Ministry of Power
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Azadi Ka Amrit Mahotsav

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NEERMAN 2022

(National Energy Efficiency Roadmap for Movement towards Affordable & Natural Habitat)

COMPENDIUM OF AWARDED PROJECTS

BEEP
BUILDING ENERGY EFFICIENCY PROJECT

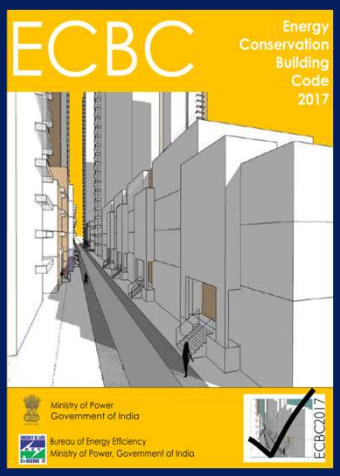
ABBREVIATIONS

AAC	Autoclaved Aerated Cement Block
APFC	Automatic power factor control panel
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BEE	Bureau of Energy Efficiency (BEE)
BMS	Building Management System
CO	Carbon monoxide
COP	Coefficient of Performance
DG	Diesel Generator
DGU	Double glazing units
EPI	Energy performance index
GRIHA	Green Rating for Integrated Habitat Assessment
HVAC	Heating, ventilation, and air conditioning
kW	Kilowatt
LED	Light-emitting diode
LEED	Leadership in Energy and Environmental Design
LPD	Lighting Power Density
NBC	National Building Code
PV	Photovoltaic
RETV	Residential Envelope Transmittance Value
SHGC	Solar heat gain coefficient
SRI	Solar Reflectance Index
UPS	Uninterruptible power supply
UV	Ultraviolet
VAV	Variable air volume
VFD	Variable frequency drives
VLT	Visible Light Transmission
VRV	Variable Refrigerant Volume
WWR	Window to Wall Ratio
XPS	Extruded polystyrene

NEERMAN Awards

India's building stock is expected to double in the next 15 years and buildings are expected to emerge as the largest electricity consuming sector in the country. The residential and commercial buildings accounts for 31% of the electricity consumption and is rising at 10-12% annually. Population growth combined with increasing electricity demand and affordability for thermal comforts (by using air-conditioners) are expected to exponentially increase the energy consumption in buildings. NITI Aayog, a premier think-tank of the Government of India, estimate 6-10 times increase in electricity demand in commercial buildings and 4-10 times increase in residential buildings during 2012 to 2047. It is crucial that the new buildings in the country are designed to be energy efficient and thermally comfortable.

In this context, BEE hosted the first National Energy Efficiency Roadmap for Movement towards Affordable and Natural habitat (NEERMAN) Awards. NEERMAN Awards for Energy Efficient Building Design in India were institutionalized with the objective to acknowledge and encourage exemplary building designs complying with BEE's Eco-Niwas Samhita (ENS) and Energy Conservation Building Code (ECBC).



NEERMAN AWARD PROCESS

The awards are well designed, offers transparency, and are objective and rigorous. A collaborative approach was adopted by forming an honorary technical committee with selected experts. The first technical committee advised on the methodology, process and long-term strategy for the awards. The nominated projects were short-listed by technical committee. The second technical committee identified award winners from the shortlisted projects.

1. Launch of NEERMAN Awards
2. Registration and Submission of Nominated Projects
3. Stage I Evaluation leading to shortlisting of projects
4. Stage II Detailed Evaluation and site visits to shortlisted projects
5. Announcement of Awards

ENS PROVISIONS

Residential buildings or those which are a part of 'Mixed land-use', on a plot area of ≥500 m² could apply for the awards. Projects also must have received Occupancy Certificate between 1 January 2017 and the date of submission 31 August 2021. Projects were scored as per their performance pertaining to:

	ENS Score	Lighting	Lifts	Water Pumps	Renewable Energy	Special Features
Points Allotted	75	5	5	5	5	5

ECBC PROVISIONS

Commercial Building with connected load ≥100 kW or contract demand of ≥120 kVA, and having 100% of high side HVAC, 50% of low side HVAC and 50% of lighting equipment installed could apply for the awards. Projects also must have received Occupancy Certificate between 1 January 2017 and the date of submission 31 August 2021. Projects were scored as per their performance pertaining to:

	Building Envelope	Lighting & Controls	Comfort System & Controls	Electrical & Renewable Energy
Points Allotted* *Business Category	10	30	50	10

NEERMAN AWARDS EVENT

NEERMAN AWARDS 2022

The winners of the BEE's 1st NEERMAN Awards were felicitated during International Conference and Exhibition ANGAN 2022 on 15th September 2022 at New Delhi. The NEERMAN awards saw participation of building projects across the country from Jammu & Kashmir to Andaman & Nicobar Islands.

LIST OF WINNERS

ENS - Residential

Market Rate Housing Category:	The Crest : Tower B The Crest : Tower C

ECBC - Commercial

Business Category:	Infosys CRESCENT SEZ Ph-1
Naturally Ventilated building:	New Academic Block, DBRAIT
Educational Category:	Administration Building, Main Campus, Kashmir University
Health Care Category:	Jupiter Lifeline Hospitals Ltd
Hospitality Category:	ITC Kohenur
Shopping Complex Category:	IKEA, Navi Mumbai

Exemplary Awards

Building Envelope:	Ela Green School
Lighting and Controls:	Kenna Metal, GES BLOCK
Electrical & Renewable Energy Systems:	KREDL Corporate Office Building
Comfort Systems and Controls:	Infosys CRESCENT SEZ Ph-1

CASESTUDY: The Crest : Tower B & Tower C

BUILDING TYPOLOGY : Market Rate Housing

Location: Gurugram

State: Haryana

Climate: Composite

Area: 3,35,000 sq.m

Year of Completion : 2018

Developer: DLF Limited

RETV
Tower C: 5.45 W/m^2
Tower B: 5.85 W/m^2

Roof U-Value
0.3 W/m^2.K

Glass U-Value
1.5 W/m^2.K

The Crest is a luxury housing campus catering to over 600 dwelling units. There are five towers within the campus. These LEED Gold (BD+C) and GRIHA 3 star rated buildings are designed to achieve quick and measurable benefits in environmental quality and energy savings. Its design goal is illustrating the principles of sustainable development and creating more liveable communities.

ENVELOPE FEATURES

Passive design measures were adopted early in the design stages in terms of building orientation to ensure maximum daylight while providing mutual shading to each other.

Tower C and Tower B have achieved low Residential Envelope Transmittance Value (RETV) by :

- Integrating shading strategies in forms of well placed jaalis, balconies and vertical projections optimised to achieve an average effective SHGC of 0.125.
- Double Glazed Windows (DGUs) which are 3 times better in thermal performance over Single Glazed Units have been installed in the project.
- Efficient envelope materials include 200 AAC block wall and 75 mm XPS insulation on roof.

The building construction is done using materials which have high recycled content, low embodied energy and are regional for overall material efficiency

LIGHTING DESIGN

All the lighting installed in the building are LED based, meeting the Lux levels as prescribed in NBC. By ensuring well day-lit spaces, ensured savings in overall lighting consumption.

LIFTS

Four features that make the installed lifts energy efficient are : Gearless traction, Regenerative breaking, efficient LED lighting and VFD's on electric motors

CASESTUDY: Infosys CRESCENT SEZ Ph-1, Block-1

BUILDING TYPOLOGY : Business & Exemplary performance in Comfort Systems & Controls

Location: Bengaluru

State: Karnataka

Climate: Temperate

Area: 63,450 sq.m

Year of Completion : 2019

Developer: Infosys

Lighting Power Density exceeding Super ECBC requirement

Radiant Baffle system

248 KW capacity of Mono-Silicon PV

Infosys CRESCENT SEZ Ph-1, Block-1 is a Pre-Cast building which has 3 Basement and Ground + 9 floors. It is an 8-hour use office building which accommodates 7000 occupants.

ENVELOPE FEATURES

The building form is developed to provide benefit of mutual shading.

- The façade, with a low WWR of 33% is covered with double glazed windows with 0.2 SHGC.
- The roof has a low U-Value exceeding Super ECBC requirement. This is done by application of 100 mm insulation and 55 mm foam spray.
- A narrow floor plate helps 77% of spaces to be naturally daylit. Vision glazing and light shelves help in deeper and unform distribution of daylight.
- All the terrace areas have SRI coating.

LIGHTING DESIGN

The project has achieved low LPD in office spaces of 4.84 W/m^2 and outdoor landscape of 0.17 W/m^2.

Occupancy, Daylight sensors and movement controls installed in interior spaces reduce lighting energy use. Astronomical time switches are installed for outdoor lighting.

COMFORT SYSTEM

The project has provision of centralized Air Conditioners for Office spaces with four water cooled chillers with maximum COP of 7.19.

- The HVAC system is equipped with Radiant baffle systems, which reduces the energy consumption, ie., 51% energy saving over base case as per ASHRAE Std.
- Cooling tower with high efficiency of 92% is installed.
- All the systems is integrated & monitored through BMS.

ELECTRICAL & RENEWABLE ENERGY DESIGN

Sub- Metering is provided for all energy utilities. Energy efficient motor and dry type transformers are also installed. Renewable energy is generated by 248 kW roof PV.

CASESTUDY: New Academic Block, DBRAIT

BUILDING TYPOLOGY: Naturally Ventilated Building

Location: Port Blair

State: Andaman and Nicobar Islands

Climate: Warm & Humid

Area: 5396 sq.m

Year of Completion : 2017

Developer: DBRAIT

Courtyard for enhanced Natural Ventilation

Louvers and shaded windows for daylighting

Solar PV installed of 80 KW capacity

New Academic Block in Dr B R Ambedkar Institute of Technology Campus Port Blair, is a G+3 structure constructed for seismic zone V and a sloping terrain. Availability of energy efficient construction materials and sourcing from the mainland was a constraint that the project located on the island had to overcome. The building is certified with GOLD rating by IGBC-CII in the year 2018.

ENVELOPE FEATURES

The building form takes inspiration from vernacular architectural design practices of Southern India. The building has a central courtyard, which allows for daylighting and natural ventilation throughout the day.

- The building's WWR is 32%.
- The windows are of 6mm thick UV protected glass are provided with wide overhead corridors and box type shading devices. Clerestory windows are provided with louvers.
- The building is used in day-time hours and 80% of the spaces are naturally daylit.

LIGHTING DESIGN

Low interior lighting LPD of 3.9 W/m^2 exceeds SuperECBC performance requirement

NATURAL VENTILATION SYSTEM

The classrooms are aligned all along the courtyard. With windows and ventilators on exterior façade and the opposite walls looking into the courtyard seamless flow of cool breeze is possible.

- The project has an appreciable openable window to floor area ratio of 28%.
- 100% of regularly occupied spaces are cross-ventilated.
- BEE 5 Star rated ceiling fans are installed.

ELECTRICAL & RENEWABLE ENERGY DESIGN

An energy management system is in place. BEE 4 Star DG set and grid-connected Rooftop Solar panels are installed. The total anticipated load of the building is 273.5 kW, out of which 80 kW is generated by Solar.

CASESTUDY: Administrative Building, Main Campus, Kashmir University

BUILDING TYPOLOGY :Educational

Location: Srinagar

State: Kashmir

Climate: Cold

Area: 10,000 sq.m

Year of Completion : 2021

Developer: Kashmir University

Extensive use of Double Glazing Unit for Daylighting

Atrium equipped with Mechanical Ventilation Fans

Installed Comfort system sensors and controls

The building is designed for spatial and material optimization, energy efficiency, human interaction, comfort and the celebration of traditional timber design in a contemporary context. The building functions are developed in two distinct blocks around a central atrium space. The tree forms a focal point from the entrance, through the atrium space, which is an “all weather” space for gatherings, chance meetings, and setting up of temporary exhibitions.

ENVELOPE FEATURES

The building is naturally lit with extensive use of glass which are energy efficient DGUs. The roof has 50mm fibreglass insulation and wall areas enclosing service spaces have a built in Trombe wall system.

LIGHTING DESIGN

The circuits of the glare free LED lighting, are designed to maximize the use of natural lighting. So lights close to the windows and glazing can be switched off separately, while some interior lights may continue to be used.

COMFORT SYSTEM

The project has Variable Refrigerant Flow system installed, each zone is independently climate controlled, using all-weather VRV air-conditioning.

- The system also has enthalpy control, so that when the outdoor conditions are pleasant, the compressors shut down and only fresh air is circulated through the building.
- Timeclock, occupancy controls, dampers, VAV fan control, temperature and fan controls and centralized demand shed controls are installed
- The central atrium has heat sensors and mechanical ventilation fans. These switch on to flush warm air, in case it rises above a set point.
- During peak summers, openable top hung windows within the DGU curtain wall system to assist with natural ventilation.

ELECTRICAL & RENEWABLE ENERGY DESIGN

BEE 4 Star rated DG Sets, an UPS of 94% efficiency at 100% load are installed.

CASESTUDY: Jupiter Lifeline Hospitals Ltd

BUILDING TYPOLOGY : Health Care

Location: Pune

State: Maharashtra

Climate: Warm & Humid

Area: 26,580 sq.m

Year of Completion : 2018

Developer: Jupiter Lifeline Hospitals Ltd.

Roof U-Value 0.31 W/m^2.K

Interior LPD exceeds Super ECBC requirements

Free Cooling in patient floors

Jupiter Hospital is a 350-bed multi-specialty, tertiary care hospital. The building has 3 underground floors, 9 overground floors + 1 service floor.The project is a BEE 4-star rated hospital. It has achieved an EPI of 136 kWh/m^2 year

ENVELOPE FEATURES

- Semi unitype clear glass DGU has been used in the project which has a U-Value of 2.8 W/m^{2}K.
- The roof is insulated with extruded polystyrene (XPS) which brings the U-Value to 0.31 W/m^{2}K.

LIGHTING DESIGN

Energy efficient interior lighting achieves low LPD of 2.56 W/m^2 which exceeds SuperECBC requirement. Also, motion sensors are installed in interior spaces to reduce lighting energy use.

COMFORT SYSTEM

In hospitals, HVAC system are important as the cooling and ventilation requirements are stringent in comparison to other commercial buildings. The project has employed several energy efficiency measures:

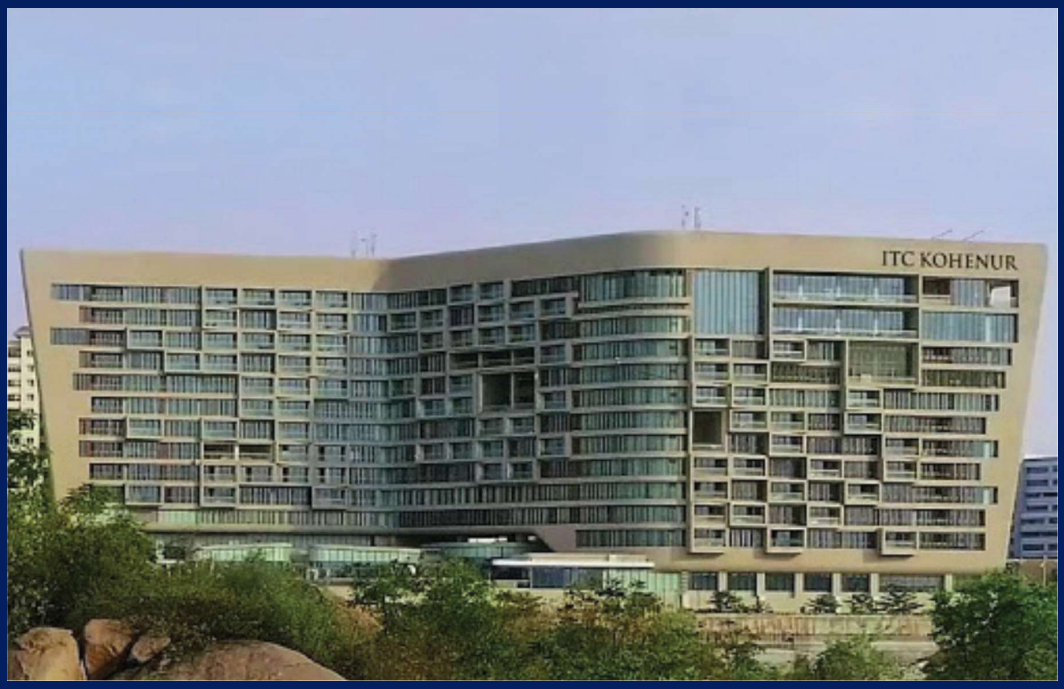
- Controls like timeclock, temperature controls, occupancy controls, fan controls, and dampers.
- Patient floors have the provision of free cooling, which allows outside air when suitable for space cooling, to directly be supplied without passing through the cooling coil.
- The TFA has heat recovery wheel to cool fresh air using exhaust air.
- Condenser water is used for reheating in AHUs. They are located so as to make heat sink free of interference from heat discharge by devices located in adjoining spaces, and not to interfere with other such systems installed nearby.

ELECTRICAL & RENEWABLE ENERGY DESIGN

DG sets provided on site are BEE 3 star rated and motors have an efficiency of IE 2.

CASESTUDY: ITC Kohenur

BUILDING TYPOLOGY : Hospitality



Location: Hyderabad

State: Telangana

Climate: Composite

Area: 49,950 sq.m

Year of Completion : 2018

Developer: ITC Limited

Façade openings placed judiciously.
WWR of 32.46%

Interior LDP is 50% more efficient over ECBC baseline.

Expanded Polystyrene insulation on Piping and ductwork

The project has Ground to 14 floors and two-level basements. The design is inspired by nature. Passive architectural strategies along with energy efficient active measures have been implemented.

ENVELOPE FEATURES

The building mass is tapered downwards to reduce solar heat gain on East and West facades. Energy efficient design features of the project are:

- High performance DGU is installed for adequate daylighting and reduce solar heat gain.
- Box type shading over windows forms an enormous jaali like structure over the façade. Vertical shading devices are added to obstruct low angle sun.
- Planted green walls with integrated irrigation reduces temperature by 3-4^{0}C in enclosing space. Also, the green terrace on third floor provides 1^{0}C temperature reduction

LIGHTING DESIGN

Highly efficient LED indoor lighting is designed such that the internal LPD is 5.5 Watts/m^2. All guest rooms have master control devices, daylit spaces have daylight sensors and programmable dimmer-based lighting is provided in all public areas. LED outdoor lighting has automatic timer-based controls.

COMFORT SYSTEM

A centralized air conditioning system with electric centrifugal magnetic bearing chillers is installed

- All the motors have an efficiency of IE3. The project has also provided time clock and VAV fan controls.
- Cooling tower have variable speed drives for optimum efficiency.
- BMS system controls and monitors the HVAC system based on inputs received from temperature sensors, pressure differential sensors, CO sensors etc

ELECTRICAL & RENEWABLE ENERGY DESIGN

Energy meters are installed to monitor energy use for all major end uses. 5 kW PV and solar hot water heaters are installed on the terraces.

CASESTUDY: IKEA Navi Mumbai

BUILDING TYPOLOGY : Shopping Complex

Location: Navi Mumbai

State: Maharashtra

Climate: Warm & Humid

Area: 21,972 sq.m

Year of Completion : 2020

Developer: IKEA India Pvt. Ltd.

Efficient envelope Comprising of Insulated walls and roof

Maintenance of power factor as required by ECBC

1251 KW of Rooftop Solar

Energy efficiency in shopping complexes is crucial, as studies suggest they use about three times as much electricity per square foot as office spaces.

IKEA Navi Mumbai store is a branch of the world's leading Swedish home furnishing retailer. It is LEED GOLD Certified building.

ENVELOPE FEATURES

- The project has employed an efficient envelope comprising of 50mm Puff insulated walls and 100mm Puff insulated roofs.
- Double Glazing Units helps the fenestration achieve a low SHGC of 0.25
- Skylights comprise 2% of the roof area

LIGHTING DESIGN

Controls and sensors help reduce lighting energy demand in the project. Occupancy sensor, movement controls and daylight sensors are installed in the interiors. Astronomical light switch is installed for exterior lighting.

COMFORT SYSTEM

As most of the energy use of shopping complex typology of building is due to cooling, capturing savings in this area offers huge potential. IKEA Navi Mumbai has implemented the following energy efficient technology:

- Efficient chiller of 6.4 COP is installed. This exceeds the Super ECBC performance requirement.
- Cooling tower efficiency also exceeds Super ECBC requirements.

ELECTRICAL & RENEWABLE ENERGY DESIGN

Motors of IE 2 & 3 efficiency are installed. Power factor and distribution as required by ECBC are maintained. The project has taken advantage of the massive roof space with the installation of 1251 kW of rooftop solar. 100% of hot water requirement is met with solar water heating capacity.

CASESTUDY: Ela Green School

Exemplary performance of Building Envelope

Location: Chennai

State: Tamil Nadu

Climate: Warm & Humid

Area: 7,900 sq.m

Year of Completion : 2018

Developer: Ela Green School

Light shelves for enhanced daylighting

Insulated building envelope

Ela Green School building was conceived to be green and sustainable rightly from the early design stage. It is a Ground + 3 floor structure designed for a capacity of 768 students. The project has also achieved LEED Platinum rating.

ENVELOPE FEATURES

The built form and orientation is optimized considering energy consumption and ventilation. Energy efficient envelope features of the project are:

- Insulated hollow core slab is used as roofing material. The roof is also shaded by rooftop Solar PV.
- Insulated concrete walls with a U-Value of 0.61 W/sq.m.K, vegetated green walls, and DGUs with a U-Value 1.6 W/sq.m.K are incorporated in faces exposed to high amount of radiation: South east and North west facades. The green walls also mitigate heat island effect.
- Staggering of the blocks help in enhancing daylight, ventilation and views. The corridors act as buffer spaces and eliminate heat gain from low sun angles.
- Building simulations suggest the project's window design and assisted natural ventilation strategy increased the comfort hours from 23% (base case) to 44%, as 9°C temperature difference is achieved between indoors and outdoors.

CASESTUDY: KREDL Corporate Office Building

Exemplary performance of Electrical & Renewable Energy Systems

Location: Bangalore

State: Karnataka

Climate: Temperate

Area: 12,360 sq.m

Year of Completion : 2021

Developer: KREDL

ECBC Compliant
Oil type transformer

50 KW capacity of
On-site Renewable Energy

The corporate office of Karnataka Renewable Energy Development Limited is a daytime operating building with two basements, ground and six floors above. Approximately 9,683 m^2 of area is conditioned. The overall WWR is 34.3 %.

ELECTRICAL & RENEWABLE ENERGY DESIGN FEATURES

- An 11kV class, oil type transformer meeting ECBC requirements is installed on site.
- IE 3 (premium efficiency) class motor is installed on site. This meets the ECBC+ performance requirement.
- BEE 5 star rated DG sets is installed.
- Power factor in all 3 phases is maintained at the point of connection. An automatic power factor control panel (APFC) panel is installed to regulate power factor for distribution.
- The power cabling is also sized such that the losses do not exceed 3% of the total power usage.
- Uninterruptible Power Supply (UPS) has an energy efficiency of 92.79%, at 100% load.
- A total of 50 kW of Solar panels is installed on building roof.

CASESTUDY: Kenna Metal, GES Block

Exemplary performance of Lighting and Controls

Location: Bangalore

State: Karnataka

Climate: Temperate

Area: 1750 sq.m

Year of Completion : 2021

Developer: Kenna Metal

Envelope is designed for daylighting.
Daylit area are provided with daylight control.

Low Interior Lighting Power Density of 2.71 W/m^2

Kenna Metal project comprises of 'Global Engineering Services' block which has ground and two floors above. It is an 8-hour use office building, accommodating 233 occupants. The building is designed to have staggered office wings in the cardinal directions connected through a central core.

Also, windows on the façade have high VLT (visual light transmittance). These are shaded by overhangs with a typical projection factor of 0.3. Daylight controls installed in the peripheral spaces of the floor space ensure consistent quantity and quality of light.

LIGHTING FEATURES

- LED lighting is installed in the interiors reduce energy demand. LPD in office areas of 2.71 W/m^2 exceeds Super ECBC performance requirements.
- Daylight sensors, occupancy sensors and dimmer controls are installed in the project.
- Occupancy sensors as required by ECBC are installed in Toilets.
- Exterior lighting power density in areas such as entry canopy, landscaped spaces, driveways, and parking exceeds ECBC + requirement.

NEERMAN 2022

COMPENDIUM OF AWARDED PROJECTS

ABOUT NEERMAN

The NEERMAN Awards launched in 2021, are national-level recognition for exemplary building designs complying with BEE's Energy Conservation Building Codes. With a total of 17 categories of awards, it covers all types of residential and commercial building. NEERMAN Awards also aim to document and disseminate awarded projects to inspire others to learn and adopt similar practices. They are being conducted annually by Bureau of Energy Efficiency (BEE), supported by Indo-Swiss Building Energy Efficiency Project (BEEP).

ABOUT BUREAU OF ENERGY EFFICIENCY

Bureau of Energy Efficiency (BEE) is an apex Government of India organization developing policies and strategies with a thrust on self-regulation and market principles with the primary objective of reducing the energy intensity of the Indian economy within the overall framework of the Energy Conservation Act, 2001.

ABOUT THE INDO-SWISS BUILDING ENERGY EFFICIENCY PROJECT

The Indo-Swiss Building Energy Efficiency Project (BEEP) is a bilateral cooperation project between the Ministry of Power, Government of India, and the Federal Department of Foreign Affairs of the Swiss Confederation. The overall goal of the project is to reduce energy consumption in new commercial, public, and residential buildings in India through energy-efficient and thermally comfortable design. The project has four key components: building design, building technologies, building policy and outreach.

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National Energy Efficiency Roadmap for Movement towards Affordable & Natural Habitat