BUILDING GREEN

ENERGY SAVING BENEFITS OF IMPLEMENTING BUILDING ENERGY CODE IN GUJARAT

HIGHLIGHTS

- Buildings, especially commercial buildings, are developing at a rapid pace in India and are already a major energy consumer. Estimates suggests India will have 3.2 billion square meters of commercial floor space by 2037.
- Advancing energy efficiency in buildings across India is critical to saving energy, increasing energy access, combating pollution and strengthening prosperity. Building energy codes are effective tools for ensuring energy efficiency in the construction and operation of buildings. States in India are increasingly adopting the Energy Conservation Building Code (ECBC) released by the Bureau of Energy Efficiency (BEE).
- The state of Gujarat has a rapidly growing real estate industry due to growing economic development, increasing population, and expanding industrial activity. It is central to the successful adoption and implementation of the ECBC in India.
- Gujarat is working to ensure that future commercial development is energy efficient. The state is moving toward notifying the ECBC 2017 and incorporating the ECBC 2020 amendments.
- The analysis in this factsheet shows Gujarat can save nearly 83 terawatt-hours (TWh) of energy by 2030 with effective ECBC compliance, where around 90% of newly constructured commercial buildings would be compliant with some level of the ECBC.
- Timely notification of the ECBC followed by implementation through a high-level steering committee, strengthening real estate developer engagement and deepening capacity building for local experts are strategies to ensure the estimated energy savings are actually achieved through the ECBC.

Gujarat can save as high as

83 TWh of energy by 2030 with effective compliance with ECBC

assuming 90% of the newly constructed commercial buildings will be ECBC compliant.

Gift City in Ahmedabad. Source: Indian Express

INTRODUCTION

India's building sector is already the country's second-largest consumer of electricity, and it is expected to be the largest by 2030.[1] Projections indicate that India will have 3.2 billion square meters of commercial floor space by 2037.[2] Constructing these yet to be built commercial buildings as energy efficient will provide large energy and monetary savings, increase thermal comfort, and reduce air pollution. To promote energy conservation and to capitalize on opportunities for building energy savings, India's BEE developed the ECBC for commercial buildings in 2007 and updated it in 2017. Eighteen states and two union territories (UTs) have made progress on ECBC and are developing an ecosystem for energy efficient buildings. Other states are in the process of notifying and implementing the code. Gujarat, one of the largest states in terms of economic output, is in the process of notifying and enforcing the ECBC. This factsheet highlights the potential energy savings and emissions reduction Gujarat could achieve with ECBC implementation and compliance.

BUILDING ENERGY CODES SAVE ENERGY

Building energy codes are effective tools for ensuring energy efficiency in design, construction and operation of buildings. Estimates suggest energy performance standards that require new buildings to incorporate energy efficiency designs can yield a 30 to 40 percent reduction in energy use.[3] Building energy efficiency is also a focus of the 2019 India Cooling Action Plan (ICAP). The ICAP estimates that a 20 percent reduction in cooling demand is possible through climate appropriate building design and a higher adoption of the ECBC in new commercial development. Natural Resources Defense Council (NRDC) and Administrative Staff College of India (ASCI) estimate that if states across India adopt energy saving building codes and leading developers go beyond minimum code requirements for commercial buildings, approximately 3,453 TWh of electricity could be saved cumulatively between 2014 and 2030.[4] That is equivalent to powering 358 million Indian homes between the same period.[5] A study conducted for the city of Ahmedabad also show large peak load reduction advantage by implementation of the ECBC. It estimates that a minimum peak reduction of 1,139 Megawatts (MW) is observed with the ECBC 2007 whereas maximum demand reduction of 4,743 MW is observed due to the implementation of the Super ECBC 2017 in the city of Ahmedabad.[6] Therefore, new commercial construction presents one of the best opportunities to lock-in energy savings by building right the first time. In addition, ECBC implementation also helps to reduce peak energy demand since ECBC compliant buildings consume less electricity for cooling in peak summer hours due to efficient envelope and HVAC systems.

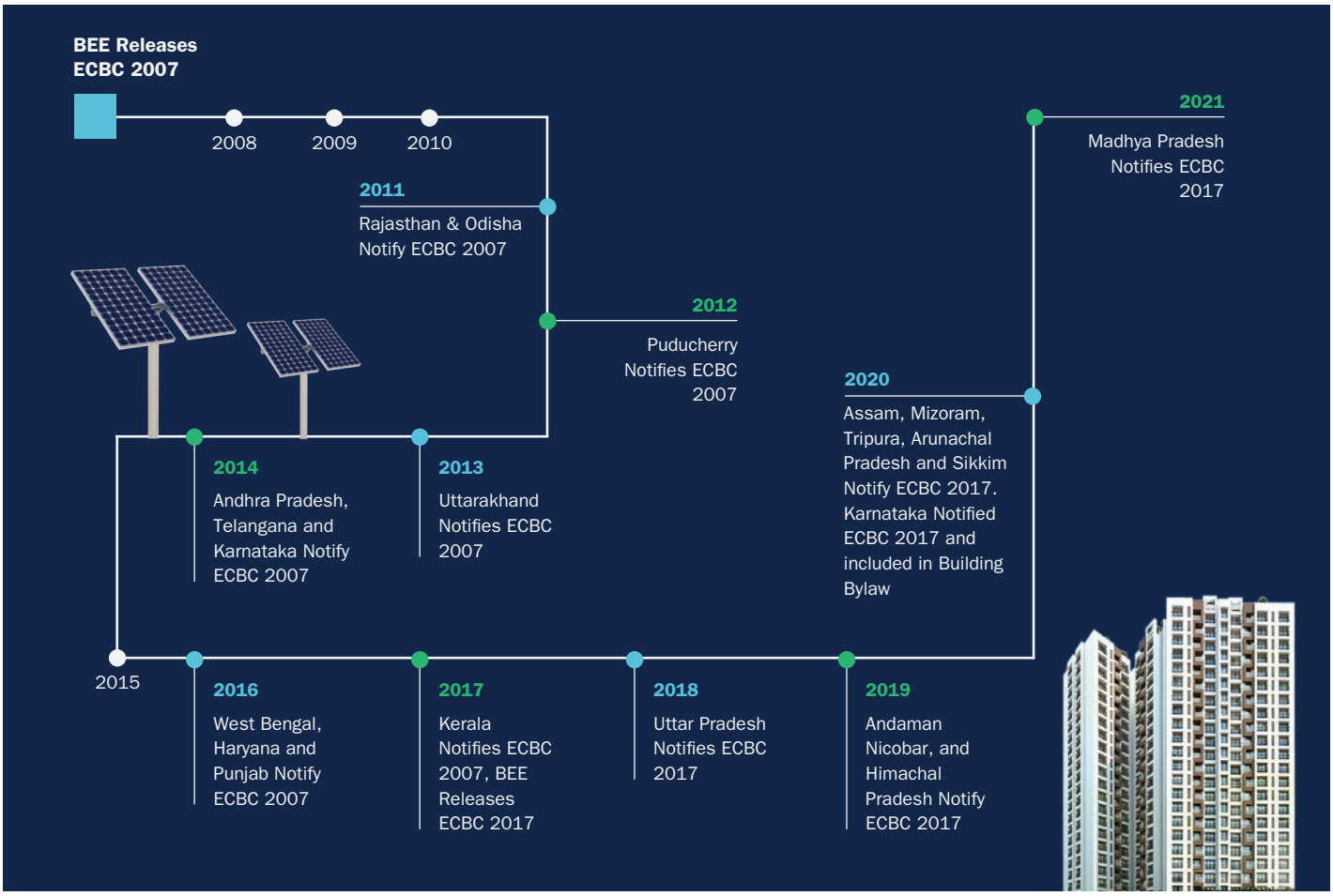
Overview of the ECBC

The ECBC sets minimum efficiency standards for new commercial buildings. It is a model for Indian states to modify, adopt, and implement the code as state law. The code is structured to encourage states to achieve more than minimum ECBC standard. The ECBC 2017 sets the minimum energy standards for commercial buildings with a connected load of 100 kilowatt (kW) or greater or a contract demand of 120 kilovolt-ampere (kVA) or higher. There are three levels of energy efficiency associated with the 2017 code: ECBC, ECBC+ and Super ECBC. The ECBC is intended to be the mandatory performance level, whereas the latter two are voluntary. The mandatory ECBC level uses up to 25 percent less energy than a non-compliant building, the ECBC+ uses 35 percent less energy and the Super ECBC uses half the energy of a typical building. There are two approaches for compliance: the prescriptive method and the whole building performance method.[7] The prescriptive method specifies performance requirements while selecting and installing building materials and equipment. The whole building performance method allows for flexibility in design while adopting digital tools to envisage building performance. In addition, Super ECBC buildings coupled with on & off site renewable energy is an easy gateway to net zero energy buildings for major commercial developers, paving the way to decarbonize their projects.

STATE-LEVEL PROGRESS ON ENERGY CODE COMPLIANCE

Eighteen states and two UTs have notified the code as of September 2021.[8] Madhya Pradesh recently adopted the code, making it mandatory for new commercial construction starting November 1, 2021. Uttar Pradesh is the only state that has amended, revised, and approved the code.

Figure 1. **ECBC Notification Timeline Across States**



Source: BEE and NRDC, 2021

ENERGY SAVINGS THROUGH IMPLEMENTATION OF THE ECBC IN GUJARAT

Gujarat is a leading industrialized state in India and has a population of over 60.4 million.[9] The state has a rapidly growing real estate industry due to a growing trading sector, increasing population, and expanding industrial activity. Gujarat is working to ensure that future commercial development is energy efficient. The state is moving towards the adoption of ECBC 2017. The amended code is awaiting approval from the state cabinet and is yet to be notified. The BEE and Gujarat Energy Development Agency (GEDA) are working with public & private stakeholders and knowledge partners on extensive training and awareness programs for the compliance and implementation of the ECBC in the state.

A 2015 study assessed the potential benefits of the ECBC implementation in Gujarat.[10] Estimates suggest that the ECBC would help save 6,200 (MW) of electricity capacity addition and INR 6,75,00 Crores ($9 billion) from avoided capacity additions and operation and maintenance costs by 2050, assuming a high level of compliance. Applying mandatory building codes to both commercial and residential buildings would save an additional INR 8,25,00 Crores ($11 billion) by 2050, compared with the voluntary green building rating and certification programs, assuming high compliance for both.

A 2017 study found that without building energy policies, building energy consumption would grow rapidly in Gujarat and triple between 2010 and 2050.[11] Energy use in the state would grow by 15 times in commercial buildings and by four times in urban residential buildings between 2010 and 2050. In a high implementation scenario (99% compliance by 2026), the ECBC could help save up to 419,800 gigawatt-hours (GWh) in building electricity cumulatively in Gujarat between 2017 and 2050, which could help avoid around 134,400 MW of electricity capacity additions. Extending the ECBC beyond the commercial sector and having energy codes for both commercial and residential buildings can

achieve additional savings and result in around 193,700 GWh additional electricity savings and INR 2,40,000 ($32 billion) additional economic savings from avoided capacity additions between 2010 and 2050.

In 2018 BEE introduced part 1 of the building energy codes for the residential buildings called the Eco-Niwas Samhita (ENS). In 2021, BEE released part 2 of the residential building code.

ENERGY SAVINGS FROM FIVE CODE COMPLIANCE SCENARIOS

NRDC and ASCI modelled five scenarios reflecting various levels of building code compliance and ratings programs participation, to complement earlier studies and to measure the potential energy savings and carbon emission reductions in Gujarat. This analysis assumes that Gujarat makes the ECBC 2017 mandatory and examines a phased compliance over time instead of only high initial compliance, as was assumed in earlier studies.

1. Business as Usual (BAU): no compliance with the ECBC or ratings programs
2. 40 percent ECBC, 5 percent ECBC+ compliance: 40 percent of commercial buildings comply with the ECBC, and an additional 5 percent of commercial buildings comply with ECBC +
3. 60 percent ECBC, 5 percent ECBC+, 5 percent Super ECBC compliance: 60 percent of commercial buildings comply with the ECBC, 5 percent of commercial buildings comply with ECBC+, and additional 5 percent of commercial buildings comply with Super ECBC
4. 40 percent ECBC, 50 percent Above Code Compliance: 40 percent of commercial buildings comply with the ECBC, 25 percent of commercial buildings comply with ECBC+, and additional 25 percent of commercial buildings comply with Super ECBC
5. 60 percent ECBC, 5 percent ECBC+, 5 percent Super ECBC compliance with Improved ECBC: 60 percent of commercial buildings comply with an ECBC that is improved every five years, 5 percent of commercial buildings comply with ECBC+, and additional 5 percent of commercial buildings comply with Super ECBC

Based on the methodology of the current analysis, Table 1 shows the electricity use in TWh across the five compliance scenarios from 2017 to 2030.

Methodology

To calculate electricity consumption and energy savings, NRDC and ASCI modelled scenarios based on previously published data.

Our model assumes that per capita commercial floorspace in Gujarat is the same as India's 2017 average per capita commercial floorspace. The total commercial floor space available in India was about 1,160 million square meters in 2017, implying a per capita commercial floor space of 0.83 square meters.[12] Commercial floor space is estimated to grow at a compound annual growth rate (CAGR) of 5.15 percent in Gujarat. Per capita commercial floorspace in Gujarat is expected to increase by almost six times between 2010 and 2050 and reach more than 4 m2.[13]

Figure 2: Gujarat Electricity Consumption by Scenario by 2030

(source: NRDC and ASCI analysis)

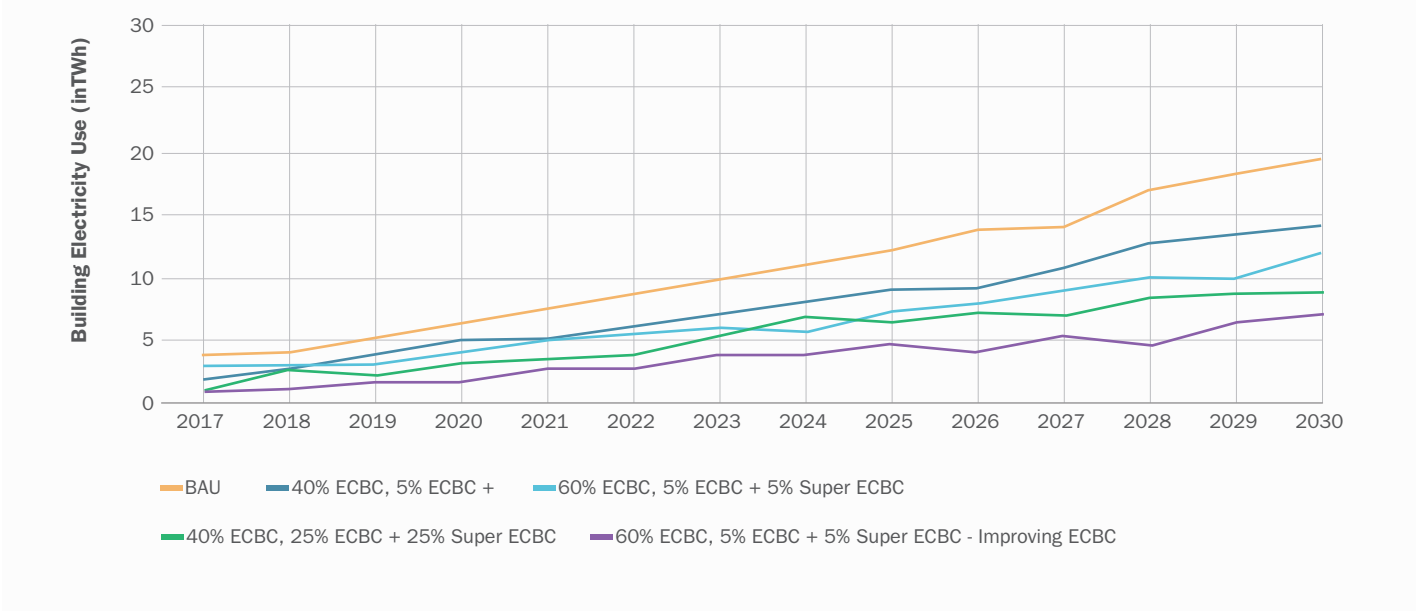


Table 1: Cumulative Energy Savings (2017-2030) by Level of ECBC compliance and ratings program participation for Gujarat

Commercial Floor Space Building Electricity Use (TWh)					
Year	Business as Usual (BAU)	40% ECBC, 5% ECBC +	60% ECBC, 5% ECBC+, 5% Super ECBC	40% ECBC, 25% ECBC +, 25% Super ECBC	60% ECBC, 5% ECBC +, 5% Super ECBC - Improving ECBC
2017	4	3	3	2	2
2018	4	3	3	2	3
2019	5	4	3	2	3
2020	6	5	4	3	4
2021	7	5	5	3	4
2022	8	6	5	3	4
2023	9	7	6	4	5
2024	10	8	6	4	6
2025	11	9	7	5	6
2026	13	9	8	5	7
2027	14	10	9	6	7
2028	16	12	10	6	8
2029	17	13	10	7	9
2030	19	14	11	8	9
Total	**143**	**108**	**90**	**60**	**77**
Unit Savings from BAU		**35**	**53**	**83**	**66**

Source: NRDC Analysis

Table 2: Input into the Analysis

Estimate of commercial floor Space in 2017	54,436,302 m2
Compounded annual growth rate (CAGR) of commercial floor space	5.15%
BAU average building energy consumption	146.43 kWh/m2-yr
The ECBC average building energy consumption	95.04 kWh/m2-yr
The ECBC + average building energy consumption	86.67 kWh/m2-yr
5-year improvement in the ECBC energy consumption	15%
BAU annual energy consumption growth rate	1.6%
Electricity source avoided by energy efficiency	Other bituminous coal

Source: NRDC, 2021

The analysis shows that without building energy policies, building energy use in Gujarat would grow by around five times in commercial buildings between 2017 and 2030 (Table 1). The ECBC provides an opportunity to improve energy efficiency in commercial buildings and could reduce building electricity use in Gujarat by around 19 percent in 2030, compared to the no ECBC compliance scenario.

Even minimal code compliance by commercial buildings in Gujarat (40 percent complying with the ECBC, five percent exceeding the code (ECBC+)) translates into 35 TWh of cumulative energy saved by 2030, which is enough to power as many as 3.5 million Indian households per year over the next nine years (2021-2030) based on the current level of annual energy consumption. On the other hand, in a relatively more stringent (best case) scenario (40% ECBC, 25% ECBC+, 25% Super ECBC), the benefits translate into cumulative energy savings of 83 TWh by 2030. Modelling in the electricity price and cumulative energy savings, this translates into monetary savings of INR 42,000 Crores ($5.6 billion) by 2030.[14] Additional savings are expected to come from avoided costs to build, finance, maintain, and operate newer and existing power plants.

Real Estate Developers can be Agents of Change

Real estate developers drive demand for building development and are critical to achieving energy efficiency in the built environment. Engaging with the real estate developers at every step is important to ensure streamlined energy code development and compliance. Public and private collaboration has been critical to some of the state's successful implementation of the ECBC. Of the three key stakeholders in the building energy efficiency market (government officials, developers, and buyers) real estate developers can serve as the lynchpin of effective compliance with the ECBC. However, it is crucial for the government to engage and be receptive to real estate developers regarding the ECBC. This can be done by demonstrating proof of concept by implementing demonstration projects to showcase actual energy savings; undertaking extensive capacity in the building code and new compliance process for developers; and creating a well-functioning ecosystem with accessible energy efficient materials and a local pool of experts on building energy efficiency. A local pool of experts can help guide developers with the new energy-efficient features of building development and ensure availability of energy-efficient building materials to prevent supply disruptions. Informed developers help contractors comply with the ECBC specifications and effectively incorporate energy-efficient designs. Developers influence how buildings are managed and operated, which ensures energy savings are sustained.

Leveraging Voluntary Green Building Rating Programs

There are several green building certification programs running successfully in India. Green building rating programs complement the objectives of building energy codes. While the ECBC aims to set a minimum threshold of energy savings in new building construction, the green rating programs go beyond the ECBC and support construction of greener and healthier buildings incorporating parameters over and above energy conservation.

- **Leadership in Energy and Environmental Design (LEED):** LEED is an internationally recognized green building rating system. India ranks third in the world, outside of the U.S., for LEED certification with more than 1,400 LEED-certified buildings.[15] It has certified 3,369 LEED projects, totaling over 1,797 million square feet of certified space.[16]
- **Indian Green Building Council (IGBC)'s Green Building Rating Systems:** The Confederation of Indian Industry (CII)-IGBC pioneered India's green building movement in 2001. IGBC has facilitated over 6,055 green building projects amounting to over 7.6 billion square feet of green building footprint in the country.[17] IGBC's Green Building rating systems focuses on energy efficiency and encourages stakeholders to follow and exceed the ECBC 2017 compliance requirements.
- **Green Rating for Integrated Habitat Assessment (GRIHA):** GRIHA Council is an independent, not-for-profit society to promote and administer green buildings in India. GRIHA was adopted as the national rating system for green buildings in India in 2007. The ECBC compliance is mandatory for all GRIHA compliant building since 2007. GRIHA currently has over 2,109 projects, with an approximate footprint of 565 million square feet.[18]

Source : Pixabay

NEXT STEPS TO IMPLEMENT THE ECBC IN GUJARAT

While Gujarat has taken bold initiatives on climate change, clean energy, and clean transportation, the state is yet to implement the ECBC. As the state makes progress on adopting the code and designs an implementation framework, there are important lessons the experience of other states that can be incorporated. These include:

1. **Timely notification with high-level steering committees:** States that have high levels of political support have streamlined the ECBC notification and amendment. Steering and technical committees at the state level are effective in guiding the process and ensuring strong decision making. Gujarat has successfully established an ECBC Technical Committee, consisting of experts from different departments. This has the potential to ensure buy-in at the highest levels of the state government. The technical committee in Gujarat meets periodically and had a key role to play in developing the amended code for the state. The Committee should now focus on advancing notification and advice the to stakeholders in developing an implementation framework. Subsequently, the technical committee can guide the process of ECBC compliance on a periodic basis and guide the involved agencies as the process evolves.

2. **Clear government agency roles:** States that have clearly identified roles for government agency responsibilities, such as code notification, adoption, compliance and implementation, have been more successful in advancing energy efficiency. In Gujarat, while the code will be notified by the energy department, it will be implemented under the Urban Development Department by the Municipal Corporations via inclusionin the building bylaws. Clear roles of each department and stakeholder should be defined and each department (such as those of the public works department, the roads and buildings department) should be trained on the ECBC. In addition, there is a need to strengthen the technical capacity within the State Designated Agency and the ECBC Cells to ensure effective implementation of ECBC compliance procedures.

3. **Strengthen real estate developer engagement:** States with involvement from real estate developers have been successful in advancing energy-efficient buildings. Stakeholders should strengthen engagement with real estate developers at each step, including formal consultations, steering committees, peer-to-peer education, case studies, and more. GEDA, as the ECBC nodal agency, conducted several roundtables and capacity building workshops for real estate developers. More capacity building events for developers and architects are needed to increase the comfort with the code. The ECBC cell appointed by BEE at GEDA is planning such workshops and events over the next two years.

4. **Deepen capacity building for local experts**: States that have effectively developed supportive ecosystems have created customized training programs on building energy efficiency with local architects, engineers, and other experts. Specifically, training and materials to support code implementation and enforcement systems are critical to the compliance ecosystem. Appropriate training of construction workers on energy efficient building designs, potentially in collaboration with Construction Skill Development Council of India, can also be explored. Gujarat should prioritize creating a supportive ecosystem in terms of availability of local experts with knowledge on ECBC compliance and develop knowledge materials to ensure outreach and documentation. In addition, the state can also explore including ECBC compliant building materials and technology in the Public Works Department's (PWD) Schedule of Rates (SoR), like it has been done in Uttar Pradesh. This will act as a ready reference point for the real estate developers.

5. **Expand online compliance tools for building permissions:** Gujarat, along with Haryana, Madhya Pradesh, Karnataka, Kerala, Jharkhand, Uttar Pradesh, Maharashtra, and Rajasthan, is in the process of adopting online building permission management systems. To effectively ensure compliance, the state can include ECBC compliance as a requirement in the online application prior to receiving building permissions. Online compliance systems make it simpler for developers to complete building applications and for local governments to track project development. In addition, other evolving mechanisms such as Building Energy Passports and the recently announced National Energy Efficiency Roadmap for Movement towards Affordable and Natural Habitat (NEERMAN) Awards by BEE are other ways of encouraging ECBC adoption and compliance. [19]

ENDNOTES

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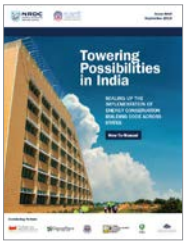
XIX. 19 The National Energy Ef!ciency Roadmap for Movement towards Affordable and Natural habitat (NEERMAN) Awards for Energy Ef!cient Building Design in India are being constituted with the objective to acknowledge and encourage exemplary building designs complying with BEE’s Energy Conservation Building Codes. The NEERMAN Awards will be for two categories of buildings:
- “Commercial””based on ECBC, 2017 (Revised: April 2018),
- “Residential””based on Eco-Niwas Samhita 2018.

More information available at https://www.bee-neerman.com.

Highlighted Reports



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

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Getting Cities Climate-Ready: The Story of India's First Mandatory Energy Efficient Building Compliance System & How to Guide in Five Steps

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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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