debris [8]. Maximize the use of recycled content materials, modern resource efficient engineered materials, and resource efficient composite type structural systems wherever possible. Maximize the use of re-usable, renewable, sustainably managed, bio-based materials. Remember that human creativity and our abundant labor force is perhaps our most valuable renewable resource. The best solution is not necessarily the one that requires the least amount of physical work.

Strategic Approaches and techniques:

- Optimize the use of engineered materials which make use of proven engineering principles such as engineered trusses, composite materials and structural systems (concrete/steel, other…), structural insulated panels (stress skin panels), insulated concrete forms, and frost protected shallow foundations which have been proven to provide high strength and durability with the least amount of material.
- Identify ways to reduce the amount of materials used and reduce the amount of waste generated through the implementation of a construction waste reduction plan. Adopt a policy of “waste equals food” whereby 75% or more of all construction waste is separated for recycling and used as feedstock for some future product rather than being landfilled. Implement an aggressive construction waste recycling program and provide separate, clearly labeled dumpsters for each recycled material. Train all crews and subcontractors on the policy and enforce compliance.
- Identify ways to use high-recycled content materials in the building structure and finishes. Consider everything from blended concrete using fly ash, slag, recycled concrete aggregate, or other admixtures to recycled content materials such as structural steel, ceiling and floor tiles, carpeting, carpet padding, sheathing, and gypsum wallboard. Consider remanufactured office furniture and office partition systems, chairs and furniture with recycled content or parts.

F. Innovation and design process

To provide design teams and projects the opportunity to be awarded points for exceptional performance above the requirements set by the LEED building rating system and / or innovative performance in green building categories not specifically addressed by the LEED building rating system. To provide building operations, maintenance and upgrade teams with the opportunity to achieve additional environmental benefits achieved beyond those already addressed by the LEED 2009 for Existing Buildings: Operations & Maintenance Rating System [14]. Identify the intent of the proposed innovation credit, the additional environmental benefits delivered, and the proposed requirements for compliance, and the proposed performance metrics to demonstrate compliance and the approaches (strategies) used to meet the requirements, the proposed requirements met during the performance period [4].

Strategic Approaches and techniques:

- The first type includes those strategies that greatly exceed the requirement of existing LEED credits. For instance, a project that incorporates energy or water efficiency measures that provide extraordinary savings and greatly exceed the requirements of their respective LEED credits would be appropriate for this credit.
- The second type of innovation strategies are those that are not addressed by any existing LEED credits. Four independent sustainability measures may be applied to this credit but they must have significant environmental and occupant benefits are applicable.
- Innovation is beyond what would be deemed as good design. Points for exemplary performance are available only for those credits where the outcome provides outstanding, measurable benefits to the environment and / or building occupants.

LEED v4 for Operations & Maintenance: Existing Buildings

Y	?	N	Project Checklist		Date: 16/04/16	
0	0	0	**Location and Transportation**		15	**Earned**
			Credit	Alternative Transportation	15	14
0	0	0	**Sustainable Sites**		10	
Y			Prereq	Site Management Policy	Reqd	
			Credit	Site Development-Protect or Resto	2	1
			Credit	Rainwater Management	3	0
			Credit	Heat Island Reduction	2	1
			Credit	Light Pollution Reduction	1	1
			Credit	Site Management	1	0
			Credit	Site Improvement Plan	1	1
0	0	0	**Water Efficiency**		12	
Y			Prereq	Indoor Water Use Reduction	Reqd	
Y			Prereq	Building-Level Water Metering	Reqd	
			Credit	Outdoor Water Use Reduction	2	2
			Credit	Indoor Water Use Reduction	5	3
			Credit	Cooling Tower Water Use	3	0
			Credit	Water Metering	2	0
0	0	0	**Energy and Atmosphere**		38	
Y			Prereq	Energy Efficiency Best	Reqd	
Y			Prereq	Minimum Energy Performance	Reqd	
Y			Prereq	Building-Level Energy Metering	Reqd	
Y			Prereq	Fundamental Refrigerant Managem	Reqd	
			Credit	Existing Building Commissioning–	2	2
			Credit	Existing Building Commissioning–	2	2
			Credit	Ongoing Commissioning	3	0
			Credit	Optimize Energy Performance	20	20
			Credit	Advanced Energy Metering	2	0
			Credit	Demand Response	3	0
			Credit	Renewable Energy and Carbon Off	5	3
			Credit	Enhanced Refrigerant Managemen	1	0
0	0	0	**Materials and Resources**		8	
Y			Prereq	Ongoing Purchasing and Waste P	Reqd	
Y			Prereq	Facility Maintenance and Renovati	Reqd	
			Credit	Purchasing- Ongoing	1	0
			Credit	Purchasing- Lamps	1	1
			Credit	Purchasing- Facility Management	2	1
			Credit	Solid Waste Management- Ongoin	2	2
			Credit	Solid Waste Management- Facility	2	0
0	0	0	**Indoor Environmental Quality**		17	
Y			Prereq	Minimum Indoor Air Quality Perforn	Reqd	
Y			Prereq	Environmental Tobacco Smoke Co	Reqd	
Y			Prereq	Green Cleaning Policy	Reqd	
			Credit	Indoor Air Quality Management Pr	2	0
			Credit	Enhanced Indoor Air Quality Strate	2	1
			Credit	Thermal Comfort	1	0
			Credit	Interior Lighting	2	0
			Credit	Daylight and Quality Views	4	4
			Credit	Green Cleaning- Custodial Effective	1	1
			Credit	Green Cleaning- Products and Mat	1	0
			Credit	Green Cleaning- Equipment	1	0
			Credit	Integrated Pest Management	2	2
			Credit	Occupant Comfort Survey	1	0
0	0	0	**Innovation**		6	
			Credit	Innovation	5	5
			Credit	LEED Accredited Professional	1	1
0	0	0	**Regional Priority**		4	
			Credit	Regional Priority: Specific Credit	1	1
			Credit	Regional Priority: Specific Credit	1	1
			Credit	Regional Priority: Specific Credit	1	1
			Credit	Regional Priority: Specific Credit	1	1
0	0	0	**TOTALS**		110	72

Certified: 40-49 points, **Silver:** 50-59 points,
Gold: 60-79 points, **Platinum:** 80+ points

Fig. 2. LEED-EB check list

LEED Accredited Professional

To support and encourage the operations, maintenance, upgrade and project team integration required by LEED to streamline the application and certification process. The intent is to have a LEED accredited professional to guide the design process and maintain focus on environmental and health goals throughout design and construction. Because LEED is more successfully accomplished earlier it is started in the design process, it is best to have a LEED accredited professional on the team as early as possible [13]. That said, the point can be achieved by having the profession accredited prior to application for certification. At least one principle participant for the project team must successfully complete accredited professional exam for credit achievement.

G. Regional Priority (RP)

To provide an incentive for the achievement of credits that address geographically specific environmental, social equity, and public health priorities.

Strategic Approaches and techniques

To earn up to four of the six Regional Priority credits we have been identified by the USGBC regional councils and chapters as having additional regional importance for the project's region.

The credit points achieved or not achieved for a case study conducted for a NICMAR campus classroom block against the standard requirements of LEED O+M: Existing Buildings v4 - LEED v4 checklist and by using fundamental principle, techniques and approach are shown in Fig. 2.

VI. CONCLUSION

This paper concludes that it gives the information of techniques and approaches by which we can convert the existing non-green building to a green building by making the suitable changes in the system process of checklist and the usability of the resources. By referring techniques and approaches during the application of LEED to the existing building we should get the number of points a project earns determines the level of LEED certification. This paper has given the information to new stakeholder about basic requirement to design or convert the existing building into green building by using credit categories which are applicable for the LEED existing building checklist. In applying green features for existing building we understood the basic awareness of LEED rating system credit categories, its features, methodology and importance of this organization. LEED therefore, have significant role in the process of assessing the sustainability criteria in existing buildings.

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