CHAPTER 3:
LITERATURE REVIEW
Following literature related to the subject was studied to get the in-depth knowledge into the subject.

Affordable & Sustainable Housing concept though started in recent times was being dealt in the western world for quite a long time. Author Schumacher, E. F., in his book titled “Small is Beautiful: Economics as if People Mattered” published by Harper & Row, 1973 was a critique of classic economic theory, which emphasized growth at all environmental costs. Schumacher, an economist himself, challenges western man’s attitude toward nature and the “illusion” of technology. The focus is on the inherent contradiction in the assumption of endless economic growth and the reality of finite resources. The book addresses the dangers of encouraging developing countries to model their economic/industrial policies on the Western example.

Authors Watson, Donald, and Kenneth in their book “Climatic Design: Energy-Efficient Building Principles and Practices” published by McGraw-Hill, 1983 discuss various principles particularly in Part I of the document discusses primarily passive responses to climatic conditions, vernacular architecture, site orientation and planning, and psychometric principles are examined; methods of calculating solar radiation, solar geometry, and heat flow are given. In Part II it focuses on the scientific application of the principles discussed in Part I whereas Part III lists various climatic data for U.S. cities.

In another book authored by Spirn, Anne Whiston titled “The Granite Garden: Urban Nature and Humane Design” published by Basic Books, 1984 describes successful cities, ancient and modern, have developed by heeding their natural geography and evolving over time. These communities offer humane, sustainable lifestyles that allow their inhabitants to remain in contact with nature. Utopian, “planned” communities are unable to accomplish this level of comfort, because the design process doesn’t allow for this critical evolution. The traditional
planning process itself, with its emphasis on physical manipulation of the landscape, creates a variety of environmental and socio-economic problems.

In order to exploit the natural energy sources author Brown, G. Z. , in his book titled “Sun Wind and Light” published by John Wiley, 1985 examines the design decisions that affect a building’s energy use. The article emphasized on utilizing onsite resources in the forms of solar, wind, and geothermal energy.

Author Gordon, David in the book “Green Cities: Ecologically Sound Approaches to Urban Space” published by Black Rose Books, 1990 has compiled essays examining international approaches to urban design and the assumptions upon which these paradigms are based. It discusses a redefinition of urban park land, the concept of the dependent city, the modification of macro- and microclimates that result from development, and more. It provides both introductory and intermediate levels of information about green cities and includes listings of selected horticultural services and suppliers, organizations and demonstration projects, and an introductory bibliography.

Further author Anderson, Bruce in his book “Solar Building Architecture” published by The MIT Press, 1990 which is a 12-volume series, summarizes federally sponsored research in solar energy systems. Various discussions are limited to the use of solar radiation for heat however it does not cover photo-voltaic, wind or wave power, or biochemical energy production. A brief examination of historical, climate-responsive architecture is included, but the focus is on current technology, research, and applications. Urban planning and site issues, energy storage and distribution, and the importance of building envelope design are also discussed.

Author Fitch, James Marston in his book titled “Historic Preservation: Curatorial Management of the Built World” published by University Press of Virginia, 1990 presents economic, aesthetic, and cultural arguments for the preservation and/or adaptive reuse of existing structures into sustainable buildings. It traces the history of the historic preservation movement in the U.S where
preservation theory and specific techniques for reconstituting damaged buildings into sustainable buildings are explained. It also includes a section on designing additions to historic buildings and retrofitting old buildings with new mechanical/electrical systems for making them energy efficient.

In subsequent advancement authors Vale, Brenda, and Robert in their book “Green Architecture: Design for an Energy-Conscious Future” published by Thames and Hudson, 1991 have illustrated with examples about the environmentally friendly architecture. The greenhouse effect, patterns of consumption, and other environmental issues are addressed in the context of architecture and sustainable design. Various case studies of existing buildings are included which gives insight into environmentally friendly architecture.

Author Crowther, Richard L who is a practicing architect in his book “Ecological Architecture” published by Butterworth Architecture, 1992 has showcased applied sustainable design concepts. He argues for the necessity of sustainable design, discusses the strategies, and leads through the design process. Eleven case studies of his buildings are included which address concepts for interior as well as exterior issues and the need for integration of technology and aesthetics. The economics of design choices, at the micro and macro levels, are examined. The book includes a reference section for design issues and suggestions for improving sustainability.

Author Brand, Stewart in his book “How Buildings Learn: What Happens After They’re Built” published by Penguin Books, 1994 examines the adaptive reuse of existing structures. In this various guidelines for designing easily adaptable building are discussed. “Built for Change,” discusses change in architecture and construction methods that support constant revision over time. Adaptive reuse, durability, and design for sustainable buildings are explained in terms of both whole buildings and materials. It also discusses the concept “Function Melts Form,” which is all about adaptation, flexibility, and the importance of functions predominance over the form of the building.
In another book authored by Yeang, Ken titled as “Designing With Nature: The Ecological Basis for Architectural Design” published by McGraw-Hill, 1995 discusses the conflict between the designer’s concept of the environment and the ecologist’s view. It assumes and argues for a “finite-resource” approach to design. It defines a series of overlapping, dynamic ecosystems and explores how these ecosystems are affected by building. It develops a framework for ecological design based on the correlation between user requirements and environmental impact.

Authors Barnett, Dianna Lopez & William D. Browning in their book titled “A Primer on Sustainable Building” 1995 introduced the concept of sustainable design, reasons for using its principles, and general guidelines for its application. It deals with site development, transportation issues, building configuration, alternative energy systems, water conservation, and building materials. It includes an extensive listing of other publications, non-profit groups, and journals that deal with sustainable design issues.

Regarding the financial aspect of going green author Kats, G. in the report given to California’s Sustainable Building Task Force, 2003 titled as “The Costs and Benefits of Green” on the basis of large sample of cost data on achieving energy star ratings from LEED certification, contractor samples, USGBC surveys, the average costs are reported to be about 3 to 5 % extra.

In feasibility study of a zero energy home in Newfoundland, titled as “Renewable Energy”, 2004 states that in a zero energy home annual energy consumption is equal to the annual energy production using one or more available renewable energy resources. In St John’s, Newfoundland wind is the readily available renewable energy resource. The average annual wind speed in St John’s is 6.7 m/s. This paper presents a feasibility study of a wind energy conversion system based zero energy home in Newfoundland. This study is based on year round recorded wind speed data, solar data and power-consumed data in a typical house in Newfoundland. National Renewable Energy Laboratory’s software HOMER is used to select an optimum energy system. A detailed analysis, description and expected performance of the system are presented in this paper.
In another study done by S.H. Oh in the paper “Eco-friendly architecture authentication case study” published by University of Seoul, 2005 explains Eco-friendly housing. It means the housing which co-operates with the environment. Eco-housing largely means considering energy resource or wastes which harmonizes with the surround-environment and makes a clean and healthy environment for people living in there.

In the paper titled “The Costs and Benefits of High Performance Buildings”, 2007 it has been examined that private developers are leading the way in accommodating the burgeoning demand for high performance buildings. Several leading investors CALPERS etc. have recently announced efforts to increase their emphasis on green over the next several years. Several cities, like Boston, Los Angeles or San Francisco, have mandated LEED certification, while others, like Toronto, have provided incentives (i.e. rebates) for energy conservation methods. A great local incentive that costs cities very little but saves developers significant money is the promise of faster entitlement and permit reviews and or reduced permit fees or bonus densities.

In an another case study of zero energy house design in UK, titled “Energy and Buildings”, 2009 various possible solutions for zero energy building design in UK are discussed in this paper. Simulation software (Energy Plus and TRNSYS 16) are employed in this study, where Energy Plus simulations are applied to enable facade design studies considering building materials, window sizes and orientations and TRNSYS is used for the investigation of the feasibility of zero energy houses with renewable electricity, solar hot water system and energy efficient heating systems under local weather conditions. Various design methods are compared and optimal design strategies for typical homes and energy systems are provided.

Author Unwin, S. in his book “Analyzing Architecture” published by The Cromwell Press, 2009 suggest the idea, that analyzing architecture and studying its fundamentals, will lead to improving the sustainable design. He suggests, to develop understanding of architecture as "an identification of a place" by its basic and modifying elements. It should be considered how the building element can do more
than one thing, by sensible and thoughtful design. An example of elements doing
more than one thing could be a roof used as a path or bridge; raised area of a floor-
acting as a platform; a fire place is not only warming up the room, but place around
which people socialize and perform; a verandah is giving shelter, but also could be
offering wide view to beautiful natural landscape; etc. Elements with only one
function would appear self-centered and too pretentious, even unnecessary.

Author Disch of Goethe Institute in his paper “It’s not enough to hang a sign
saying ‘solar architect’ on your door.” 2010 explains that a sustainable building
differs from the conventional building due to its design, the construction materials
used, which are all certified as suitable for "green" construction and have no adverse
impact on human health. Its facades are designed in such a way that they protect the
building from noise pollution and act as shields for the ventilation elements. The
construction technology, used for the sustainable buildings are responsible for
creating the positive energy balance. The extensive glazing maximizes the use of
sunlight and reduces the need for artificial lighting. Closed sections of the facade are
fitted with metal panels in which vacuum reduces heat loss to almost zero despite
the low construction strength. The use of vacuums for insulation is an innovative
technique. Disch uses climate responsive techniques like large openings on the south
side, small ones on the north; cooling the building units at night-time in the summer;
heat recovery from exhaust air, and south-facing photovoltaic roofs. The
fundamental principle is to capture as much solar energy as possible while keeping
heat loss to the minimum necessary as per the prevailing climate. "Green" building
is essential to protect the environment, and energy-neutral construction is vital for
climate protection.

Author Wilson Robin, Kennedy in his book “Kennedy Green House:
Designing an Eco-Healthy Home from the Foundation to the Furniture” 2010
documents the transformation of the home by a ‘‘Green Dream Team,’’ from the
drawing of architectural plans to the selection of eco-friendly building materials and
power sources to the retooling of the home with health-promoting, energy efficient
appliances and furnishings. Along the way, author Robin Wilson provides
information and tips on how these changes can be implemented by any homeowner,
whether it’s a broad renovation or simple, affordable replacements of common household items. The book focuses on maximizing energy, water efficiency, and indoor air quality of the buildings. The LEED-certified (Leadership in Energy and Environmental Design), renovated Kennedy house showcases the latest in green technologies, sustainable building practices, and healthy home initiatives. Kennedy Green House aims to inspire others to take action to improve the quality of their environment and health, and to serve as an educational tool for homeowners, builders, and interior designers.

In a journal of green building “Adoption of Green Building Guidelines in Developing Countries Based on U.S. and India Experiences”, 2012 since sustainable construction is entering the mainstream; many developing countries are either currently pursuing green building guidelines or are planning to pursue them in the near future. This research paper attempts to formulate an implementation strategy for the rapid adoption of these guidelines for the developing nations. This implementation strategy is based on the detailed review of the major green building guidelines globally and contextual information of Indian society collected through a survey questionnaire. The proposed strategy in the paper shows that it is important for green building initiatives to identify: the organizations that accelerate the adoption of green building guidelines in a society, the incentives and barriers associated with the green building guidelines, and the necessary motivations for the adopter organizations. An informed approach in the form of this implementation strategy might potentially contribute to the acceleration of green building guidelines' adoption in developing countries.

In the research paper “Preview of Green building industry” conducted by LEED India (IGBC), 2014 it has been already established that the outcome of human activities is harming the environment. Various measures and initiatives at global level are being taken to diminish the effects of it. To support this and to safeguard the environment green building concepts were promoted by organizations with certain rating system such as Leadership in Energy Efficiency Design (LEED) in United States, BREEAM in Netherlands, Green star in Australia and Indian Green Building Council (IGBC) and various organizations in various countries promoted
green buildings, lately it caught up with developing countries. India is no exception where LEED was among the first to be introduced. It was later customized to LEED India by Indian Green Building Council. TERI (The Energy Research Institute) became nodal agency for urban development under MOUD (Ministry of Urban Development) & Energy Conservation Building Codes were also brought into practice for Indian Green Building scenario. These agencies provided certain guidelines for building green buildings altering the current practice of building construction. These organizations promote green buildings strategies and distinguish it by certifications. These organizations have set a goal to make green buildings. TERI GRIHA three star rating has become a baseline for new government buildings, TERI sets a target of 15 million sq. ft by the end of 2016 and IGBC sets a target of 50% of new buildings to be green by 2025. This has given rise to a new trend in the market of green materials to be used in buildings to construct building into green. These developments in construction industry have influenced the market and economy. The traditional approach of construction is immensely popular in developing countries, including India too. Amidst this new development, India, traditionally has a rich culture of human progression and settlements with diverse culture in various parts of country with different climatic conditions with variety of building styles in practice. Cold Himalayan belt of North and North East; Hot Arid Region in West and Central part, Warm Humid in Coastal Regions has its own character. This can be attributed to the social customs and climatic adaptations. Hot dry climate of Rajasthan with “Mud Architecture” to “Tiny Bamboo houses” in North East, preferring the local materials and climate in construction. The unique construction techniques contributed to comfortable living within the building and were low cost. However these buildings were itself sustainable by using locally available materials, minimum alteration to natural form and climatically modified construction techniques to keep comfortable stay inside building in the absence of any mechanical ventilation devices. The 2008 LEED for Homes Rating System with its widest coverage maintains a broad understanding of sustainable housing design. The system measures the overall performance of a building in eight various categories namely
• Innovation and Design Progress (ID): It concerns special design methods, unique regional credits, measures not currently addressed in the Rating System, and exemplary performance levels.

• Location & Linkages (LL): It concerns the placement of homes in a socially and environmentally responsible ways in relation to the larger community.

• Sustainable Sites (SS): It concerns the use of the entire property so as to minimize the project’s impact on the site.

• Water Efficiency (WE): It concerns water-efficient practices, both indoor and outdoor.

• Energy & Atmosphere (EA): It concerns energy efficiency, particularly in the building envelope and heating and cooling design.

• Materials & Resources (MR): It concerns efficient utilization of materials, selection of environmentally preferable materials, and minimization of waste during construction.

• Indoor Environmental Quality (EQ): It concerns improvement of indoor air quality by reducing the creation of and exposure to pollutants.

• Awareness & Education (AE): It concerns the education of homeowner, tenant, and/or building manager about the operation and maintenance of the green features of a LEED home.