Net Zero Energy Buildings

For Indian Railways stations and buildings

New Delhi | October 27th 2017

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US-INDIA CO-OPERATION ON CLEAN ENERGY

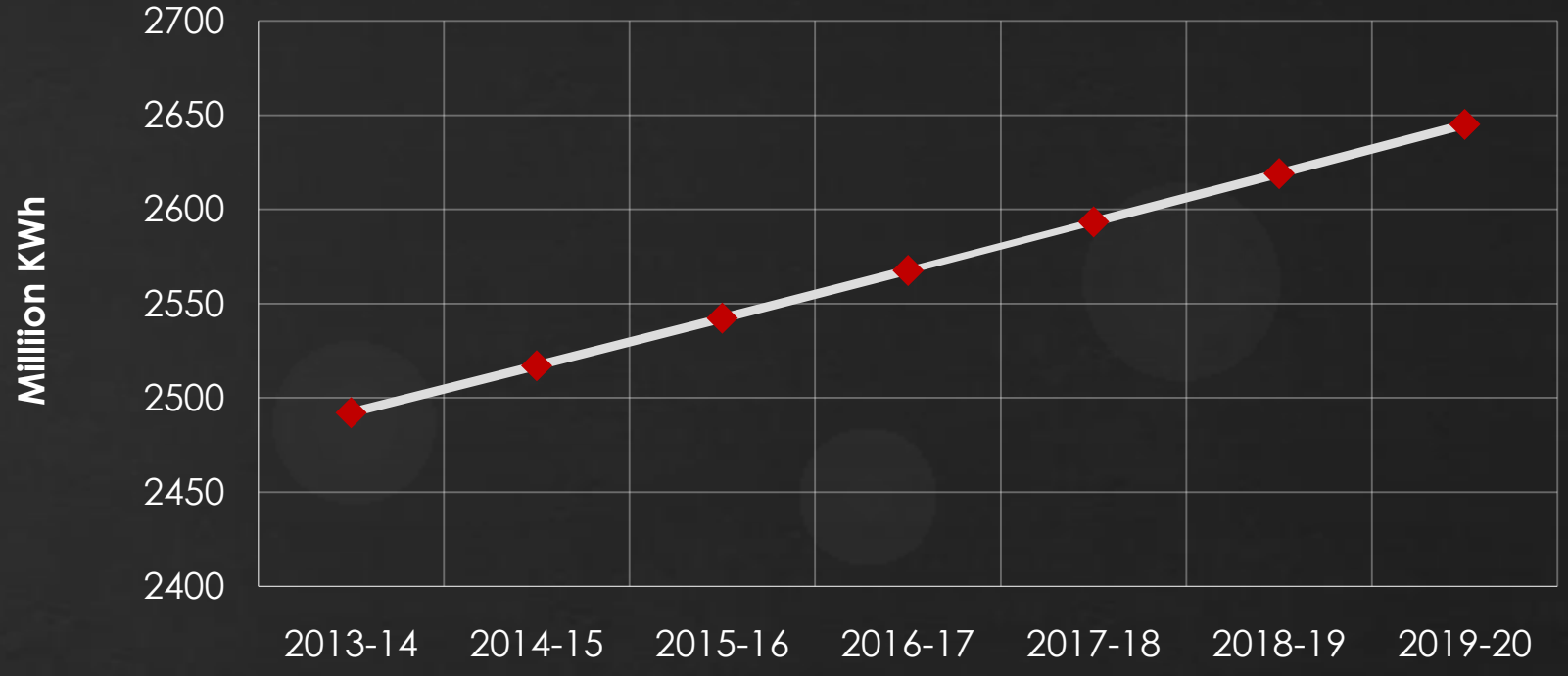
PACE D – PARTNERSHIP TO ADVANCE CLEAN ENERGY-DEPLOYMENT TECHNICAL ASSISTANCE PROGRAM

MAITREE – MARKET INTEGRATION AND TRANSFORMATION FOR ENERGY EFFICIENCY

Partnership with Indian Railways

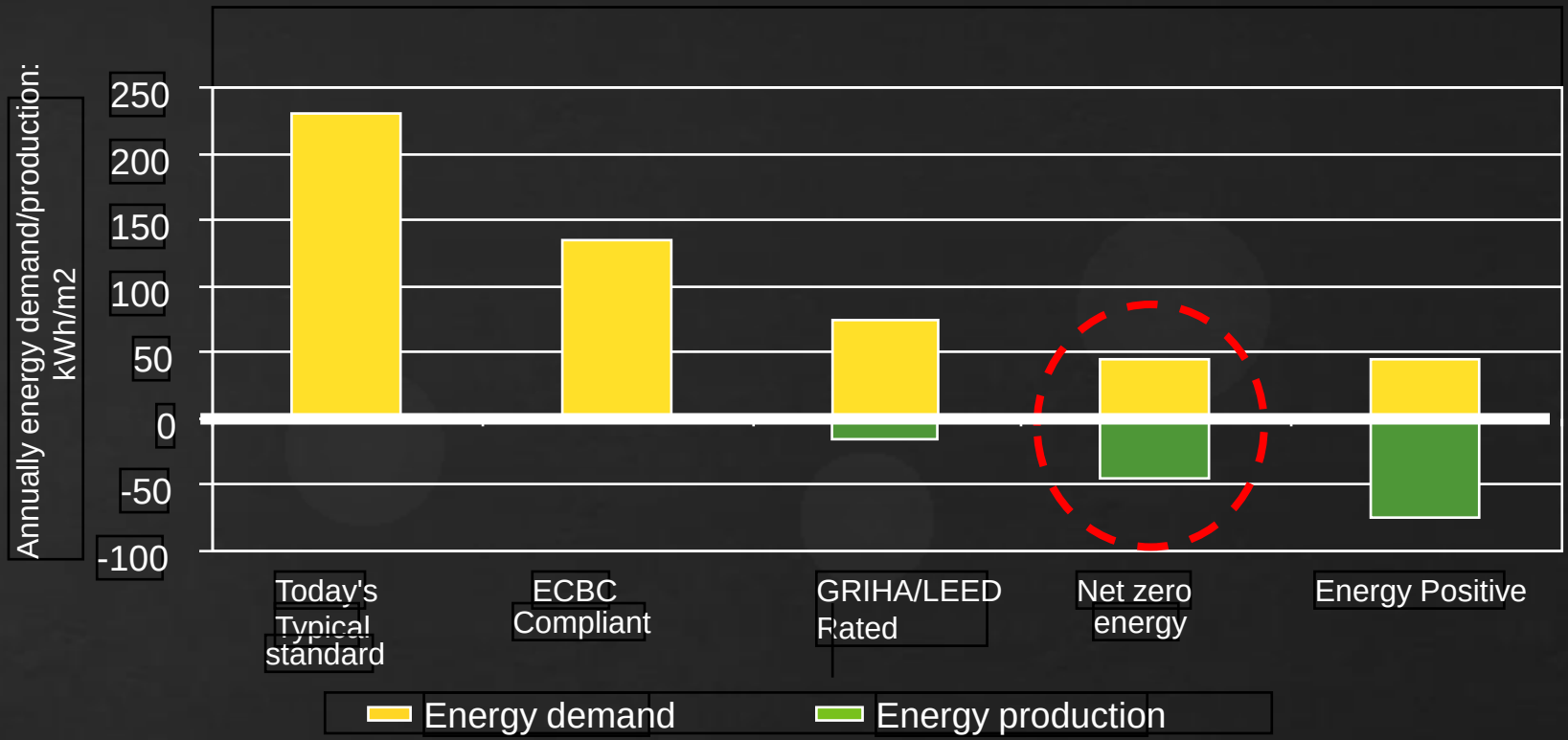
- Net Zero Energy Buildings (NZEB) Vision
- NZEB technical specifications
- NZEB technologies and materials procurement
- Action plan and M&V framework
- Capacity building

Indian Railways – Diverse Building Portfolio



Non traction energy use projection

Source : Central Electricity Authority (CEA)



Towards Net Zero – Typical Building Energy Use

(kWh/m^2/yr)

- Rating system achievement (i.e. GRIHA 5 Star, IGBC Super Platinum or LEED Platinum)
- Energy use savings (> 50% reduction from current use)
- Occupant comfort (>90% satisfaction)
- Renewable energy targets (i.e. 100% of energy supplied by onsite, offsite and/or RE)

Redevelopment of existing IR stations - Vision

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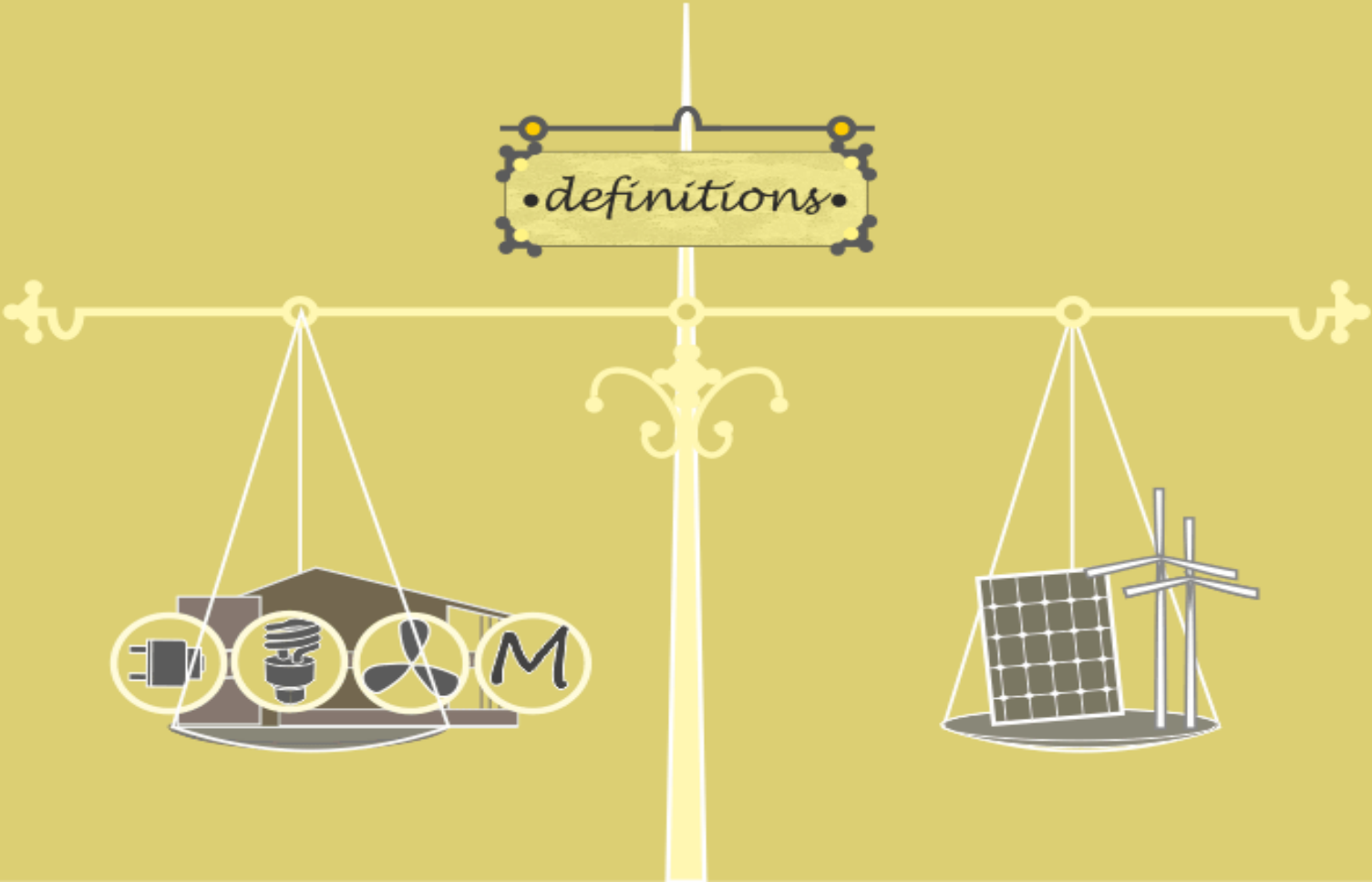
- Net Zero Energy
- Net Zero Water
- Net Zero waste
- Rating system achievement (GRIHA 5 star, IGBC Super Platinum or LEED Platinum)

New Station Development for IR - Vision

What is a Net Zero Energy Building?

Buildings that,



- Buildings with low energy demand: especially for heating & cooling
- Use renewable energy in and integrated way
- Reducing embodied energy of materials.
- Reducing transport

Key Factors for Net Zero Emissions

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Design Phase

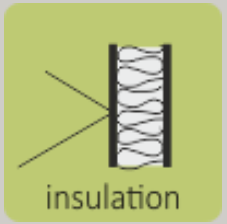
Procurement phase

Construction Phase

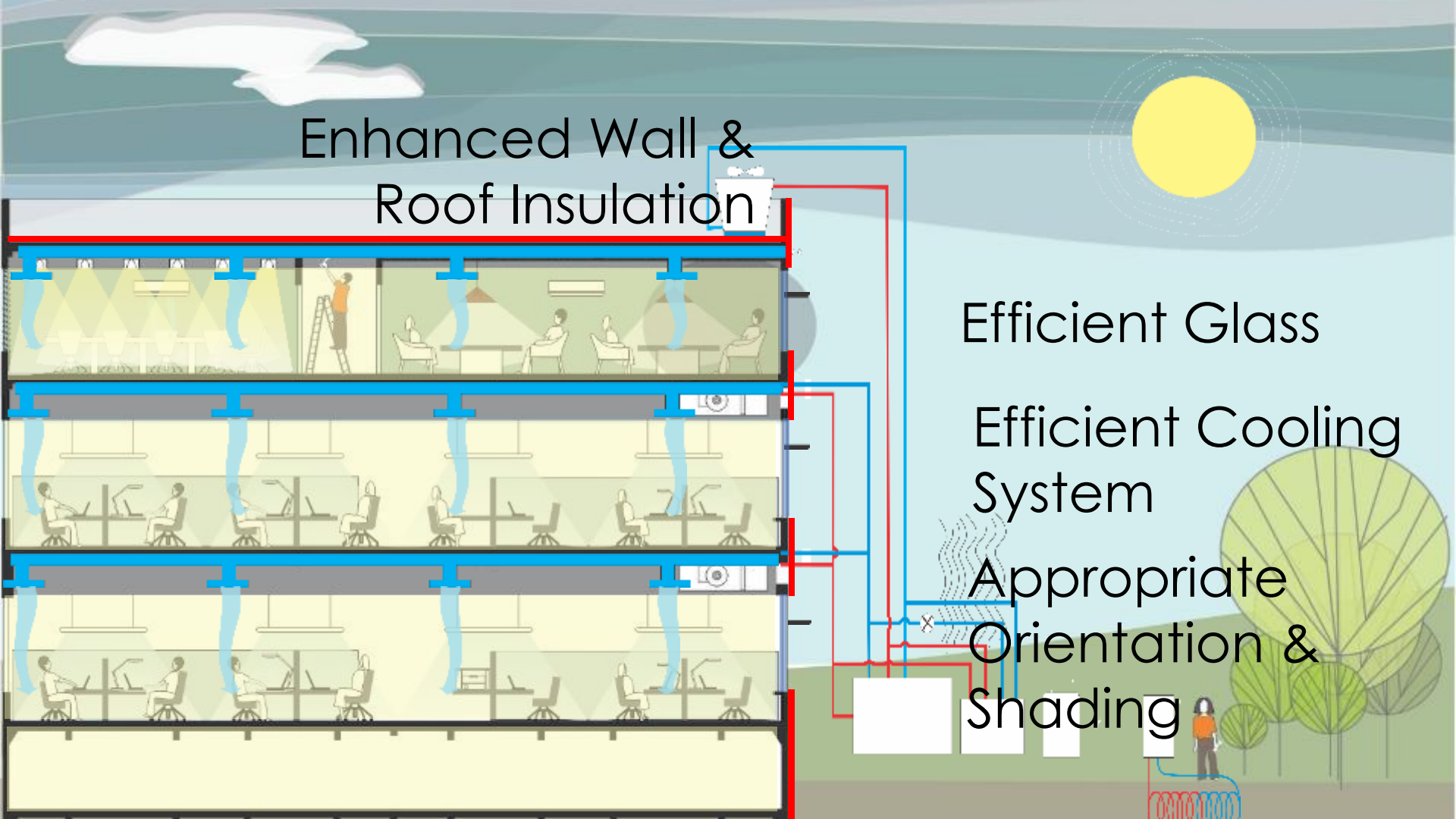
Post-Construction Phase

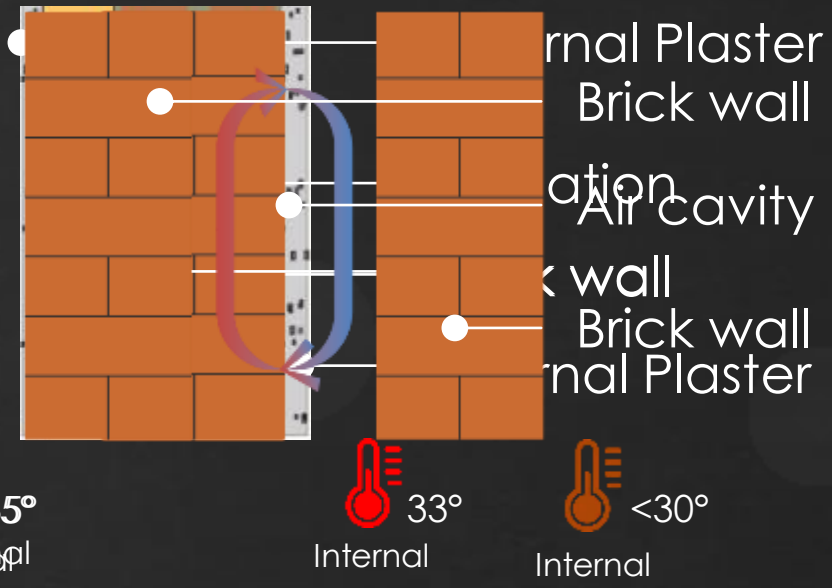
Project Life-Cycle

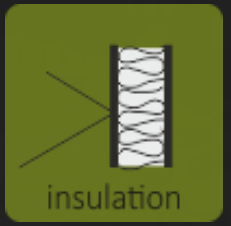
Approach for NZEB



Design Strategies for Energy Efficiency


Enhanced Wall &
Roof Insulation
Efficient Glass
Efficient Cooling
System
Appropriate
Orientation &
Shading





10- 20%

Reduction by 5°- 8°

Wall

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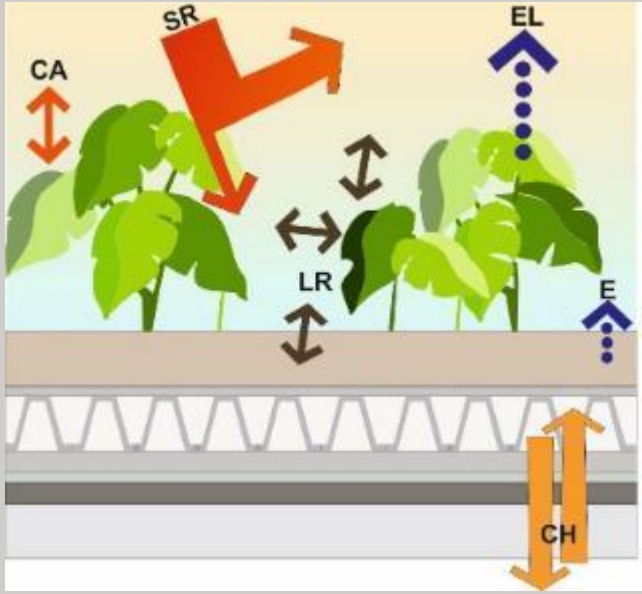
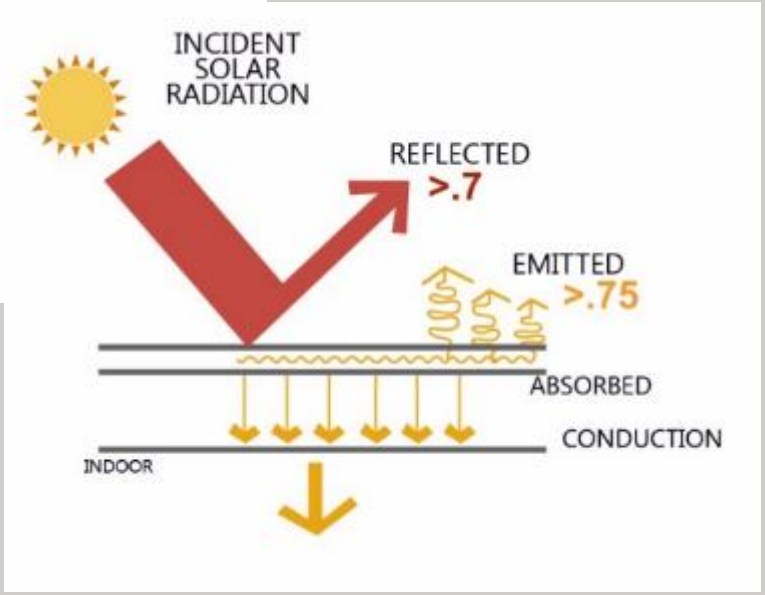
Roof

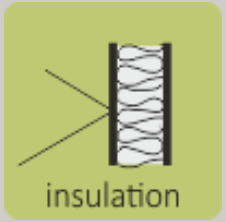


SR - Solar Radiation
EL - Evapotranspiration on leaves
E - Evaporation on soil surface
CH - Conductive heat flux
CA - Convective heat flux with ambient air
LR - Long-wave radiation heat transfer

Green roof



Cool roof



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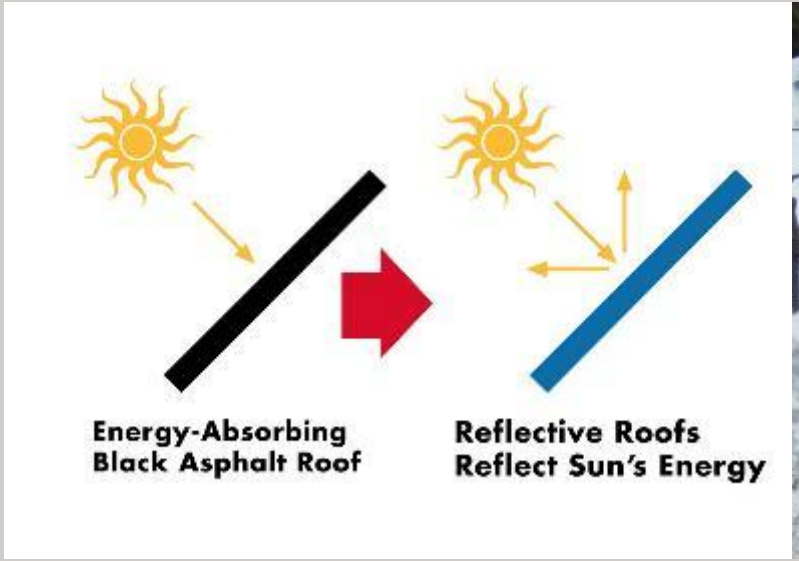

insulation

fenestration

Cooler by 4°- 5°

High SRI paint

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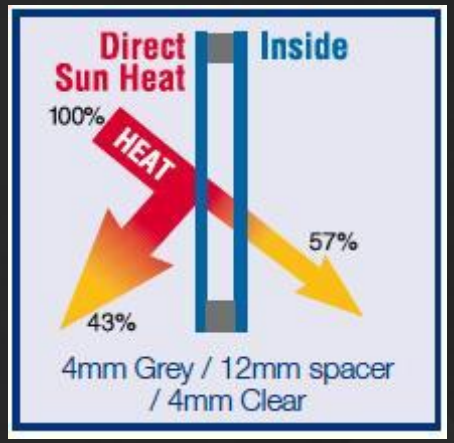
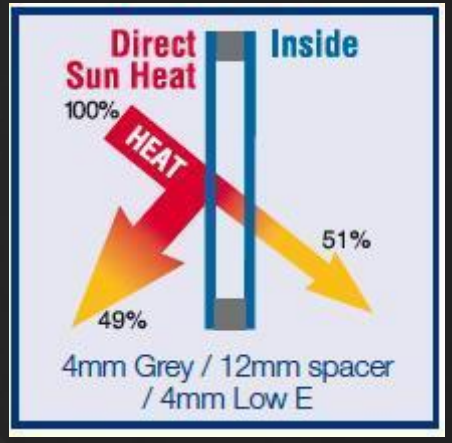
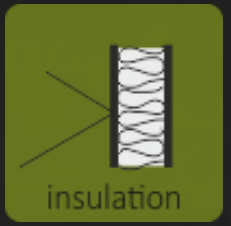
Standard single glazed glass offers little resistance



Insulated glass can reduce heat gain by 25%.



Low E Insulated glass can reduce heat gain by 33%.



Glass

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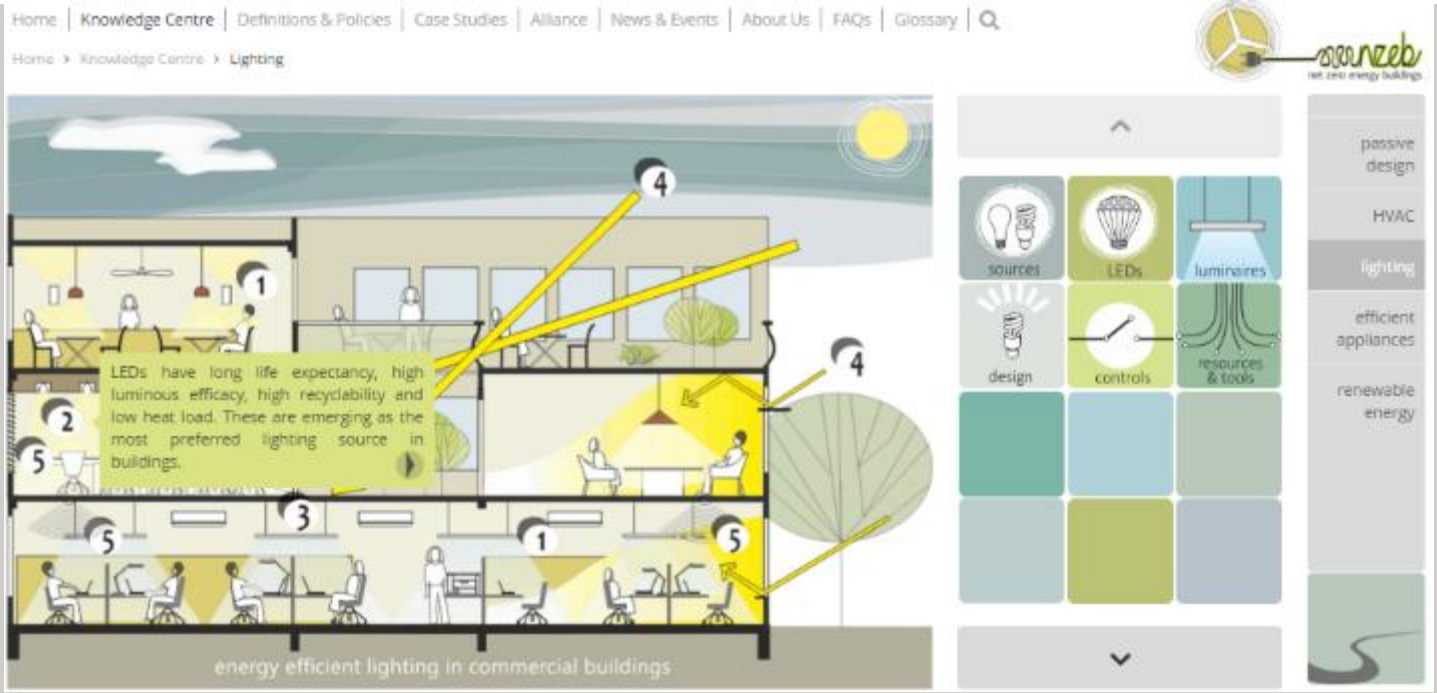
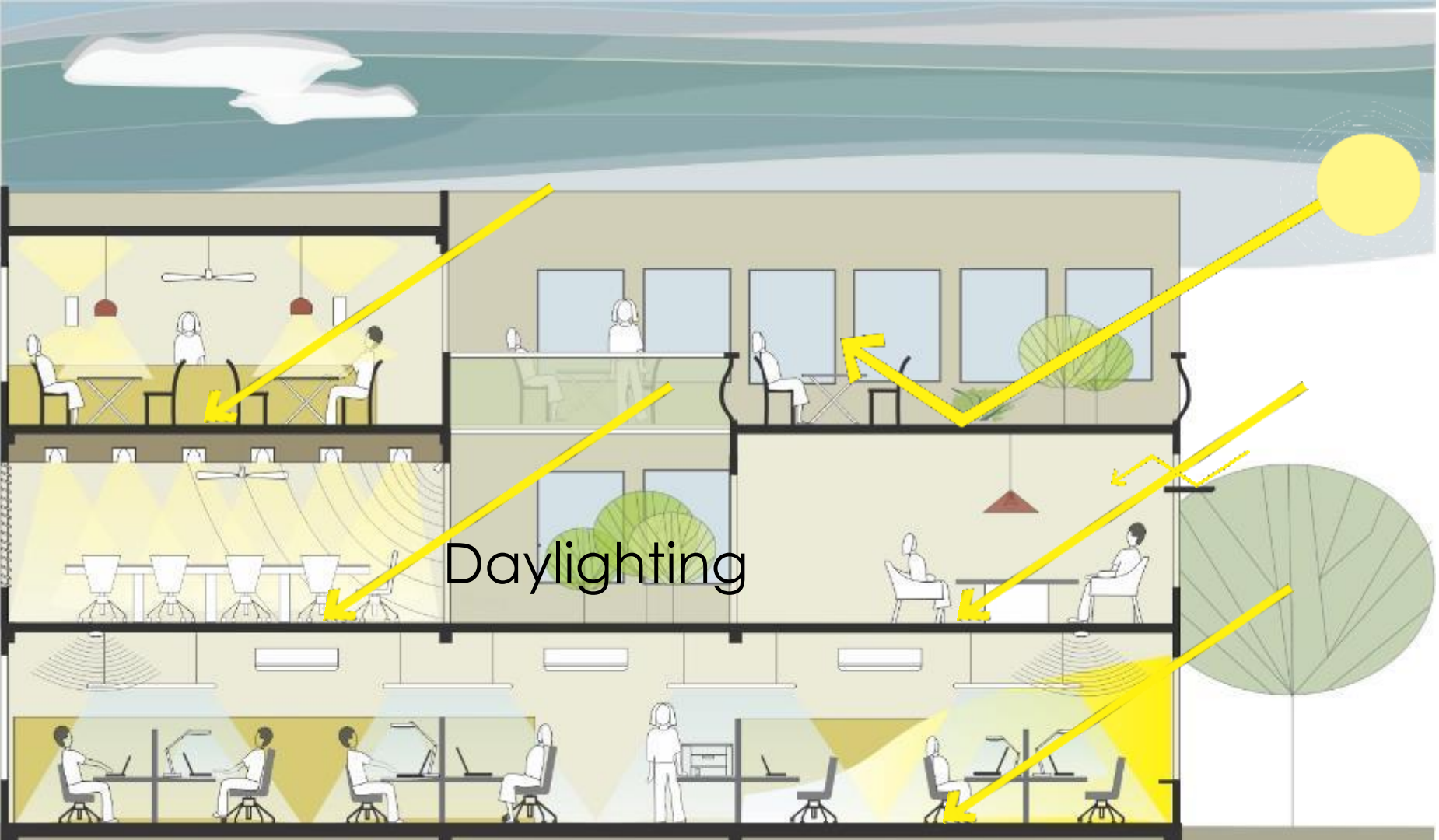
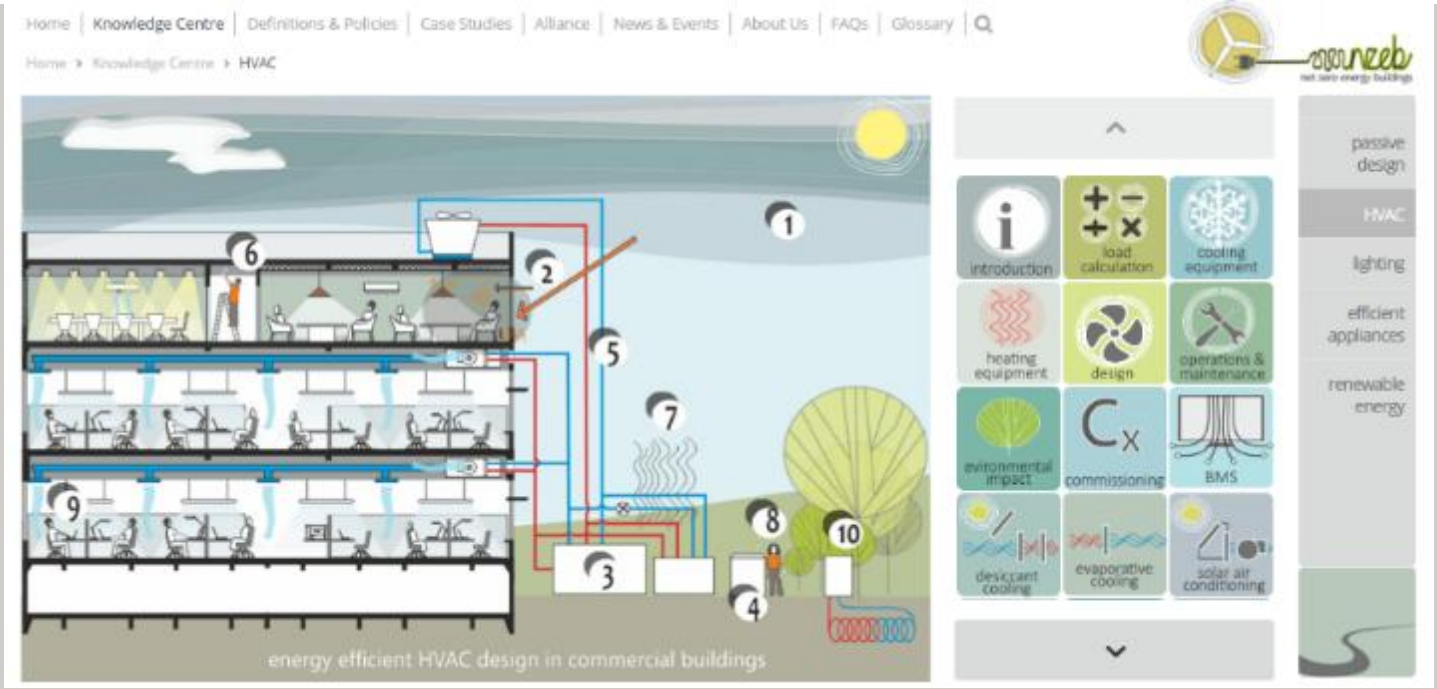
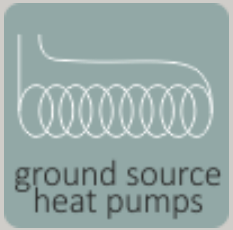


Daylighting and Energy Efficient Lighting

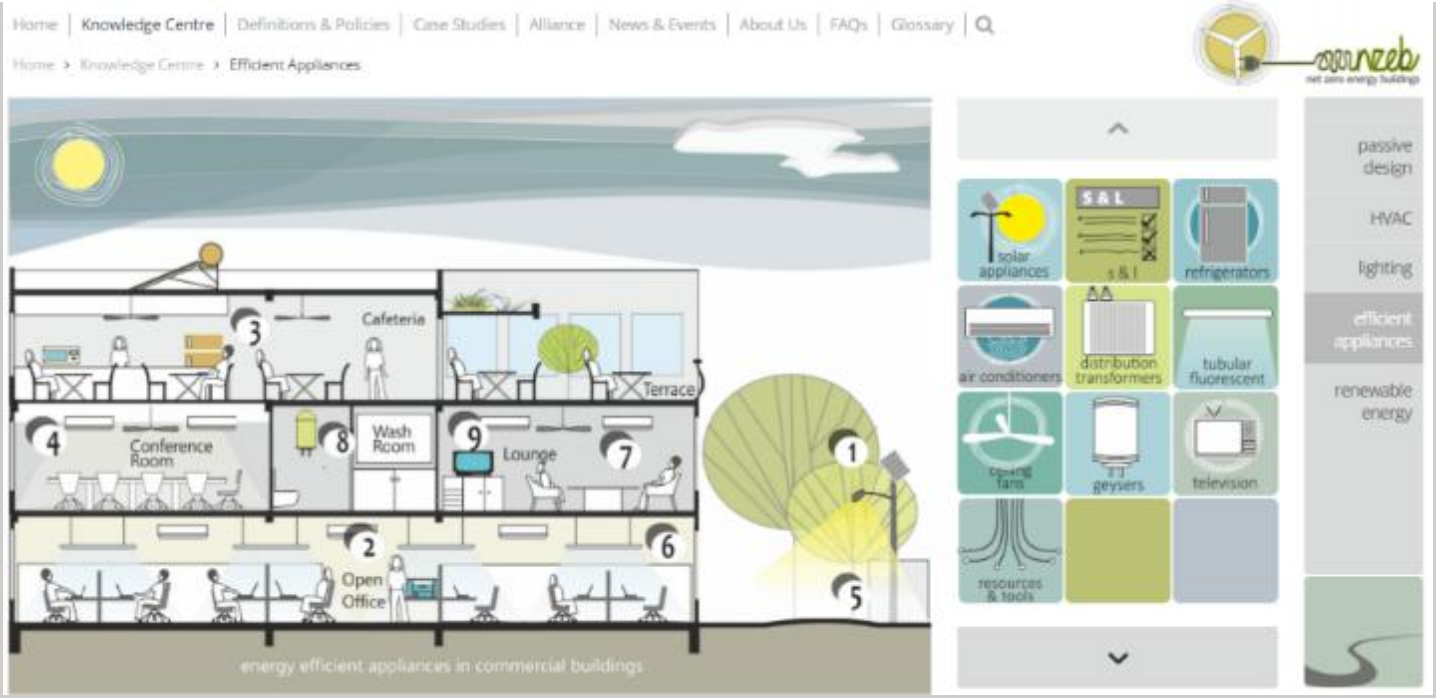

Daylighting


Efficient Lighting
&Controls

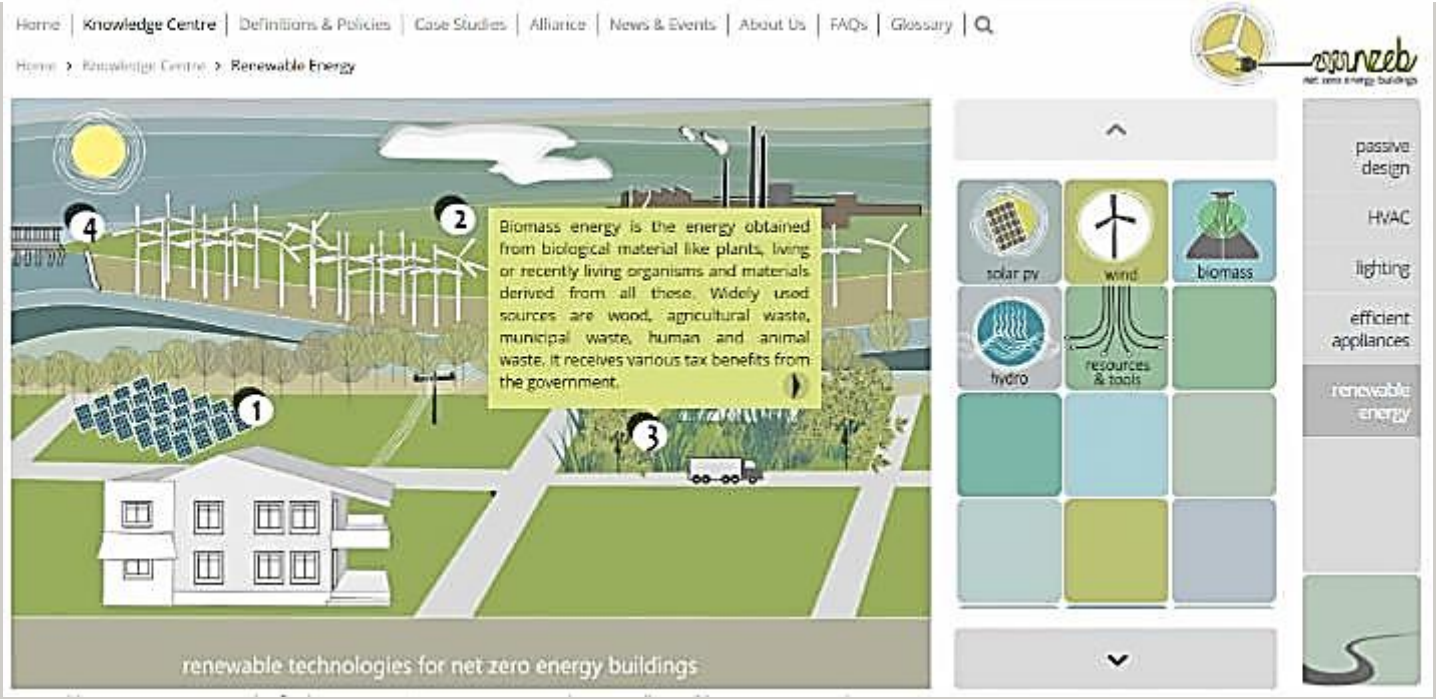


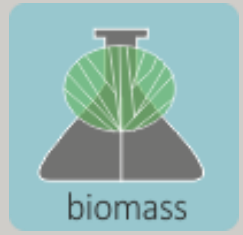


Energy Efficient Air-Conditioning



Energy Efficient Appliances

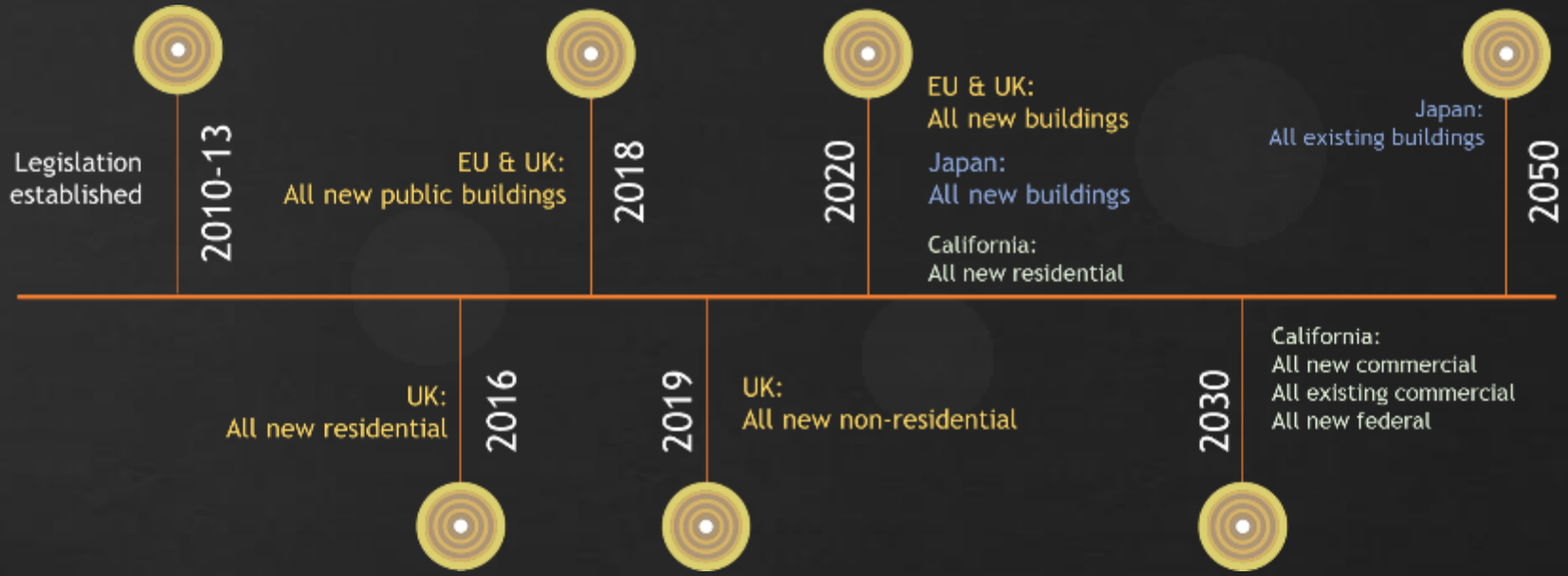




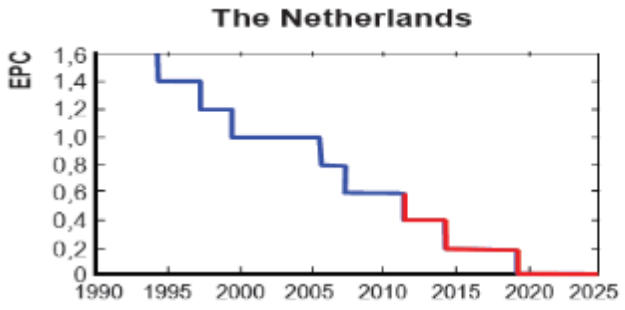
Renewable Energy Integration

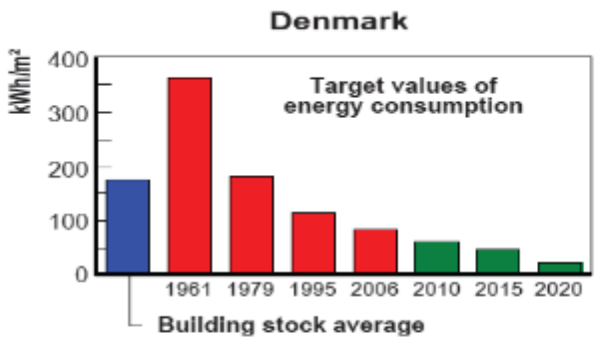
NZEB – Global Approaches

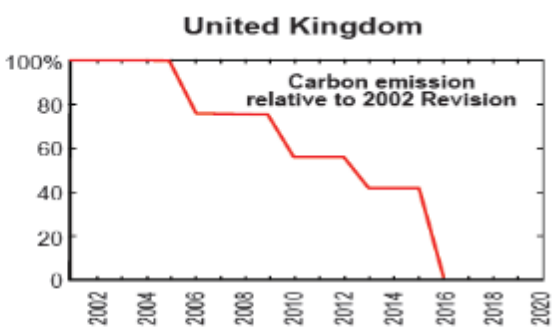
Countries have declared timelines for converting their building stock to NZEBs

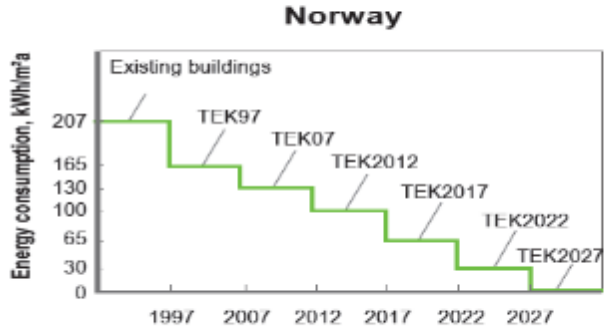


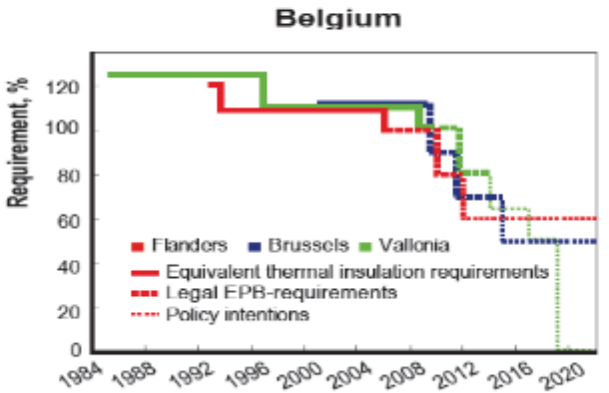
Roadmap for Leaders in NZEBs

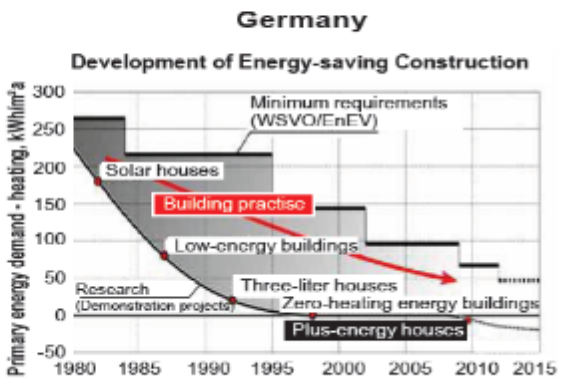












Roadmap to NZEB: Many Countries have already started

Source: REHVA

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International Case Studies

The building's EUI is **41 kWh/sqm/year.** The on-site PV system is sized to meet net-zero site energy at an EUI of **45 kWh/sqm/year**

Daylighting enters deep into the space **reducing** the amount artificial lighting required.

Natural ventilation at ZEB helps **reduce** the air conditioning load.

BCA Zero Energy Building, Singapore

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1.6 MW of photovoltaics on site;
450 kW on rooftop

50 % better than ASHRAE 90.1, 2004 Standard

The building's energy model predicts an EUI of **33 kBtu/ft2/year.**
The on-site PV system is sized to meet net-zero site energy at an EUI of **35 kBtu/ft2/year**.

NREL Research Support Facility
Golden, Colorado, USA

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The inverted pyramid shape **increases** ground space for landscaping while **maximizing** roof space for **PV panels**

Self shading, **Radiant cooling**, **Low-e glazing**, & **Light shelves** were some of the **passive design** elements used.

Annual On-Site Renewable Energy Exported **2 kBtu/ft.**

Malasiya's Energy Commission Headquarters (Diamond Building), Putrajaya, Malasiya

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A **micro CHP** is used throughout the year to cover basic loads.

A building SPV plant of **55 kW** is installed to meet the remaining primary energy demand.

Facade designed to provide **efficient** solar control, natural lighting und passive solar energy gain.

Energy Plus Primary School, Hohen Neuendorf, Germany

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NZEB: Examples from India


Indira Paryavaran Bhawan, New Delhi

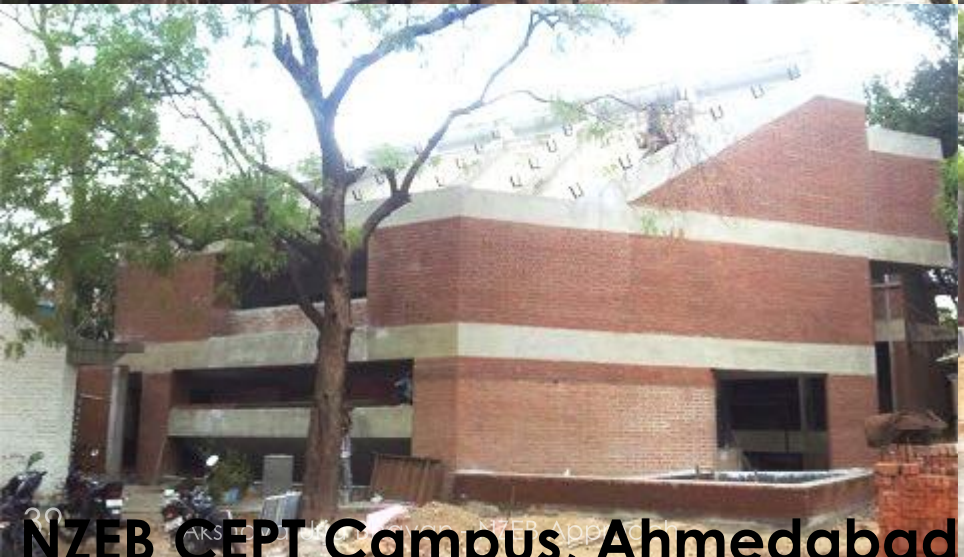
Akshay Urja Bhawan HAREDA, Panchkula; Haryana

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

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

UHBVN, Panchkula, Haryana






NZEB CEPT Campus, Ahmedabad

Nalanda University Campus, Rajgir, Bihar

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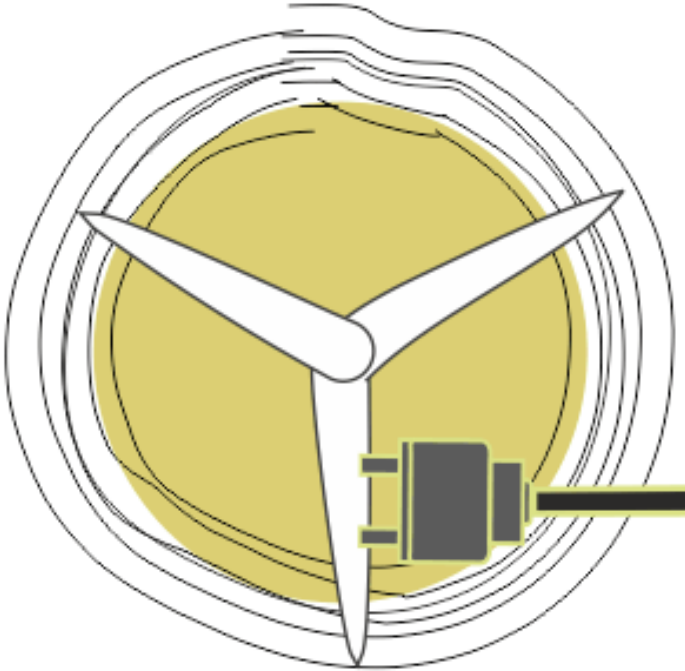
ENERGY IS LIFE
BEE
CONSERVE IT



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Thank You

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