



Net Zero Buildings

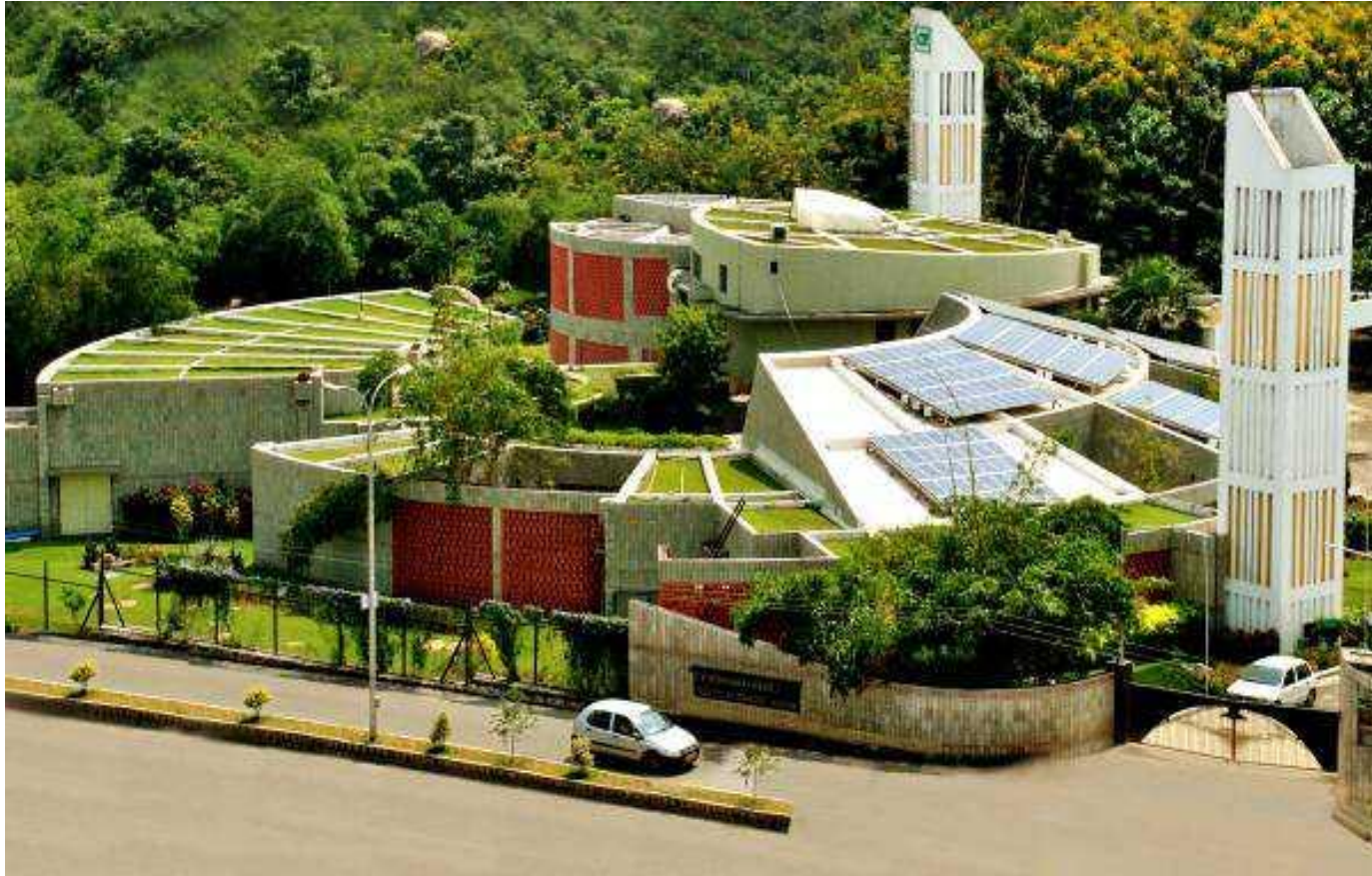
Indian Green Building Council

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

CII-Sohrabji Godrej Green Business Centre (IGBC HQ), Hyderabad, India



**Inaugurated by Dr A P J Abdul Kalam
Hon'ble President of India on 14 July 2004**

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Indian Green Building Council (IGBC)

❖ IGBC formed by CII in 2001

- CII - Apex Indian industry association formed in 1895

❖ Vision of IGBC

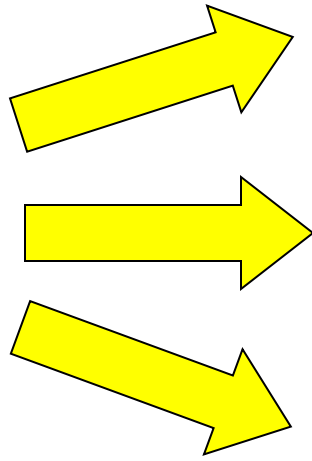
- Enable 'sustainable built environment for all'
- India to be one of the global leaders in sustainable built environment by 2025



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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Indian Green Building Council
Greening India since 2001

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**



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...**



IGBC Green Rating Systems

Commercial	Health & Wellbeing	Industrial	Built Environment
<p>IGBC Green New Buildings</p> <p>IGBC Green Existing Buildings</p> <p>IGBC Green Interiors</p> <p>IGBC Green Campus</p> <p>IGBC Green Data Centres</p>	<p>IGBC Green Healthcare Facilities Rating</p> <p>IGBC Wellbeing Rating*</p>	<p>IGBC Green Factories</p> <p>IGBC Green SEZ</p>	<p>IGBC Green Cities</p> <p>IGBC Green Villages</p> <p>IGBC Green Township</p> <p>IGBC Green Landscape</p>
	Residential	Education	Transit
	<p>IGBC Green Homes</p> <p>IGBC Green Residential Society</p> <p>IGBC Green Affordable Housing *</p>	<p>IGBC Green Schools</p>	<p>IGBC Green Metro Stations</p> <p>IGBC Green Existing Metros</p> <p>IGBC Green Railway Stations</p>

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 Townships
(For Townships & Large Developments)
Rating System
Pilot Version

Abridged Reference Guide

October 2013

IGBC Green Landscape

IGBC Green Landscape
Rating System
Pilot Version

Abridged Reference Guide
March 2013

www.igbc.in

IGBC Green Homes

IGBC Green Homes
Rating System
Version 2.0

Abridged Reference Guide
March 2011

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IGBC Green New Buildings
Rating System
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Abridged Reference Guide
July 2014

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Greening India since 2001

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Rating System
Pilot Version

Reference Guide
September 2014

Indian Green Building Council
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IGBC Green Factory Building
Rating System
Pilot Version

Abridged Reference Guide
July 2009

Cost of Green Buildings - Indian Experiences

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

❖ Cost showing a decreasing trend (18% in 2003 to 2% in 2008)

Benefits in IGBC Green Buildings

Environmental Benefit Category	Average Benefits /Million Sq.ft
CO₂ reduction	12,000 – 15,000 Tons
Energy savings	13,000 - 15,000 MWh
Water savings	43,000 - 45,000 KL
Construction waste diverted from landfills	400-450 Tons
Renewable energy, (Installed capacity)	5-6 MW

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

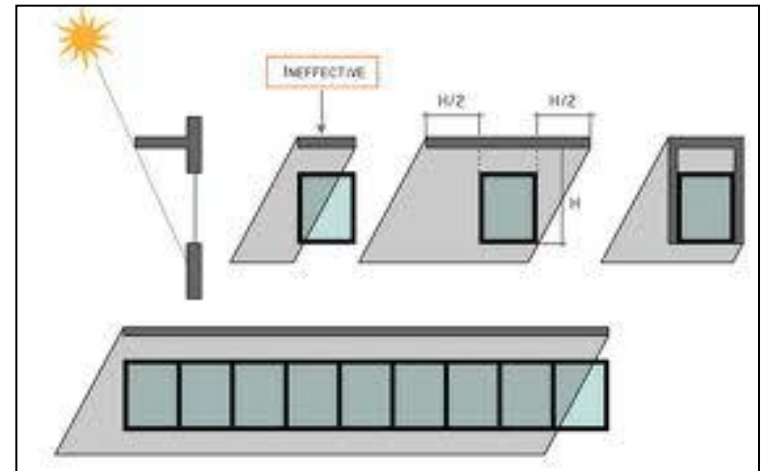
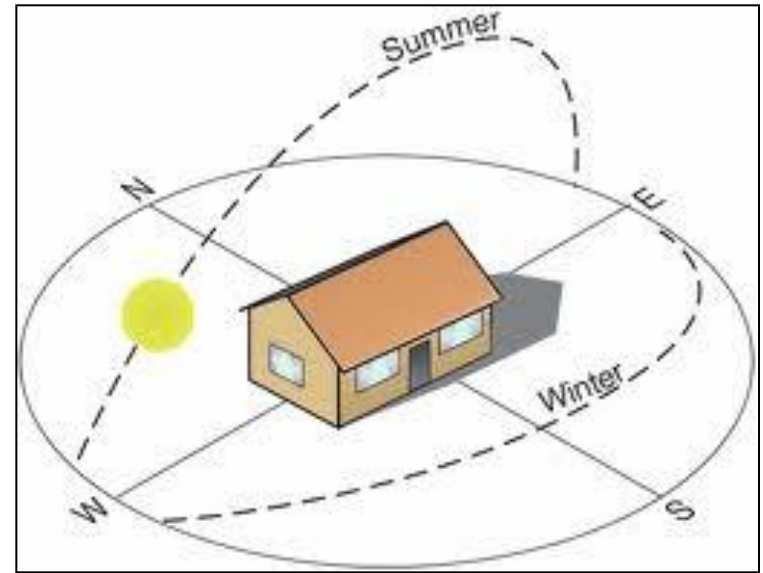
➤ **East - West**

❖ 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

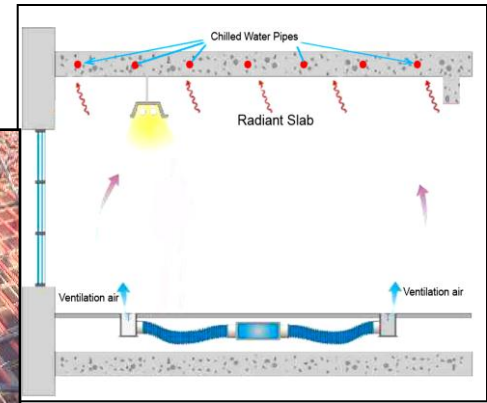


RMZ Ecospace, Kolkata

❖ **Centralised chilled water based HVAC System**

➤ **High COP > 6.3**

Radiant Cooling Technology

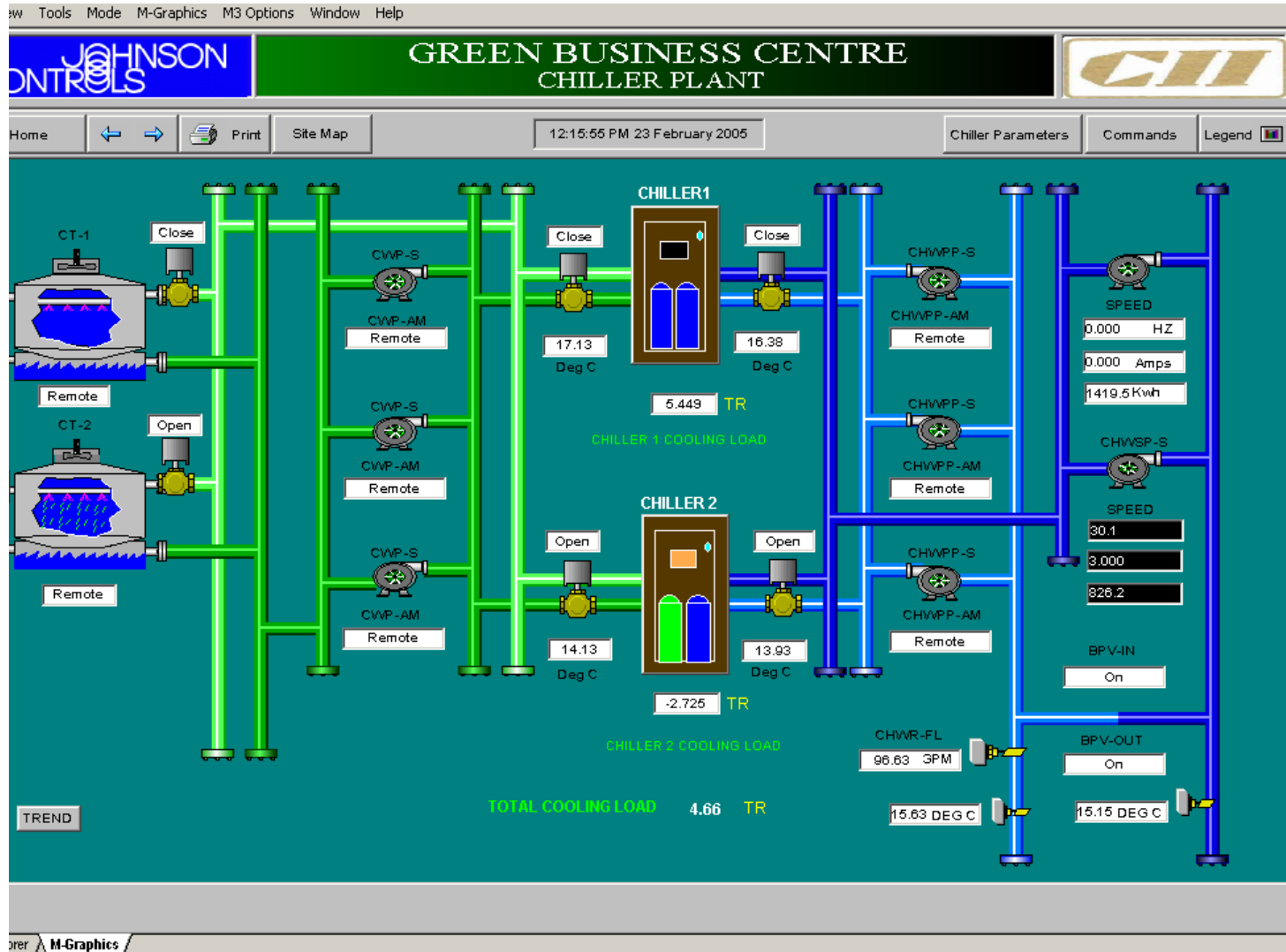


Infosys, SDB-1, Pocharam campus, Hyderabad

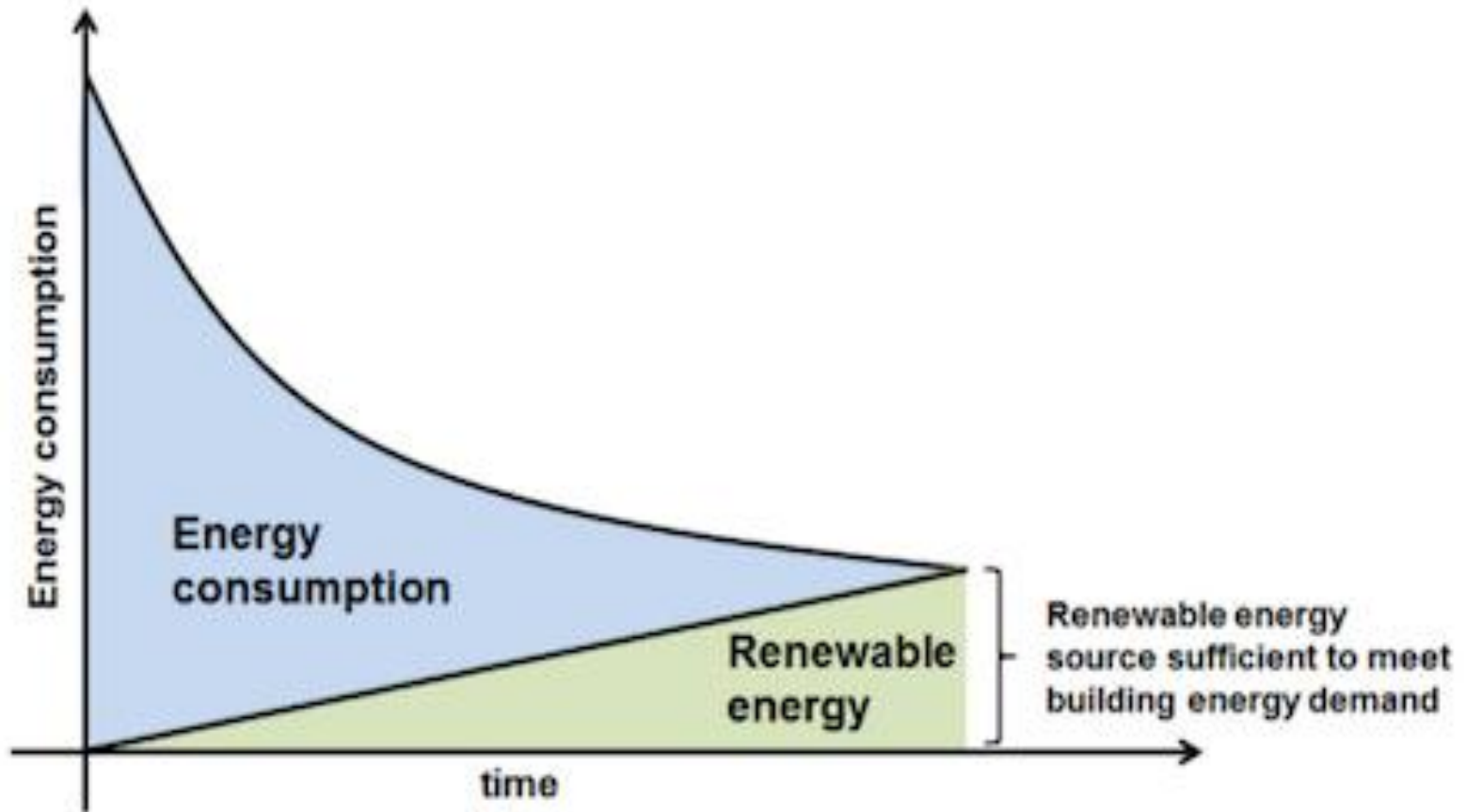
❖ **30-40% efficient than conventional air conditioning systems**

➤ **Possible CoP : 8**

4. Controls and BMS



Net-Zero Energy Buildings



Buildings will export power to grid

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**

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



4) Building Integrated Solar PVs



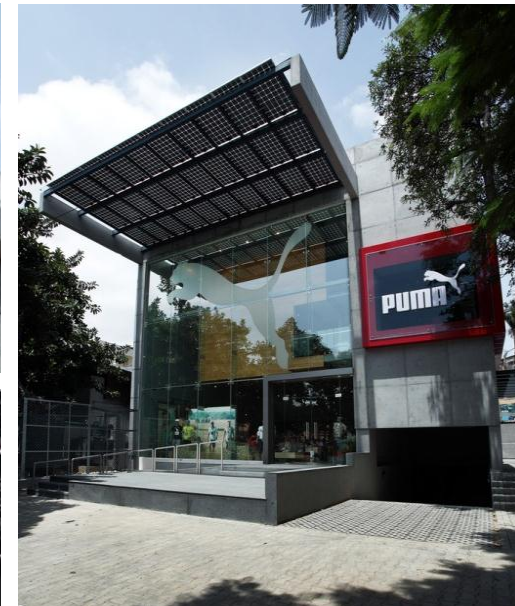
❖ Innovative use of canopy

- Cuts off solar radiation from east
- Building Integrated Photovoltaic capacity:

7.2 kW



Delta Power, Rudrapur

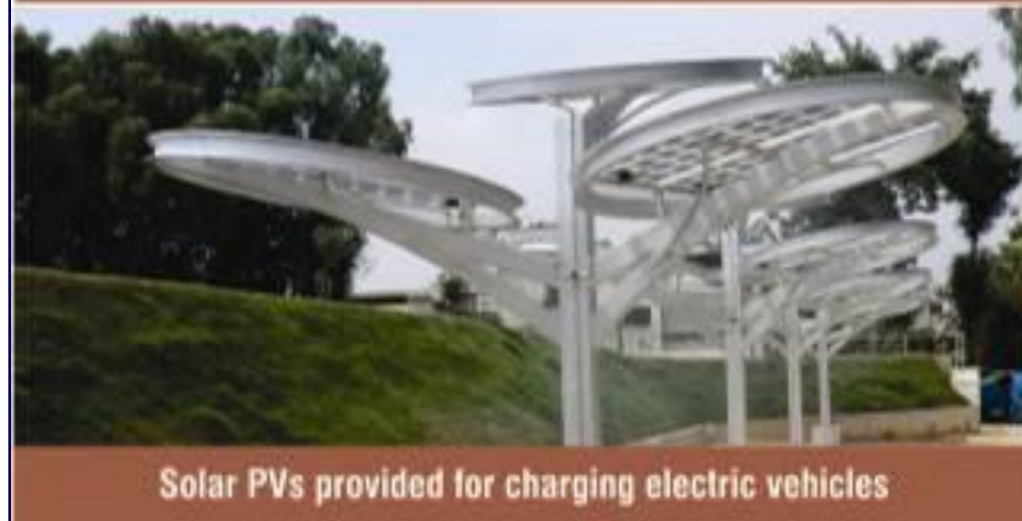


Innovative use of canopy in PUMA, Bangalore –
IGBC Platinum

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5) Solar Structures for Shading



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



Turbo Energy Limited, Chennai – Platinum rated

© Confederation of Indian Industry

7) Onsite Wind-Solar Hybrid



Suzlon One Earth, Pune
IGBC Platinum



8) Off-site Renewable Energy Investments



Bearys Golden Research Triangle, Bangalore
Platinum Rated

**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

Solar Photovoltaic



Danfoss Industries Pvt Ltd - Production Buildings
Chennai - IGBC Platinum



IDBI, Mumbai
IGBC Gold



REVA Administrative Block, Bangalore
IGBC Platinum

Micro Wind Turbine



Suzlon One Earth, Pune- IGBC Platinum



Oval Nest, Pune- IGBC Platinum



Building Integrated Photovoltaic



Canopy in PUMA, Bangalore
IGBC Platinum



Indian Railways Institute of Civil Engineering
Pune - IGBC Platinum



Delta Power Solutions Pvt Ltd
Rudrapur - IGBC Gold

Solar Air-conditioning



Turbo Energy Limited, Chennai



Net Zero Buildings



MoEF's Indira Paryavaran Bhawan
New Delhi - IGBC Platinum



New Paryavaran Bhawan of GPCB
Gandhinagar - IGBC Gold



Eco Commercial Building, Noida - IGBC Platinum



Sun Carrier Omega, Bhopal - IGBC Platinum

❖ **IGBC has facilitated over 8 MW of Renewable Energy**

till 2017!



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



New Paryavaran Bhavan, Gujarat Pollution Control Board (GPCB), Gandhinagar

❖ **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**



Eco-Commercial Building, Greater Noida



Installation of Solar PVs

4. Bayer's Eco Commercial Building, Noida

Net Zero Building – IGBC Platinum



Bayer's Eco Commercial building, Noida

❖ 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



Sun Carrier Omega, Bhopal

❖ Energy Demand & Supply :

- Requirement : 114 MWh / year
- RE Generation : 140 MWh / year



Net Positive Energy Building



6. Net Zero Home, Bhubaneswar IGBC Platinum Rated



Indian Green Building Council
Greening India since 2002

© Confederation of Indian Industry



Net Zero Home, Bhubaneswar

IGBC Platinum Rated



Net Zero Waste



Approach for Construction Waste Management

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



❖ **Reuse / Sale / Donation**

Towards 'Zero' Solid Waste

❖ Solid waste management

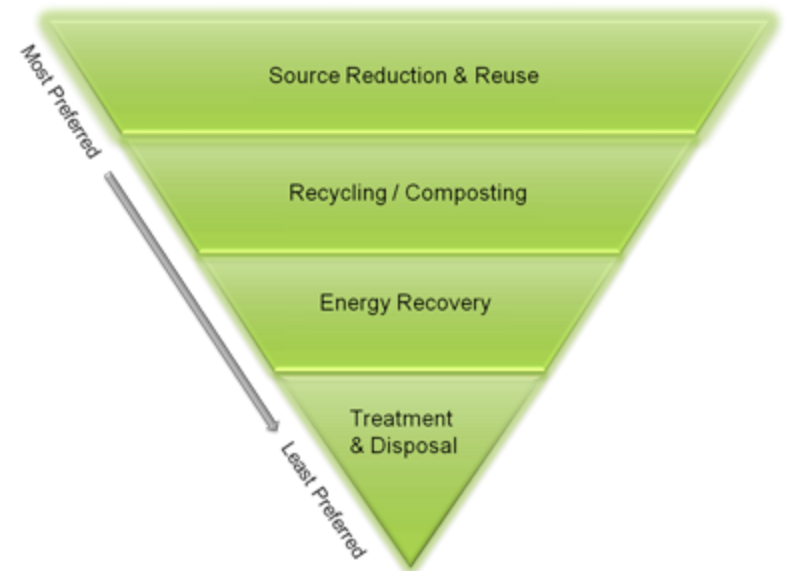
- Home / community level
- Recycle waste based on Waste management hierarchy



Segregation at source



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**

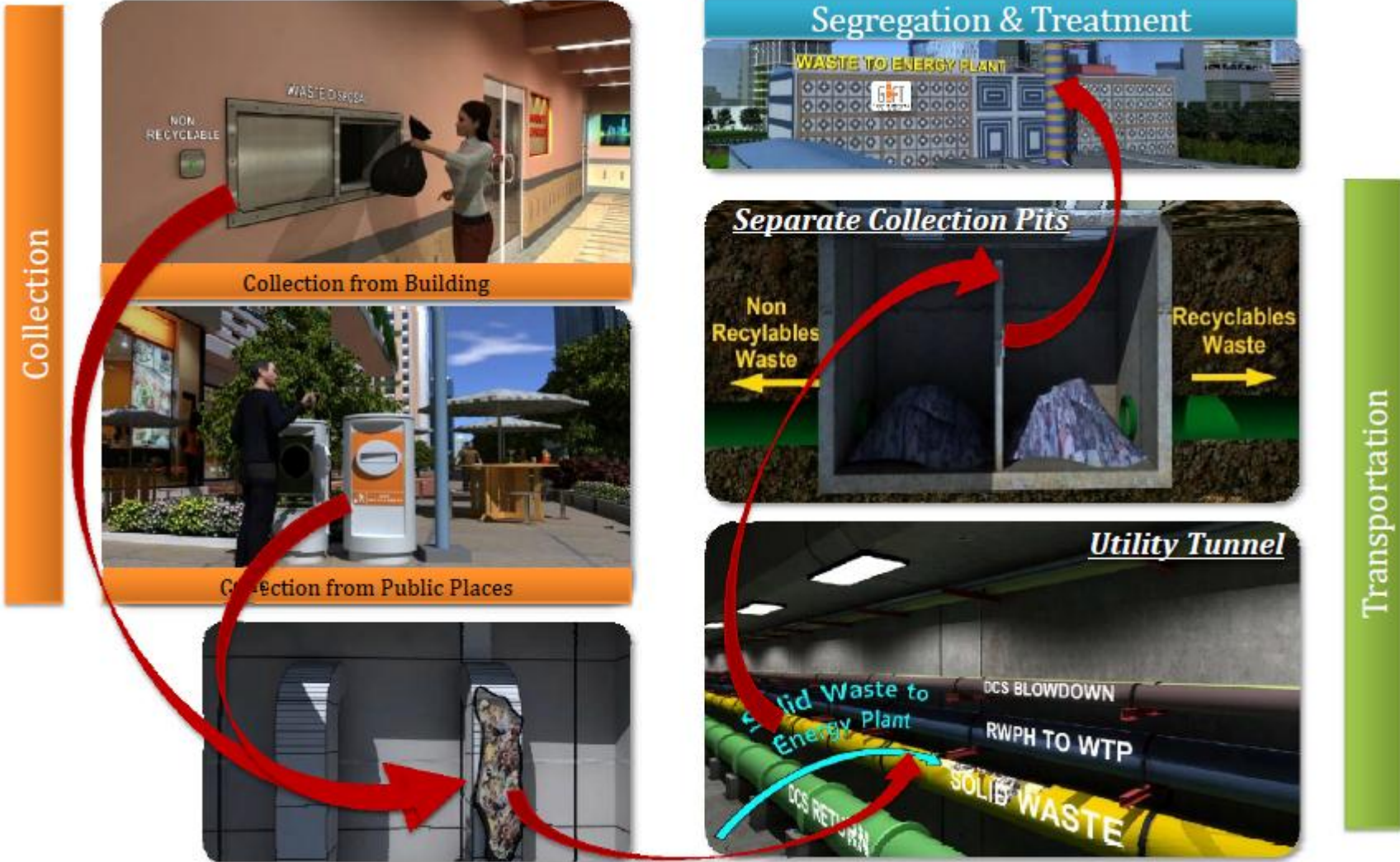
- **Bio degradable waste into fuel & compost**



Pellet making machine

GIFT City, Gandhinagar

AUTOMATIC COLLECTION, TRANSPORTATION AND SEGREGATION SYSTEM



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.



Purple lines to convey treated water

❖ 100% On-site Rainwater Harvesting

- Reduces dependency on municipal water supply and improve water table



Rain water harvesting Pond

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**



IGBC Headquarters, Hyderabad
India's First Platinum Rated Green Building

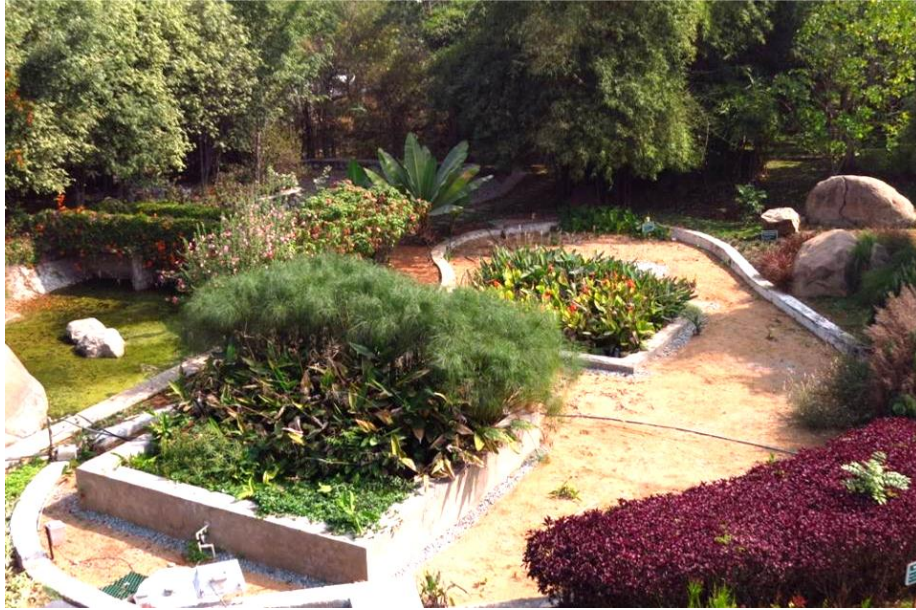
Root Zone --→ Phyto Remediation



CII – Sohrabji Godrej Green Business Centre
Hyderabad



Phytoremediation



CII Sohrabji Godrej Green Business Centre



Commissioner of Industries, Hyderabad

- 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



Cooling requirement for HVAC Make-up



Irrigation



Dual Plumbing Lines

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



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



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"

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Live



Learn



Work



Shop



"The best way to predict the future is to design it"

Buckminster Fuller

Play



Travel





Go Green . . .

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