Leading the transition to clean energy

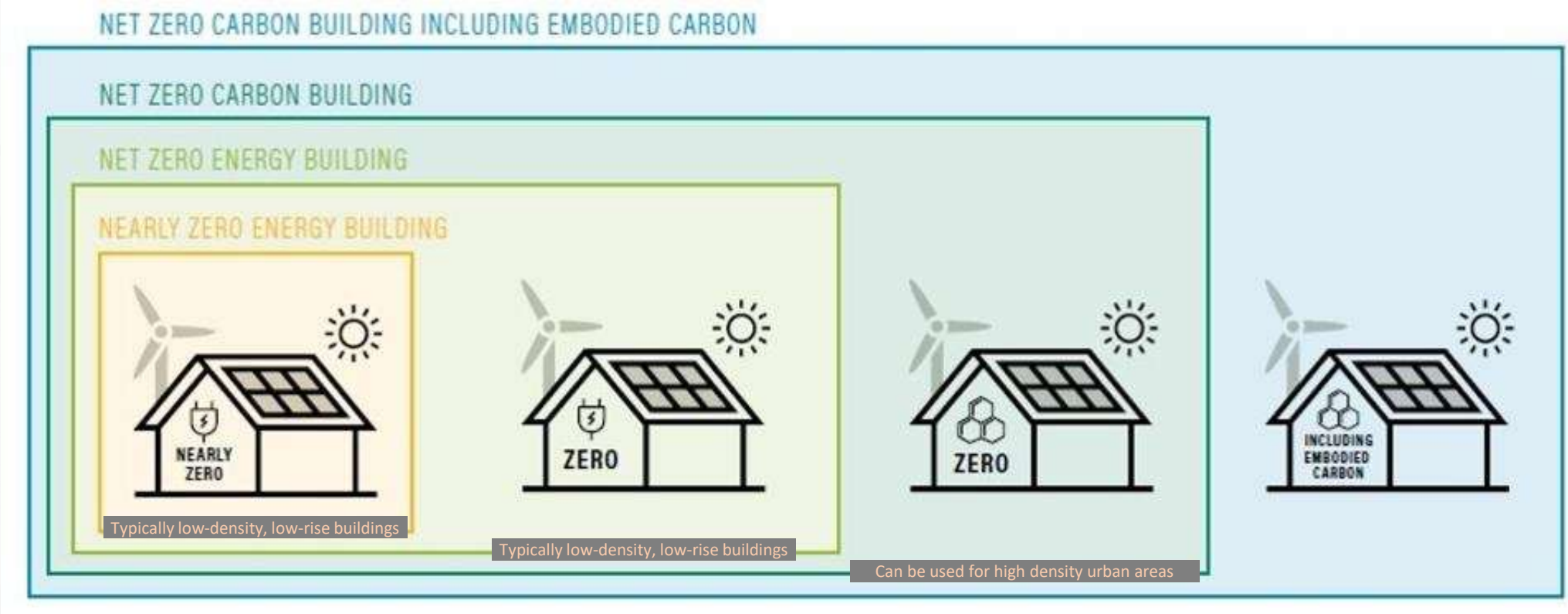
Net-zero carbon buildings

ANGAN

14 Sep 2022

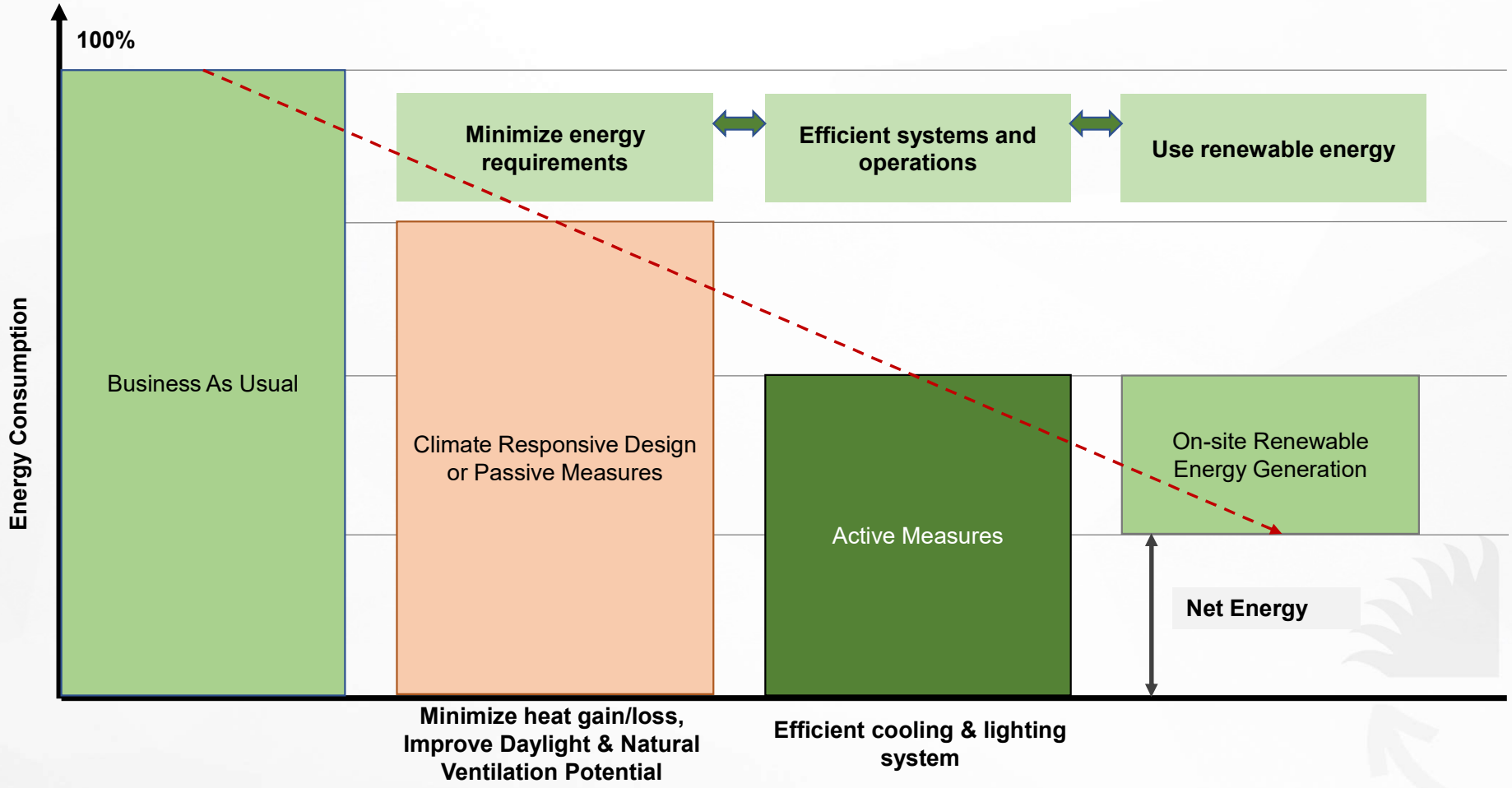
Sonia Shukla
International Institute for Energy Conservation

ZERO CARBON BUILDING CONCEPTS



Source: World Resources Institute

Designing near or net zero energy buildings



Source: BEEP

BEEP
BUILDING ENERGY
EFFICIENCY PROJECT

BEEP-RE

Objective: Design, showcase, implement and monitor building integrated new and innovative Renewable Energy technologies suitable in the local context and applicable for multi-storey buildings

Mahindra **Kanakapura,** Bengaluru

EE and Demand Reduction measures

BEEP

+

RE on-site and green energy from grid

BEEP-RE

→

India's First

Net-Zero Energy

Homes

Designing first Net-Zero homes

Objective: to develop first net-zero residential project in India

4-step approach

BEEP

- Incorporating passive design features – Orientation, natural ventilation (CRD)
- Using energy efficient equipment and designs

BEEP-RE

- RE resource identification and installation at the site
- Strategy for procuring remaining energy from BESCOM

Activities performed

01

Site Assessment

- Sun path, Shadow analysis, weather data (solar insolation, wind flow and direction), Quantification of solid waste etc.
- Identification of maximum potential for each identified technology which site can accommodate

02

Technology Evaluation: Siting and Performance Simulation

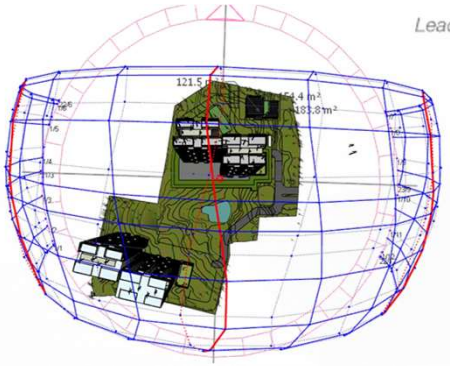
- Annual yield analysis of each identified technology as per resource availability using 3D model of site and buildings and professional simulation tools
- Policy and regulatory analysis

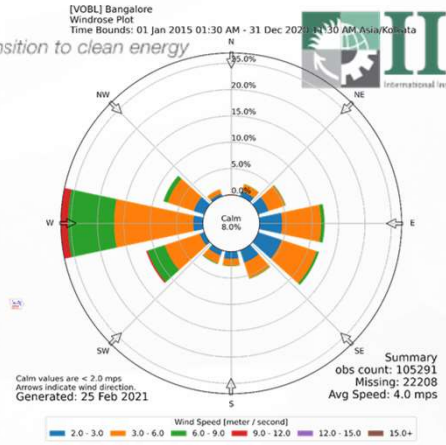
03

Cost Benefit Analysis and Recommendation

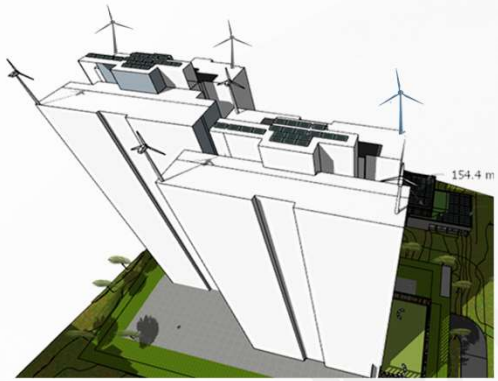
- Recommendations are provided to design team on proposed technologies' installation and maintenance, possible design changes required, changes in structural design etc.

STEP 1 **Site RE Resource Assessment**





STEP 2 **Shading and siting**

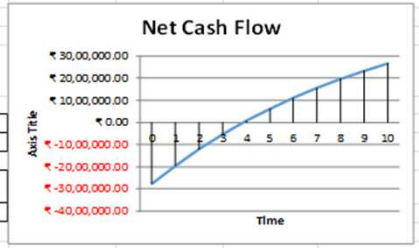


STEP 3 **Cost benefit analysis and recommendation**

Cost-Benefit Analysis

Key Variables

RE system Capacity	60		
Cost of RE installation (including installation, commissioning & testing) Rs/kW	₹ 46,000		
Estimated energy generation kWh/year	99864		
Current cost of electricity	₹ 9.00	IRR	NPV
System lifespan (years)	10	29.77%	₹ 26,59,949.52
Incentives (capital Subsidy)	0%		
Annual Increase in Cost of Grid Electricity	0.50%	Simple Payback (years)	3.07
Performance Degradation of RE system	1.00%		
Discount Rate	10%		



EE and Demand Reduction measures – BEEP

Heat Gain from Roof

Roof insulation

Heat Gain from Wall

160mm Monolithic concrete wall

High SRI paint

To Reflect Solar Radiation

- Up to **95%** reduction in discomfort
- Up to **15%** energy savings
- **~ ₹45 Lakh/year** electricity cost saving for occupants

Proposed Renewable Energy System

Leading the transition to clean energy

Solar Generation = 51,772 kWh

Wind Generation = 78,268 kWh

Total RE Generation from towers = **1,30,040** kWh

~INR 11 lakh savings each year

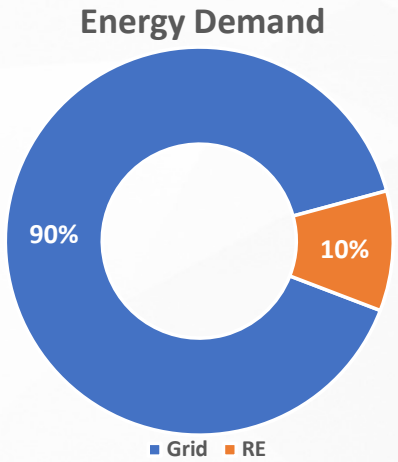
Solar Generation = 97,073 kWh

~INR 8.5 lakh savings each year

Phase 1 (Tower A+B)
16 kWp solar +20 kW Wind Energy System

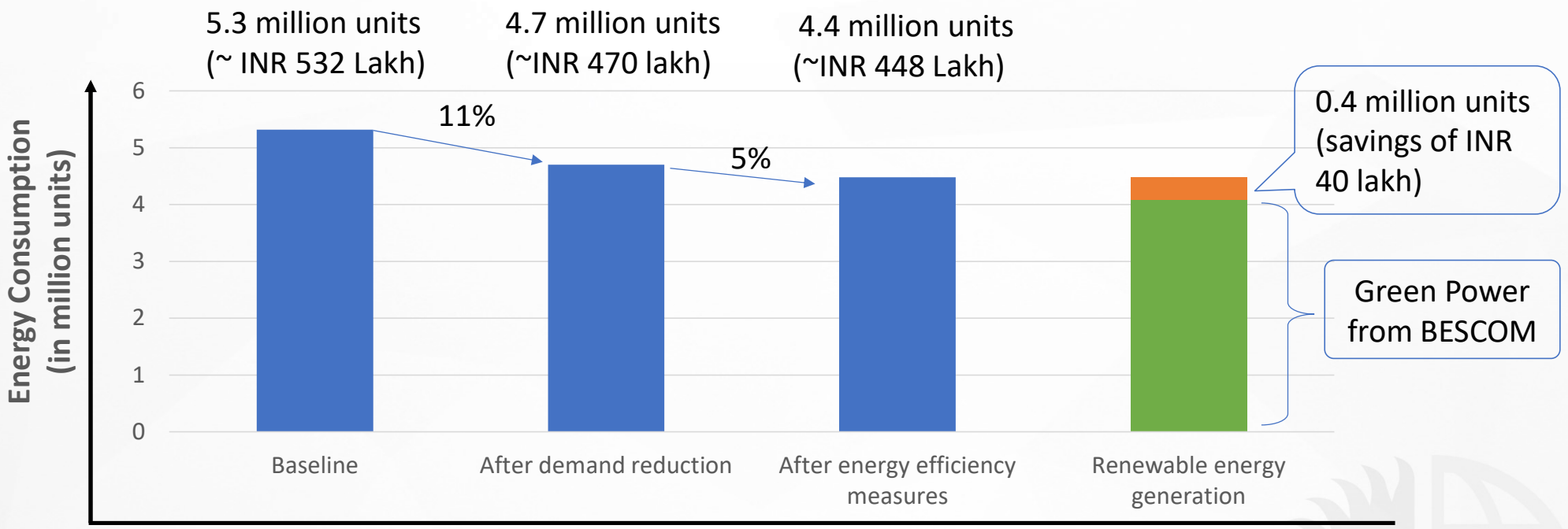
Phase 2 (Tower C+D)
16 kWp solar +20 kW Wind Energy System

60 kWp Solar PV on Sales Gallery



The grid electricity provided by BESCOM shall be green energy @additional 50 paise per unit on top of prevalent tariff

Savings



Savings per year

~ 18 lakh kWh

CO2 emissions savings per year

~ 1400 t CO_2e

Learnings

- EE/RE interventions need to be done at the project design for maximum potential.
- Collaborative effort is required for accepting and integrating sustainability elements
- Financial viability of proposed options