
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

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Decentralized Electricity Solutions
Environment Education & Youth Services
Energy Environment Technology Development
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Sustainable Habitats
Water Resources
Bio-Technology & Bio-Resources
Resources Regulation & Global Security
Modeling & Economic Analysis

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Industrial Energy Efficiency
Sustainable Development Outreach
Social Transformation



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

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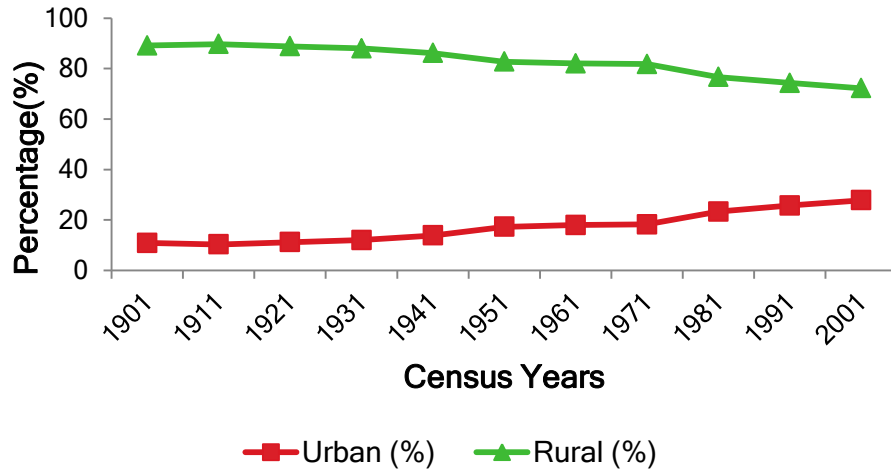
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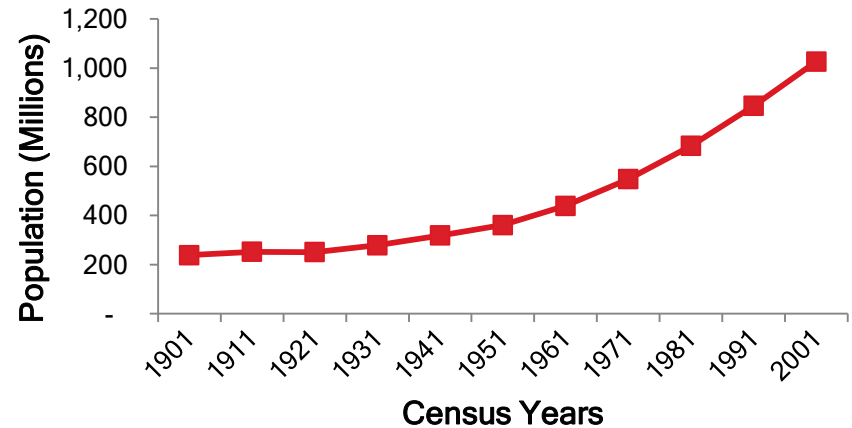
Urbanization & Population Growth

India's Urbanization

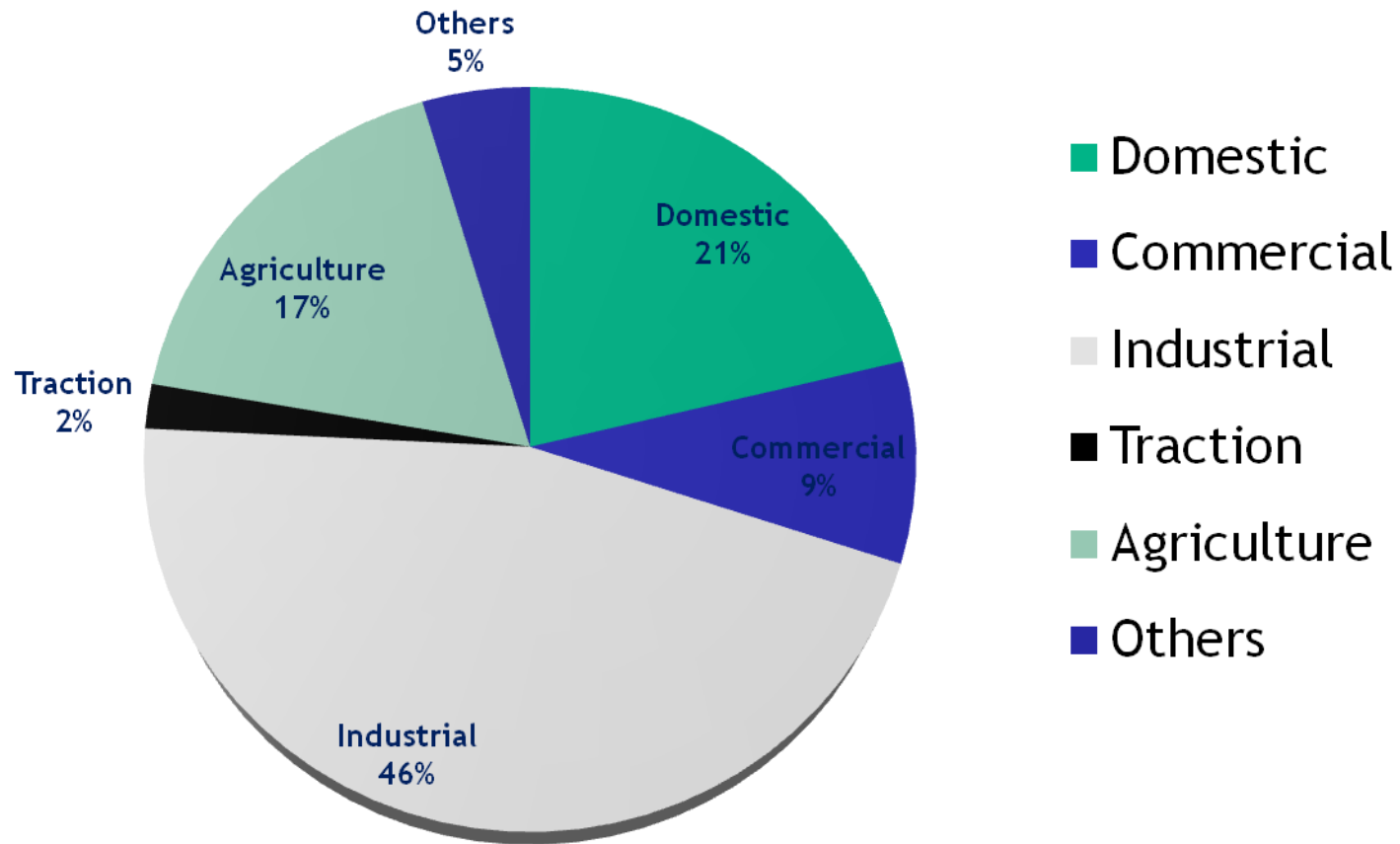


- Population of India will reach from current 1.2bn to 1.4bn by 2025
- By 2030, 40.8% (600mn) of India's population will be living in urban areas compared to current 28.4%

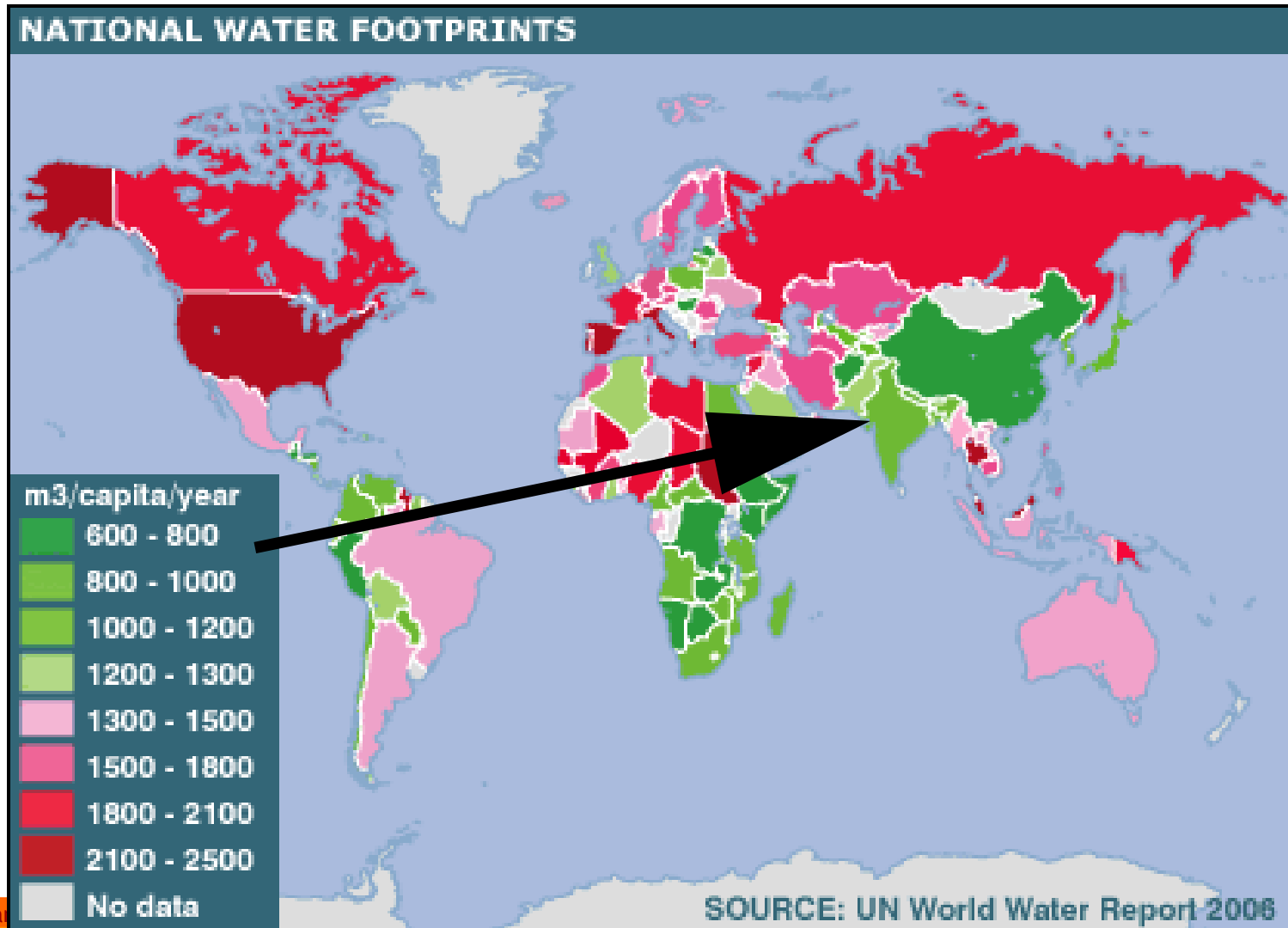
India's Population Growth



Annual electricity consumption(611 Billion units) in India-sectoral break up:2008-09



WATER



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

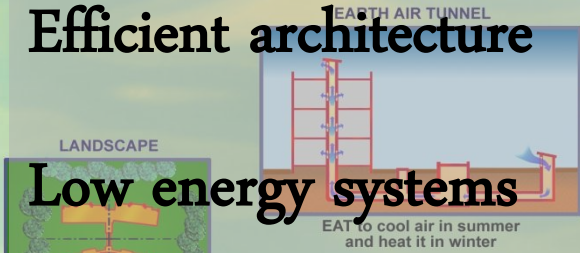
3 Initiatives to address issues holistically

- Practice what you preach: own buildings and developments are shining examples of sustainable design
- Integrating energy efficiency into building byelaws of Bangalore
- Incentivising urban housing : National housing bank/kfW Bankgruppe programme

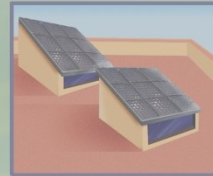
ENERGY EFFICIENT SUSTAINABLE HABITAT, TERI-Retreat,

PASSIVE SPACE CONDITIONING

Efficient architecture



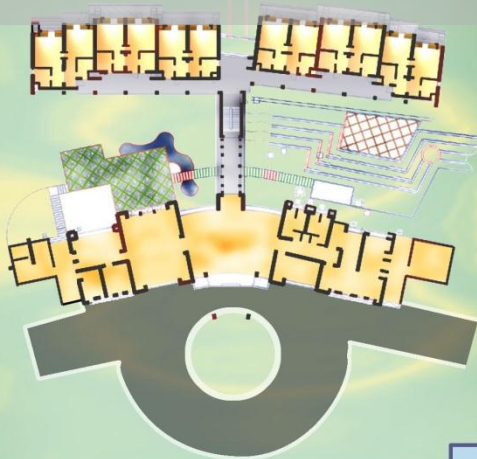
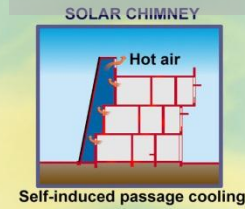
PHOTOVOLTAIC MODULES



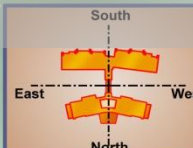
Low energy systems

Earth coupled cooling system

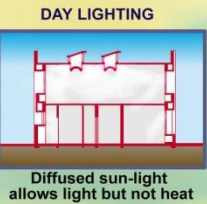
High trees on east and west side to reduce solar radiation. Deciduous trees on south side to allow winter sun



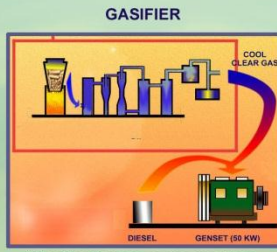
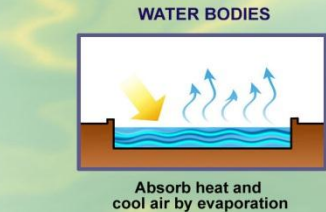
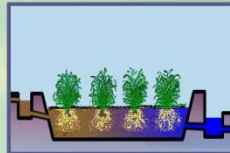
SOLAR ARCHITECTURE



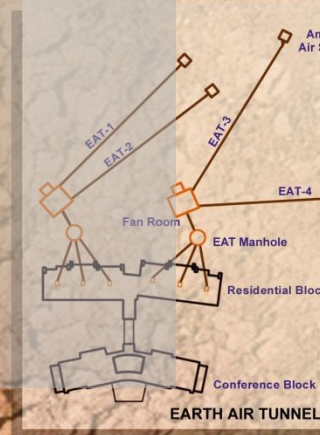
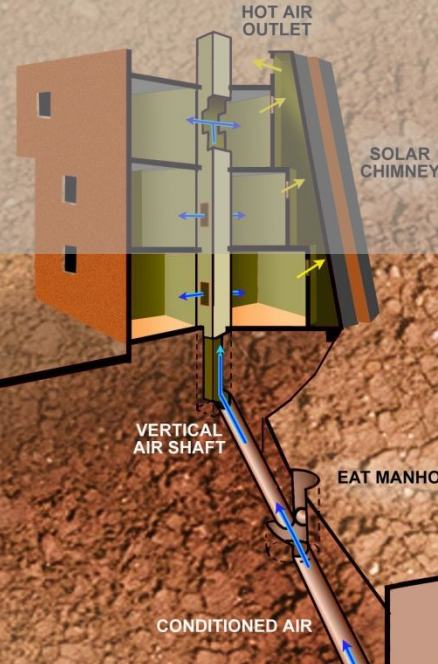
HOT WATER SOLAR PANELS



ROOT ZONE



teri
SUSTAINABLE HABITAT AT GUALPAHARI



HEATING OF AIR IN WINT
AND COOLING OF AIR IN
BY CONDITIONING AIR TI
NETWORK OF UNDERGR

TERI-Retreat, Gurgaon



Root zone system



Gasifier

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



Solar PV



Solar thermal

TERI's Smart Mini-Grid at the RETREAT

First smart mini grid with solar PV, biomass gasifier and wind energy as sources of power



Loads Served: Lighting, Computers, Kitchen

Total Load



8.5 kW

Total Resources



9.5 kW



Available Resources

Solar

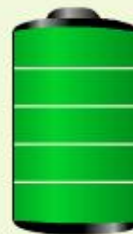


8 kW

Wind



1.5 kW



Biomass



0 kW

Diesel



0 kW

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

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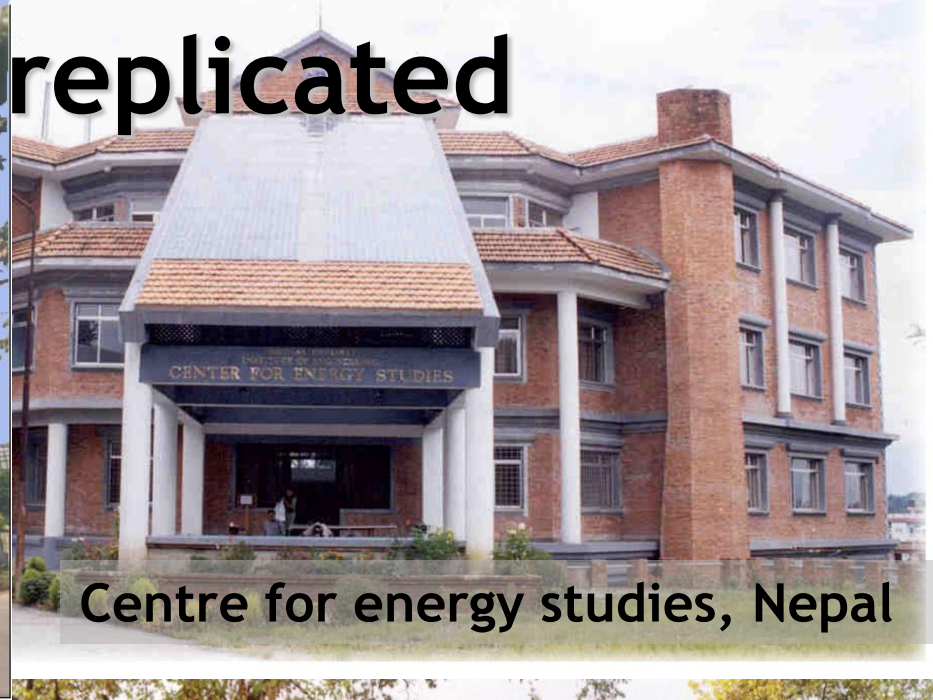
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Knowledge replicated



WBPCB Building, Kolkata



Centre for energy studies, Nepal



WBREDA office, Kolkata



Laboratory building, IIT Kanpur

Green interventions not limited to high end buildings.....

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Silkworm rearing house: Bangalore

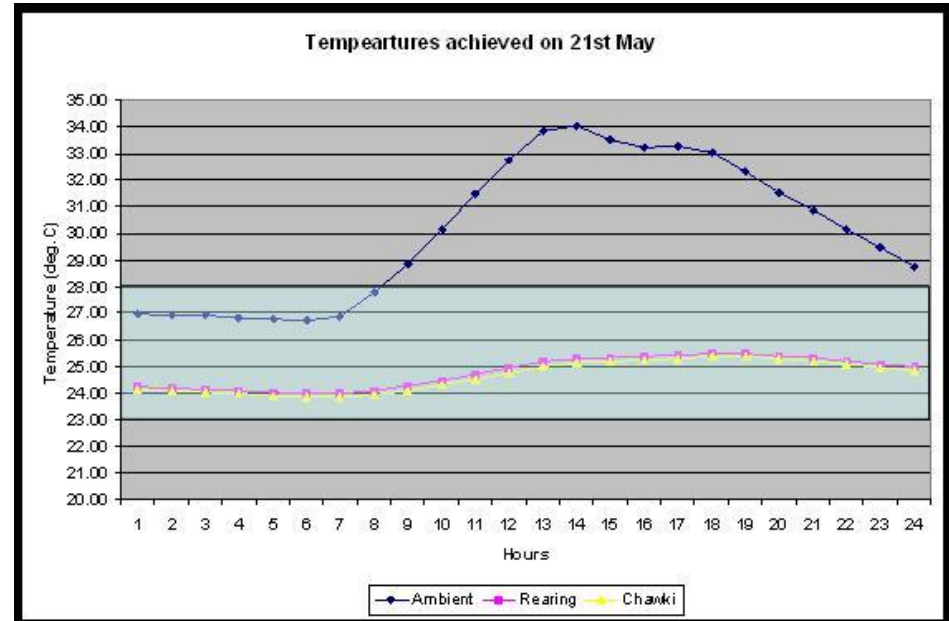


Thermal comfort requirement: Chawki room: 25 to 28 deg C with 70-90% RH

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

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GRIHA-Green Rating for Integrated Habitat Assessment

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



What gets measured gets managed

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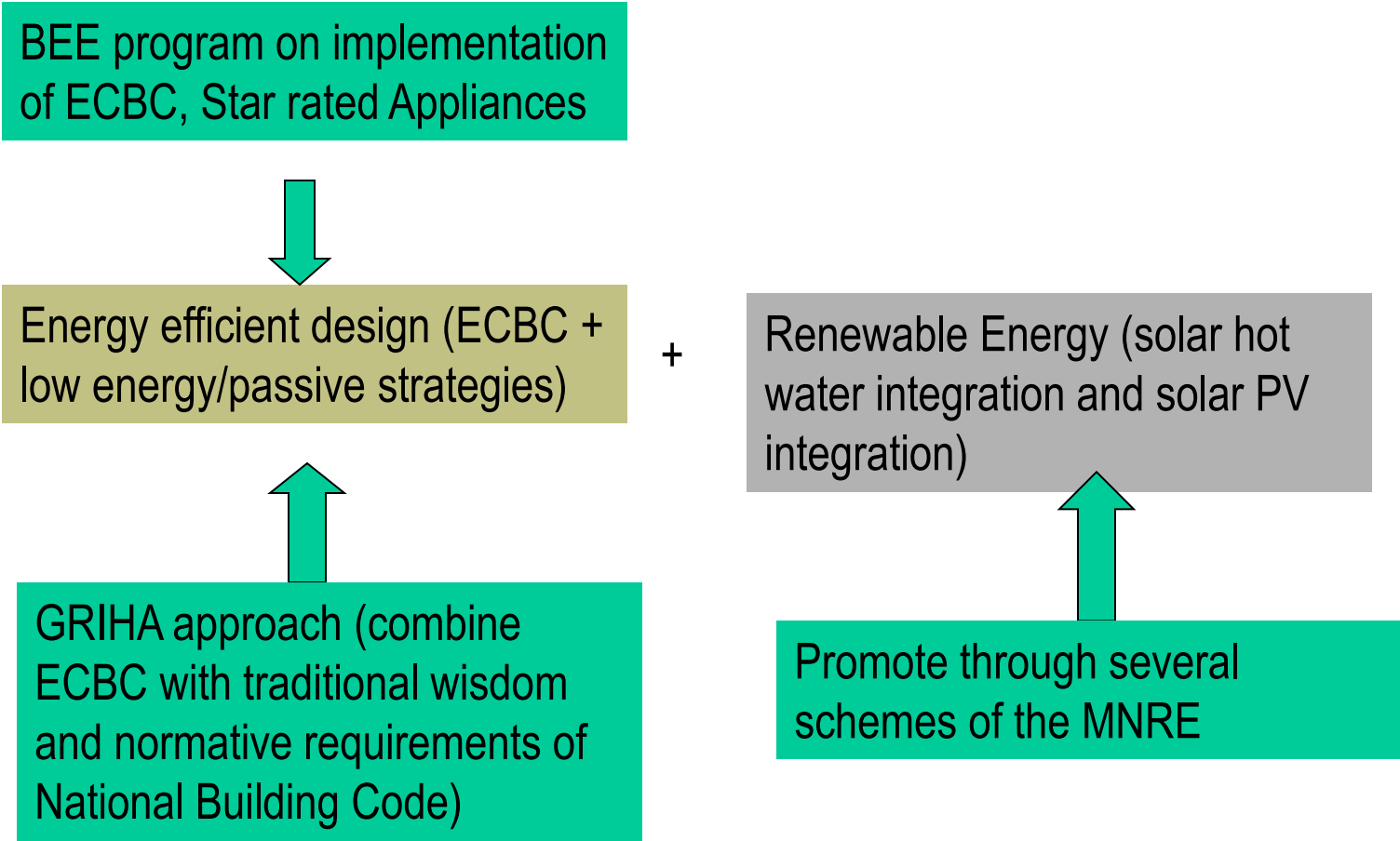
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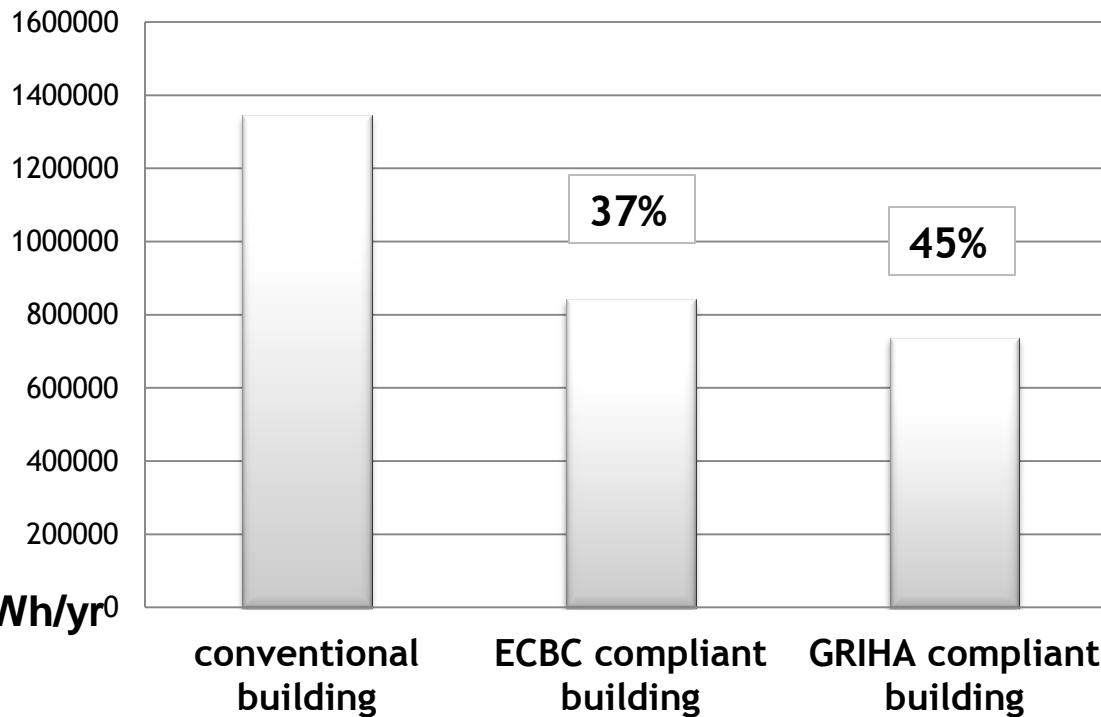


Synchronized with policies and programs



GRIHA Compliant Building: ECBC +

Energy saving potential in a ECBC and GRIHA compliant building



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

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Development of Policies, Regulations and Guidelines for Bangalore Municipality & Development Authority



Vidhana Soudha in Bangalore, is the seat of the state legislature of Karnataka

- **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.

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Working with the BEE to integrate Energy efficiency and Energy Conservation Building Code in building byelaws nationwide.....National Mission on Sustainable Habitat

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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

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The IT Toolkit entrance

IT Toolkit EnEff:ResBuild India

File Navigation Help



Benchmark

Benchmark

Calculate energy demand of residential buildings

Assessment

Case study viewer

Case studies

View different energy efficiency measures

Energy efficiency measures

Contact the participating organisations

Contact

Start | Fußball - ZDF.de Sp... | ZDF.de - Bundesliga... | E:\Hans\KfW Indien\... | Assesmenttool in the... | 2010-12-02_321117... | IT Toolkit EnEff:Re... | 18:20

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The assesment tool structure

IT Toolkit EnEff:ResBuild India - New Project

File Variants Visibility Navigation Help



Toolkit for energy efficient residential buildings in India

Navigation

- Project
- Generate the building
- Building area and paramet...
- Building envelope
- Lighting
- Space cooling systems
- Space heating system...

Show which results

Which energy type to show

Final Energy (Electricity)

Related To

Floor area

Sample building

Apartment type

2 BHK

Select sample building:

2 BHK apartments A

Number of storeys:

12

Rotate floor plan:

North



Generate building

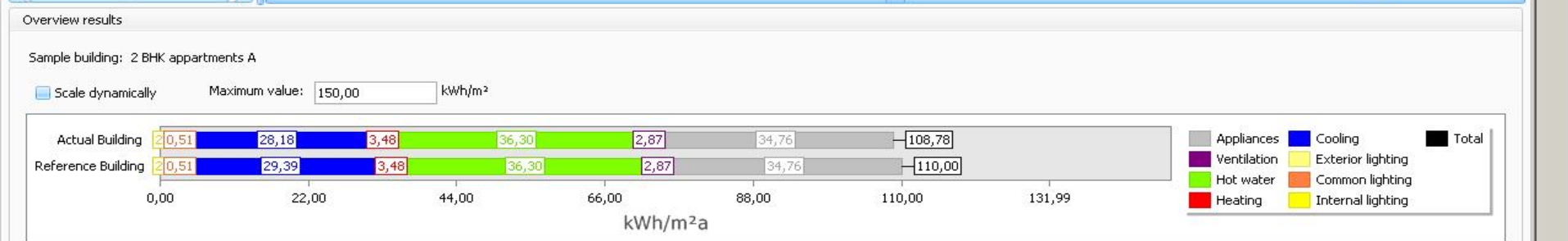
Building sample pictures



Floor plan

Information

Sample building and geometry



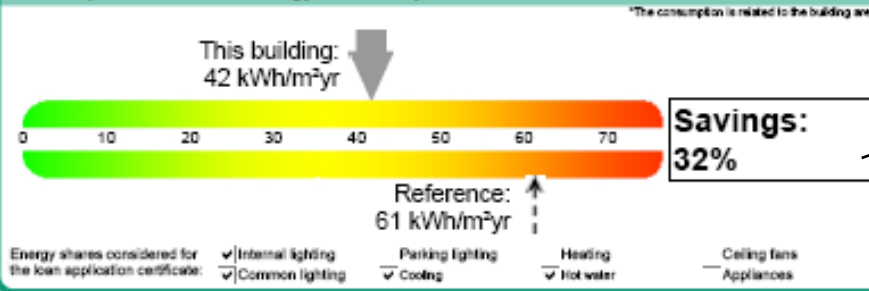


Project: Sahara

Building:

Address of project:	Table of results - Electrical energy in kWh/m ² yr:		
		This building	Reference building
	Internal lighting	12,81	12,81
	Common lighting	1,54	1,54
	Parking lighting	0,00	0,00
Occupant/Owner:	Cooling	20,27	35,80
	Heating	3,25	3,25
	Hot water	6,97	11,16
	Ceiling fans	1,74	1,74
	Appliances	28,00	28,00
Building parameters:			
Building type:	Residential building		
Total building area:	5.174,00 m ²		
Climatic zone:	New Delhi		
Created with:	EnEffResBuild:India Version 0.9.1.0		

Consumption of electrical energy in kWh/m²yr:



Savings from various ECMs

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

<input type="checkbox"/> Daylit area in the core area is 20% to 40%	<input type="checkbox"/> Presence detection or photo sensors for outdoor and s
<input type="checkbox"/> Solar street lights	<input type="checkbox"/> Efficient water pumps
<input type="checkbox"/> Efficient transformers	<input type="checkbox"/> Tailored user manual

Issue:

04.07.2011

Date

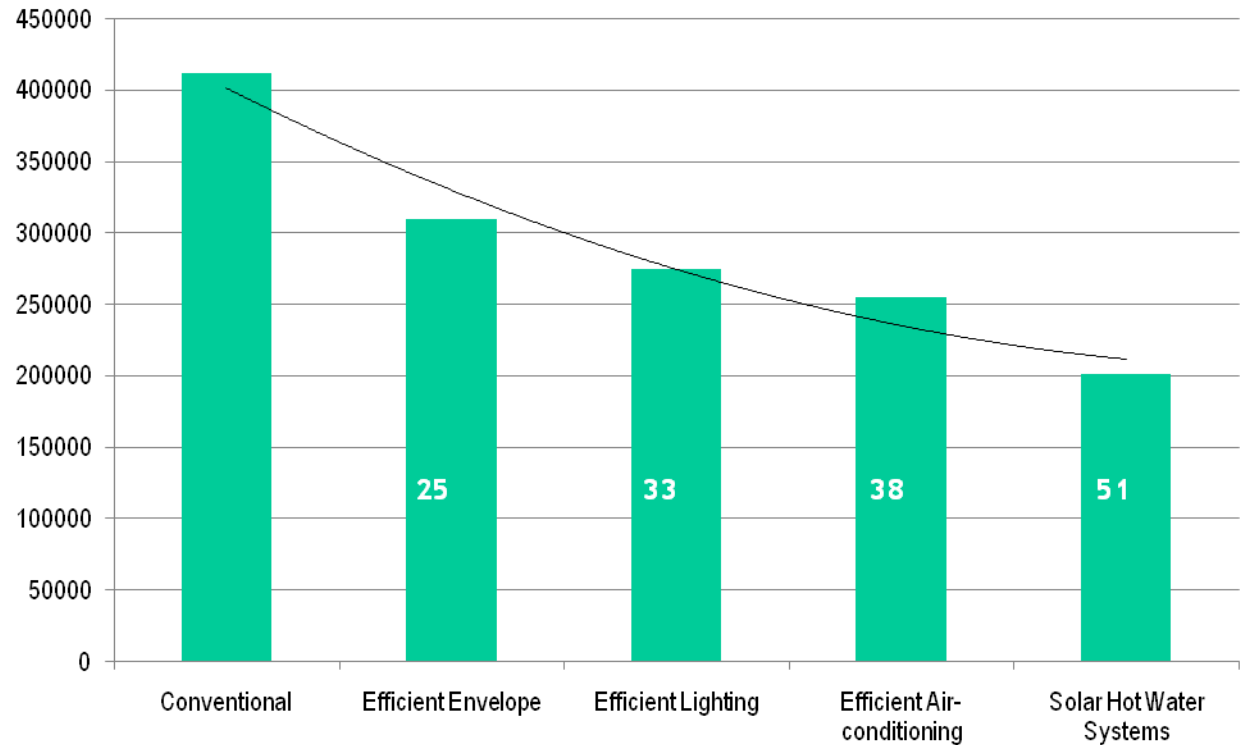
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Signature



Saving potential

Annual Energy Consumption (kWh/sqm/yr)



Energy Conservation Measures –

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

Some budgetary allocation by Govt 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

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