CHAPTER 1:
INTRODUCTION
1.0 THE CONTEXT

“Green,” these days is a term that is getting universally acclaimed and worldwide popular. There are many inferences drawn about what is green & going green. In relation to Housing “Green” might mean where there is minimum impact on environment, less wastage, minimal consumption of energy etc. A house can transform into environment friendly by reusing waste or not producing any inside and out. Affordable & sustainable housing are real tests all over the world including India. By and large there is a clash between the technological advancements and sustainability. In India affordable housing has by and large been developed for the economically weaker sections of the society.

The world's total population is projected to grow by 1.76 billion persons, during 2000-2024, with some 86% of this growth expected to take place in the cities and towns of developing countries. By 2030, as stated by the projections of the United Nations (UN) Population Division, urban population shall exceed the countryside tenants; by 2050 completely two-thirds of their occupants are liable to live in urban regions. By 2050, India is liable to be the most crowded nation with an anticipated populace of 1.69 billion compared with China’s 1.30 billion. It is assessed that in excess of 70 million new urban lodging units will be required throughout the following 20 years in India. The ultimate size of India’s population when the population stabilization is achieved will be about 1.72 billion around 2060, according to the population projection by the United Nations Population Division (UNPD). Urbanization and urban expansion is happening even faster. Cities are estimated to occupy less than 0.5% of the Earth’s total land area, For centuries, cities were compact with high population densities, and the physical extent of cities grew slowly. This trend has been reversed over the last 3 decades and urban areas around the world are expanding on average twice as fast than their populations. The model results for India shows on average a 4.84% urban land expansion growth rate with
30% from population growth and around 23% from growth in GDP per capita for the period 1970 to 2000. If current trends continue globally, more than 5.87 million km² of land have a positive probability (>0%) of being converted to urban areas by 2030, and 20% of this (1.2 million km²) have high probabilities (>75%) of urban expansion. Nearly half of the increase in high probability urban expansion globally is forecasted to occur in Asia, with China and India absorbing 55% of the regional total.

Although urban land area contain relatively small fraction of the total Earth surface, urban areas drive global environmental change. Urban expansion and increasing land-cover change drives deforestation. In the light of these realities of urbanization and its consequences, with 17% of current global population in India, it is necessary to design policies for sustainable housing in a manner that provide balance between environment and urban growth. This rapid & uncommon urbanization suggests for ecological, economic and social sustainability to have a livable planet. This not only involves developing sustainable building technologies applicable to various climate regions, economic conditions, and residential customs in India, it also involves the management innovations for urban governance.

1.1 AFFORDABLE & SUSTAINABLE HOUSING

Affordable housing means small & sufficient housing units using low cost construction material, constructed in blocks built on cheap/subsidized land at the periphery of the city. Basic aspects of sustainable residential design also contain increasing population density, mixed land use and proximity to public transport. In India the above concept is being increasingly adopted in cities. However, the sustainability of affordable housing remains sometimes questionable.

The sustainability can be defined as meeting the needs of today without compromising the needs of future generations. Sustainable housing has the potential to produce good quality housing at a price that is affordable both in the short and long term. Thus, sustainable housing must aim at economic, social and environmental sustainability from planning to implementation phase and at the same time result in housing that is affordable, accessible and environmentally less
damaging. The National Urban Housing and Habitat Policy-2007 intends to promote sustainable development of habitat in India with a view to ensuring equitable supply of land, shelter and services at affordable prices to all sections of society. Though the sustainable housing has lot many repercussions but it should be coherent with few characteristics of sustainable development.

(i) help for the very poor because they are left with no option other than to destroy their environment,

(ii) the idea of self-reliant development, within natural resource constraints,

(iii) the idea of cost-effective development, means that development should not degrade environmental quality

(iv) the issues of disease control, appropriate technologies, food security, clean water and shelter for all,

Thus, in order to be sustainable, housing initiatives must be economically viable, socially acceptable and affordable, technically feasible and environmentally-friendly. The concept of sustainability and sustainable housing projects are crucial for developing countries. In India, neither sustainable housing design nor sustainability philosophy seems to become a major determinant for architectural design process. Yet, the country shares the same problems with the others in the world. Sustainable design is not a choice, but a requirement in the world since the sustainability paradigm emerged in the last quarter of the 20th century. It offers not only a healthy ecosystem, but also many advantages for both the dweller and the country in terms of environmental, economical, social, cultural and health issues. Although India is still in its infancy in terms of sustainable development yet there are lot of efforts being made in the direction..

A green building is one that is designed to reduce or eliminate the impact on human health and the natural environment. This is accomplished by incorporating materials and operational elements that are environmentally responsible and resource efficient throughout the life cycle of the building. How “Green,” a building can transform depends upon the number of the incorporated elements that are used and their associated impact to the human health and the environment. The life cycle of a green building is an aspect that is also drawing more attention as it has an even
broader impact on the community. The life cycle of a green building is defined as the life expectancy of any components that make up the structure and impact on the operation of the structure over an established period of time. Life cycle can also consist of the overall impact to society in terms of a green environmentally friendly building and any associated environmental contributions that may be made. Owning a green home and providing the environmental benefits are somewhat negated when the owner drives a gas consuming vehicle that adds pollutants to the atmosphere. Another good example is the homeowner who claims not to use fertilizers or pesticides but hires a landscaper to do it. All these activities together can negate the benefits of the green building and have an impact on the community and indeed to society as well.

An important aspect of a green structure is its “Carbon Footprint.” A carbon footprint is the release of carbon dioxide from energy use. Energy use includes that used for the manufacture and harvest of products used in construction of a building. This use also includes the energy used in the operation of a building such as heating, cooling, lights as well as other aspects. The use of carbon footprinting is new to the building industry and has only recently started to be used as part of the design and operational efficiency.

In the past the trend in building green has been more focused on the building itself, but is now leaning more toward a whole approach to include a perspective of the greater community and the global impact. The design starts early and considers such factors as location in reference to public transportation, proximity to employment, schools, shopping as well as other aspects. Is the building being constructed on virgin land or can it be built on land already in use? Can existing on-site resources be used in some aspect of construction? The importance in early design is to build in consideration of the more global impact both short and long term. It is important to consider as many impacts as possible that resource use can have of the greater community.
1.2 FOCUS

The research examined various criteria used in the decision-making of the elements for determining green construction for an institute, office and home. Rating system called LEEDS (India) (Leadership in Energy and Environmental Design) developed by the United States Green Building Council (USGBC) and the Indian Green Building Council (IGBC). Research conducted for this thesis, also looked at existing buildings that have been successfully completed and examined the criteria used in making them green. Again from the Indian context various criteria used for evaluation of green building by GRIHA was studied in detail. Case studies of few buildings were done for apprehending various provisions in green rating. Thereupon a techno-economic feasibility study of stone dust fly ash cement bricks was done for promoting affordable housing. A sample apartment flat was tested through IT Toll Kit (Eneff Res Build India) for savings in energy consumption. From the information collected, various design strategies for Hot & Dry climatic zone of Rajasthan were drawn. The research work utilizes published articles, standards, codes and regulations pertaining to the green elements used for commercial and home construction.

This thesis defends that applying affordable & sustainable design principles in the housing projects in Rajasthan, India will be beneficial not only for the occupants and the society, but also for the country itself. Firstly, it will have environmental benefits like preserving nature and its resources. Employing this paradigm to the new buildings will be a possible step to reach a better quality environment. Secondly, it will have social benefits such as increasing the quality of the housing blocks as well as the occupants’ life. Moreover, it will strengthen community ties. It will help to sustain cultural and regional issues. Furthermore, it will help the dweller to be aware of the sustainable life style. Thirdly, it will have economical benefits in the short and long term.

The general aim of this study is comprehending, utilizing and promoting affordable & sustainable housing design in Rajasthan, India. Besides, the study also aims to understand the relations between sustainability and housing design. In other words, it is considering the influence of the sustainability paradigm towards
architectural housing design. Also, as an outcome of this critical research, significant proposals and suggestions will be realized towards utilization of the sustainability concept as a dominant input in the design process in the frame work of the housing construction domain for hot & dry climate of Rajasthan.

The thesis consists of Twelve chapters. First one is this introduction part where a general framework for the content of the thesis is introduced. In the second chapter research objectives & methodology has been evolved & in third chapter literature review is done to get an idea about the previous studies on similar or related topic. In the fourth chapter, sustainable housing design will be considered with the help of the theoretical background of sustainability. In fifth chapter a detailed study of LEED, which is a rating system for India and provides a framework for sustainable housing design and energy efficiency, will be done. This part will be the theoretical part of the thesis. In this chapter, to understand the limits of sustainable housing design, the LEED for Homes Rating System will be used. Under its subheadings, the different aspects of sustainable housing design will be identified. The sixth chapter contains a study of GRIHA for India rating system as a framework for sustainable housing design & energy efficiency. In seventh chapter various housing case study projects will be critically evaluated in terms of sustainable housing design. In the eighth chapter techno–economic feasibility study of fly ash cement stone dust bricks is done for affordable housing. Now in ninth chapter a testing of sample apartment is done for energy savings with the help of IT tool kit. The tenth chapter deals with various design strategies evolved for affordable & sustainable eco homes for Rajasthan. Conclusion and proposals are submitted in chapter eleven whereas the further scope of work is discussed in chapter twelve. Finally in appendix listing of various references & publications is done.