Net Zero Buildings

Indian Green Building Council

16 February 2017
CII – Sohrabji Godrej Green Business Centre, Hyderabad, India

A unique Public – Private Partnership
(CII, Govt of Andhra Pradesh, USAID and Pirojsha Godrej Foundation)

India’s First Platinum Rated Green Building
Indian Green Building Council (IGBC)

- IGBC formed by CII in 2001
  - CII - Apex Indian industry association formed in 1895

- Vision of IGBC
  - Enable ‘sustainable built environment for all’
  - India to be one of the global leaders in sustainable built environment by 2025

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Green Building Movement in India

In 2001, 1 Green Building 20,000 sq.ft.

3,958 Green Building Projects
4.48 Billion sq. ft.

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Green Building Statistics of India

- **Green Building Footprint**
- 3,958 projects (4,480 Million sq.ft)

- **1,600+** Green Homes
- **250+** Green Factories
- **1,600+** Green Offices
- **45+** Green Townships
- **1** Green City
- **8** Green Villages

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IGBC Major Milestone

Four Billion Square feet
3950 + Projects Going Green

India stands 2nd in the World
IGBC’s initiatives – innovative and inspirational
Involvement of all stakeholders...
<table>
<thead>
<tr>
<th>Commercial</th>
<th>Health &amp; Wellbeing</th>
<th>Industrial</th>
<th>Built Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGBC Green New Buildings</td>
<td><strong>IGBC Green Healthcare Facilities Rating</strong>&lt;br&gt;<strong>IGBC Wellbeing Rating</strong>*</td>
<td>IGBC Green Factories&lt;br&gt;IGBC Green SEZ</td>
<td>IGBC Green Cities&lt;br&gt;IGBC Green Villages</td>
</tr>
<tr>
<td>IGBC Green Existing Buildings</td>
<td></td>
<td></td>
<td>IGBC Green Townships</td>
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<tr>
<td>IGBC Green Interiors</td>
<td></td>
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<td>IGBC Green Landscape</td>
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<tr>
<td>IGBC Green Campus</td>
<td></td>
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<tr>
<td>IGBC Green Data Centres</td>
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<tr>
<th>Residential</th>
<th>Education</th>
<th>Transit</th>
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<tbody>
<tr>
<td>IGBC Green Homes&lt;br&gt;IGBC Green Residential Society&lt;br&gt;IGBC Green Affordable Housing *</td>
<td>IGBC Green Schools</td>
<td>IGBC Green Metro Stations&lt;br&gt;IGBC Green Existing Metros&lt;br&gt;IGBC Green Railway Stations</td>
</tr>
</tbody>
</table>

**Only Green Building Council in the World to have 20 Different Ratings**
Rating programs aligned with:

MoEF
Government of India

BEE
Star Rating Programme

Energy Conservation Building Codes (ECBC)

National Building Code of India

IGBC Green Townships

IGBC Green Landscape

IGBC Green Homes

IGBC Green New Buildings

IGBC Green Schools

IGBC Green Factory Building
## Cost of Green Buildings - Indian Experiences

<table>
<thead>
<tr>
<th>Building</th>
<th>Year awarded</th>
<th>Built-in Area (sq.ft)</th>
<th>Rating Achieved</th>
<th>% increase in cost</th>
<th>Payback (Yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CII-Godrej GBC, Hyderabad</td>
<td>2003</td>
<td>20,000</td>
<td>Platinum</td>
<td>18 %</td>
<td>7 years</td>
</tr>
<tr>
<td>ITC Green Centre, Gurgaon</td>
<td>2004</td>
<td>1,70,000</td>
<td>Platinum</td>
<td>15 %</td>
<td>6 years</td>
</tr>
<tr>
<td>Wipro, Gurgaon</td>
<td>2005</td>
<td>1,75,000</td>
<td>Platinum</td>
<td>8 %</td>
<td>5 years</td>
</tr>
<tr>
<td>Technopolis, Kolkata</td>
<td>2006</td>
<td>72,000</td>
<td>Gold</td>
<td>6%</td>
<td>3 years</td>
</tr>
<tr>
<td>Spectral Services Consultants Office, Noida</td>
<td>2007</td>
<td>15,000</td>
<td>Platinum</td>
<td>8%</td>
<td>4 years</td>
</tr>
<tr>
<td>Kalpataru Square</td>
<td>2008</td>
<td>3,00,000</td>
<td>Platinum</td>
<td>2%</td>
<td>2 years</td>
</tr>
<tr>
<td>Suzlon One Earth, Pune</td>
<td>2010</td>
<td>8,00,000</td>
<td>Platinum</td>
<td>2%</td>
<td>2 years</td>
</tr>
</tbody>
</table>

*Cost showing a decreasing trend (18% in 2003 to 2% in 2008)*
## Benefits in IGBC Green Buildings

<table>
<thead>
<tr>
<th>Environmental Benefit Category</th>
<th>Average Benefits /Million Sq.ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ reduction</td>
<td>12,000 – 15,000 Tons</td>
</tr>
<tr>
<td>Energy savings</td>
<td>13,000 - 15,000 MWh</td>
</tr>
<tr>
<td>Water savings</td>
<td>43,000 - 45,000 KL</td>
</tr>
<tr>
<td>Construction waste diverted from landfills</td>
<td>400-450 Tons</td>
</tr>
<tr>
<td>Renewable energy, (Installed capacity)</td>
<td>5-6 MW</td>
</tr>
</tbody>
</table>
Approach to Net Zero

- Zero Energy
- Zero Water
- Zero Waste
- Zero Carbon
Net Zero Energy
Approach to Net Zero Energy

1. Orientation

2. Envelope measures
   - Wall, Glazing, Fenestration, Shading, Skylighting, Roof

3. Equipment & systems
   - Chiller, VFD, Lighting

4. Controls
   - BMS, Temperature, Humidity
1. Building Orientation

- Ideal building orientation
  - East - West

- Less radiation on North & East facade
  - Maximum openings for direct light

- Sun path diagram
  - Instrument for analysis & design of daylight in building
2. High Performance Envelope
Cavity Walls, Double Glazed Units & Living walls

- Reduced heat gain by design
- Significant energy savings
3. Equipment & systems

District Cooling System

- Centralised chilled water based HVAC System
  - High COP > 6.3
  - RMZ Ecospace, Kolkata

Radiant Cooling Technology

- 30-40% efficient than conventional air conditioning systems
  - Possible CoP : 8
  - Infosys, SDB-1, Pocharam campus, Hyderabad
4. Controls and BMS
Net-Zero Energy Buildings

Buildings will export power to grid

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1) Renewable Energy & Daylight

Solar Panels on South

North Lighting
2) Rooftop 1 MW Grid Integrated Solar PV*

Thyagaraj Sports Complex, New Delhi
IGBC’s Gold Rated

* Biggest Roof Top Solar PV at the time of installation

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3) Solar Farms

- Solar farm inside campus
  - Capacity: 300 kW
  - 18% of total energy need

Solar Farm in IMGEOS & NDEM Facility of ISRO, Shad nagar, IGBC Platinum

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4) Building Integrated Solar PVs

- Innovative use of canopy
  - Cuts off solar radiation from east
  - Building Integrated Photovoltaic capacity: 7.2 kW

Delta Power, Rudrapur
5) Solar Structures for Shading

Parking area shaded with Solar PVs

Solar PVs provided for charging electric vehicles
6) Solar Air-conditioning

- Entire building solar air-conditioned through Vapour absorption system
  - 90 TR hot water fired VAM system
    - Caters to 36,000 sq.ft
  - Reduction in HVAC electrical load of 117 kW

- In-situ wind turbine of capacity 5kW
7) Onsite Wind-Solar Hybrid

Suzlon One Earth, Pune
IGBC Platinum
8) Off-site Renewable Energy Investments

12.1 MW Wind Mill Installed at Thirunelveli & Theni, Tamil Nadu PPA for 40,00,000 kWh/Year equal to 50% of energy consumption by BGRT

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IGBC Certified Buildings: RE Systems Installed

- IGBC has facilitated over 8 MW of Renewable Energy till 2017!

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IGBC Certified
Net Zero Energy Buildings
1. MoEF’s Indira Paryavaran Bhawan, New Delhi
Net Zero Building – IGBC Platinum

- N-S Orientation – Limiting WWR
- Energy Demand & Supply:
  - Requirement: 14,21,000 kWh/year
  - RE Generation: 14,91,000 kWh/year
- Extremely Low Lighting Power Density – 0.5 W/sft
- Efficient HVAC with Screw Chillers, VFD’s
2. Gujarat Pollution Control Board (GPCB), Gandhinagar

Net Zero Building – IGBC Gold

**80 kW solar PV installed**

**Energy Demand & Supply:**

- Requirement: 42 MWh / year
- RE Generation: 40 MWh / year

First Government Green Building in Gujarat
3. Eco-Commercial Building, Greater Noida
Net Zero Building – IGBC Platinum

- **Area**: 20,000 sq.ft
- **Solar PV Capacity**: 56 kW
- **Energy Demand & Supply**:
  - Requirement: 79,000 kWh/year
  - RE Generation: 89,000 kWh/year
Energy Demand & Supply:

- Requirement: 79,000 kWh / year
- RE Generation: 89,000 kWh / year

Generates more Energy than required!
5. Sun Carrier Omega, Bhopal
Net Zero Building – IGBC Platinum

- **Energy Demand & Supply:**
  - **Requirement:** 114 MWh / year
  - **RE Generation:** 140 MWh / year

**Net Positive Energy Building**
6. Net Zero Home, Bhubaneswar
IGBC Platinum Rated
Net Zero Waste
Approach for Construction Waste Management

- Waste concrete for road laying
- Broken bricks
- Paint containers for reuse
- Packing wooden material
- Broken glass
- Cement bags
- Scrap steel
- AAC blocks

Reuse / Sale / Donation
Towards ‘Zero’ Solid Waste

- Solid waste management
  - Home / community level
  - Recycle waste based on Waste management hierarchy

Waste segregation at source = 80% of Treatment
Zero-solid Waste Discharge Site

- Entire organic waste treated and reused on-site

MoUD’s Residential Complex, New Moti Bagh, Delhi

- Solid Waste Management Plant
  - Bio degradable waste into fuel & compost

Pellet making machine

© Confederation of Indian Industry
GIFT City, Gandhinagar

AUTOMATIC COLLECTION, TRANSPORTATION AND SEGREGATION SYSTEM

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Net Zero Water
Approach to Reduced Water Demand

Water Efficient Fixtures

- Low flow fixtures
- Aerators
- Sensor based Fixtures

Low Flush Fixtures

- Dual Flush
- Sensor based Urinals
- Waterless Urinals
Towards Zero Water Discharge

❖ Invest on 100% Waste Water Treatment & Reuse

➢ 90% of treated water to be reused for Flushing, Public landscape irrigation & Agriculture.

❖ 100% On-site Rainwater Harvesting

➢ Reduces dependency on municipal water supply and improve water table
IGBC Headquarters, Hyderabad
India’s First Platinum Rated Green Building

- Zero water discharge
  - Recycling of 100% grey water reuse for agriculture

- 35% reduction on potable water use
  - High efficient fittings
  - Installation of waterless urinals

- Rain water harvesting
  - Collection pond at site
  - 8 Lakh litres capacity
Root Zone --> Phyto Remediation
Phytoremediation

- Investment Rs 50,000 per m³
- No operating cost
- Payback: 3 to 5 yrs
- Application
  - Domestic sewage
  - Industrial wastewater
  - Municipal wastewater
100% Wastewater treatment & Reuse

Hybrid – Water & Air cooled Chiller system
Effective usage of treated grey water

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Green Cities – The Future

Present:
Individual Buildings & Townships

Next:
Transit Facilities like Metro Rail

Future:
Entire City Green!

Cities to set example of Green & Smart Cities

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Green Building Congress 2017

Dates: 5 – 7 October 2017
Jaipur

We look forward to your participation in a major way
To Sum Up

- Green Buildings
  - Excellent opportunity to reduce operating costs from day one

- Tremendous benefits
  - Tangible & Intangible

- Long term benefits

“Green makes Business Sense”
“The best way to predict the future is to design it”
Buckminster Fuller