TERI and GRIHA’s initiatives towards greening India and the green practices that it champions for infrastructure sector

ACE TECH 2010

13th November 2010
Mili Majumdar, Director, Sustainable Habitat Division, TERI New Delhi
Sustainable habitats in India: Issues, approaches and way forward
TERI’s perspective

Regional Conference on Green Buildings: The GRIHA Approach
25th November, 2011

Mili Majumdar, Director, Sustainable Habitat Division, TERI New Delhi
India’s Urbanization

Population of India will reach from current 1.2bn to 1.4bn by 2025

By 2030, 40.8% (600mn) of India’s population will be living in urban areas compared to current 28.4%

India’s Population Growth

Population of India will reach from current 1.2bn to 1.4bn by 2025

By 2030, 40.8% (600mn) of India’s population will be living in urban areas compared to current 28.4%
Annual electricity consumption (611 Billion units) in India - sectoral break up: 2008-09

- Industrial: 46%
- Agriculture: 17%
- Domestic: 21%
- Commercial: 9%
- Traction: 2%
- Others: 5%
Current approaches to ensure sustainable urbanism and buildings

- Policy and regulatory approaches/National programs and plans
  - Environmental clearance
  - Energy Conservation building code
  - Mandates on green rating
  - National mission on sustainable habitats

- Voluntary and market driven approaches
  - Green building rating systems
  - Appliance labeling (partly mandatory)

Lack of integration and uniformity and clarity on application domain (e.g. ECBC does not talk about residential buildings); Environmental clearance is a nightmare for many builders; piecemeal approach results in islands of excellence in a sea of environmental chaos; implementation challenges
3 Initiatives to address issues holistically

iß Practice what you preach: own buildings and developments are shining examples of sustainable design

iß Integrating energy efficiency into building byelaws of Bangalore

iß Incentivising urban housing: National housing bank/kfW Bankgruppe programme
Efficient architecture

Low energy systems

Earth coupled cooling system
TERI-Retreat, Gurgaon

Root zone system
Gasifier

40% savings in energy costs; 100% waste water recycling and reuse

Solar PV
Solar thermal
First smart mini grid with solar PV, biomass gasifier and wind energy as sources of power.
TERI-Bangalore

Solar Wall
Solar Water Heating
Non Airconditioned
Daylit

Building consumes only 30kWh/sqm/annum
Facilitated over 75 green buildings/campus in the country
Knowledge replicated
Green interventions not limited to high end buildings.....
Silkworm rearing house: Bangalore

Thermal comfort requirement: Chawki room: 25 to 28 deg C with 70-90% RH

Rearing room: 23 to 25 deg C with 70-80% RH

Non uniform heating/cooling leads to loss in 50-70% of yield
Solar passive silkworm rearing house for enhanced productivity

Strategies for summer:
- Roof pond with insulation; Insulated wall and roof; Wall shading
- Solar chimney on south wall with adjustable vents (to improve ACH in the rearing room)
- Air Inlet from north wall covered with wet gunny bags for added humidity
Culminating into GRIHA....tool to engage, enable and measure
GRIHA-Green Rating for Integrated Habitat Assessment

Tool to facilitate design, construction, operation of a green building, and in turn .... measure “greenness” of a building in India

What gets measured gets managed
Synchronized with policies and programs

BEE program on implementation of ECBC, Star rated Appliances

Energy efficient design (ECBC + low energy/passive strategies)

GRIHA approach (combine ECBC with traditional wisdom and normative requirements of National Building Code)

Renewable Energy (solar hot water integration and solar PV integration)

Promote through several schemes of the MNRE
GRIHA Compliant Building: ECBC +

**ECBC Compliance:**
- Insulation
- High Performance glass
- Controls
- Efficient electrical, mechanical and lighting systems

Incremental cost: 15%
Payback period < 5 years

**GRIHA Compliance:**
- ECBC +
- Passive principles (shading, orientation, controlled glass area)
- Higher indoor design conditions (higher by 1 deg C)
- Optimized lighting design

No further incremental cost
Payback period: < 4 years
Integrating energy efficiency into building byelaws
Development of Policies, Regulations and Guidelines for Bangalore Municipality & Development Authority

Project aim: To develop policies, regulations, guidelines to achieve energy efficiency and promote renewable energy in both existing and new buildings in the city of Bangalore.

Beneficiary organization: Bangalore Development Authority (BDA) & Bhurat Bangalore Mahanagara Palike (BBMP)

Project outputs
- Policies, guidelines & regulations to achieve energy efficiency at building level.
- Financial mechanism for implementation of the framed policies & regulations.
- Web based tool for dissemination of project.
- Capacity building & education material.
Development of Energy Related Building Guidelines & Regulations for Bangalore City

The framework comprises of 9 Sections. These are mentioned below:

- Solar passive design integration in new buildings.
- Provide roof treatment to cut heat gains.
- Window design for day lighting, ventilation and to reduce solar heat gains.
- Energy Efficient Artificial lighting & Renewable energy based external lighting
- Energy efficient air conditioning design for buildings.
- Use of BEE labelled equipments and appliances to achieve energy efficiency in new and existing buildings.
- Solar water heating systems for residential and commercial buildings.
- Energy efficient electrical systems for building
- Perform mandatory energy audit for existing commercial buildings with connected load in cases of 500kW or 600KVA and reduce energy consumption by 20% over previous year.
Working with the BEE to integrate Energy efficiency and Energy Conservation Building Code in building byelaws nationwide......National Mission on Sustainable Habitat
Mainstreaming energy efficiency

National Mission on Sustainable Habitat
- Energy Efficiency in Residential and Commercial Sector
- Management of Municipal Solid Waste
- Promotion of Urban Public Transport

ECBC 2007, NBC 2005, GRIHA guidelines, LEED guidelines, TERI’s indigenous research
- Generic energy efficiency guidelines
- Climate specific guidelines
- Latitude specific guidelines for solar shading

Municipal building byelaws
Incentivising urban housing...promotional programme of the National Housing Bank
<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Benchmark</th>
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<tbody>
<tr>
<td>Calculate energy demand of residential buildings</td>
<td>Assessment</td>
</tr>
<tr>
<td>Case study viewer</td>
<td>Case studies</td>
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<tr>
<td>View different energy efficiency measures</td>
<td>Energy efficiency measures</td>
</tr>
<tr>
<td>Contact the participating organisations</td>
<td>Contact</td>
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The assessment tool structure
### Table - Electrical energy in kWh/m²yr:

<table>
<thead>
<tr>
<th>Address of project:</th>
<th>This building</th>
<th>Reference building</th>
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<tbody>
<tr>
<td>Internal lighting</td>
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<td>Common lighting</td>
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<tr>
<td>Parking lighting</td>
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<table>
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<td>Heating</td>
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<td>Ceiling fans</td>
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<tr>
<td>Appliances</td>
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<td>28.00</td>
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</table>

### Building parameters:

- **Building type:** Residential building
- **Total building area:** 5,174.00 m²
- **Climatic zone:** New Delhi
- **Created with:** EnEffResBuildIndia Version 0.9.1.0

### Consumption of electrical energy in kWh/m²yr:

- **This building:** 42 kWh/m²yr
- **Reference:** 61 kWh/m²yr

### Savings:

- **Savings:** 32%

### Qualitative parameters (0 out of 6 measures are applied in this building):

- Daylight area in the core area is 20% to 40%
- Presence detection or photo sensors for outdoor and security lighting
- Solar street lights
- Efficient transformers
- Efficient water pumps
- Tailored user manual

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**04.07.2011**

**Signature**
Energy Conservation Measures –

- Efficient Envelope Materials
- Efficient Lighting System
- Efficient AC system
- Solar Hot Water System

Annual Energy Consumption (kWh/sqm/yr)

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Efficient Envelope</th>
<th>Efficient Lighting</th>
<th>Efficient Air-conditioning</th>
<th>Solar Hot Water Systems</th>
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<td>(kWh/sqm/yr)</td>
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</table>
Some budgetary allocation by GoI for greener habitats

- 108 crores INR (USD 24 million) under National Mission on Sustainable Habitats

- MNRE and BEE has cumulatively proposed budgetary allocation of 325 crore INR (USD 72 million) for plan period of 2012-2017
Conclusion

- Sustainability is a goal that can be achieved with a holistic thinking
- Awareness and integrated approach yields maximum benefits
- Design driven approach over product driven approach
- Mainstreaming needs collective and progressive thinking
Thanks