



# A COMPARATIVE ANALYSIS AMONG SELECTIVE GREEN LIBRARIES OF USA AND INDIA IN THE LIGHT OF LEED FUNDAMENTAL EVALUATION INDICATORS

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**Abstract:** *Green design is an emerging trend, defining the library of the 21st century. The emerging concept of the “green library” is growing gradually in the human’s mind and attracting the librarians of different types of libraries to develop this type of library. This article presents an overall outline of green libraries and depicts a comparative study of green libraries features between the USA and India on the basis of LEED’s five main parameters including innovation and design. It also gives a short description of these total 19 libraries. This study shows that there are very few libraries in India that have carried out and formed on the basis of LEED’s fundamental categories features with comparison to the United States, namely Anna-Centenary Library, Kotturpuram, Chennai, PermaKarlo Library, Ladakh, and Karnataka University Library, Dharwad. This paper emphasis establishing and implement the green libraries concept in India in a larger way by the togetherness of libraries, librarians, and Government.*

**IndexTerms - Green Library, Green Building, Leadership in Energy and Environmental Design, Indian Green Building Council, India.**

## 1. Introduction:

A Green Library is a library built with environmental concerns in mind. Green libraries are a part of the larger green building movement.<sup>[12]</sup>The Online dictionary of Library and Information Science (ODLIS) defines green /sustainable libraries, as a library designed to minimize negative impact on the natural environment and maximize indoor environmental quality by means of careful site selection, use of natural construction materials and biodegradable products, conservation of resources (water, energy, paper), and responsible waste disposal (recycling, etc.).<sup>[15]</sup>Library is not only a repository of knowledge of the past and present, but also an important information resource to raise people awareness about the future. Green libraries

took an initiative to enhance public awareness about environmental issues through their collections, by designing the building itself as environmentally safe and sustainable facility and library programs they offer to their users.

## 2. Need and significance of the study

In India there are not available so much research work on green libraries, from where we can learn and start to implement greenness in our libraries.. Green library movement is infancy state in our country, where other countries like USA, Canada have moved forward in Green Library movement. This comparative analysis of certain 'green libraries in USA and India' will help the professionals for planning green libraries.

## 3. Scope and Limitation of the Study:

Green Library is the new concept in the field of Library and Information Science. Sufficient document is not available on this topic. Therefore, this work has been done by searching, gathering and assimilating the all information from websites and different articles. It is not possible to give all information in every aspect. This study is limited to only ten (10) USA and nine (9) Indian libraries comprising University, Public libraries and National Institute of Technology libraries. The study tried to focus on greenness. Quantification of greenness was not possible.

## 4. Objectives of the Study:

This study has been undertaken with the following objectives:

- To analyze the importance of green libraries;
- To study the LEED standard for green libraries;
- To explain and analysis the some green library initiatives and their features at the international (USA) and national level (India) on the basis of LEED fundamental evaluation indicators.

## 5. Methodology:

In the 2000s (decade) a number of high-profile green libraries have built in the U.S. and in the rest of the world. 10 Green Libraries have been selected sequentially from USA Green Libraries Directory A-G and 9 Green Libraries have been taken from India at the National level for this study. These total 19 libraries comprise of different types of libraries like Public Library, University Library, and the National Institute of Technology Library. These mentioned libraries are categorized and explained below on the basis of LEED's (Leadership in Energy and Environmental Design) five main evaluation indicators, namely Site Location, Water Conservation, Energy Efficiency, Material and Resources, Indoor Air Quality, and Innovation and Design. Features of a total 19 green libraries have been given in two tables, namely Table- No: 1 for the United States and Table- No: 2 for India. Basically, it has been tried to show how the LEED certification parameters (evaluation indicators) have been maintained by the libraries of two countries through a comparative analysis.

## 6. Literature Review:

Antonelli (2008) has stated that environmental challenges like energy depletion and climate change will influence the type of information resources and programs libraries will provide to their communities. Tseng (2008) has introduced the planning and architectural design features, and the post-occupancy evaluation (POE) of the Beitou Branch Library in the Taipei Public Library System and given solutions in response to the public's suggestions for improvements. He has also shared the experience of Taipei Public Library in planning and designing a diamond class green library and may increase public libraries' concerns about the issues of environmental protection and energy conservation. Abbey (2012) has examined the state of scholarship in these arenas and is further intended to broaden the scope of the green discussion within the archives community. Barnes (August 2012) has identified ways that public libraries can use their buildings to demonstrate green technologies and practices and show their patrons how to apply them at home, at work, and in the community. Aulisio (2013) states that there are very few academic libraries in the United States that are LEED certified. He argues that a green library is something more than just the architecture. By using example initiatives and providing recommendations for green library operations, it can be determined that a green library does not necessarily entail a green

building, but it does involve a green mission. Chakraborty (June,2013) has given emphasis on emerging issues like hygienic and environmental awareness. She has also presented the report of a survey of some important libraries in the four metropolises (Kolkata, Mumbai, Delhi and Chennai) of India. Binks, Braithwaite, Hogarth, Logan and Wilson (2014) have provided recommendations that can be used by public library services and associated organisations when considering building or refurbishing library buildings. Shah, Kumar and Kumar (September, 2015) have explained term “Green” and special challenges met by libraries to be Green. Points out steps involved such as site selection, water and energy conservation, building material and indoor air quality. They have suggested the proper planning of buildings with solar energy system and roof water harvesting, etc. Rabidas (2016) has opined that Green buildings are also one of the creations of modern architectures that are widely used in latest technologies. He has also explained what green library building is, how they are accredited, what are the things required for, and also what is the future of Green Library Buildings in our modern India. Bhattacharya (August,2017) states that Green Library Movement which is comprising of librarians, libraries, cities, towns, college and university campuses committed to greening libraries and reducing eco-degradation. Environmental destruction sets of a downward spiral of ecological deterioration. Green Libraries expound the needs of a library, sustainable design and real cost savings in energy consumption. The paramount goal of green buildings is to develop and use sustainable energy-efficient resources in construction, maintenance. Gundawar (2017) has identified that the areas where the libraries can be environment-friendly, to study the design aspects of eco-friendly libraries, to investigate the measures for sustaining the eco-friendliness of the library and to convert the existing library into an eco-friendly library adopted in India, to identify the obstacles in planning eco-friendly libraries in India, to study the standards for eco-friendly buildings. Recommendations are given for NAAC accreditation, state government, library associations, course designers, university librarians, and universities and educational institutes are given. Meher and Parabhoi (2017) have highlighted the conditions of environment, their impacts on society and efforts of leading organizations towards an eco-friendly earth, developed standards for the betterment, green India, green library, role of a librarian, features of green library, initiatives in India and outside India. They have focused the importance of green library in ongoing era and green library initiatives in India. Thomas (2017) believes that concept of Green Libraries gradually attracting attention of library administrators worldwide and the efforts to develop green libraries are on rise. This is becoming a kind of movement now and has started gaining momentum in India as well though it initially started in USA, UK and Canada, He also has discussed about current scenario of green libraries development in India and other developing countries. Bangar (January 2018) has highlighted the conditions of green library, role of a librarian, features of green library, Initiatives in India. Saha (2019) has discussed about overview of the technical development of green libraries of academic institutions in US based libraries and other developing countries i.e. UK, Canada and India.

## 7. LEED Standard for Green Libraries:

There are lots of standards for Green Libraries. Among them Leadership in Energy and Environmental Design (LEED) is one of the popular standard developed by the non-profit organization, the United States Green Building Council (USGBC) in the year 2000.<sup>[12]</sup> It includes a set of rating systems like Certified, Silver, Gold, Platinum according to the point score. Their point based rating has a total of 100 base points and buildings can be categorized as certified (40 points), silver (50), gold (60), or platinum (80+).<sup>[12]</sup>

According to the LEED, the following evaluation indicators are considered to create green library.

- 1) Site Selection;
- 2) Water Conservation;
- 3) Material and Resources;
- 4) Energy Efficiency;
- 5) Indoor Air Quality; and one extra category for
- 6) Innovation and Design.

## 8. Green Libraries in the Light of LEED Evaluation Indicators:

### 8.1 USA

#### 8.1.1 ANYTHINK BRIGHTON. BRIGHTON, CO

- Site location: Located in historic downtown Brighton;
- Innovation and Design: The first carbon-positive library in the USA;
- Energy Efficiency: The building includes a 108 kw photovoltaic system which generates more than a third of the building's power and will save the library \$30,000 a year in energy costs.
- Water Conservation and Material Resources: Also uses geothermal heating and cooling, and incorporates Solar tubes which are reflective tubes that capture daylight and deliver it inside to illuminate interior spaces. <sup>[10]</sup>

#### 8.1.2 BALLARD BRANCH. SEATTLE PUBLIC LIBRARY. SEATTLE, WA

- Site location: The Ballard branch was selected by the American institute of architects committee on the environment as one of the top ten green projects for the 2006. <sup>[10]</sup>
- Innovation and Design and Water Conservation: Features a green roof which helps to insulate the building and reduces the amount of rain water that would flow into storm drains. <sup>[10]</sup> Building designed to shade harsh light and take advantage of natural daylight, decreasing need for artificial light.
- Energy Efficiency and Material Resources: To conserve energy the building incorporates 17 solar panels on the roof and uses occupancy light sensors in offices. Seven skylights strategically placed take advantage of natural daylight.
- Indoor Air quality and Innovation and Design: Ventilation systems that monitor indoor air quality. The restrooms feature waterless urinals, Recycled carpet, glass, and ceiling tiles were used throughout the building. <sup>[10]</sup>

#### 8.1.3 BLAIR LIBRARY. FAYETTEVILLE PUBLIC LIBRARY. FAYETTEVILLE, AR

- Site location: It was one of the first public libraries in the US to register with the U.S. Green Building Council (USGBC) in the state of Arkansas to register for LEED certification, and the first municipal building to be certified. <sup>[10]</sup>
- Water Conservation: The 88,000 square foot facility features a cistern to catch rainwater for irrigation <sup>[10]</sup> saving about 500,000 US gallons (1,900,000 L) of water a year.
- Energy Efficiency: In 2009, the library received a grant from the City / County Management Association to install 10 kW solar panels for energy generation.
- Material and resources, Indoor Air quality and Innovation and Design: A white membrane roof, cork flooring, recycled content furnishings, waterless urinals low VOC finishes and fabrics etc. <sup>[10]</sup>

#### 8.1.4 BOZEMAN PUBLIC LIBRARY. BOZEMAN, MT

- Site Location: The site was deemed a “brownfield” site and was remediated of the heavy metal and asbestos contaminants. <sup>[10]</sup>
  - Material and resources and Innovation and Design: The building utilizes natural day lighting, green materials that have high recycled content, a 34 kW photovoltaic system; <sup>[10]</sup>
  - Water Conservation: Waterless urinals, landscaping requiring low irrigation requirements, R-20 translucent wall panels (Kalwall), storm retention ponds; <sup>[10]</sup>
  - Energy Efficiency: “night sky” compliant exterior light fixtures, night flushing to reduce summer cooling loads and high efficiency HVAC equipment. <sup>[10]</sup>
- #### 9.1.5 BROWARD COMMUNITY COLLEGE/SOUTH REGIONAL LIBRARY. PEMBROKE PINES, FL
- Site Location: Opened February 1, 2007 the Library is the first green LEED certified facility in Broward County. <sup>[10]</sup>

- Material and resources and Innovation and Design: The building utilizes bookshelves and furnishings made from sustainably harvested wood, carpet made from recycled fibers, and low emitting VOC materials. <sup>[10]</sup>

#### 8.1.6 BUDLONG WOODS BRANCH. CHICAGO PUBLIC LIBRARY. CHICAGO, IL

- Site Location and Energy Efficiency: Officially opened as a green library in 2003 and incorporates a 16kw photovoltaic system which provides seven percent of the buildings energy. <sup>[10]</sup>
- Material and resources and Indoor Air quality: Also incorporated improved wall and roof insulation, lighting controls, and windows that keep heat out but let in light, which enable it to need twenty percent less energy than required by the Chicago Energy Code. <sup>[10]</sup>

#### 8.1.7 CENTRAL LIBRARY. SEATTLE PUBLIC LIBRARY. SEATTLE, WA

- Innovation and Design: Reduced the "heat island effect" by planting trees around the building and using drought resistant plants in the landscaping. <sup>[10]</sup>
- Material and resources: Uses automatic lighting controls to reduce light pollution. Over 20 percent of the building products used in the Central Library were manufactured within 500 miles of Seattle and more than 75 percent of demolition and construction waste was recycled. <sup>[10]</sup>
- Water Conservation: All irrigation provided by rainwater collected from building exterior and stored in a 40,000-gallon tank. <sup>[10]</sup>

#### 8.1.8 CANDLER LIBRARY. EMORY UNIVERSITY. ATLANTA, GA

- Site Location and Material and resources: New building materials were composed of 60% recycled materials and 43% of raw building materials were manufactured within 500 miles of the library; <sup>[10]</sup>
- Water Conservation: The building features low flow water aerators for reduced water consumption; <sup>[10]</sup>
- Energy Efficiency: optimized energy performance by using automation devices and occupancy sensors for building heating and cooling; <sup>[10]</sup>
- Indoor Air quality and Innovation and Design: To improve indoor air quality, incorporated low volatile organic compound (VOC) emitting paints, carpets, and adhesives. <sup>[10]</sup>

#### 8.1.9 COUNCIL TREE LIBRARY, FORT COLLINS, CO

- Innovation and Design: The first LEED commercial interior library in the U.S. to receive platinum status and the second library in the nation to receive platinum, in all LEED programs. The Library's comprehensive green cleaning plan won a LEED innovation credit. <sup>[10]</sup>
- Water Conservation: 55%; Material and resources- 92% construction waste recycled; 85% certified sustainable wood products; and Energy Efficiency- 97% Energy Star equipment. <sup>[10]</sup>

#### 8.1.10 DARIEN LIBRARY, DARIEN, CT

- Site Location and Water Conservation: Located on a brownfield site, the library incorporated water conservation on site for grey water usage. <sup>[10]</sup>
- Innovation and Design and Material and resources: The Darien Library won the 2009 top award for Institutional/Public Building from the Connecticut Green Building Council (CTGBC). Highlights of the new building include geothermal wells used for both a heating and cooling source. <sup>[10]</sup>
- Energy Efficiency: Incorporated heavy mass to provide thermal efficiency and comfort. <sup>[10]</sup>

## 8.2 INDIA

#### 8.2.1 ANNA-CENTENARY LIBRARY, KOTTURPURAM, CHENNAI, TAMILNADU

- Site Location: The library is located in a well developed area in Kotturpuram, Chennai, amidst Educational and Institutional buildings and on a location with easy access from all parts of the city; <sup>[9]</sup>
- Water Conservation: Waste water is reused on the grounds; <sup>[9]</sup>
- Innovation and Design: In order to lower heat island effect of the building, the library terrace area is painted with high albedo paints and the Auditorium terrace and Library terrace level at 1st, 2nd and 3rd floor are covered with green roof. <sup>[9]</sup>

- **Material and resources:**The project used building materials with recycled content value of 12 % by cost of the total material cost, and 75 % of the construction waste were reused within the site or sent for recycling; <sup>[9]</sup>
- **Energy Efficiency:**On the roof, solar panels can be established to consume solar energy which makes the library a solar powered library. LED and CFL lighting, high efficiency motors, pumps and fans enable monitoring and control of lighting and ventilation. <sup>[9]</sup>

#### 8.2.2 PERMAKARPO LIBRARY, LADAKH

- **Site Location:**The PermaKarlo Library is part of the Druk White Lotus School, which is located in the Indian Himalayas. <sup>[17]</sup>  
Amongst the technologies and design solutions used on site:
- **Material and resources-** ventilated Trombe Walls, wool insulation, a mud roof; <sup>[17]</sup>
- **Energy Efficiency and Innovation and Design-** timber panelling and even solar panels on the roof. <sup>[17]</sup>

#### 8.2.3 KARNATAKA UNIVERSITY LIBRARY, DHARWARD

- **Site Location:** A clean area for students with new dimensions, informative signage boards, corners for deep studies & group discussions, a space for heritage walks, a centre for photographs, paintings and water colours. This concept of Green Library provides a study atmosphere in a natural-green environment with lush greenery. <sup>[13]</sup>
- **Innovation and Design and Energy Efficiency:** The University has taken every care to see that the Green Library is given a facelift both in terms of maintenance and infrastructure, incorporating modern pergolas, Gurukul Huts, open granite mantaps, granite tables with benches beneath the trees, solar lightings, etc. The facilities include sitting, supply of drinking water, WiFi connectivity and other facilities etc. <sup>[13]</sup>

#### 8.2.4 NATIONAL LIBRARY OF INDIA, KOLKATA

- **Site Location:** Trees whisper, the road gets strewn with green and yellow leaves.

#### 8.2.5 DELHI UNIVERSITY LIBRARY, DELHI, MADRAS UNIVERSITY LIBRARY, MADRAS AND MUMBAI UNIVERSITY LIBRARY, MUMBAI

- Any sufficient important information is not available for these three libraries, that is why categorization based on LEED evaluation indicators could not be done like other mentioned libraries.

#### 8.2.6 CALCUTTA UNIVERSITY LIBRARY, CALCUTTA

- **Material and resources:** Bookshelves and other related accessories had been made from wood because wood are biodegradable therefore it is not harmful to the environment.

#### 8.2.7 NIT LIBRARY SILCHAR, ASSAM

- **Site Location:** It is a well-equipped Library, centrally located with easy access, and the building institute surrounded by a natural-green environment.

## 9. Comparative Study and Analysis:

### 9.1 green libraries: usa

Sl. No.	Name of the Green Libraries (USA)	Site Location	Water Conservation	Energy Efficiency	Material and resource	Indoor Air quality	Innovation and Design	LEED certification
1	ANYTHINK BRIGHTON. BRIGHTON, CO	Historic downtown brighton		ground source heating and cooling, 108kW photovoltaic system	use of recycled materials	incorporates Solatubes which are reflective tubes that capture daylight and deliver it inside to illuminate interior spaces	First carbon-positive library	✓
2	BALLARD BRANCH. SEATTLE PUBLIC LIBRARY. SEATTLE, WA	It was selected by the American Institute of Architects committee on the environment as one of the top ten green projects for the 2006	a green roof helps to insulate the building and reduces the amount of rain water that would flow into storm drains	building incorporates 17 solar panels on the roof and uses occupancy light sensors in offices	Recycled carpet, glass, and ceiling tiles were used throughout the building	Ventilation systems that monitor indoor air quality	Building designed to shade harsh light and take advantage of natural daylight, decreasing need for artificial light	
3	BLAIR LIBRARY. FAYETTEVILLE PUBLIC LIBRARY. FAYETTEVILLE, AR	Fayetteville Historic Square, making it a textbook smart growth project	rainwater for irrigation ;10 waterless urinals	10 kW solar panels for energy generation	recycled content furnishings	cork flooring	a white membrane roof	✓
4	BOZEMAN PUBLIC LIBRARY. BOZEMAN, MT	"brownfield" site	waterless urinals	a 34 kW photovoltaic system	Using green high recycled material	high efficiency HVAC equipment	natural day lighting	✓
5	BROWARD COMMUNITY COLLEGE/SOUTH REGIONAL LIBRARY. PEMBROKE PINES, FL	Broward County			carpet made from recycled fibers	low emitting VOC materials	bookshelves and furnishings made from sustainably harvested wood	✓
6	BUDLONG WOODS BRANCH. CHICAGO PUBLIC LIBRARY. CHICAGO, IL			a 16kw photovoltaic system		incorporated improved wall and roof insulation, lighting controls		✓
7	CENTRAL LIBRARY. SEATTLE PUBLIC LIBRARY. SEATTLE, WA	using drought resistant plants in the landscaping	Rainwater for irrigation		Construction waste was recycled		Uses automatic lighting, planting trees	✓
8	CANDLER	building	low flow	using	60%	low volatile		✓

	LIBRARY.EMORY UNIVERSITY. AT LANTA, GA	materials were manufactured within 500 miles of the library	water aerators for reduced water consumption	automation devices and occupancy sensors for building heating and cooling	recycled materials	organic compound (VOC) emitting paints, carpets, and adhesives		
9	COUNCIL TREE LIBRARY, FORT COLLINS, CO		55% water savings	97% Energy Star equipment	92% construction waste recycled, 85% certified sustainable wood products		Library's comprehensive green cleaning plan won a LEED innovation credit	✓
10	DARIEN LIBRARY, DARIEN, CT	Located on a brownfield site	water conservation on site for grey water usage	geothermal wells used for both a heating and cooling source			Incorporated heavy mass to provide thermal efficiency and comfort	✓

Table- No:1

## 9.2 green libraries: india

Sl. No.	Name of the Green Libraries(India)	Site Location	Water Conservation	Energy Efficiency	Material and resources	Indoor Air quality	Innovation and Design	LEED Certification
1	Anna-Centenary Library, Kotturpuram, Chennai, Tamilnadu	library is located in a well developed area in Kotturpuram, Chennai	Waste water is reused on the grounds	solar panels can be established to consume solar energy, using LED and CFL lighting	Recycled materials		lower heat island effect of the building, the library terrace area is painted with high albedo paints	✓
2	PermaKarlo Library, Ladakh	PermaKarlo Library is part of the Druk White Lotus School, which is located in the Indian Himalayas		solar panels on the roof	ventilated Trombe walls, wool insulation		timber panelling, a mud roof	
3	Karnataka University Library, Dharward	This Library provides a study atmosphere in a natural-green environment with lush greenery		solar lightings			incorporating modern pergolas, Gurukul Huts, open granite mantaps, granite tables with benches beneath the trees, supply of drinking water, WiFi connectivity and other facilities etc.	
4	National Library of India, Kolkata	Trees whisper, the road gets strewn with green and						

		yellow leaves						
5	Delhi University Library, Delhi							
6	Calcutta University Library, Calcutta				Bookshelves and other related accessories made from wood			
7	Madras University Library, Madras							
8	Mumbai University Library, Mumbai							
9	NIT Library Silchar, Assam	centrally located with easy access, and the building institute surrounded by a natural-green environment						

Table- No:2

Table No.1 and Table No. 2 show the information of total 19 libraries of USA and India respectively. Two tables give the information of each library based on LEED evaluation indicators and also about LEED certification. According to our study and observation, Anythink Brighton Library located in historic downtown Brighton, becomes the first carbon-positive library in the United States. The building includes a 108 kw photovoltaic system. It uses geothermal heating and cooling system, and incorporates Solartubes which are reflective tubes that capture daylight and reflect it inside to illuminate interior space. Seattle Public Library of Ballard Branch has a green roof which helps to insulate the building and reduces the amount of rain water that would flow into storm drains. The building incorporates 17 solar panels on the roof and uses occupancy light sensors in offices for saving electric energy. Ventilation systems are used for monitoring the indoor air quality and recycled carpet, glass, and ceiling tiles are used throughout the building. The Fayetteville Public Library is one of the first public library in the United States to register with the U.S. Green Building Council (USGBC). This library includes many green design techniques. The library has been built a few blocks away from the Fayetteville Historic Square, incorporating a white membraneroof, 10 kw solar panels and during construction, almost 99% of the construction waste has been recycled or reused. Water collected on the roof is reused for landscape irrigation and the library's 10 waterless urinals served as a successful pilot project for the Arkansas Department of Health and Human Services. Bozeman Public Library is located on a Brownfield site. The building utilizes natural day lighting, high green materials recycled content, a 34 kW photovoltaic system for energy conservation, waterless urinals, high efficiency HVAC equipment for maintaining indoor air quality. South Regional Library of Broward Community College is the first green LEED certified building in Broward County. The Library utilizes bookshelves and furnishings made from sustainably harvested wood, carpet made from recycled fibres, and low emitting VOC materials. Chicago Public Library of Budlong Woods Branch officially opened as a green library in 2003 and comprises a 16kw photovoltaic system. The building design includes improved wall and roof insulation, lighting controls, and windows for indoor air quality. Seattle Public Library of Seattle uses automatic lighting controls to reduce light pollution and the heat island effect has been reduced by planting trees around the building and by using drought resistant plants in the landscaping. More than 75 percent of construction waste was recycled and used. Irrigation is provided by rainwater collected from building exterior. Candler Library of Emory University utilizes 60% recycled materials within 500 miles of the library. The building is employed low flow water aerators for reduced water consumption and optimized energy performance by using automation devices and occupancy sensors for building heating and cooling. Indoor air quality is maintained by assimilating low volatile organic compound (VOC) emitting paints, carpets, and adhesives. Council Tree Library's comprehensive green cleaning plan has won a LEED innovation credit. The achievements of building construction include: 55% water savings; 92% construction waste recycled; 85% certified sustainable wood products; and 97% Energy Star equipment. The Darien Library located on a brownfield site, building design includes geothermal wells

used for both a heating and cooling source and incorporated heavy mass to provide thermal efficiency and comfort. The library utilizes water conservation on site for grey water usage. In case of India, Anna Centenary Library is located in a well developed area in Kotturpuram, Chennai with easy access from all parts of the city. The shape and form of the building have been designed in such a way that the library terrace area is painted with high albedo paints for lower heat island effect. Recycled materials are used to reduce the environmental impact. The energy consumption reducer such as using LED and CFL lighting and solar panels are placed. Waste water is used for landscape irrigation. The PermaKampo Library, another green library in India is located in the Indian Himalayas and part of the Druk White Lotus School. The building is maintained by sustainable and beautiful features of good green design. The technologies and designs have been used on site, ventilated Trombe Walls, wool insulation, a mud roof, timber panelling and even solar panels on the roof. Karnataka University Library, Dharwad vision is to reinvent a green space for students and culture. This concept of Green Library provides a study atmosphere in a natural-green environment with lush greenery. The University has taken every care to see the green library infrastructure, incorporating modern pergolas, Gurukul Huts, open granite mantaps, granite tables with benches beneath the trees, solar lightings, etc. Besides these, sitting arrangements, supply of drinking water, WiFi connectivity etc. are provided to the students. In USA among ten, nine libraries have achieved LEED certification except for one library, viz. Seattle Public Library of Ballard Branch. From this side, India is far behind. A very few libraries are going to green in India namely Anna-Centenary Library, Kotturpuram, Chennai, PermaKampo Library, Ladakh, and Karnataka University Library, Dharwad and among nine libraries only Anna-Centenary Library has acquired the LEED certification. Among the rest of the libraries, Delhi University Library, Madras University Library, Mumbai University Library could not be categorized and compared with others due to lack of proper and adequate information. But on the other hand, the National Library of India, Kolkata, Calcutta University Library, Calcutta, NIT Library Silchar, Assam have taken the green library initiative and they are trying to build the eco-friendly library by implementing of green library evaluation indicators like innovative design, materials and resources, energy consumption, water conservation, etc. within the premises of the library.

## 10. Conclusion:

The Green building movement is of great importance to save our environment all around the world. In this context, green libraries take a major role. This article displays a comparative study between the green libraries of the United States and India based on LEED's standards. The analysis of the study shows that green library features could not be implemented on a large-scale in India in comparison to the United States. To increase the green libraries in India, libraries, librarians, and also Government have a great responsibility to popularize this new concept, creating awareness among staff and readers and implement the idea in all types of libraries. We should be leading our country forward by establishing a large number of Green Libraries.

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