Programs and policies on sustainable habitat: Indian perspective

German Indian sustainability and climate change dialogue
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Building sector poses environmental challenges


Construction sector contributes to 12% of India's GDP and growing at 9.2%
Residential/commercial sector accounts for >30% of total electricity consumption
Domestic water consumption is 30 billion m³ and projected increase to 111 billion m³ by 2050

In next five years….

Projected growth of real estate sector

- 20 million dwelling units (7 million in urban)
- 19 million sq m of commercial space
- 13 million sq m of retail space in 526 malls
- 50,000 hotel rooms

Policies/programs to mainstream green construction

Energy Conservation Act 2001 enacted

Energy Conservation Building Code (ECBC)2007 launched

Appliance labeling launched

Ministry of Power/Bureau of Energy Efficiency empowered to mandate ECBC

Environmental Clearance from the Ministry of Environment and Forests/State Environment Impact Assessment Authority mandatory for all large constructions

Resource(energy,water) efficiency integral part of clearance

Convergence is crucial to implementation and mainstreaming

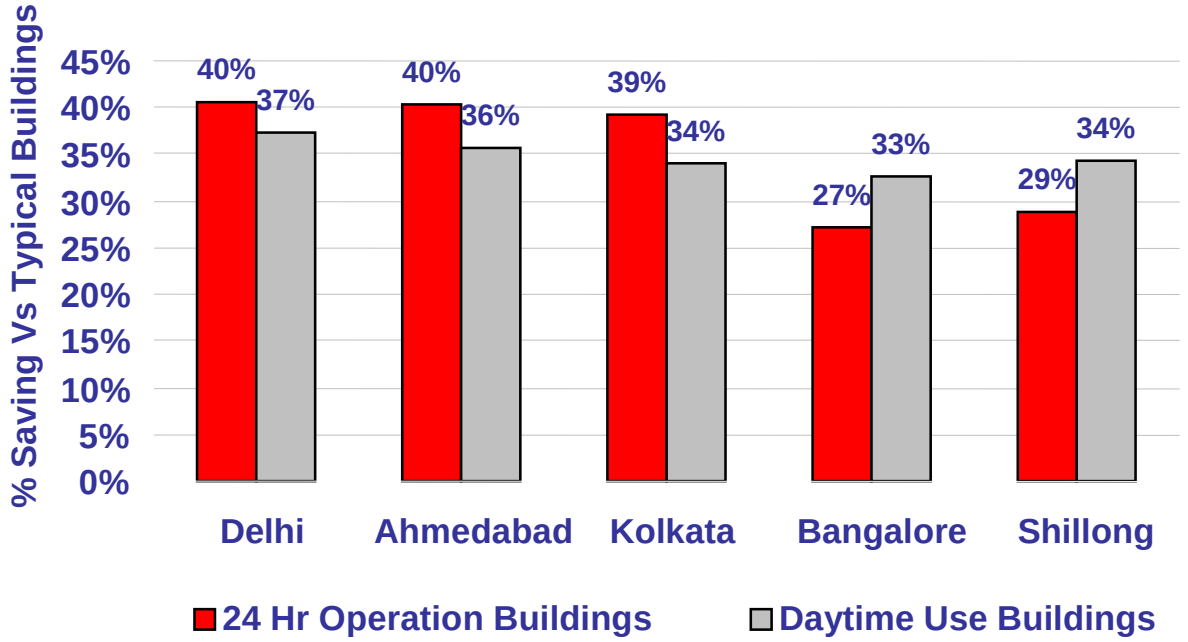
Ministry of New and Renewable Energy Sources incentivises energy efficient buildings through its **solar buildings program**

National green building rating system being launched

National Action Plan on Climate Change

Mission on Sustainable Habitat

ECBC: 25%-40% Reduction in Building Energy Use(commercial buildings)



National Energy Savings	=	Code Stringency	X	Level of Compliance	X	Adoption Rate

- First Cost Impact, Payback Periods, HVAC system sizing impact

Slide courtesy: Tanmay Tathagat, IIEC

Energy Saving potential of labeled appliances

S. No.	Particulars	Refrigerators (Frost Free)	Refrigerators (Direct Cool)	Refrigerators (All)	TFL	ACs	Ceiling Fans (1200 mm)	Motors (<15k W)	Total (Without CFL)	CFL
1.	No. of products currently in use (Million) (31 December 2005)	5.5	22.5	28	338	7.09	67	1.68		108
2.	Total energy use by the products (Million kWh/Year) (2005-06)	3500	7300	10800	31202	8447	15075	24988	90512	2464
3.	Contribution to demand (MW) (2005-06)	716	1493	2209	6383	1728	3084	5112	18516	504
4.	Current Annual Sales (Million/Year)	1.04	2.82	3.86	195	1.3	16	0.36		57
	Energy Savings Potential									
5.	2007 (Million kWh/Year)	50	119	169	325	34	3365	314	4207	3016
6.	2011 (Million kWh/Year)	674	1136	1810	674	479	9747	974	13684	4644
7.	2015 (Million kWh/Year)	3153	3235	6388	1397	2071	23698	3051	36605	8122
8.	2020 (Million kWh/Year)	9436	8166	17602	3476	8682	48408	6455	**84623**	**13081**
	Demand Saving Potential (MW)									
9.	**2007**	10	24	35	66	7	688	64	860	617
10.	**2011**	138	232	370	138	98	1994	199	2799	950
11.	**2015**	645	662	1307	286	424	4848	624	7489	1662
12.	**2020**	1930	1671	3601	711	1776	9903	1320	**17311**	**2676**

Energy saving measures in residential buildings

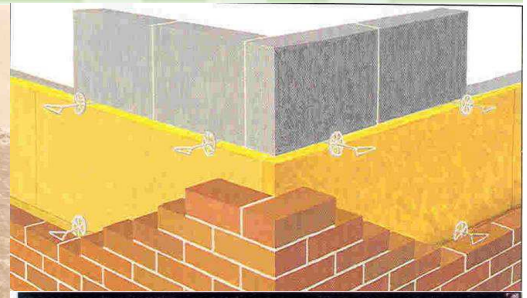
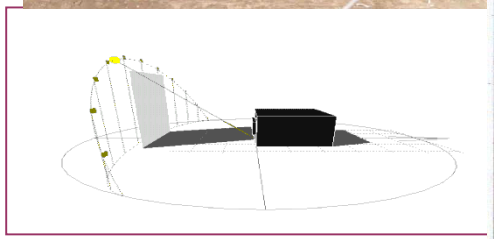
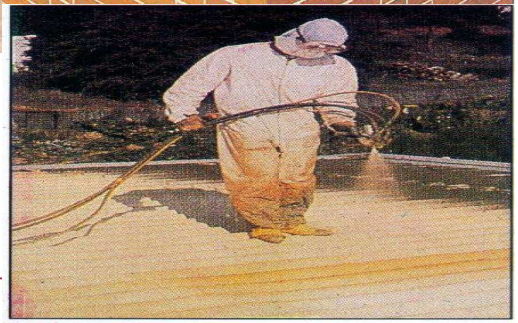
30% energy savings potential

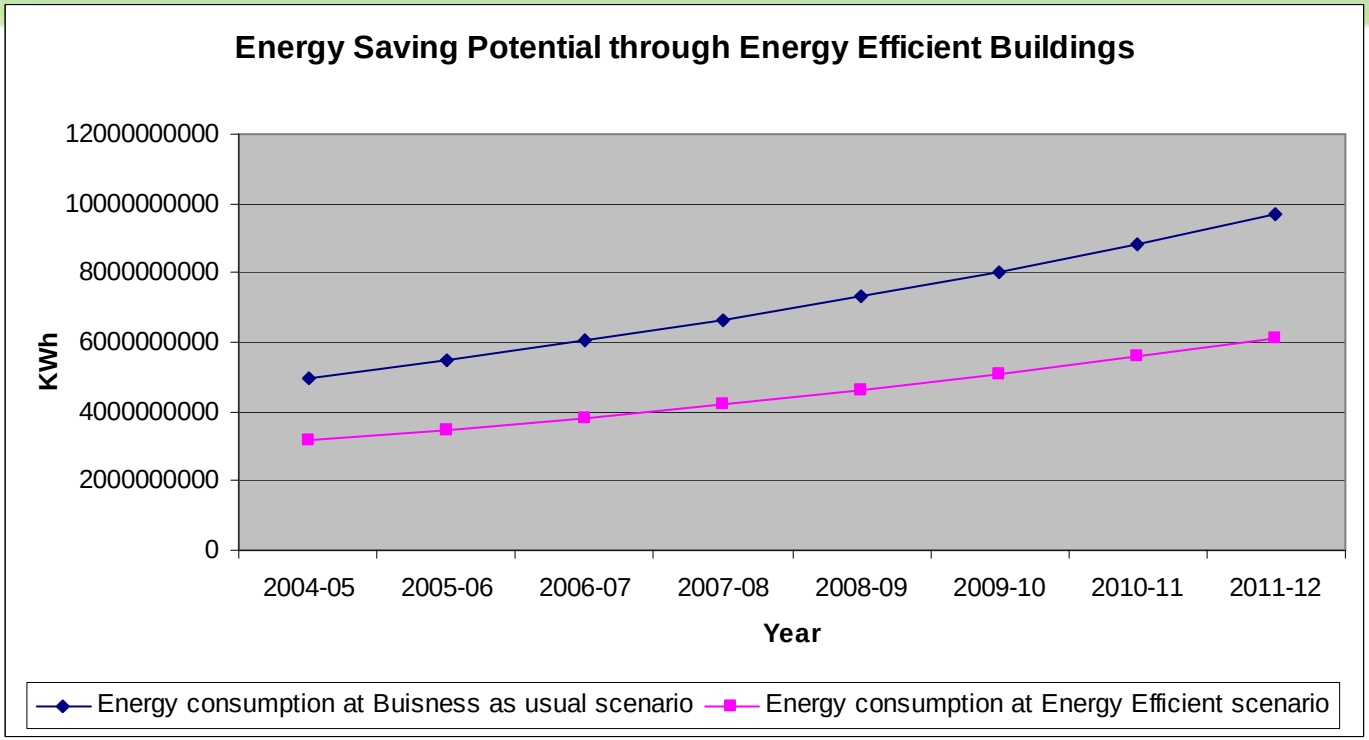
•Proper design (solar passive concepts, selective insulation, shading and day lighting)

•Energy Efficient lighting

•Labeled air conditioners and refrigerators

•Solar water heating system

Huge gap between between demand and supply

National Mission on Sustainable Habitat

- To make habitat sustainable through improvements in energy efficiency in buildings, management of solid waste and modal shift to public transport

Highlights of Mission on Sustainable Habitat

- Costs and Financing:
  - Integration of energy efficiency options with housing financing schemes
  - Appliance financing schemes to incentivise purchase of labelled appliances
  - Utility based programme for supporting initial incremental costs
  - Carbon market financing to offset incremental costs

- Research and Development
  - Energy efficient building products and components (e.g glazing, insulation, appliances etc)
  - User friendly energy simulation tools
  - Light emitting diodes

- Technology Transfer and Capacity building
  - Technology transfer from developed country
  - Dissemination and capacity building of different user groups
  - Curriculum development

Highlights of Mission on Sustainable Habitat

- Policy and regulatory mechanisms
  - Implementation of Energy Conservation Building Code 2007
  - Environmental clearance for large construction projects
  - Flexible performance based codes with incentives for innovation

- Delivery options
  - Bachat Lamp Yojana Model needs to be pursued wherein CDM revenues can be utilised to meet incremental investment
  - Energy Service Companies need to be promoted to implement energy efficiency retrofits though performance contracting route
  - Programmatic CDM by bundling projects

Rating to mainstream energy efficiency in buildings

CII led rating initiative ,LEED

Several corporate buildings have undergone LEED rating

11 million sq m registered

GRIHA rating developed and administered by TERI

25 projects with 1.3 million sq m built up area registered

Government of India adopted GRIHA as national rating system(5 million sq m in 11th plan)

Eco housing in Pune

Joint program of the Pune Municipal Corporation and USAEP/USAID

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

Key Highlights

- Sets performances benchmarks for key resources like, energy and water
- Facilitates integration of traditional knowledge on architecture with present day technology
- Integrates all relevant Indian codes and standards(e.g National building code 2005, Energy Conservation Building Code 2007, IS codes)
- Is in complete alignment with government policies and programs (e.g Environmental clearance by the MoEF)

IIT Kanpur environmental sciences building-5 star GRIHA rated

ECBC compliant envelope and systems

EAT system for pre cooling of fresh air

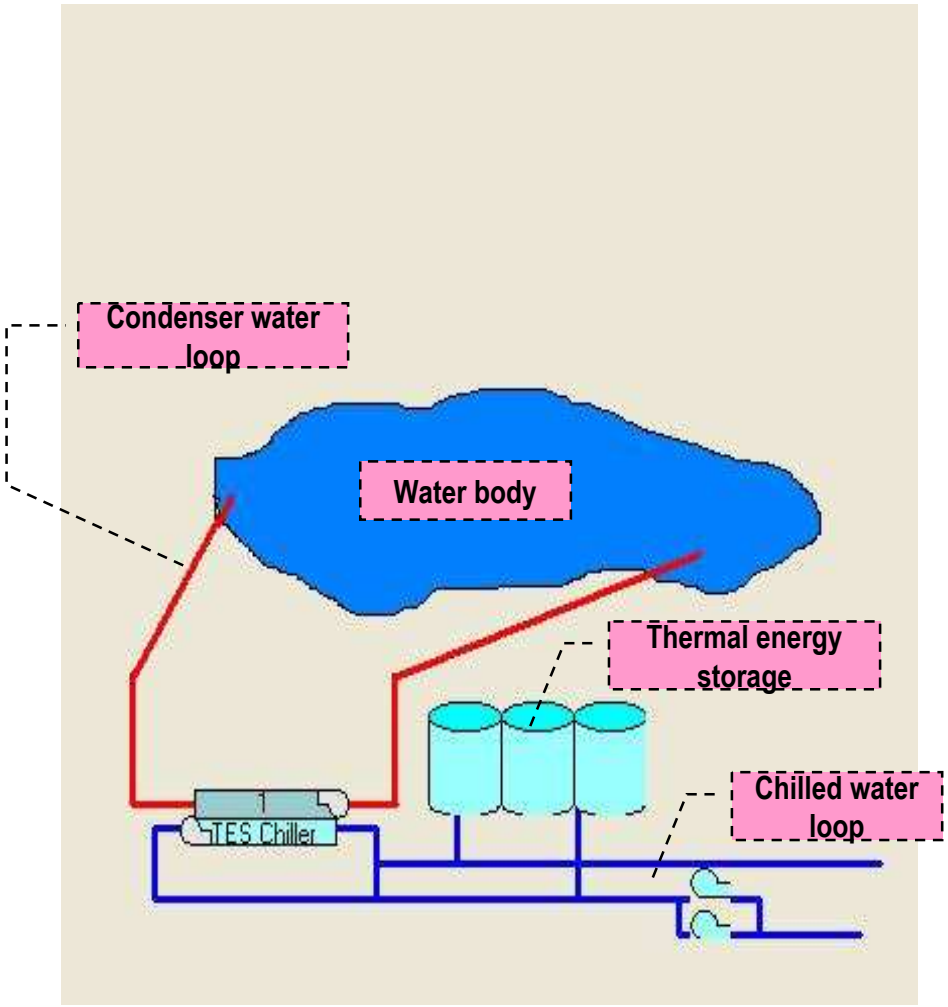
Solar PV to meet 30% of lighting energy consumption

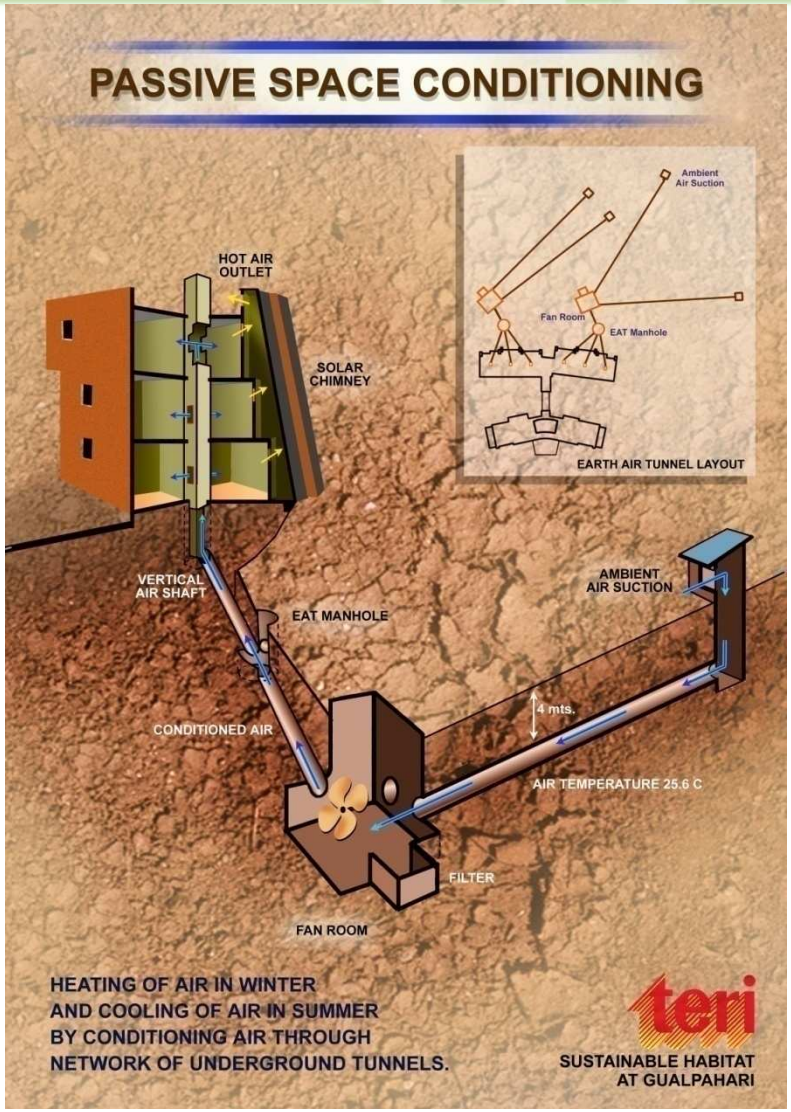
Energy consumption 98kWh/sqm /annum for ac spaces and 14 kWh/sqm/annum for non ac spaces; Water consumption reduced by 25% over BIS standards

Solar Passive Architectural Design Strategies

- **Water body to cool the micro climate**
- **Orientation of building : North – South**
- **External shading devices : Shaded roof and windows.**
- **Optimized window design by selection of Low E glass and external shading.**
- **Daylight integration in all living spaces.**

Low energy strategies





TERI-Retreat, Gurgaon

Efficient architecture

Low energy systems

Earth coupled cooling system

TERI-Retreat, Gurgaon

Root zone system

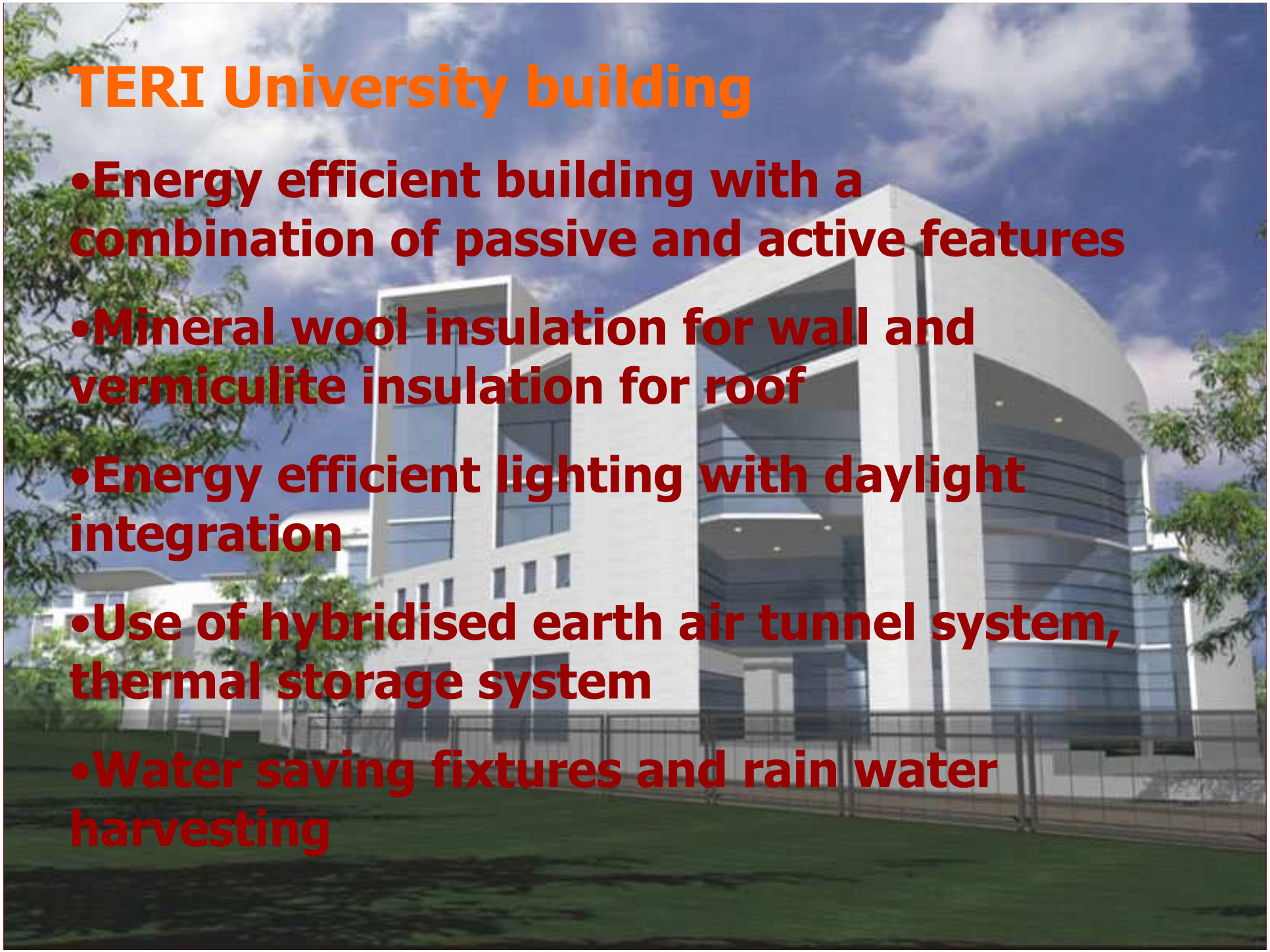
Gasifier

40% savings in energy costs at 25% increased cost (of 15% of accounted for by PV)

100% waste water recycling and reuse

Solar PV

Solar thermal



TERI University building

- Energy efficient building with a combination of passive and active features
- Mineral wool insulation for wall and vermiculite insulation for roof
- Energy efficient lighting with daylight integration
- Use of hybridised earth air tunnel system, thermal storage system
- Water saving fixtures and rain water harvesting


TERI-Bangalore
SOLAR WALL
SOLAR WATER HEATING
DAYLIGHTING

Some important initiatives by the Government at Central and State level

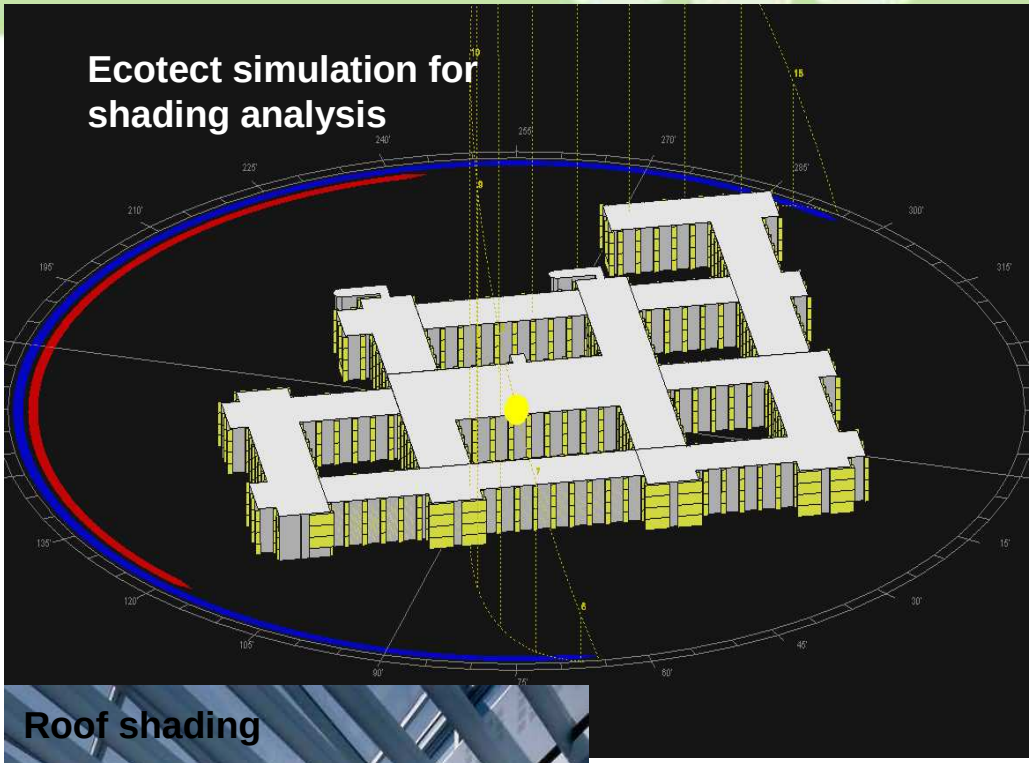
Initiative of Ministry of health and family welfare

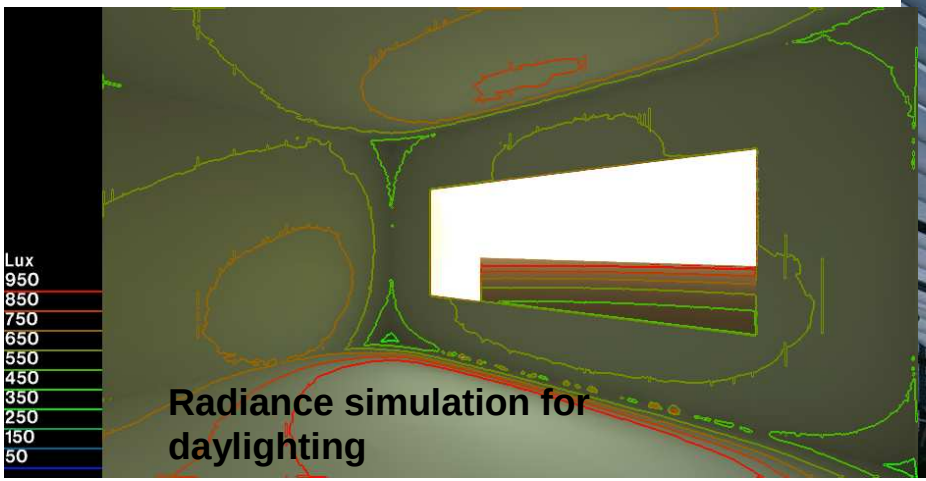
Six All India Institute of Medical Sciences(0.3 million sq m)

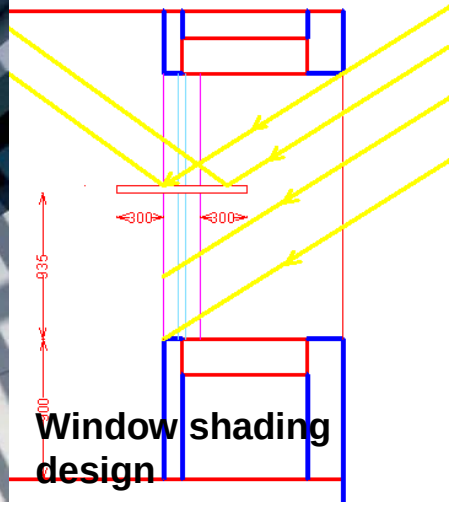
In Hrishikesh,Bhopal, Raipur, Patna, Bhuvneswar and Jodhpur

Green design(energy efficiency, water efficiency and efficient waste management)

Energy code compliant







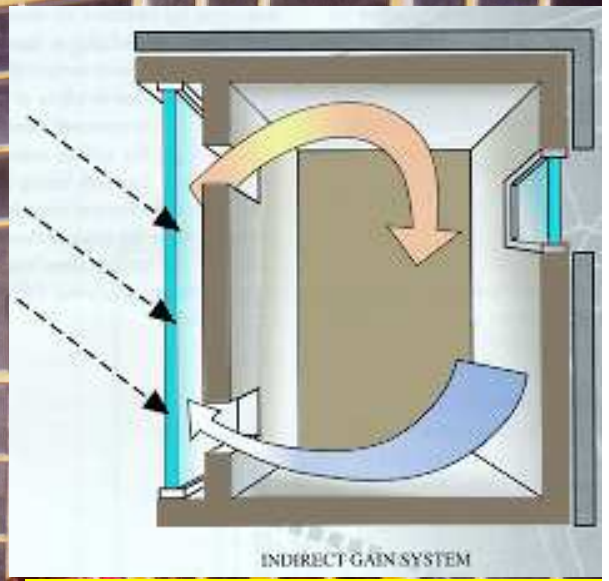
Some other State level initiatives

- Haryana state government has notified several EE measures e.g use of SWHs, CFLs in public buildings, construction of energy efficient buildings
- Himachal Pradesh has mandated solar passive concepts in public/govt. buildings
- Thane municipality has done exemplary work on street lighting, incorporation of SWH in buildings , bio methanation
- Tariff incentives in West Bengal ,Karnataka, Rajasthan on use of renewable energy

Architectural design to harness solar potential in cold climate

Sarai of Tabo Gompa, Spiti

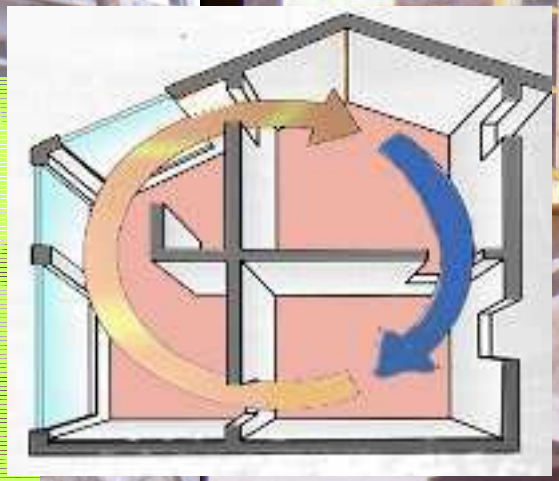
Ar Subhendu Kaushik



Himurja building,Shimla

Ar Arvind Krishan:

Indoor temp range of 18-28 deg C with corresponding ambient condition of 9-15 deg C.No auxiliary heaters



Sunspaces and trombe wall for cold climate in India to reduce auxiliary heating need

Solar housing complex, Kolkata,West Bengal

- The complex comprises 25 houses each of Duplex Type with floor area of each house as 1760 sq. ft. and an open area of 860 sq. ft.

Individual Houses

- 2.0 kW roof top solar PV with grid connectivity, metering and stand alone facility for 4 hrs. operation.
- ETC based solar water heater of 130 lpd capacity to meet hot water requirements
- Hydro-pneumatic water supply system with 40% less energy consumption.
- LED/CFL lighting fixtures.
- Passive solar features with swimming pool in South; Solar Chimney; special insulation in South-West walls; & adequate ventilation and natural lighting.

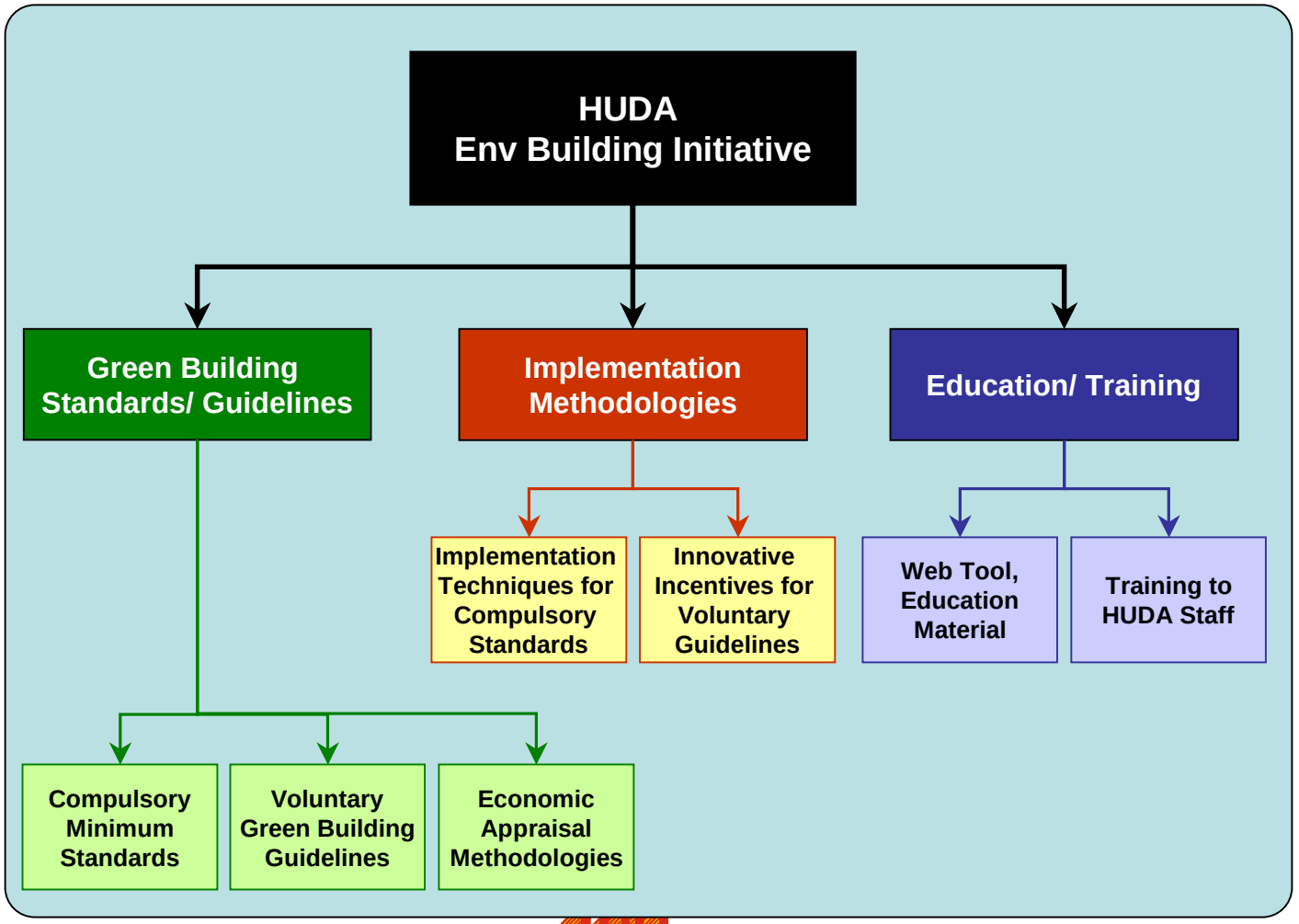
- **Community Hall & surrounding area**
- A Swimming Pool heated with solar collector.
- 8 kW Roof Top Solar PV System (grid connected).
- 4kW BIPV System (grid connected).
- Demonstration of 1.2 kW concentrating type Solar PV System (grid connected).
- Stand alone high mast Solar Street Lights with Battery at the top and high power FL.
- Battery operated pick-up Van.
- Solar PV operated name plate and signage.
- Solar PV operated garden lights.

Highlight: Grid interactive PV with net metering

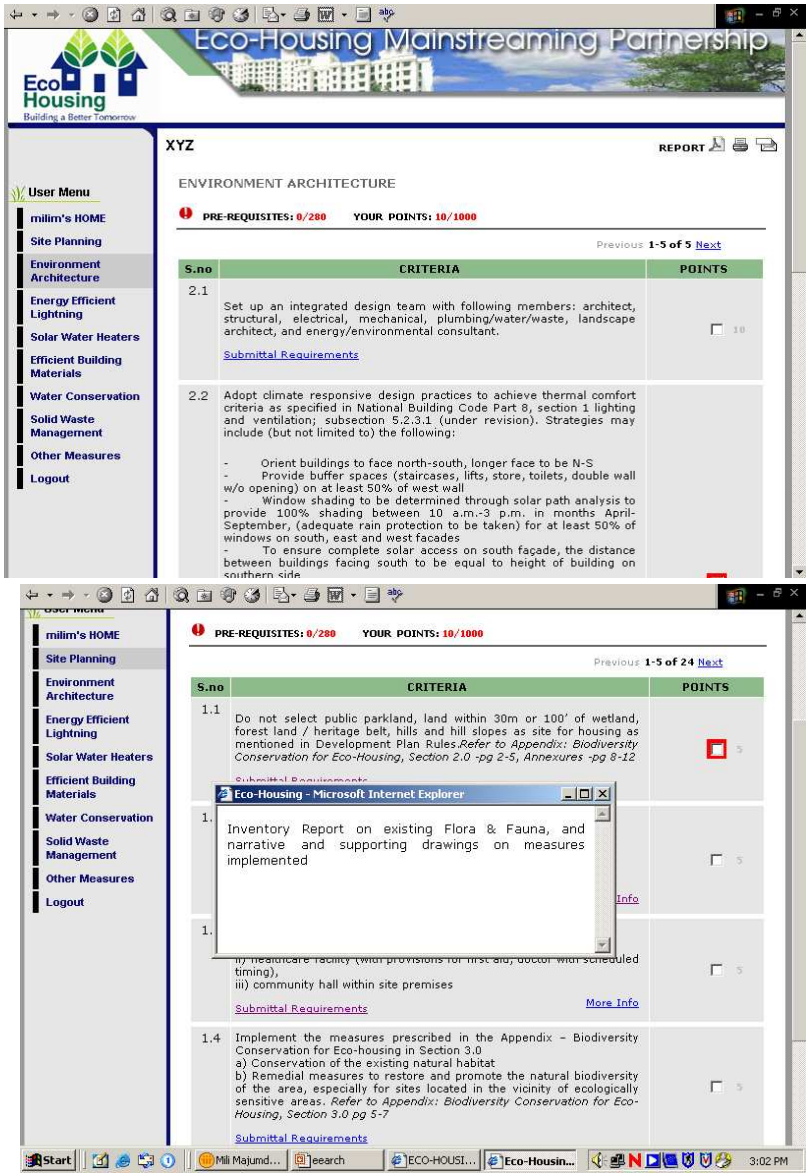
Greater Hyderabad Initiative: Development of Environmental building regulations for Hyderabad

- Aid Hyderabad Urban Development Authority in sustainable development of Greater Hyderabad
- Provide a higher quality environment for current and future generations
- Engage community in sustainable development
- Make Hyderabad a global leader in sustainability
- Increase education of green building design practices
- Disparage the notion that environmental building design equates to higher building costs.

Project Structure



Eco housing mainstreaming project of Pune Municipal Corporation



- **Technical criteria for development of eco housing has been developed**
- **Website set up for information dissemination**
- **Study tours to international eco housing projects have been undertaken.**
- **Plans for incentivising the program**
- **Capacity building modules for imparting training to users, enablers and policy makers have been developed**

CCI

Global program on Energy Efficiency through building retrofits

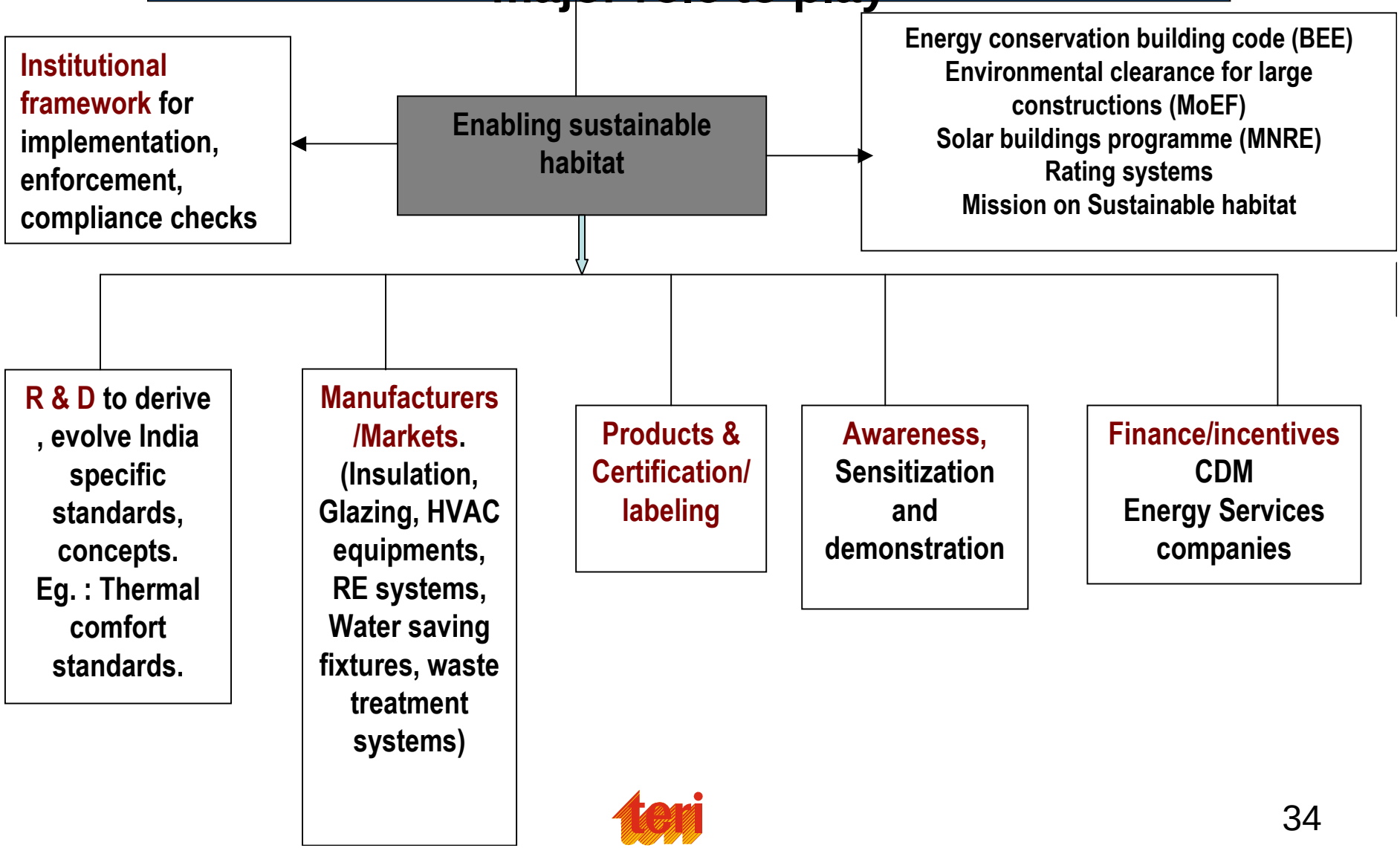
- Energy Efficiency Building Retrofit Program through performance contracting.
- Participating cities in the program: Bangkok, Berlin, Chicago, **Delhi**, Houston, Johannesburg, Karachi, London, Melbourne, Mexico City, **Mumbai**, New York, Rome, Sao Paulo, Seoul, Tokyo, Toronto
- Creates a purchasing consortium
- Mobilize the best experts in the world to provide technical assistance
- Creates and deploys common measurement and information flow tools
- Creating building codes and standards

40 member cities and 13 affiliates

Suggested roadmap to sustainability in buildings….should address

1. Demand creation (for products, services, expertise) necessary to move markets
2. Innovation in policies and programs (carrots and sticks)
3. Innovative financing
4. Motivation at all levels (developers, utilities, owners and users)
5. Knowledge building

Addressing challenges through an integrated framework and bilateral cooperation has a major role to play



Thank you