

Sustainable Development – Built Environment for mankind

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ABSTRACT

The present age is known as "the age of high expectation!" in a democratic country like India the common man looks toward the built environment i.e. man made environment as a development engine to filter the climate, natural as well as social and aesthetic to provide the highest quality of life with a desire "Livability Index"^[1].

Rapid growth in population and migration, scarcity of spaces and poor land use, country planning, poverty in development of infrastructures and other related challenges are in front of planners, bureaucrats, politician, social workers and a common man to full fill their dreams. Creation of built Environment for mankind through eco-urbanism, green Architecture and use of eco-friendly construction material are the important subjects connected with sustainable development in order to protect the earth, green the earth and heal the earth!

Cities in China Shenzhen ,Hong Kong, Singapore ,Malaysia, Japan and neighborhood planning in UK, Chandigarh, New Jaipur, Gandhinager and newly constructed hill station Lavasa city in India have shown the ways to tackle such type of problems related to planning, transportation, housing and tourism etc.

Keywords

Built environment, eco- urbanism, Green Architecture, eco-friendly material

1. INTRODUCTION

Cities are considered as 'Engines of growth'! It is also said that cities are the reflections not just of their people but also their aspirations, their art of enjoying culture and nature with cosmopolitanism. Hence, we need city planners who should have knowledge of necessity of urban and rural planning, economical utilization of land and related resources for creating picturesque surroundings for stress free life with latest technology for development and renewal of cities. Increase in population gives pressure on resources at the local level and its severe scarcity, threat of climatic change, air, water, land and soil pollution

2. SUSTAINABLE DEVELOPMENT

World Commissions on Environment and development, a Bruntland Commissions interpretation of sustainability, defines sustainable development as "Meeting the needs of the present without compromising the ability of the future generations to meet their own". All environment issues are related to population growth, energy consumption, global warming and pollution. The concept of sustainable development stresses the need for ecological determinism so as to achieve qualitative growth within the limits of the

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ecosystems carrying capacity hence sustainable development is an integral part of our sustainable health life.

2.1 Challenges in sustainable development

It is clear! the earth will suffer, world population present and future will suffer!; if due care is not taken to save the earth, heal the earth and green the earth! .It is predicted that, we need 1.4 planets to support the life style to which, we have become accustomed or we could start to save the earth by making small changes to our living; for this reasons the most important is , the vulnerable part of the earth's ecosystem. It is affected by –Ozone hole, green house effect, acid rain, exhaustive use of resources etc. (1) **Ozone holes** – Damages to the ozone layer in the earth's atmosphere is caused by groups of chemicals called chlorofluorocarbons (CFCs) and chlorofluoromethene (CFM).

The damage to the ozone results in more ultra violet radiation getting through to the earth's surface. CFC's are used in different equipments, either as refrigerants, fire extinguisher system and aerosols or as foaming agents for plastics insulants. It is found that CFC's while passing through the ozone layer break down to their basic constituents one of which is chlorine .This chlorine helps in destroying ozone atoms .One atom of chlorine in CFC destroys; one lakh atoms of ozone .There is a need of alternative materials and complete banning of CFCs. CFM is released by chemical fertilizer factories and supersonic planes. (2) **Greenhouse effect** – Global warming is related to the destruction of forests. Carbon enters the atmosphere as carbon dioxide, which is produced when fossil fuels are burned, i.e. fuels containing carbon, coal, wood, natural gas, petrol and oil produces CO₂ after burning this CO₂ combines with other gases such as methane, sulphur oxides, nitrous oxides and CFCs to create green house effect which helps to arise in

global average temperature. These trees, plants help in reducing CO₂. Hence, it is necessary to control the use of fossil fuels; along with planting of trees and plants on a mass scale. (3) **Acid rain** – Acid rain results with an increase in pollutants, particularly sulphur dioxide from coal-fired power stations and nitrous oxides from vehicles exhausts. They dissolve in the rain to form dilute sulphuric acids and nitric acids and destroy trees, shrubs etc. Hence, mass transportation system instead of individual vehicles is the need.

Controlled optimum consumption of natural resources and its extraction is also the challenges in sustainable development in front of us; to save the earth and heal the earth.

3. BUILT ENVIRONMENT

A constant struggle of a man is in imagining and creating an ideal environment in the form of shelter and settlements. Shelter is the basic need of man along with food and water. Man has always shown tendencies to make settlements in the form of a groups or communities; shelter provides protection from the sun, rain, wind, safety, privacy etc for a mankind. Settlements in the form of villages or towns play vital role in providing infrastructures; in the form of housing along with road network, water supply, drainage system and essential other services. Hence, a settlement like a village or town is a big psychological shelter to man; while a house or home is an individual shelter for stress free living. The natural environment with varying climate is not suitable to the life style of man; who is always trying for suitable transformation of the natural environment for his use. This transformed environment is known as man-made or built environment.

Urban and rural settlements are considered as an environmental filters and controls are achieved through regional planning, country planning, town planning and development planning of cities by different zones, roads green belts, parks, gardens, conserving natural and creating artificial water bodies, recreational and open spaces. An urban forest can be created by selecting and planting suitable types of trees, floras with maintaining bio diversity parks to reduce the temperature, noise, air and soil and land pollution.

3.1 Planned Settlements^[1]

Cities to be built are for peoples, around peoples, their needs, their dreams, their love for nature, arts and crafts, quality education, healthcare, catering to all strata of income peoples also need plentiful public spaces for sports, entertainments, museums, art galleries, amusement parks, use of river, seashore or lakes, ponds for creating worth remembering colourful places and hill tops to enjoy scenery, sky, sky line of their city with good network of roads net and other important structures.

An ideal city should be remembered for its (1) **Equality**-no distinction between rich and poor, architect/planner has to go

beyond buildings as a guardian of the built and un-built environments (2) **Infrastructure**- new and creative and innovative ways of think will provide new housing recreational centers, bridges, flyovers, walkways, metro-rails/monorail, with well maintained water supply, sewerage treatment plants, etc (3) **A sense of belongingness** – cities become a place of hopes and expectations; personal involvement of happy citizens will make cities an engine of growth, through time and space (4) **Sense of place**-it is necessary to preserve monuments, heritage structures, historical places in cities to promote tourism as a help for growth to create greatest opportunities for welfare of society.

3.2 Case study of planned Settlements

3.2.1 Chandigarh

Le Corbusier planned this city as living organism, with the capital complex in the North representing head, the city centre the heart, the open spaces the lungs, the network of roads as the circulation system, the industrial area the viscera and the cultural and educational belts, the intellect. The conception of the city has been formulated on the basis of four major functions: living, working, spirit, circulation and care of the body.

3.2.2 Lavasa city (Maharashtra)^[2]

Lavasa city (refer fig1) near pune is planned as per considerations given under new urbanism. The manmade environment blends itself into the natural environment without disturbing the innate nature of the place. Lavasa, the first Hill station, is set amidst 25000 acres over seven hills and enjoys a spectacular, 60 km lake front; special planning authority was set up by government to finalize plans. Lavasa is planned on the basis of new urbanism, development and is planned across four town centers. It is India's first city to use a 3-D enabled; Geographic Information System (GIS) and is completely e-governed. It has state of the art, optic fiber cable network and telecom infrastructure to enable effective e-governance. All residential units are planned and designed as smart houses; offering enhanced security, automation, music and picture libraries, live and record TV, Video games, etc.

Now, we need peoples; who understand how to manage cities; as cities are complex organisms, so many peoples have to live in cities and peoples are a city's strength. We have to create new systems of preserving the geology, restoring it and enhancing it; while creating urbanizations. Lavasa city will be managed through the Environment Management Plan (EMP). This is a plan of constant evolving action that address ecology concerns of several levels from topsoil management, tree plantation and mass plantation with technologically superior process of hydro seeding soil, water, air, land pollution control and monitoring system.

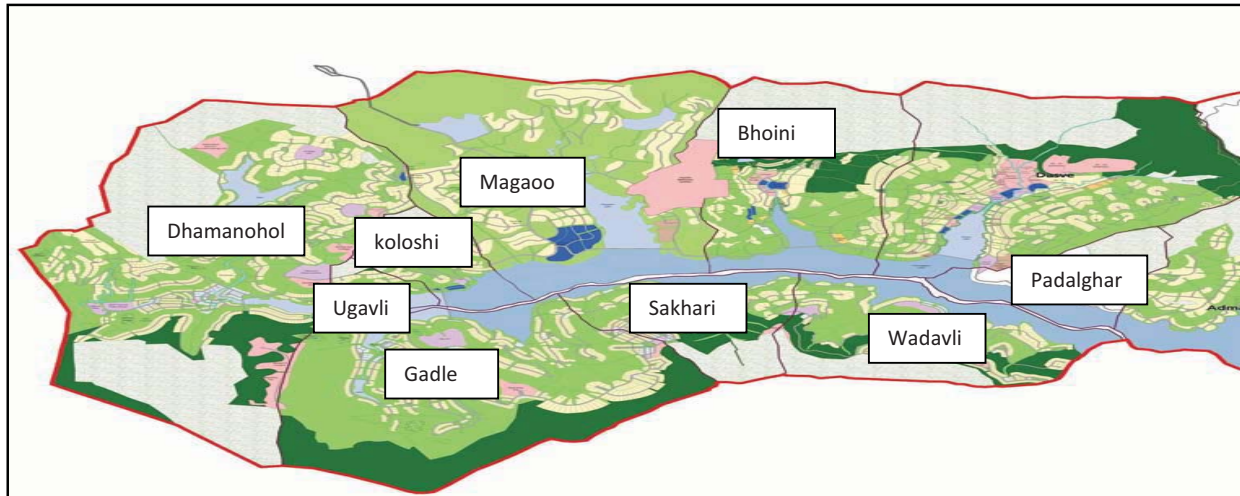


Fig 1: Lavasa City

4. GREEN BUILDING

"A Green building should create delight when entered, serenity and health when occupied and regret when departed"

Green Building principles reflect through the complete building life cycle and are aimed at reducing impact upon the environment. The essential element of green building is to make the most efficient use of resources such as energy, water raw material and maintenance activities to ensure that these will not make the burden to environment.

Green Building materials are those with least environmental impacts throughout their life cycle, whether measured in terms of energy used, scarce of natural resources or air and water emissions by reusing or recycling materials which have substantial environmental benefits; well beyond the weight of the material actually reused or recycled on site. Green building projects, like others are required to meet the highest safety and performance requirements. The most significant benefits involves; the reduced use of energy, reductions in air and water pollution during resources extraction, manufacturing and the safeguarding of scarce natural resources.

4.1 Benefits of the Green Building ^[12]

- Green home is more energy efficient; utilizes less or optimum level of water and other natural resources.
- Green home is eco-friendly in the sense ;it puts less wastes into the environment.
- A green home can save almost 40-50% of operating costs ; optimizes life cycle economic performance.
- It utilizes alternative energy sources like sun ,wind ,geothermal , biomass energy ,etc.
- Vermiculture way of composting; using earthworms to speed up the process in compost pit.
- Rain water harvesting ;the process of accumulating , storing rainwater for various purposes.
- Grey water collection, treatment and reuse facilities.
- Segregating, storing, effective disposal of solid wastes.

- Using of low wattage bulbs BEE (The Indian Bureau of Energy efficiency) star rated electrical equipments.
- Sewage treatment plant (STP) in township
- Water is used in self-sustainable manner; through reducing, recycling and reusing strategies. It saves potable water to an extent of 30-50%
- Use of eco-friendly , smart and natural materials
- Indoor and outdoor plants and trees
- Enhance and protect ecosystems , biodiversity
- Improve air and water quality
- Reduce solid waste and e-waste
- Reduce operational costs
- Enhance asset values and profits
- Improve employee productivity ,comfort and health

4.2 Green Building in India

The energy and resource Institute plays a very important role in developing green building capacities in the country. TERI came up with a rating system called GRIHA which was adopted by the Government of India as the National Green Building Rating System for the country. GRIHA aims at ensuring that all kinds of buildings become green buildings. The strengths of GRIHA lies in the fact ;it rates even non air conditioned buildings as green and puts great emphasis on local and traditional construction knowledge. The CESE building in IIT Kanpur become the first GRIHA rated building in the country and it scored 5 stars, highest in GRIHA under the system. It has become a model for green buildings in the country and proved that with a little extra investment, tremendous energy and water savings is possible. There are various projects which are the first of their kinds to attempt for green buildings rating like apartments of residential buildings and non-air conditioned buildings.

The Confederation of Indian Industry^[11] (CII) plays an active role in promoting sustainability in the Indian construction sector. The CII is the central pillar of the Indian Green Buildings Council or IGBC. The IGBC has licensed the LEED (Leadership in Energy and Environment Design) green Building Standards from the United States. Green Building

Council; currently is responsible for certifying LEED for new construction and LEED-CORE and SHELL GREEN buildings in India. All other projects are certified through the U.S. Green building Council; there are many energy efficient buildings in India, situated in a variety of climatic zones. One of these is RMZ Millennia Park, Chennai; India's largest LEED gold-rated core and shell green building.

4.3 Certification System of LEED and PMC

4.3.1 Rating System of LEED^[6]

It is a performance oriented system where credits are earned for satisfying criterion designed to address specific environmental impacts inherent in the design and construction. Different levels of green building certification are awarded based on total credits earned.

4.3.1.1 Points Distribution for Different Credits

Prerequisite Erosion and Sedimentation Control Required

Credits 1	Site selection	1
Credits 2	Development and community connectivity	1
Credits 3	Brownfield Redevelopment	1
Credits 4.1	Alternative Transportation , public Transportation Access	1
Credits 4.2	Alternative Transportation ,Alternative Fuel Refueling Stations	1
Credits 4.3	Alternative Transportation ,parking capacity	1
Credits 5.1	Reduced Site Disturbance ,protect or Restore Open Space	1
Credits 5.2	Reduced site Disturbance ,Development Footprint	1
Credits 6.1	Storm water Design ,Quantity Control	1
Credits 6.2	Storm water Design ,Quality Control	1
Credits 7.1	Heat Island Effect ,Non Roof	1
Credits 7.2	Heat Island Effect ,Non Roof	1
Credits 8	Light Pollution Reduction	1
Credits 9	Tenant Guidelines	1
	Total	14

Water Efficiency -6 possible Points

Credits 1.1	Water efficient landscaping, reduce by 50%	1
Credits 1.2	Water efficient landscaping, No potable Use or No Irrigation	1
Credits 2	Water Efficiency in Air conditioning System :Reduce by 50%	1
Credits 3	Innovative Wastewater Technologies	1
Credits 4.1	Water Use Reductions 20%	1
Credits 4.2	Water Use Reduction, 30% reduction	1

	Total	6
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4.3.1.2 Energy and Atmosphere - 14 possible points

- Prerequisite 1.
- Fundamental Building Systems Commissioning Required
- Prerequisite 2.
- Minimum Energy Performance Required
- Prerequisite 3.

CFC Reduction in HVAC and R Equipment Required

Credits 1	Optimize Energy performance	8
Credits 2	Renewable Energy,1%	1
Credits 3	Additional Commissioning	1
Credits 4	Ozone Depletion	1
Credits 5.1	Measurements and Verifications-Base Buildings	1
Credits 5.2	Measurements and verifications-Tenant Sub-Metering	1
Credits 6	Green power	1
	Total	14

4.3.1.3 Materials and Resource 11 possible points

Prerequisite 1 .Storage and collection of Recyclables Required

Credits 1	Building Reuse	3
Credits 2	Construction Waste Management	2
Credits 3	Resource Reuse	2
Credits 4	Recycled Content	2
Credits 5	Local /Regional Materials	1
Credits 6	Certified Wood	1
	Total	11

4.3.1.4 Indoor Environmental Quality

- 11 possible points
- Prerequisite 1.
- Minimum IAQ performance required
- Prerequisite 2

Environmental Tobaccos Smoke (ETS) control required

Credits 1	Outdoor Air Delivery Monitoring	1
Credits 2	Increased ventilation	1
Credits 3	Construction IAQ Management Plan (during construction)	1
Credits 4	Low - Emitting Materials	3
Credits 5	Indoor chemical Pollutant Source Control	1

Credits 6.1	Controllability of System, Thermal comfort	1
Credits 6.2	Thermal Comfort, Design	1
Credits 7	Daylight and Views	2
	Total	11

4.3.1.5 Innovation and Design Process

5 possible points

Credits 1	Innovation in Design	4
Credits 2	LEEDTM Accredited Professional	1
	Total	5

LEED INDIA CERTIFICATION LEVELS

Ratings	Points
Certified	23-27
Silver	28-33
Gold	34-44
Platinum	45-61

4.3.2 Certification Mechanism in PMC

- Science and Technology park (STP), University of Pune and eventually sustainable Building Technology centre (SBTC), once it is set up will serve as the apex body for the certification of Eco-Housing Certification along with International Institute of Energy conservation (IIEC)
- The Developer; submits the project layouts and documents to the Building Permission Department of Pune Municipal Corporation (PMC) to ensure that the project meets the existing PMC norms.
- On approval, the developer registers his project for Eco-housing certification with STP and pays towards fee Rs 2/sqft.
- The developer hands over the application Form (2 copies), Tracking sheet (2 sets) and submittals (2 sets) as indicated in the Eco-housing tracking sheet to STP
- STP scrutinizes registration phase documents with the help of submittals and visits the site; issues Provisional certificate and certified Tracking sheet; based on the star rating system. PMC grants 25% of total rebate certificate on all premium to the developer
- Validation team evaluates compliance with eco-housing assessment criteria during different phases of construction based on the intent of compliance of the Developer according to the Certified Tracking sheet and gives the final star rating.
- The final Eco-housing Rating Certificate is handed over after completion of the project validity of which is granted for 5 years and after which the certificate has to be renewed
- PMC will then extend the rest 25% of rebate on the premiums for Eco-housing certified projects.

4.3.2.1 Rating system of PMC

The Eco-Housing assessment criteria and rating system, it is applicable only to residential projects. The voluntary rating system incorporates global best practices to help developers and architects design and evaluate the green quotient of new residential projects. To determine the environmental performance of a building, the Eco-Housing assessment criteria are divided into the following eight broad categories.

Site planning	260
Environment Architecture	80
Efficient Building Materials	200
Energy Efficient Lighting	50
Solar Water heaters	50
Water conservation	200
Segregation of waste	80
Other Innovative Technologies	80
Total number of points	1000

The assessment criteria have a total of 88 measures. Only 27 of the 88 measures are mandatory. The maximum achievable points are 1000 and the project has to get a minimum of 500 points to qualify for Eco-Housing rating. Each measure has a submittal requirement and the necessary documentations should be enclosed with the Eco-Housing proposal to show compliance with the measures being attempted. The Eco-Housing rating system is based on the number of points earned. The rating achieved depends on the number of voluntary measures incorporated in addition to the mandatory ones.

Points achieved	Star rating
500	*
501 – 600	**
601 -700	***
701 – 800	****
More than 800	*****

5. CASE STUDIES IN PUNE CITY

Star Rating	Rebate in total premium	Rebate offered with provisional certificate
*	10%	5%
**	20%	10%
***	30%	15%
****	40%	20%
*****	50%	25%
Star rated Projects		Star
Nyati Environ, Phase I,II,III		*****
Kumar Sublime –Building A & B		*****
Cross over country		*****
Rohan Mithila, Plot B,C,D		*****
Kool Homes - Solitaire		***
Kool Homes –Arena		***

6. CONCLUSION

Built environment for mankind is essential to provide quality of life to all; to achieve happiness which will increase productivity and economy for national health and prosperity.

Sustainable urban and rural development with new towns and townships, renewal of settlements for livability is necessary along with Green Buildings to balance urbanization and environment.

The green building process starts from using sustainable materials for construction, environmental friendly resources and providing green amenities to ensure green approach.

Sustainable materials are those that are locally available and use the least amount of energy for the manufacture, transport, during construction and for maintenance.

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