



# PARTNERSHIP TO ADVANCE CLEAN ENERGY-DEPLOYMENT (PACE-D) TECHNICAL ASSISTANCE PROGRAM

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## Towards Net-Zero Energy Buildings – Vision for Indian Railways Stations

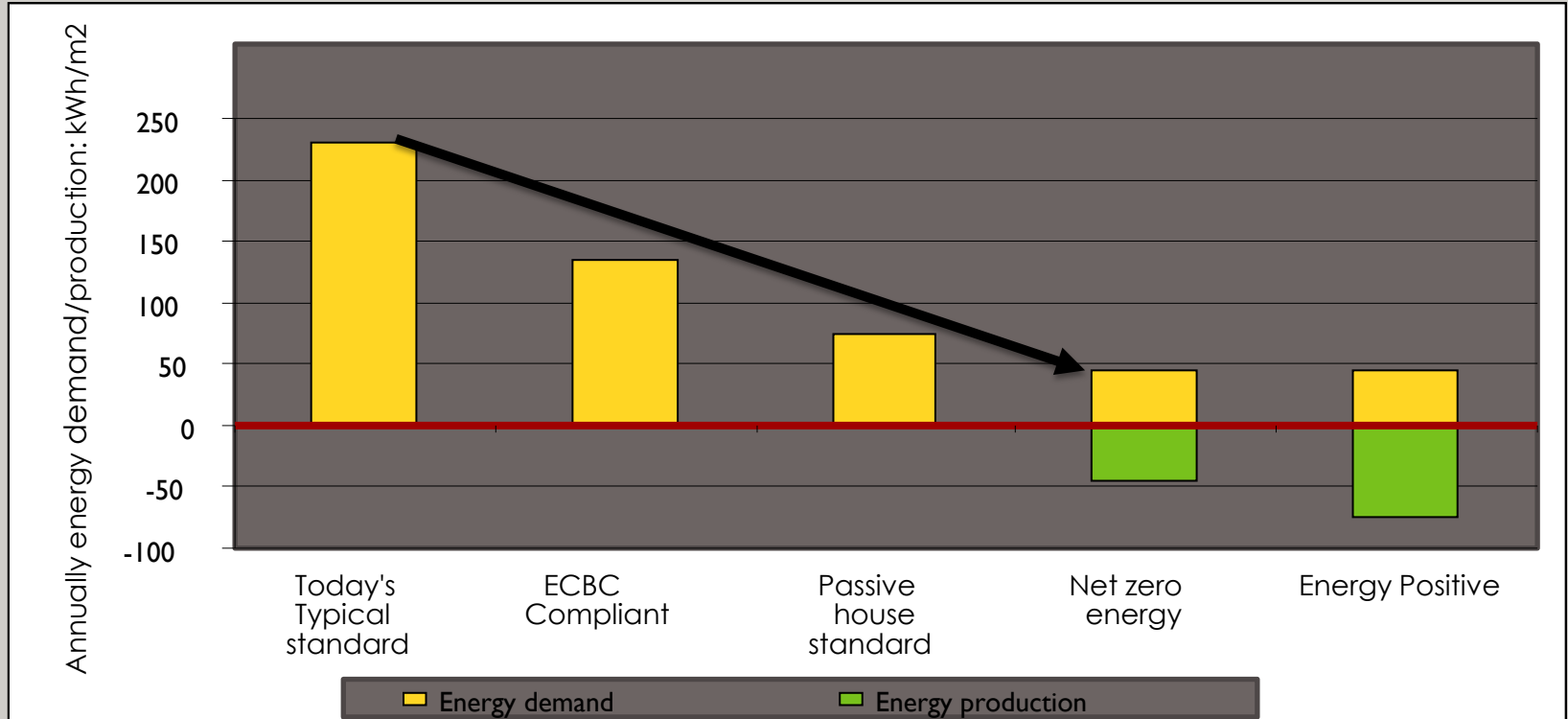
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# Typical Commercial Building Energy Use (kWh/m<sup>2</sup>/yr)



# What is a NZE Building ?

A Building/Campus that produces as much energy in a typical year as it consumes

- Consumes grid power when needed
- Feed power to grid when it has surplus



# Key Factors for Net Zero Emissions

- Buildings with low energy demand: especially for heating & cooling
- Use renewable energy in an integrated way
- Reducing embodied energy of materials.
- Reducing transport energy through smart cities concepts

## Vision for Indian Railways

- Minimize the environmental impact of development and make new station infrastructure carbon neutral in the long run



## Net Zero Objectives for Indian Railways

- Net Zero Energy Use
  - Annual Energy through renewable energy to be more than used onsite
- Net Zero Waste
  - No waste sent to landfill
- Net Zero Run-off
  - No storm water to leave the project boundary

# Existing Green Initiatives by Indian Railways



- Benchmarking of energy consumption and regeneration.
- Installation of energy-efficient appliances like LED bulbs.
- Harnessed about 13 MWp of Solar Energy.
- MoR and MNRE have signed an MoU on Solarization of IR
- Wind energy being installed at several locations
- Solar powered train - trials under plan
- MoR with the support of USAID PACE-D TA Program is in process of tendering 50 MWp SRT

# Potential RE

**Railways can adopt a number of advanced RE technologies for achieving NZE status**

- Small Wind and Hybrid Systems
- Waste to Energy
- Bio-fuels
- Hydrogen Energy (Fuel Cells)
- Offshore Technologies
- Energy Conservation



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# Recent Examples of NZEB in India

# Indira Paryavaran Bhawan, New Delhi



Akshay Urja Bhawan HAREDA, Panchkula; Haryana

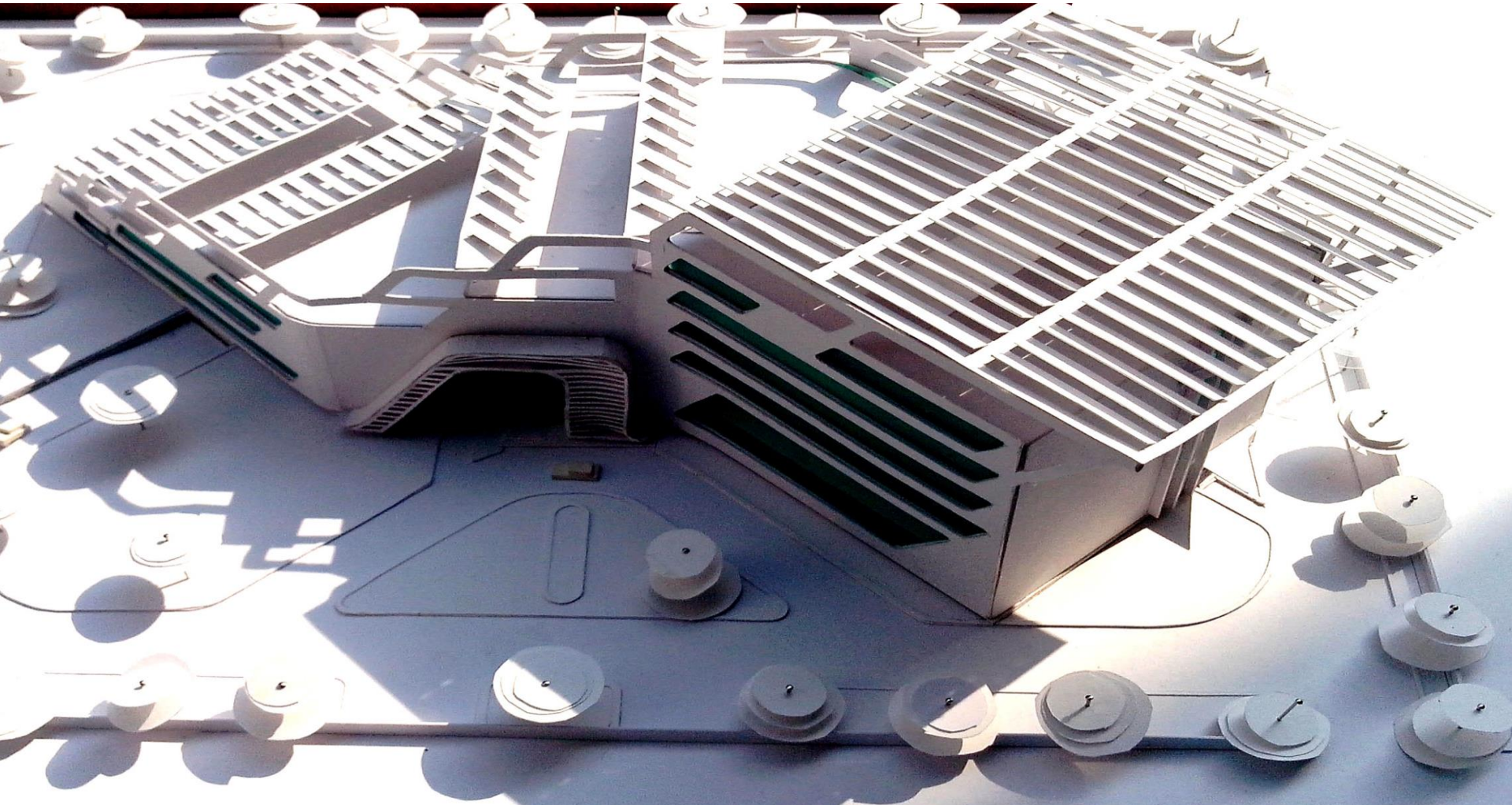


Shunya - The Net Zero Energy Home Prototype, NOIDA, UP



Grid Corporation of Odisha Ltd (GRIDCO) Office, Bhubaneswar, Odisha





UHBVN, Panchkula, Haryana

Bayer Material Sciences, Greater NOIDA, UP



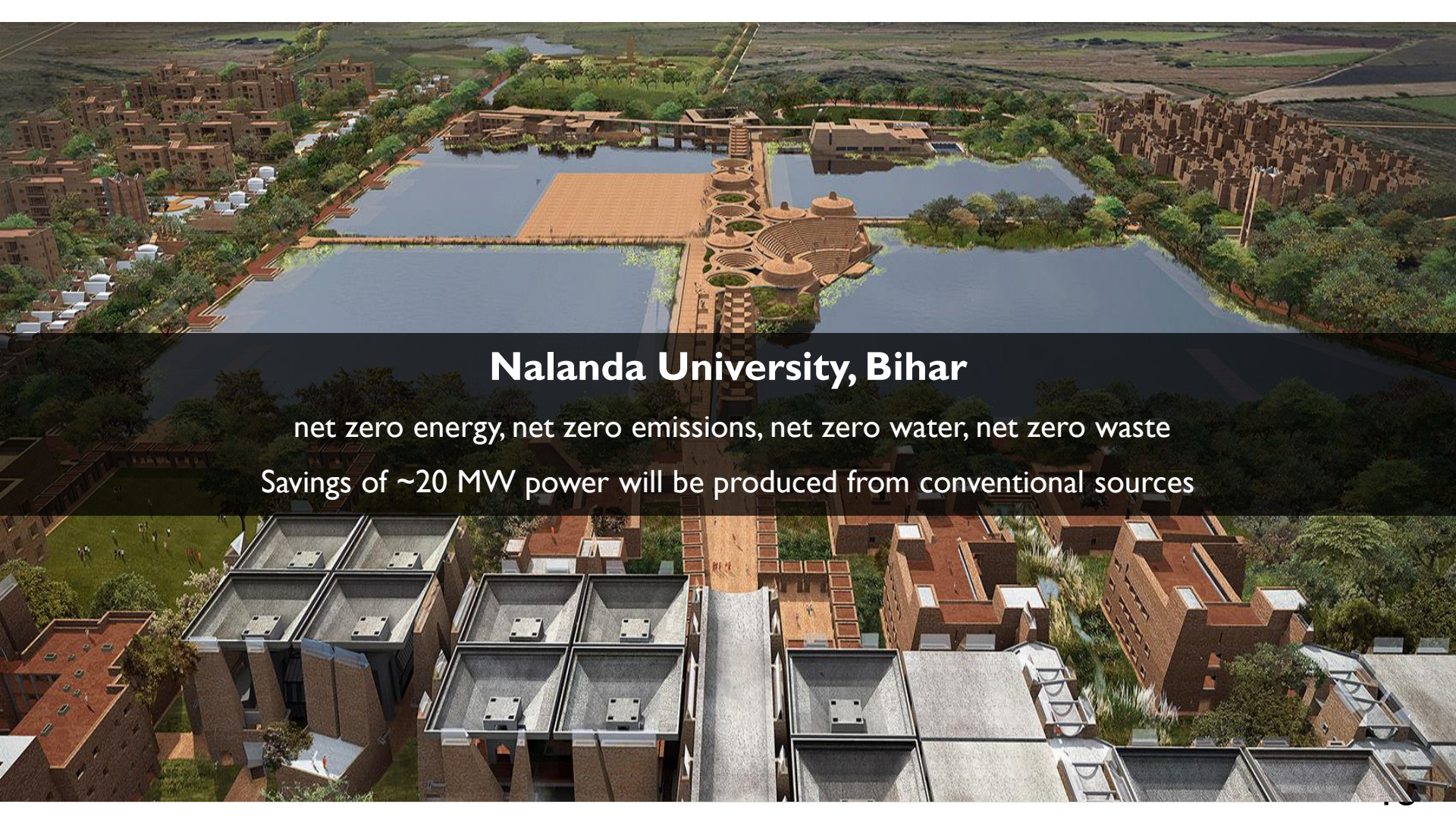
# SunCarrier Omega Private Limited, Bhopal, M.P



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# USAID PACE-D TA Project: NZEB support





## Nalanda University, Bihar

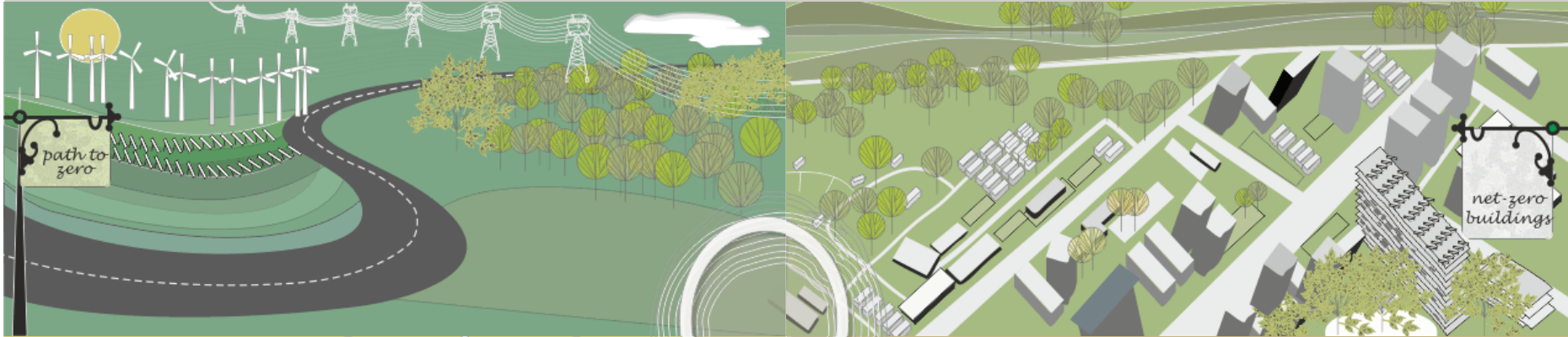
net zero energy, net zero emissions, net zero water, net zero waste

Savings of ~20 MW power will be produced from conventional sources

## PACE-D Assistance to Nalanda University

- Incorporated NZEB requirements in design dossier
- Assisted in selection of project design team
- Assist in technology and material procurement processes
- Review of technical specifications (materials and technology)
- Review of NZEB strategies proposed by architects
- Facilitate contact with technology providers

one stop site for information on NZEBs for architects, engineers, academia, policymakers, developers, facility managers



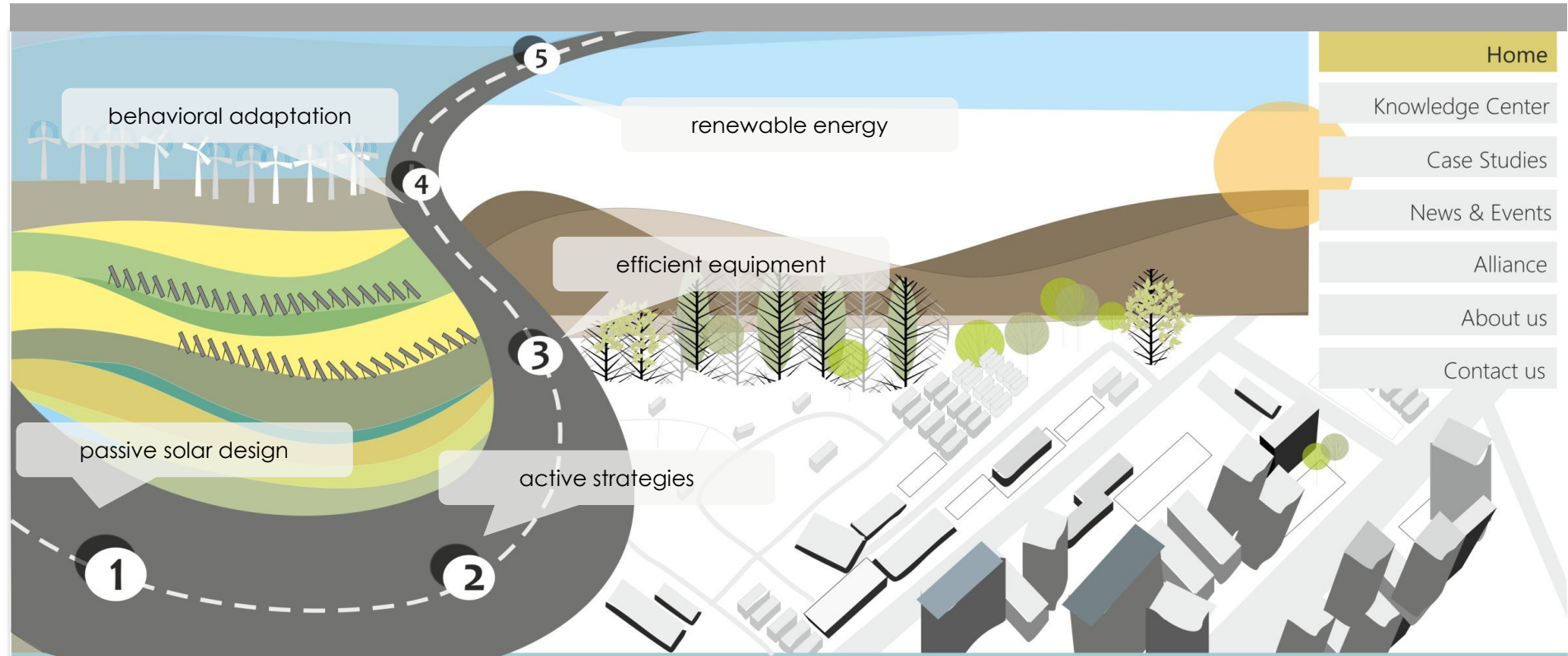
towards net zer

energy buildings



NZEB KNOWLEDGE PORTAL: [www.nzeb.in](http://www.nzeb.in)

Home
Knowledge Center
Case Studies
News & Events
Alliance
About us
Contact us



path to zero

passive solar design

active strategies

efficient equipment

behavioral adaption

renewable energy

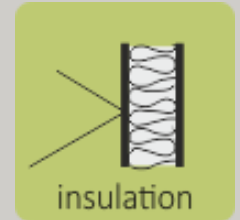
NZEB

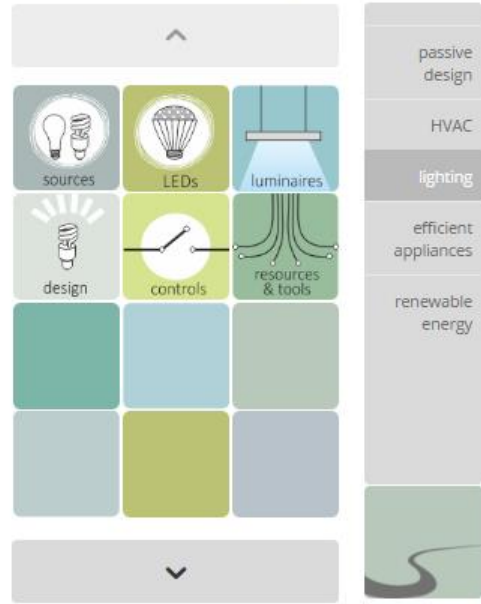
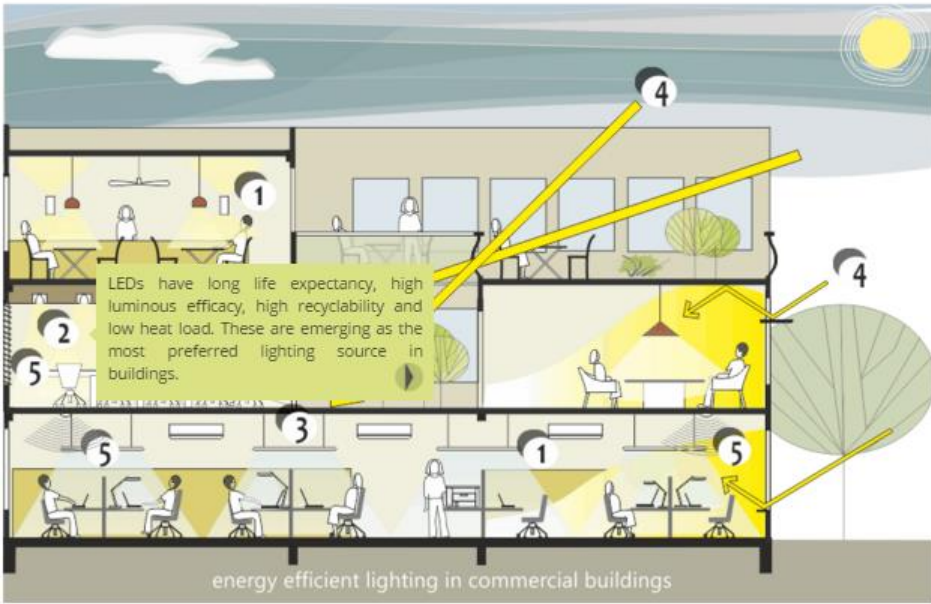
nearly zero energy buildings



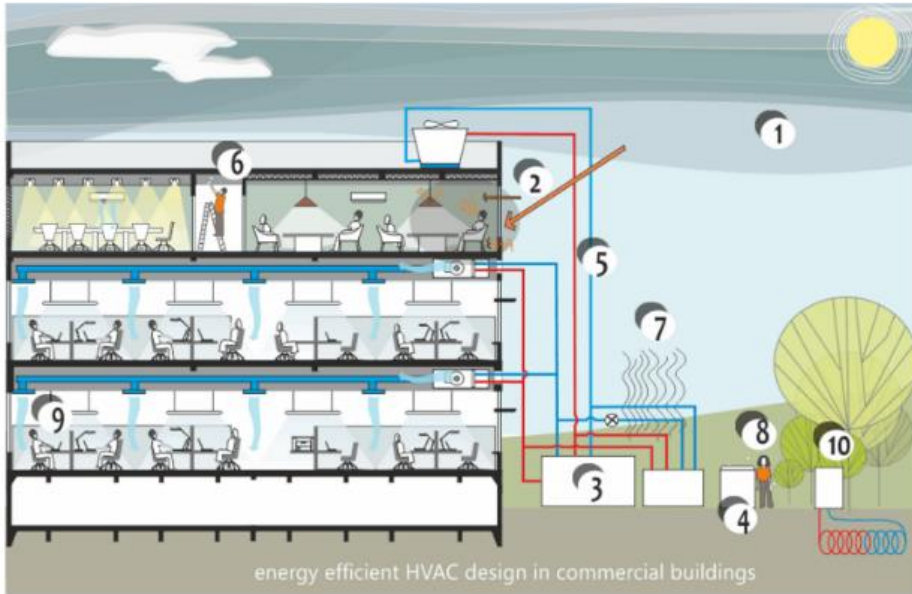
## Approach for NZEB

# I. Design Strategies for Energy Efficiency



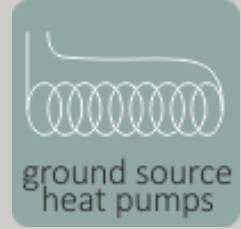


## 2. Daylighting and Energy Efficient Lighting

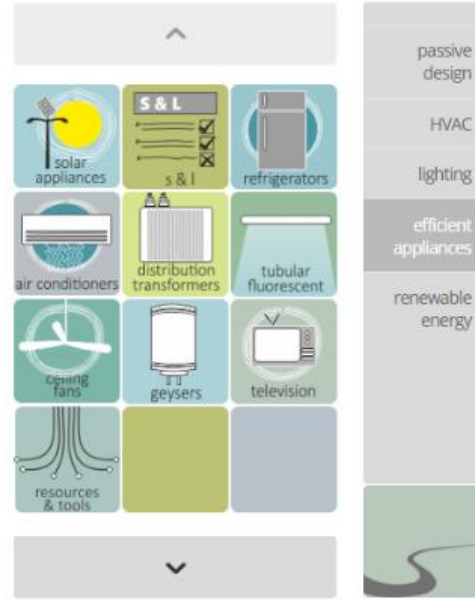


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introduction	load calculation	cooling equipment
heating equipment	design	operations & maintenance
environmental impact	commissioning	BMS
desiccant cooling	evaporative cooling	solar air conditioning
v		

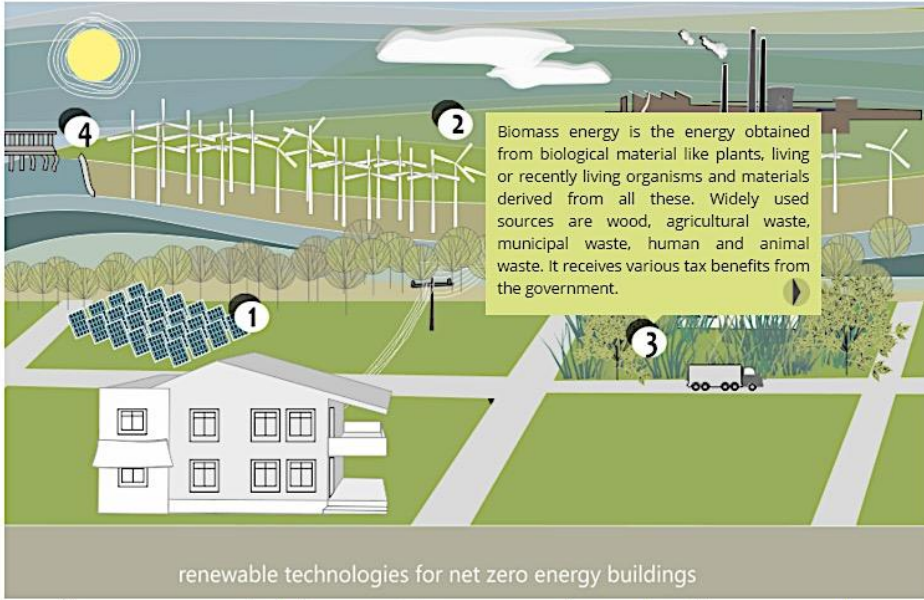
- passive design
- HVAC
- lighting
- efficient appliances
- renewable energy



# 3. Energy Efficient Air-Conditioning



# 4. Energy Efficient Appliances



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solar pv	wind	biomass
hydro	resources & tools	
v		

- passive design
- HVAC
- lighting
- efficient appliances
- renewable energy



# 5. Renewable Energy Integration

# Support to Indian Railways

- Vision document for the Indian Railways
- NZE strategy and process for Indian Railways
- Tender Specifications for station to be identified
- Detailed Baseline assessment
- Procurement stage support – tender evaluation and detailed design
- Design support to the contractor
- Construction stage support
- M&V protocol
- Final third party verification post occupancy

# Net-Zero BUILDINGS are the FUTURE

पूर्णमदः पूर्णमिदं पूर्णात् पूर्णमदच्यते।  
पूर्णस्य पूर्णमादाय पूर्णमेवावशिष्यते॥

That is Absolute, This is Absolute, Absolute arises out of Absolute  
If Absolute is taken away from Absolute, Absolute remains

An aerial view of a blue and white train with solar panels on the roof, parked at a station. The train is on tracks, and there are several people standing near the platform. A yellow structure is visible on the right side of the platform. The text "Thank You" is overlaid in the center of the image.

**Thank You**