



Case Study

Building Smart from the Start: Implementation of Energy Saving Building Codes in Uttar Pradesh



Highlights on Uttar Pradesh Energy Regulatory Commission Building

Location:	Lucknow
Total Project Area:	5288 m ²
Baseline EPI:	123.2 kWh/m ² /year
EPI:	67.7 kWh/m ² /year
Energy Savings:	45%
Estimated Payback Period:	4.6 years
Certification Level:	BEE 5 Star Rating ¹

Uttar Pradesh Energy Regulatory Commission (UPERC) - ECBC Compliant Building

Source: Uttar Pradesh New and Renewable Energy Development Agency

Key Messages

- Uttar Pradesh has established a transparent compliance process for Uttar Pradesh Energy Conservation Building Code (UPECBC) by engaging local authorities and establishing clear roles for state and local agencies.
- Uttar Pradesh set up two high-level committees for streamlining the development and implementation of the Energy Conservation Building Code (ECBC) an ECBC Draft Committee, and a Steering Committee.
- Uttar Pradesh adopted a three-pronged strategy for ECBC implementation that includes execution by development authorities, stakeholder engagement and capacity building efforts, and integrating ECBC with the building approval process.
- According to Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) 134 buildings in Uttar Pradesh are ECBC certified, yielding an estimated annual energy reduction of 171 GWh annually.²



Executive Summary

Residential and commercial buildings in India account for nearly 30% of total electricity consumption. With skyrocketing urbanization, this is expected to increase to 48% by 2042.³ Promoting energy efficiency in buildings across Indian cities is critical to saving energy, combating pollution, achieving India's climate goals and strengthening prosperity.

Building energy codes are effective tools that ensure energy efficiency in the construction and operation of buildings. Energy performance standards can yield a 30% to 40% reduction in energy use.⁴ Sustained energy savings from the building sector is particularly crucial in India, as more than 50% of building stock that will exist in the year 2030 is yet to be built.⁵ To promote energy conservation and to capitalize on opportunities for building energy savings, the Indian government developed the Energy Conservation Building Code (ECBC) for commercial buildings for state adoption. Fifteen states and two union territories in India have notified the code, making it mandatory; other states are in advanced stages of code notification.⁶

Uttar Pradesh (UP) has been working toward implementation of the ECBC. As part of notifying the ECBC in 2018, Uttar Pradesh conducted capacity-building workshops and established a simple compliance process.⁷ The Uttar Pradesh Energy Conservation Building Code (UPECBC) is incorporated into state building bylaws, modified for climatic characteristics and stipulates minimum requirements for buildings to meet energy-efficiency standards.⁸

Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) is the state designated agency (SDA) or the nodal agency responsible for implementing the UPECBC. However, the code compliance is reviewed at the local level. The state's Urban Local Bodies (ULBs) (called development authorities in UP) have been instrumental in helping incorporate UPECBC into the local building bye-laws and building approval process.⁹

Uttar Pradesh adopted a three-pronged strategy for ECBC implementation – execution by development authorities, stakeholder engagement and capacity building efforts, and integrating ECBC with the building approval process. This strategy helped Uttar Pradesh develop a streamlined compliance

process where the building owner and/or developer seeks two approvals, the first during building design and the second, upon completing construction. This two-step compliance approach aligns with the state's "ease of doing business" policy.¹⁰ Uttar Pradesh currently has 134 ECBC buildings either built or under construction.¹¹ Uttar Pradesh's ECBC implementation strategy and compliance process can serve as an example for other Indian states to follow.

Building Codes Save Energy and Costs

India has the highest projected volume of new construction globally.¹² New commercial floor space is estimated to rise at an annual rate of 5% to 6% over the next two decades.¹³ By 2030, projections indicate that India will add 1 billion square meter of new commercial floor space.¹⁴ New construction represents an opportunity to lock in energy savings through energy-efficiency technology and decarbonize the built environment.¹⁵ Energy performance standards that require new buildings to incorporate energy efficiency designs can yield a 30% to 40% reduction in energy use.¹⁶

To reduce the building sector's growing energy consumption and capitalize on the immense potential for energy savings the Bureau of Energy Efficiency released ECBC in 2007, later amending the code in 2017.¹⁷ The ECBC sets minimum energy standards for commercial buildings and designates state agencies to certify and enforce ECBC by notifying the code. Building energy efficiency is also a main focus of the Indian Cooling Action Plan (ICAP). Released in March 2019, the ICAP projects that a 20% reduction in cooling demand is possible through climate-appropriate building envelopes and higher adoption of the ECBC in new commercial development.¹⁸ If states across India adopt energy-saving building codes and leading developers go beyond minimum code requirements for commercial buildings, an estimated 3,453 TWh of electricity could be saved cumulatively between 2014- 2030, equivalent to powering 358 million Indian homes between the same period.¹⁹

Progress on the ECBC in Uttar Pradesh

With a population of nearly 200 million, Uttar Pradesh is the most populous state in India.²⁰ Major cities in the state, such as Kanpur, Lucknow, and Noida, are urbanizing rapidly with small and mid-sized businesses driving growth in the Information Technology (IT) and Business Process Management

(BPM) sectors.²¹ Industrial growth is expected to drive commercial and residential real-estate development increasing the demand for energy from the building sector.²² This growth represents an opportunity to construct energy-efficient buildings that will lock in energy savings for years to come.

Uttar Pradesh is working to ensure that future commercial development is energy efficient. The state notified the UPECBC in July 2018.²³ The UPECBC provides minimum requirements for buildings to meet energy-efficiency standards.²⁴ It outlines specific

energy-efficient measures for building systems such as building envelope, mechanical systems and equipment for heating, ventilating, air conditioning, service hot water heating, interior and exterior lighting, electrical power and motors, and renewable energy systems. By adopting the UPECBC as a minimal requirement for specific new commercial buildings, Uttar Pradesh has ensured that buildings utilize energy-efficient technologies and yield a reduced carbon footprint. UPECBC also includes two incremental requirements that recognize buildings that meet advanced energy efficiency thresholds.²⁵

UPECBC Key Features

UPECBC prescribes three levels of energy efficiency: 1) Energy Conservation Building Code Compliant Building (ECBC Building); 2) Energy Conservation Building Code Plus Building (ECBC+ building); and 3) Super Energy Conservation Building Code Building (Super ECBC Building). The code applies to government and commercial buildings and does not apply to portions of buildings or buildings that use energy for manufacturing processes.²⁶

- **Application of UPECBC:** The UPECBC 2018 applies to buildings that meet either of the following characteristics:
 - Connected load of 100 kW or greater
 - Contract demand of 120 kVA or greater
 - Plot area of the building is more than 1000m² with a minimum 2000m² built-up area (excluding basement)²⁷
- **Prescriptive Method:** For a building to comply with the prescriptive method, it must meet minimum requirements (or maximum) for building envelope components, heating and cooling systems, and lighting (as outlined in provisions 4 through 7 of the UPECBC).²⁸
- **Whole Building Performance Method:** For a building to meet the whole building performance method, the building must have an Energy Performance Index (EPI) ratio equal to or less than one (as outlined in provision 9 of the UPECBC) and meet mandatory specifications.²⁹
- **Mandatory Requirements:** To comply with the Prescriptive or Whole Building Performance method, a building must meet specific mandatory thresholds for building envelope, ventilation, lighting controls, and electrical systems (specifications 4.2, 5.2, 6.2, 7.2).³⁰
- **Voluntary Compliance:** Buildings that do not fall within the compliance specifications can choose to comply with the UPECBC; building retrofit projects also can submit an annexure to register as an ECBC compliant building.³¹

Stakeholder Roles in UPECBC Compliance

Strong stakeholder engagement is crucial to effective code development, adoption, and implementation. In Uttar Pradesh, national, state, and local government agencies work together to ensure that new commercial buildings meet the code requirements. The State-Designated Agency (SDA) or nodal agency responsible for overseeing the implementation of the UPECBC is the Uttar Pradesh New and Renewable Energy Department Agency (UPNEDA).³² While UPNEDA has the primary responsibility for implementing UPECBC, Urban Local Bodies (ULB) known as Development Authorities in Uttar Pradesh and other state regulatory

agencies have supported the notification and the code compliance process. Development Authorities have been instrumental in incorporating UPECBC into the local building bye-laws and building approval process.

Private and professional organizations are vital to develop and implement the UPECBC. These groups provide a technical knowledge base for UPECBC compliance procedures; they also play a crucial role in knowledge sharing and building the capacity of the different stakeholders. Table 1 highlights the role of national, state, local, and support groups in the ECBC compliance process in Uttar Pradesh.

TABLE 1: Key Agencies involved in Development of UPECBC Compliance Process

Name	Type of Organization	Description of role in ECBC
Bureau of Energy Efficiency (BEE)	Statutory body under Ministry of Power, Government of India	Developed the ECBC in 2007, amended the code 2017, contributes to capacity building efforts in the states, and sets up the ECBC cell in all states. Developed ECBC Rules notified in The Gazette of India in February 2018.
Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA)	Uttar Pradesh Nodal Agency or State Designated Agency (SDA)	The state agency responsible for energy efficiency programs. Oversees the broader implementation of UPECBC, led the amendment and notification process of UPECBC 2018, and developed the compliance process.
Housing and Urban Planning Department or Concerned Development Authorities	State Department of Uttar Pradesh Concerned Development Authorities are Urban Local Bodies under the state department of Housing and Urban Planning.	The Housing and Urban Planning Department worked to introduce the ECBC in building bye-laws. Concerned Development Authorities under the state department are responsible for implementation of UPECBC 2018 in their respective jurisdictions.
Infrastructure and Industrial Development Department or Concerned Industrial Authorities	State Department of Uttar Pradesh Concerned Industrial Authorities are Urban Local Bodies under the state department of Infrastructure and Industrial Development Department.	The State Department of Industrial Development is responsible for oversight of local development and building ordinances. The concerned Industrial Authorities implement the UPECBC 2018 in their respective jurisdictions.
Green Tree Global	UPECBC Cell	Drafted UPECBC code and rules, supports technical capacity building, and assists UPNEDA in developing code processes.

UPECBC Compliance Framework

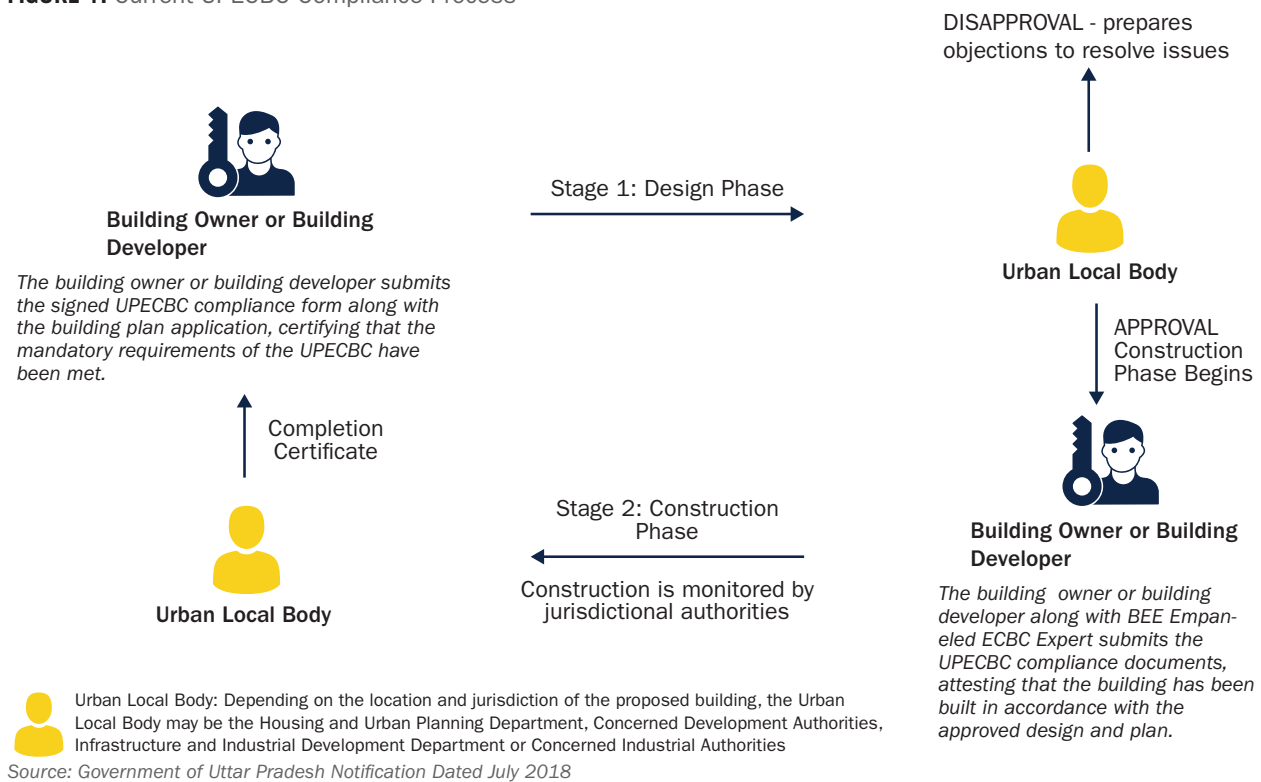
Uttar Pradesh has adopted a simple two-stage approach to code compliance. The owners or building developers go through two approvals, the first at the time of building design and the second upon the completion of construction (Figure 1).

Steps in the Current UPECBC Compliance Framework

Stage 1: To obtain building construction approval, the building owner or building developer submits a UPECBC compliance form along with the building plan application. The UPECBC compliance form is duly signed by either the building owner or building developer and architect certifying that the mandatory requirements of the UPECBC have been met.

Stage 2: After completion of building construction, the owner or building developer along with BEE Empaneled ECBC Expert submits the UPECBC compliance documents, attesting that the building has been built in accordance with the approved design and plan. Once the self-declaration, duly verified by BEE Empaneled ECBC Expert, is submitted along with other necessary approvals under the rules of Housing and Urban Planning Department or Concerned Development Authorities/Infrastructure and Industrial Development Department or Concerned Industrial Authorities in their respective jurisdiction, UPECBC is considered complete.

FIGURE 1: Current UPECBC Compliance Process³³



UPNEDA is working to align the UPECBC compliance process with BEE's 2018 ECBC rules and implementation framework, including adjusting its compliance process to include an empaneled design and construction inspection. The revised UPECBC compliance process is under approval.

UPECBC Proposed Compliance Process

The proposed compliance process requires initial approvals after the building design is completed to receive the building construction permission, and another approval upon completing construction to receive the building completion certificate. The building design will need certification from a BEE Empaneled Energy Auditor (building) at the design stage as opposed to a self-declaration by the building owner in the current compliance process (Figure 1). The new process will also require mandatory on-site check by BEE Empaneled Energy Auditor (building) during the construction phase before a completion certificate is issued by the development authority. In the current process, there is no mandatory requirement for on-site inspections during construction.

Design stage (proposed): The owner or building developer in consultation with the project architect, will seek design certification by a BEE Empaneled Energy Auditor (building). Once a compliance report is issued by the BEE Empaneled Energy Auditor (building), the owner or building developer will submit the compliance documentation to the local Housing and Urban

Planning Department and/or Concerned Development Authorities, stating that the building design complies with UPECBC.³⁴

Construction stage (proposed): During the construction phase, a BEE Empaneled Energy Auditor (building) will need to complete a mandatory on-site check. Once verified by a BEE Empaneled Energy Auditor (building) and after the construction process is complete, the owner or building developer will submit the documentation attesting that the building is constructed according to the approved design plan. In addition, the owner or building developer will also have to submit all other building approval forms to the



ATS Building in Noida
Source: GreenTree Global

local Housing and Urban Planning Department and/or Concerned Development Authorities.³⁵ On validation of the submitted documents, the concerned authority will issue a completion certificate.

Lessons from UPECBC Development and Implementation

For the UPECBC, Uttar Pradesh adopted four main steps: 1) government committees; 2) development authority execution; 3) integrating ECBC with the building approval process; and 4) stakeholder engagement and capacity building efforts. Figure 2 outlines the timeline for UPECBC notification and compliance framework development.

Government Committees

As an initial step to streamline ECBC notification, Uttar Pradesh set up two committees: the ECBC draft committee and the ECBC steering committee. The ECBC draft committee was established with the Engineer-In-Chief, Uttar Pradesh Public Works Department (UPPWD) as the Chairman and responsible for reviewing the technical draft of the code prepared by the UPNEDA. A steering committee under the chairmanship of the Principal Secretary, Energy and Additional Sources of Energy Department, then approved the draft code for notification. Since the notification, UPECBC has been incorporated in the building bye-laws by 27 Development Authorities.³⁶

Implementation by Development Authorities

In Uttar Pradesh UPECBC was incorporated by Development Authorities as compliance mandates in their respective jurisdictions. For instance, Development Authorities now require UPECBC compliance certificates to be submitted with other

building approval forms. This effort aims to create more uniformity in how ULBs regulate and oversee the UPECBC. The state is also promoting the broader adoption of energy-efficient materials in construction by incorporating these materials into the public works department's Schedule of Rates (SORs). Uttar Pradesh is one of the few states in the country to incorporate energy efficient materials in UPPWD SORs. The state incorporated SORs for energy efficient electrical equipment in 2018 and is in the process of including energy efficient civil equipment.³⁷ This inclusion has streamlined the process of adoption of energy efficiency equipment in all new public sector building construction in the state, locking in energy savings.

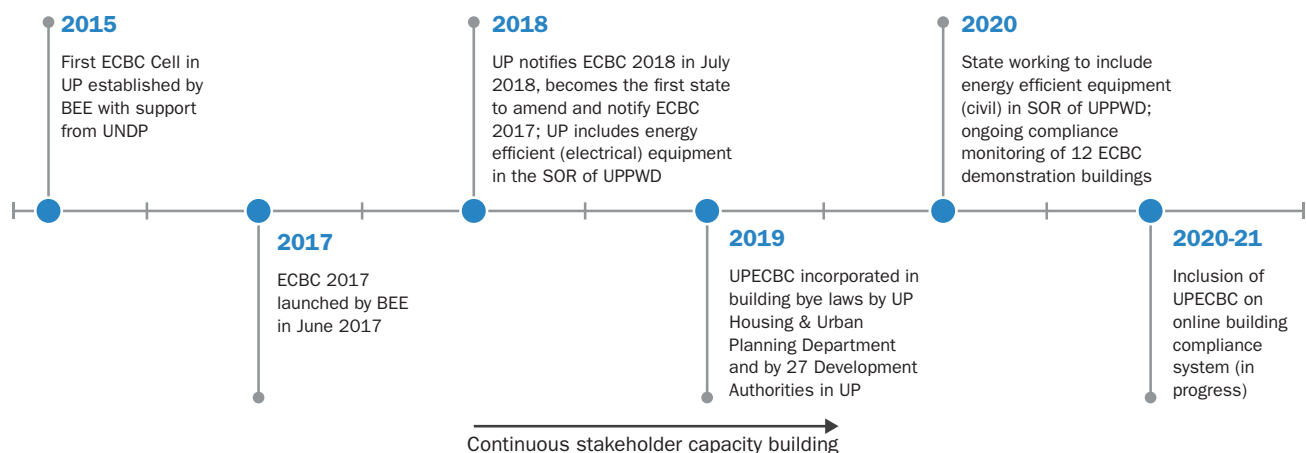
Integration of ECBC with the Online Building Approval Processes

To scale UPECBC across the state, UPNEDA is working with the Housing and Urban Planning Department to integrate the UPECBC compliance process into the existing online building approval system. The objective of the online tool is to improve user experience and streamline the UPECBC compliance process. The purpose of adopting a single online tool is to improve the state's ability to monitor and document UPECBC certified buildings and integrate the state-managed system with urban development department certification procedures. The online system will help ensure compliance, as the owner or building developer will be required to submit the UPECBC compliance certificate, and other building permits in the system.³⁸

Stakeholder Engagement and Capacity Building

To engage market leaders and government officials, UPNEDA working with the ECBC cell held several stakeholder meetings with real estate developers, building experts, and local representatives. More

FIGURE 2: Timeline of ECBC Adoption and Implementation in Uttar Pradesh




Source: GreenTree Global and UPNEDA


than 22 UPECBC capacity building workshops were organized in Uttar Pradesh in the last two years. Workshops were critical in ensuring that both, public and private, stakeholders are familiar with the UPECBC compliance and implementation process. Workshops were held to ensure development authorities, town planning department staff, and government construction agencies had the knowledge


and tools needed to manage the UPECBC process. Workshops for private sector stakeholders were also held to address concerns on process and procedures of implementation.³⁹ UPNEDA also developed various knowledge materials such as a frequently asked questions on ECBC and material directories, which are available for stakeholders to access.

Stakeholder Roles

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Real Estate Developers are instrumental for the successful implementation of the UPECBC, and they were engaged throughout the UPECBC compliance process. Informed real estate developers help ensure that contractors comply with ECBC specifications and effectively incorporate energy efficient designs in their buildings.
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Architects have been important stakeholders throughout the development of UPECBC compliance process. UPNEDA and ECBC cell have had regular engagements through capacity building workshops with architects on ECBC.
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Contractors are tasked with implementing energy efficiency upgrades and meeting UPECBC specifications, they need to be familiar with ECBC material specifications and energy conservation building practices.⁴⁰
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Energy Service Companies (ESCOs) provide technical expertise and assist project developers in identifying energy savings opportunities to comply with UPECBC.⁴¹
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Financial Institutions can help reduce the owner/builder capital outlay by promoting economic models, such as energy performance contracts or energy service agreements.
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ECBC Cell assists in the enactment of ECBC regulations, identifies training needs, and technical knowledge gaps.⁴²
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Energy Efficient Material Suppliers are important stakeholders in supplying energy efficient materials to building developers. UPNEDA has successfully engaged with energy efficient material suppliers over the years in building the ecosystem for ECBC compliance.
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Green Building Professionals are important stakeholders, providing knowledge support to both the government and real estate developers, and build confidence in the building energy efficiency market.



Building energy efficiency code enforcement is one of the easiest and most effective ways to combat climate change. UPNEDA, the SDA for Uttar Pradesh, has performed immaculately well in BEE’s implementation program. With informed stakeholders and compliance infrastructure in place, the state is definitely going to showcase the domain leadership in India.”

- Anurag Bajpai, Director, Planning & Sustainable Design, GreenTree Global

Capacity Building Trainings and Workshops

Knowledge sharing and capacity building events have been critical to encourage best practices and overall support for UPECBC. Several national and state level organizations and industry associations have conducted capacity building and training workshops for Uttar Pradesh stakeholders on ECBC and implementation of building energy efficiency measures.

Summary of Select Capacity Building Workshops:

- Role of ESCOs in Energy Efficiency and Risk Mitigation in Financing
 - Date Held: January 2020
 - Objective: discuss the role of ESCOs in promoting building energy efficiency through financing mechanisms
 - Target Audience: energy service companies
 - Partners: Bureau of Energy Efficiency (BEE), Energy Efficiency Services Limited (EESL), Municipal Energy Efficiency Program (MEEP)⁴³
- Workshop on Capacity Building of Urban Local bodies in Energy Efficiency – Lucknow
 - Date Held: February 2020
 - Objective: capacity building of urban local bodies on implementing building energy efficiency measures
 - Target Audience: Urban Housing and Development Authority Personal
 - Partners: ECBC Cell⁴⁴
- Two days of training for Financial Institutions on Energy Efficiency Financing
 - Date Held: February 2019
 - Objective: sensitizing the financial institutions on energy efficiency financing
 - Target Audience: developers, third party financiers
 - Sponsoring Groups: Indian Renewable Energy Development Agency (IREDA), Petroleum Conservation Research Association (PCRA), Energy Efficiency Services Limited (EESL)⁴⁵
- State Level Workshop on 2017 ECBC
 - Date Held: September 2018
 - Objective: capacity building and training on components of building energy code 2017
 - Target Audience: developers, energy service companies, empaneled experts
 - Supporting Groups: Alliance for Energy-Efficient Economy (AEEE), NITI-AYOG, Philips, Indian Society of Heating Refrigerating and Air Conditioning Engineers (ISHRAE)⁴⁶



LEED Platinum Certified Building in Noida
Source: Advant Navis Business Park

Looking Ahead

Promoting energy efficiency in buildings across Indian cities is critical to saving energy, charting a low carbon future and achieving India's climate goals. The progress made in Uttar Pradesh can be used to spur ECBC notification in other states in India. Uttar Pradesh's ability to engage public and private stakeholders and develop a transparent and simple ECBC compliance process can also serve as a template for other Indian states to follow.

Uttar Pradesh's experience in developing UPECBC highlights four key recommendations which can help fast track ECBC implementation in other states in India. These include:

- 1) **Timely notification with high-level steering committees:** States that have high levels of political support, such as from the Chief Secretary, have fast-tracked UPECBC notification and amendment. Steering and technical committees at the state level are effective in guiding the process and ensuring strong decision making. In Uttar Pradesh, the UPECBC draft committee and UPECBC steering committee helped build buy-in at the highest levels of governance and helped create a process to champion energy efficient buildings.
- 2) **Clear government agency roles:** Clear identification of roles for government agency responsibilities, such as code notification, adoption, implementation, and compliance, have been successful in advancing energy efficiency. For each state, a clear mapping and identification of the responsibilities of the key government agencies, including state and city level divisions of urban development departments, the energy department, and the urban local bodies, can be done by the SDAs and their ECBC Cells.
- 3) **Strengthen real estate developer engagement:** Uttar Pradesh ensured extensive engagement with real estate developers, which has been successful in advancing energy efficient buildings. Government bodies should strengthen engagement with real estate developers at each step, including formal consultations, steering committees, peer-to-peer education, case studies, and more.
- 4) **Deepen capacity building for local experts:** Uttar Pradesh effectively developed supportive ecosystem and conducted customized training programs on building energy efficiency with local architects, engineers, and other experts. In addition, the state has ensured inclusion of energy efficiency measures in existing government processes by successfully including energy efficient materials in the SORs of UPPWD. This has further streamlined the process. States should prioritize creating a supportive ecosystem in terms of availability of local experts with knowledge on ECBC compliance and also develop knowledge materials to ensure outreach and documentation.

The next recommended step for Uttar Pradesh is to set up a robust evaluation system for compliance and implementation of the UPECBC to ensure progress. A series of case studies on the compliance system, documented developer experiences, and process for commercial buildings, are also required. In addition, it is also recommended that the evaluation updates should be a part of the periodic stakeholder and steering committee meetings. The aim of the evaluation will be to improve the code compliance process and track its progress. It will also help promote recordkeeping and help gather information that may lead to broader benchmarking practices. The evaluation, through its findings and recommendations, could also contribute to improving governance, building capacity among developers, architects, and stakeholders. This will ultimately help in building better, more efficient buildings and support compliance process improvements.

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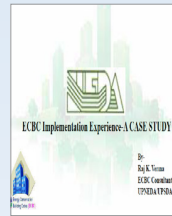
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HIGHLIGHTED REPORTS

UPECBC Specific Resources

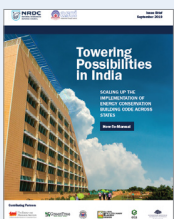


Frequently Asked Questions for Energy Conservation Building Code (ECBC)
<http://upneda.org.in/energy-conservation-building-faq.aspx>

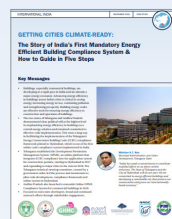


UPNEDA ECBC Implementation Experience – A Case Study
<http://www.aeee.in/wp-content/uploads/2017/05/ECBC-Implementation-Experience-case-study.pdf>

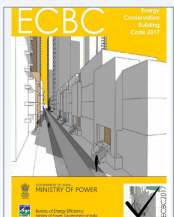
ECBC Resources



Towering Possibilities In India: Scaling Up the Implementation of Energy Conservation Building Code Across States
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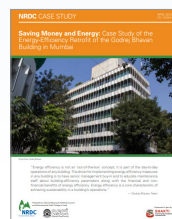


Frequently Asked Questions (FAQs) Cool Roofs
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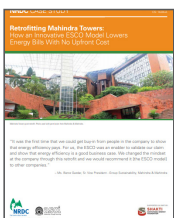
ASCI-NRDC Building Efficiency Case Studies



Building Smart from the Start: Spotlight on Energy Saving Commercial Office Building in Noida, India
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Saving Money and Energy: Case Study of the Energy-Efficiency Retrofit of the Godrej Bhavan Building in Mumbai
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Retrofitting Mahindra Towers: How an Innovative ESCO Model Lowers Energy Bills With No Upfront Cost
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