MODULE 8:
BEST PRACTICES IN BUILDING ENERGY MANAGEMENT AND CONSERVATION

GreenTree
Define . Design . Deliver

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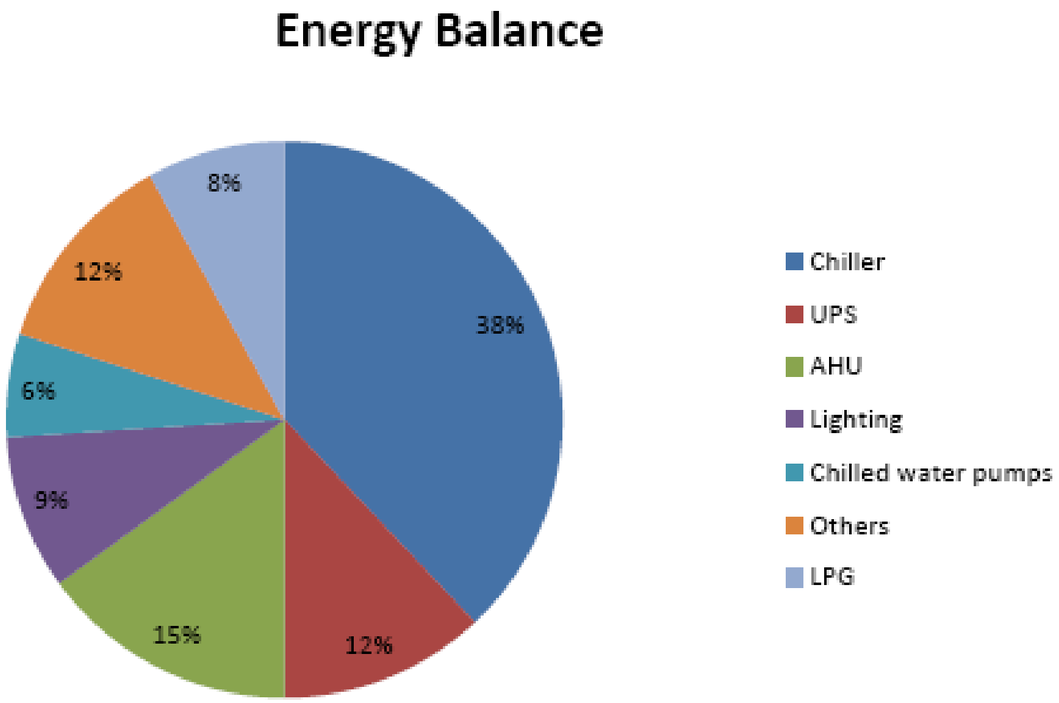
CONTENTS

INTRODUCTION

1 Introduction



- Large-scale urbanization and increasing income, and the construction industry growth rate in India is 10% as compared to the world average of 5.2%.
- Projected by 2030 that two-thirds of the buildings have yet to be built and 1 billion $m^2$of new commercial buildings will be added.
- Commercial buildings are the third largest consumers of energy, after industry and agriculture.
- Buildings annually consume about 30–35% of electricity consumption in India.

GREEN BUILDING

2 Green Building

- A Green building is one which uses less water, improves energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants, as compared to a conventional building
- A green building incorporates the following features:
    - Energy efficiency
    - Water efficiency
    - Better living conditions
    - Eco-friendly sustainable materials
    - Less transport use
    - Less waste
    - Habitat protection/restoration

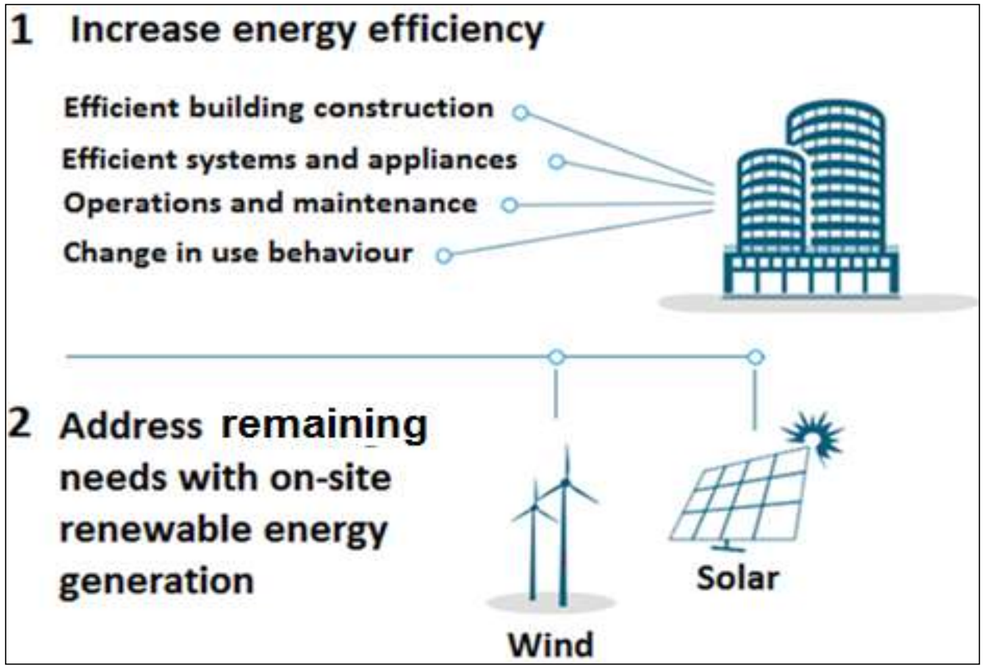
2 Green Building

- The various Green Building Rating Systems are BEE Star Ratings for buildings :
  - GRIHA:
    - ✓Green Rating for Integrated Habitat Assessment (GRIHA)
    - ✓The latest version of GRIHA is called GRIHA V – 2015. Buildings would be rated on a 1-5 star scale, with 5 star labeled buildings being the most efficient.
  - IGBC
    - ✓IGBC Green Building Rating Systems have been developed by the Indian Green Building Council (IGBC)
  - USGBC based-LEED certifications.
    - ✓LEED, which is Leadership in Energy and Environmental Design is a third party certification for design, construction and operation of a given building.
    - ✓US Green Building Council (USGBC) has completed a comprehensive update of LEED which is called LEED v4

NET ZERO ENERGY BUILDING (NZEB)

NET ZERO ENERGY BUILDING (NZEB)

3 NZEB



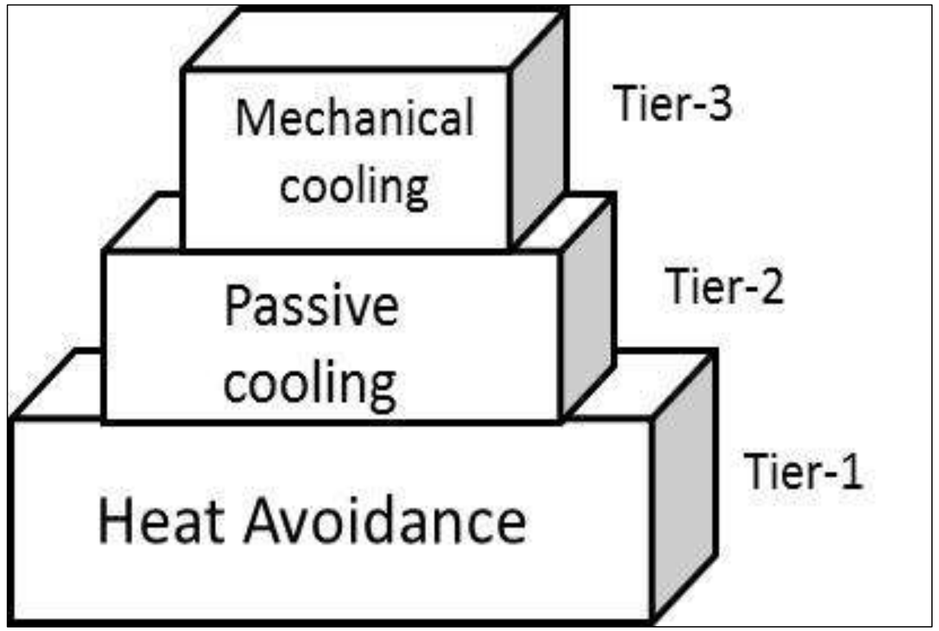
NZEB Concept

- In order to achieve their net zero energy goals, NZEBs must first reduce energy demand using energy efficient technologies, and then utilize renewable energy sources to meet the residual energy demand.

- NZEB is aimed at eliminating greenhouse gas (GHG) emissions associated with the operation of new buildings by 2030, and eliminate the GHG emissions from all buildings by 2050.

BUILDING AS AN ENERGY SYSTEM

4 Building Energy System



Sustainable Cooling Strategy

- The Energy Auditor needs to look holistically at the building when recommending efficiency measures to ensure that these energy interactions are taken into account.

- As using passive methods for cooling, the most sustainable approach would be adopting three-tier approach with heat avoidance being the first preference, followed by passive cooling, and mechanical cooling as shown in Figure

ENERGY SAVING APPROACHES FOR BUILDING

ENERGY SAVING APPROACHES FOR BUILDING

5 Energy Saving Approaches

- Some of the key Energy Efficiency Measures covering building envelope (Walls, Roofs, Windows), Heating Ventilation and Air Conditioning (HVAC) System, Lighting (indoor and outdoor), and Electrical Power and Motors are briefly described as follows:

5.1 Passive Designs

- Passive designs take advantage of local climates and reduce energy consumption for heating or cooling the building by optimizing insulation, ventilation, orientation, and shade of a building.
- Some Steps can be used Energy Saving Approach:
  - ✓Form and Orientation
  - ✓Minimizing Heat Gain through roofs
  - ✓Fenestration
  - ✓Low Energy Cooling

5.2 HVAC

- HVAC systems contribute to nearly 40% of the energy used by commercial buildings and over 50% of total energy consumption in IT buildings.

- The HVAC system types are broadly categorized as follows:

  - ✓Centralized system: Central Chilled Water System (Air cooled and water cooled)
  - ✓Distributed system (DX system): VRF, Duct able system, split air conditioners, unitary systems

5.2 HVAC

- Energy saving potential in HVAC System Design is shown in Table

Component	Cooling Load (kW/ton)		Improvement Potential
	Conventional Design	Optimized Design	
Chiller	0.75	0.50	33%
Air Distribution System	0.60	0.06	90%
Water Pump	0.30	0.04	87%
Cooling Tower	0.10	0.02	80%
Total	1.75	0.62	65%

5.2 HVAC

- High efficiency chiller: Chiller is the highest energy consumer in the HVAC system. Chiller efficiency is rated in kW/ ton or coefficient of performance (COP).
- Types of Chiller :
    - Water-cooled chillers
    - Chilled water storage
    - Ice Bank
    - Trigeneration System
- Energy-efficient pumps and fans (HVAC system): Pumps and fans which are used in HVAC system are designed to achieve higher efficiency benchmarks with use of IE3 and IE4 (most energy efficient motors)
- Air tightness
- Mixed mode ventilation System

5.3 Other Approaches

- Air tightness
- Mixed Mode Ventilation System
- Demand-Controlled Ventilation (DCV)
- Electronically Commutated Fans
- Low-temperature Variable Air Volume
- Heat Recovery Ventilation (‘HRV’) systems
- Solar Cooling
- Insulated roller doors
- Lighting
    - LED Lighting
    - Occupancy Detection
    - Daylight Dimming
    - Flexible Lighting Control

5.4 Renewable Energy

- Building integrated photovoltaic (‘BIPV’)
- Solar hot water systems

5.5 Other area

- Power factor correction
- Sub-metering systems
- Energy Efficient Appliances
- Electrical Energy Storage
- Building Energy Management System (‘BEMS’)
- Crystalline Water proofing

5.6 Emerging Trends

- BM Analytics
- Self-Learning Buildings
- Use of simulation for energy efficiency in building New Building
- Existing Buildings
- Green Leasing

CONTRIBUTION BY

Bureau of Energy Efficiency

- Mr. Abhay Bakre, Director General, Bureau of Energy Efficiency
- Shri Pankaj Kumar, Secretary , Bureau of Energy Efficiency
- Mr. Saurabh Diddi, Director, Bureau of Energy Efficiency
- Dr. Ashok Kumar, Director, Bureau of Energy Efficiency
- Mr. S. K. Khandare, Director, Bureau of Energy Efficiency
- Shri Sameer Pandita, Director, Bureau of Energy Efficiency
- Ms. Rajini Thompson. Coordinator (Exam), Bureau of Energy Efficiency

Industries

- Anant Shukla, ASEAN-German Energy Programme (AGEP), GIZ GmbH
- H. Ragavendra Prabhu, National Productivity Council (NPC)
- Idhayachander Ravichandran, National Productivity Council(NPC)
- J. Nagesh Kumar, National Productivity Council (NPC)
- Joel Franklin Asaria, National Productivity Council(NPC)
- K.V.R. Raju, National Productivity Council (NPC)
- M. J. P. Varun, National Productivity Council (NPC)
- M Narayanan, Energy Management Centre
- Padu S Padmanabhan, Water, Environment Expert
- P. Chitra, National Productivity Council(NPC)
- P. Dharmalingam, ENSAVE Consultancy and Training Pvt. Ltd.,
- P. Kanagavel, National Institute of Wind Energy (NIWE)
- R.K. Khilnani, Energy Tech Consultants Pvt. Ltd.
- R. Kumar, Energy & Sustainability,
- R. Suryanarayanan, National Productivity Council (NPC)
- Satyanarayan Seshadri, Aspiration Energy
- Sreenivasulu Deverapalli,, National Productivity Council (NPC)
- S. Srinivas, CII-Sohrabji Godrej Green Business Centre
- Suryanarayanan, National Productivity Council (NPC)
- T. Sankaranarayanan, National Productivity Council (NPC)
- Velayutham V , National Productivity Council(NPC)
- V G. Sandhya, National Productivity Council (NPC)
- V.S. Deshpande, Transparent Cogen Systems Pvt. Ltd.,

Thank You

Presentation Prepared by:

M/s GreenTree Building Energy Private Limited

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