Strategies for Eco-Housing in Indian Cities

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Present Scenario – Defeating Sustainability
Understanding “sustainable development”

- **Sustainable**: ‘long lasting’
- **Development**: improving the wellbeing of people, raising living standards and increasing facilities.
- The main **Principle of Sustainable Development**: the need of the present should be met without compromising the ability of future generations to meet their own needs.*


Sustainable building design

- **Analysis and Inference**: To understand the problem and its context, To characterize important requirements, To establish relative priorities, To determine desired objectives.
- **Application**: To formulate design strategies, To apply strategies which establish relationships between architectural form, space and energy.
- **Evaluation**: To monitor the performance of the building, To evaluate the performance with respect to the analysis of the requirement priorities and objectives.
Indirect fallout of the unrestrained human activities

- Forest degradation due to timber extraction
  - India should have 33% forest cover, today it is reduced to only 12%.
- Flash floods
- Soil erosion
- Increased CO₂ levels
- Increased temperature

A total disregard for the environment!!!

An integrated approach to ‘Sustainable’ building design:

- Enhances users’ comfort and productivity with optimum energy consumption
- Minimizes the negative impacts of the building on our environment.
- Uses resources efficiently

Towards greener buildings
Eco-Housing

• ‘Eco-Housing’ is the integration of several energy efficient, environmentally sound measures, products, and construction practices in a housing project.

Eco-Housing practice
A step towards Sustainable Building Design

Strategies for Eco Housing

• Focus Areas
  Site Planning
  Environment Architecture
  Energy Conservation
  Efficient Building Materials
  Water Conservation
  Solid Waste Management
  Other Innovative measures
Site Planning - Focus

- Biodiversity conservation
- Reducing transportation needs for common chores
- Prevention of soil erosion by proper storm water management
- Prevention of contamination of ground water by hazardous material during construction
- Reduce micro climate temperature rise

Environmental Architecture - Focus

- Encouraging the use of passive Architecture systems and technologies
- Reducing energy consumption in cooling and heating through appropriate climatic design
- Providing adequate thermal comfort and natural light
- Ensuring integrated design approach
Energy Management - Focus

- Reducing operational energy of building
- Reducing carbon emissions as well as other pollution from use of conventional energy
- Use of clean and renewable energy sources
- Conservation of fossil fuel energy source

Efficient Building Materials - Focus

- Use building material optimally
- Reduce Wastage of Materials
- Encourage recycling and reuse of building materials
- Promote use of eco-friendly and alternative building materials
**Water Conservation - Focus**

- Reduce Water Consumption
- Reuse and Recycle water
- Encourage efficient use of water for landscaping
- Monitoring of water use and prevention of losses

**Solid Waste Management - Focus**

- To efficiently manage organic and inorganic wastes
- Encourage waste recycling
- Encourage resource recovery
- Promote safe disposal of hazardous waste
Other Innovative Measures - Focus

• To ensure construction safety

• To provide minimum standard of living for construction workers

• To provide unobstructed movement for handicapped persons

• To encourage use of innovative design and technologies

MR. KARANDIKAR’S RESIDENCE
AT AHMEDNAGAR

PLOT AREA : 276.00 SQM.
BUILT UP AREA : 183.04 SQM.
ARCHITECT : SHRI ASHOK JOSHI, NAGPUR.
ENGINEER : SHRI AJAY DAGADE
YEAR OF COMPLETION : FEB. 2005
COST OF CONSTRUCTION : 6.60 LACS
Location and Climate

- Ahmednagar is located north east of Pune at 19.05 Degrees N and 74.55 Degrees E
- Climate of Ahmednagar is characterized by
  - Intensive Solar Radiation
  - Low Humidity
  - Low rainfall
  - Hot wind blow

Environmental Architecture

Reducing energy consumption through appropriate climatic design

Effective orientation to avoid direct sun light. Tilted plan prevents direct penetration of solar radiation.

Providing adequate thermal comfort and daylight

Window openings with fixed ferrocrete louvers to allow breeze in and provide diffused light and retain privacy.

Use of passive Architecture systems and technologies integrated design approach

Cross ventilation to take advantage of prevalent breeze

Separate staircase block on the south-east corner acts as a buffer.
Innovative Design of Window

- Use of low sill windows to facilitate air movement.
- Shutter less openings ensures free air circulation round the clock.
- Opening height and location adjusted to catch prevailing wind.

Energy management & Temperature control

- External walls 13’ thk constructed in modified rat trap and Joshi bond, having cavities which act as insulators.
- Normal temperature difference between inside and outside temperature is 6 to 8 degrees Celsius.
- Cavities in the masonry help to achieve temperature difference in indoor and outdoor conditions.
Energy management

• Openings to catch prevalent wind currents.
• Ucchwas in the form of 4 openings in the first floor slab provided for effective air circulation. Openings near the slab level ensures constant air movement.
• Perforated Compound Wall and Parapets to ensure constant air movement.

Energy management and Ergonomics

Kitchen cabinets with jali accommodated in window openings.

Kitchen free of insects and cockroaches.
Ergonomic Consideration in designing spaces
Energy management and waste disposal

Soil water line connected to bio gas plant generating gas for cooking

LIGHTING

- Effective orientation for Day lighting – indirect light allowed to enter with specific arrangement of louvers.

- Energy efficient light fixtures like CFL.

Eco Friendly Materials And Techniques

CEMENT BLOCKS

- (8” x8”) with 25% cement mortar and rest aggregate is used reducing quantity of cement used in the construction.

- 216 combinations are possible with these blocks
Techniques for Materials Efficiency

INVERTED SAUCER FOUNDATION

• reduces the quantity of concrete and so overall cost of the work.
• very economical
• equal in strength.
• Can be designed for use in all kinds of soil.

Efficient Construction Techniques

Use of Filler slab instead of regular RCC slab.

Conventional way of building this would have required 1000 kg steel, whereas only 425 kg steel is used in this building so, more than 50% saving in steel.
Recycle and Reuse

• Bio gas plant installed.
• Generating gas for daily supply
• Reuse of old wooden doors.

Eco-housing Program

• Initial Technical Assistance - United States Agency for International Development (USAID)

• Principal Implementing Agency - International Institute for Energy Conservation (IIEC)

• In Association with
  - National Institute for Advanced Studies in Architecture, (NIASA), Pune

• Technical Support
  – The Energy Resources Institute (TERI)
  – Rachana Sansad’s Institute of Environmental Architecture
  – Dr. Bhanuben Nanavati College of Architecture (BNCA)

• Review Credits 
  - Science and Technology Park (STP), Pune
  - Sustainable Building Technology Center (SBTC), Pune
Eco-housing Program

• **The focus** of the Eco-housing Programme is
  – to mainstream the sustainable design principles in residential building projects
  – institutionalize sustainable construction design and practices.

• **The objective** of the program is to scale up the use of energy and resource efficient technologies and practices in the residential sector. In order to achieve:
  – Lowered use of natural resource
  – Reduced ecological footprint

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Eco-housing Program – an Overview

- Eco-housing has been mentioned in the Maharashtra State Housing Policy, July 2007

- Incentivise Eco-Housing Projects through rebate in Municipal Taxes and Development Charges

- Pune Municipal Corporation has announced a significant rebate in the ‘premium’ charges levied by the local authority

- Version I of the criteria was developed specifically for Pune city by IIEC in association with the Science and Technology Park and The Energy Resources Institute (TERI) The criteria was then adapted to for Mumbai city by STP with the support of USAID and IIEC.
As part of the scale-up plan to expand the programme to other parts of the country, Version II of the criteria has been developed by IIEC for the five climatic zones of the country.

Eco-housing Program ...contd.....

- A voluntary five star rating and certification mechanism developed around the Eco-housing Assessment Criteria which serve as a baseline to quantify the environmental performance of projects.

- The criteria is applicable to all residential buildings/building complexes and single family residences.

- The criteria were finalized using a stakeholder consultative approach, which included the urban local body, developers, architects, financial institutions, NGO’s and educational institutions.
Technical Criteria - Rating

The technical criteria for the purpose of project rating

<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Total</th>
<th>% Distribution</th>
</tr>
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<tbody>
<tr>
<td>Site Planning</td>
<td>140</td>
<td>14%</td>
</tr>
<tr>
<td>Environmental Architecture</td>
<td>80</td>
<td>8%</td>
</tr>
<tr>
<td>Energy Conservation</td>
<td>240</td>
<td>24%</td>
</tr>
<tr>
<td>Efficient Building Materials</td>
<td>190</td>
<td>19%</td>
</tr>
<tr>
<td>Water Conservation</td>
<td>150</td>
<td>15%</td>
</tr>
<tr>
<td>Solid Waste Management</td>
<td>120</td>
<td>12%</td>
</tr>
<tr>
<td>Other innovative measures</td>
<td>80</td>
<td>8%</td>
</tr>
<tr>
<td>Total</td>
<td>1000</td>
<td>100%</td>
</tr>
</tbody>
</table>

Criteria – Points Distribution

- The Criteria have also been classified as Mandatory and Non Mandatory and General and Climate Specific.

- The Points Distribution is as below
The Eco-Housing Rating System

- The maximum achievable points are 1000 and the project has to get a minimum of 500 points to qualify for Eco-Housing rating.

<table>
<thead>
<tr>
<th>Points</th>
<th>Rating</th>
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<tbody>
<tr>
<td>500 - 600</td>
<td>*</td>
</tr>
<tr>
<td>601 - 700</td>
<td>**</td>
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<tr>
<td>701 - 800</td>
<td>***</td>
</tr>
<tr>
<td>801 - 900</td>
<td>****</td>
</tr>
<tr>
<td>&gt;900</td>
<td>*****</td>
</tr>
</tbody>
</table>

- The Eco-Housing rating system is based on the number of points earned. Greater the number of points achieved, higher the Eco-housing rating.

- Projects are rated from 1 Star to 5 Star

Role of National Institute of Advanced Studies in Architecture

- **Training and Capacity Building Program**
- Eco-housing Training programs) aimed at
  - Developers and Enablers i.e. Architects, Engineers, Landscape Consultants etc.
  - Financial Institutions and Policy makers
  - Users
- **The modules would cover**
  - Conceptual and technical understanding of the focus areas of Eco-housing Assessment Criteria
  - The Technical criteria
  - The Validation process and submittals
Role of National Institute of Advanced Studies in Architecture

- **Eco-housing Auditors** i.e. Experts to assess and certify building projects
- **Eco-housing Consultants** i.e. Consultants to guide the stakeholders for the implementation of the technical criteria, and generate the submittals for Eco-housing Certification.
- **Develop an Online assessment mechanism for certification** of “Eco-housing Auditors” and “Consultants”
- **Develop the training material** for all attributes under eco-housing criteria
- **Develop specialized courses** in sustainable design

Acknowledgement

- United States Agency for International Development (USAID)
- International Institute for Energy Conservation (IIEC)
- The Energy Resources Institute (TERI)
- Rachana Sansad’s Institute of Environmental Architecture
- Dr. Bhanuben Nanavati College of Architecture (BNCA)
- Science and Technology Park (STP)
- Sustainable Building Technology Center (SBTC)
- All other individuals and agencies who have directly or indirectly added their contributions to this effort.
Together let us create a greener world!