



Ministry of Housing and Urban Affairs
Government of India



Promotion of Green Buildings

TRAINING MANUAL



Supported by:



based on a decision of the German Bundestag

ClimateSmart Cities Assessment Framework
Energy and Green Buildings



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Developed by:

Climate Centre for Cities, NIUA in association with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and The Deutsches Institut für Urbanistik (DIFU) (English: German Institute of Urban Affairs).

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Executive Summary

On one hand, cities are a significant contributor of carbon emissions aggravating climate change and on the other, cities are considerably impacted by climate disasters. The recently released Global Climate Risk Index 2021 ranks India as the 7th most-affected country from climate-related extreme weather events (storms, floods, heat waves etc.). Further, studies indicate that poor planning and urban management are expected to cost Indian cities somewhere between \$2.6 and \$13 billion annually.

Cities are increasingly at the forefront of addressing both urbanization and climate change and to strengthen climate-sensitive urban development, a holistic understanding of the urban development from a climate lens is crucial. The Climate Smart Cities Assessment Framework (CSCAF) launched in 2019 by the Ministry of Housing and Urban Affairs (MoHUA), Government of India aimed to address this gap. This first-of-its-kind assessment with 28 progressive indicators across 5 thematic areas helps cities to benchmark their development, understand the gaps and further prioritize climate relevant development.

With a focus on building local capacities to develop and adopt climate measures, the Climate Centre for Cities (C-Cube) at the National Institute of Urban Affairs (NIUA) initiated a series of training aligned to the thematic areas of CSCAF - Energy and Green Buildings, Urban Planning, Green Cover & Biodiversity, Mobility and Air Quality, Water Management, Waste Management. The focus of the training is to provide a step-by-step approach of conducting studies, assessments and stakeholder consultations, establishing



committees, developing action plans and implementing relevant measures that not only makes the cities climate resilient but also helps them progress across the assessment of CSCAF.

This training module is on the 'Promotion of Green Buildings' indicator under the thematic areas of Energy and Green Building in the CSCAF. The training module provides strategies and tasks for each of the four measures in the indicator which include the inclusion of latest provisions of codes & green building rating in the general development control regulations (GDCR) / building bye-laws, functioning of green building cell at the urban local bodies level, functioning of high-level committee, promotional and penalty schemes and stakeholder co-operation for subsequent promotion of new and existing green and energy efficient buildings. The training module provide guidance to city officials to progress on compliance related to promotion of green and energy efficient buildings.





Who is the training manual designed for?



What is the focus of the training manual?



How to make use of this manual?



What are the Learning outcomes of the training?



Scope and limitations of the training

The manual is aimed at officials of urban local bodies who are responsible for promotion and adoption of green buildings in their respective cities. It may include architects, town planners, engineers and other senior officials on concerned departments of urban local bodies

The focus of the training module is to highlight four key strategies that the city officials can adopt to promotion of green buildings in their respective cities. This includes making relevant stakeholders familiar with all the green building codes, rating systems, policies, standards, guidelines, incentives, green material, technologies and analytical tools. Further, the knowledge, experience and networks developed in this process would be of great benefit to the building professional community.

Stakeholders can use this training manual to understand the broad concept of green building and its promotion. The manual covers modules on various measure related to green building promotions including key strategies and tasks to be under each measure is described in detail.

Participants will learn the concept of green buildings, its complete landscape including key stakeholders and tasks as the national, state and city level. Further, understanding on the various green building policies, codes, rating systems as applicable and strategies to promote green building concepts including green building promotional and penalty schemes.

Considering the training module is developed aligning to the indicator of CSCAF, only the four key measures that are considered under the framework are elaborated in the training.



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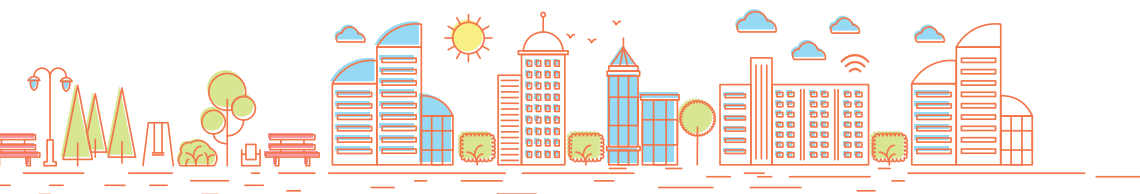
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Abbreviations

BEE	Bureau of Energy Efficiency
CSCAF	Climate Smart Cities Assessment Framework
DA	Development Authority
EC	Environmental Compliance
ECBC	Energy Conservation Building Code
EDGE	Excellence in Design for Greater Efficiencies
EIA	Environment Impact Assessment
ENS	Eco Niwas Samhita
GDCR	General Development Control Regulations
GEM	Green and Eco-friendly Movement
GHG	Greenhouse Gas Emission
GRIHA	Green rating for Integrated Habitat Assessment
HAREDA	Haryana Renewable Energy Department Agency
IGBC	Indian Green Building Council
IFC	International Finance Cooperation
IT	Information Technology
LEED	Leadership in Energy and Environmental Design
MOEFCC	Ministry of Environment, Forest and Climate Change.
MOHUA	Ministry of Housing and Urban Affairs
PEDA	Punjab Energy Development Agency
SDA	State Designated Agency
SOP	Standard Operating Procedure
ToT	Training of Trainers
ULBs	Urban Local Bodies



1

Introduction

Building sector is one of the fastest growing sector in India. Rising income levels and rapid urbanization is leading to unprecedented growth in this sector especially in cities. As per latest studies, 70% of urban India is yet to be built by 2030. The magnitude of construction that is going to take place in next few decades immense. At the same time, construction activities have a huge impact on climate change. According to International Energy Agency (IEA), buildings are currently responsible for 40% of global energy consumption and one-quarter of global human-induced CO₂ emissions. Considering the significant growth projected, the building sector has great potential to contribute in mitigating carbon emissions and addressing climate change. In this context, promoting the construction of green buildings is crucial.

So what is a green building? As per World Green Building Council “A *green building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life*”.

The CSCAF indicator on **Promotion of Green Buildings (GB)** under the thematic area of ‘energy and green buildings’ helps cities to promote green building adoption by mandating four key measures that a city can adopt. There are four measures under this indicator, as listed below:

MEASURE 1: Inclusion of Part 11 of National Building Code (NBC 2016) and/or Energy Conservation Building Codes (ECBC 2017) for commercial buildings & Eco-Niwas Samhita 2018 for residential buildings and/ or minimum level of green building rating systems notified in City Development Control Regulations (DCRs/GDCRs) and building rules/bye laws.

MEASURE 2: Functioning of green building cell in ULB for the purpose of knowledge dissemination, creating public awareness, empanelling green building vendors, designing

green building schemes and their promotions, verification and faster approvals for green buildings in the city.

MEASURE 3: Promotional/ Penalty schemes available for code compliance, pre-certification, certification of green buildings.

MEASURE 4: Functioning of high-level Green Building Committee/ equivalent comprising of ULB's Commissioner and representatives of ULB green building cell, Special Purpose Vehicles, Project Management Committee, Urban Development Department, Town Planner, Public Works Departments, Green Building Certification agencies, Developers and Building Professional Associations. The committee will provide strategic advice for the promotion and adoption of energy efficient and green buildings in the city.

In the assessment, cities are ranked based on the number of measures adopted. Cities that have not initiated any one of the four measures will achieve one-star level, cities that have implemented at least one measure will achieve two star, cities that have implemented any two measures achieve three star, cities that have implemented any three measures will achieve four star level and cities that have implemented all four measures will be at five star level. The measures are progressive levels and aspirational in nature from level '1' to level '5'.

Figure 1: CSCAF 2.0, Indicator 5 – Performance Score, Criteria and Levels



Figure 2: Climate Smart Cities Assessment Framework 2.0



As per CSCAF, cities have to submit following documents to confirm measure compliance. However, in CSCAF 2.0, the relevant data was centrally procured from IGBC, GBCI and GRIHA.

- Copy of updated General Development Control Regulations/ Building Bye-laws confirming inclusion of green building codes & rating systems.
- Gazette notifications for adoption of green building codes & rating system at city level.
- Copy of relevant government order/ circular confirming availability of promotional & penalty schemes for green buildings at city level.
- Compliance documents confirming smooth functioning of green building cell & green building high level committee may include ULB records, government orders, circulars, minutes of meetings.
- Press releases, public notices, proof of public awareness campaigns, copy of communication and knowledge dissemination products developed for promotion of green buildings.
- Training programs - agenda, photographs, reports
- Schools and colleges curriculum and/or other relevant documents as data and evidences.

1.1. Institutional framework

1.1.1. Policy and Legal Background

Government of India has made good progress in enabling the promotion of green buildings through development of new green polices, as well as through revision of existing policies to incorporate green building concepts. It is imperative that we not only adopt policies requiring all existing buildings as well as new construction to meet green building criteria, but also put in place relevant laws and regulations for effective promotion, adoption and implementation of those policies. Government of India notified National Action Plan on Climate Change in 2008, Energy Conservation Act in 2001, Environment Protection Act in 1986, National Building Code of India with inclusion on chapter on sustainability in 2005, Energy Conservation Code (ECBC for Commercial) in 2007, Eco Niwas Samhita (ECBC for Residential) in 2018 in order to encourage the construction and use of green and energy efficient buildings. The CSCAF 2.0 Indicator on Promotion of Green Buildings also focuses addresses the four key measures, that indicates the reediness of cities in regards to promotion of green building that including measure on adoption of green building codes and rating system, compliance procedures, promotional and penalty schemes, stakeholder cooperation, institutionalizing green building cell at the Urban Local Bodies level for knowledge dissemination and functioning of a high level committee (green buildings) acting as strategic advisor.

Here are the list of key government initiatives.

National Missions:

India's National Action Plan on Climate Change was formally launched in 2008. It identifies measures that promote development objectives while also yielding co-benefits for addressing climate change effectively. It mainly focus on climate change, its adaptation and mitigation, energy efficiency and natural resource conservation. Among the eight "National Missions" that form the core of the National Action Plan on Climate Change, the National Mission on Sustainable Habitat and National Mission on Enhanced Energy Efficiency are key mission promoting green and sustainable development. National Mission on Sustainable Habitat is one of the eight missions under national climate change action plan and aims to make cities sustainable through improvements in energy efficiency in buildings, management of solid waste & shift to public transport. National Mission for Enhanced Energy Efficiency aims to promote the market for energy efficiency by fostering innovative policies and effective market instruments (PIB, 2021).

Refer Document: <http://www.nicra-icar.in/nicrarevised/images/Mission%20Documents/National-Action-Plan-on-Climate-Change.pdf>

Energy Conservation (EC) Act, 2001:

The EC Act provided framework for efficient use of energy and its conservation in India. It provides the legal framework, institutional arrangement and a regulatory mechanism at the Central and State level for achieving energy efficiency goals. Five major provisions of EC Act relate to Designated Consumers, Standard and Labelling of Appliances, Energy Conservation Building Codes, Creation of Institutional Set up and Establishment of Energy Conservation Fund. Bureau of Energy Efficiency was established under the Ministry of Power to implement the provisions of the Act. The Act requires large energy consumers to meet the energy conservation norms, large commercial buildings to meet the energy building code, and appliances to meet energy consumption standards and label. (EC Act, 2001)

Refer Document: <https://legislative.gov.in/sites/default/files/A2001-52.pdf>

Environment Impact Assessment

The Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India administers the 'Environmental Clearance' (EC) procedure for projects through central/ state committees for qualifying building and township projects. The projects cleared through environmental impact assessment minimizes the negative impacts on environment. Environment impact assessment is requirement under the Environmental Protection Act (1986). It cover large-scale developmental activities including buildings with more than 20,000 sq. m. It is mandatory to obtain Environmental Clearance (EC) before starting the construction on site. Other than EC (if applicable), all the necessary statutory clearances for new/ existing building projects are given by the local government/ development authority/ urban local bodies (EIA Guidance Manual, 2010)

Refer Document: http://environmentclearance.nic.in/writereaddata/form1a/homelinks/building-construction_may-10.pdf

In addition to this MoEFCC offers a fast track environment clearance for projects that have a pre-certification by green rating agencies including IGBC, GRIHA & LEED. Few state governments have also mandated green buildings especially for government owned projects and intend to make it mandatory for all buildings in the due course of time. Local governments, especially in the larger cities with enough financial resources and severe development pressures have also started offering incentives for green buildings including free of cost additional Floor Area Ratio (FAR), rebates in property tax, stamp duty, building permit fee etc. BEE is also working towards making ECBC code mandatory for commercial buildings in all states in India.

1.1.2. Benchmarking, Standards and Guidelines

Building sector policies, codes, benchmarks, standards and guidelines are being developed to make buildings and built environment green and environment friendly. Adoption of green building codes becomes mandatory in state/ cities after inclusion in development control regulations/ building bye-laws. In addition to green building codes, voluntary green building rating systems by various green building agencies/ councils are also pushing the agenda of green and environment friendly buildings forward. Green rating systems are tools that evaluates the performance of a building & its impact on the environment based on pre-defined set of criteria's relating to the entire life cycle of the building i.e. design, construction, operation and maintenance phase and also facilitates effective utilization of site, water, energy, material resources and improves indoor environment quality.

National Building Code (NBC 2016), Part 11 "Approach to Sustainability"

Bureau of Indian Standards (BIS), Ministry of Consumer Affairs is the nodal agency responsible for development and revision of the NBC Code. NBC is a national instrument providing guidelines for regulating the building construction activities across the country. In the latest version of NBC i.e. 2016 version - Guidance has been provided for making buildings and built environment energy efficient and environmentally compatible, through the newly introduced and updated chapter on sustainability, Part 11 'Approach to Sustainability'.

National Building Code: Building by-laws are under the state governments. The Bureau of Indian Standards has developed the National Building Code (NBC) in the 1980s that guides municipalities and development authorities on building by-laws. The voluntary code covers most

Figure 3: National Building Code, Volume 1&2



aspects of building design and construction, with a small part dedicated to energy efficiency. NBC was revised in 2005. In the latest version, the code provides guidance on aspects of energy conservation (related to Day lighting and Natural Ventilation). NBC provides general guidance on potential energy-efficiency aspects of such factors as daylight integration, artificial lighting requirements, and HVAC design standards (BIS-NBC, 2018).

Refer Website: <https://www.bis.gov.in/index.php/standards/technical-department/national-building-code/>

Energy Conservation Building Code (ECBC 2017)

The Energy Conservation Building Code (ECBC) was launched in May 2007 by the Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. ECBC Code provide minimum requirements for the energy efficient design and construction of buildings. ECBC adoption, implementation., enforcement lies with the State governments and urban local bodies. BEE is the nodal agency responsible for development and revision the Energy Conservation Building Code. As on date, about 22 states in India, are at various stages of mandating ECBC, wherein most of building construction activities are happening across the country. ECBC has both prescriptive and performance-based compliance paths. The prescriptive aspect requires minimum requirements for the building envelope and energy systems (lighting, HVAC, service water heating and electrical). The performance-based compliance path requires the application of Whole Building Simulation Approach to prove efficiency over base building as defined by the code (BEE-Buildings 2020).

Figure 4: ECBC 2017 Manual



Refer Document: https://beeindia.gov.in/sites/default/files/BEE_ECBC%202017.pdf

Eco Niwas Samhita

The Eco Niwas Samhita Code is developed by the Bureau of Energy Efficiency, Ministry of Power, Government of India and is applicable to all residential use buildings built on plot area of ≥ 500 m². The code aims to promote energy efficient design and construction of residential projects including independent homes, multi-storey apartments and townships. The code has two parts.

- Eco Niwas Samhita, Part 1: It was developed and launched in year 2018. The aim is to set up minimum building envelop performance standards to limit heat gains for cooling dominated climates and to limit heat loss for heating dominated climate, as well as for

ensuring adequate natural ventilation and day lighting. (Eco-Niwas Samhita, 2018).

Refer Document: https://www.beeindia.gov.in/sites/default/files/ECBC_BOOK_Web.pdf

- Eco Niwas Samhita, Part 2: It was developed and launched in year 2021. The aim is to set minimum standards of energy efficiency in Electro-Mechanical Equipment's for Building Operation, Renewable Energy Generations, Building Services, Indoor Electrical End-use and Building Envelop parameters like embodied energy of walling materials and structural systems as mentioned in Part 1. (Eco-Niwas Samhita, 2021)

Refer Document: <https://beeindia.gov.in/sites/default/files/ENS%202021.pdf>

Figure 5: Eco-Niwas Samhita, Part 1&2



Green Building Rating Systems

Green building rating system is a tool that evaluates the performance of a building and its impact on the environment. It comprises of pre-defined set of criteria relating to the entire life cycle of building and facilitates the effective use of site resources, water conservation, energy efficiency, waste management, optimum material utilization and improve indoor environment quality.

There are pre-dominantly five green building rating agencies in India, that provides green building rating to aspirant green projects.

Figure 6: Green Building Rating Agencies, India



- **Indian Green Building Council (IGBC)**
IGBC is part of the Confederation of India Industry (CII), it started as a unique public-private partnership between CII, Government of Andhra Pradesh and Godrej Foundation in year 2001. IGBC has 28+ Green Building Rating Systems for various forms of built habitat.

Refer Website: <https://igbc.in/igbc/>

- **Green Rating for Integrated Habitat Assessment (GRIHA) Council:**
The Energy and Research Institute (TERI) and the Ministry of New and Renewable Energy (MNRE), Government of India has set-up GRIHA Council in year 2005 to promote and administer green buildings in India. GRIHA was adopted as the National Rating System for Green Buildings in India by MNRE in 2007. GRIHA has more than 7 Green Building Rating Systems for various forms of built habitat.

Refer Website: <https://www.grihaindia.org/>

- **US Green Building Council (USGBC):**
USGBC developed Leadership in Energy and Environmental Design (LEED) Green Building Rating Systems. Beginning with its launch in 2000, LEED has grown from one rating system for new construction to a comprehensive system of nine interrelated rating systems covering all aspects of the development and construction process. Effective June 2014, Green Business Certification Inc.(GBCI) began managing the certification process for all LEED rating systems in India, including the LEED India rating system, which was previously managed by the Indian Green Building Council (IGBC) since year 2001.

Refer Website: <https://www.usgbc.org/>

- **Excellence in Design for Greater Efficiencies (EDGE):**
EDGE, an innovation of International Finance Corporation (IFC), a member of the World Bank Group, is a green building certification system focus making new residential and commercial buildings more resource-efficient. EDGE is comprised of a web-based software application, a universal standard and a certification system. Green Business Certification Inc.(GBCI) administers EDGE certification in nearly

120 countries around the world is the exclusive certification provider for all EDGE buildings in India.

Refer Website: <https://edgebuildings.com/>

- Green and Eco-friendly Movement (GEM)
ASSOCHAM (The Associated Chambers of Commerce & Industry of India) has launched the GEM Sustainability Certification Program in year 2018. GEM Sustainability Certification Rating Program is based upon BEE ECBC 2017 and NBC 2016. The main objective of the rating system is to promote environment friendly green building design and construction.

Refer Website: <https://www.green-assochem.com/>

1.1.3. Green building industry stakeholders

National Level Stakeholders: Green building and energy efficiency are developed by national level agencies like central government ministries and departments for example Bureau of Energy Efficiency, Ministry of Power developed Energy Conservation Code & Eco-Niwas Samhita, Bureau of India Standards, of Consumer Affairs developed National Building Code of India. Ministry of Housing and Urban Affairs (MoHUA) developed Model Building Bye-Laws. Whereas green building rating systems in India are voluntary in nature. The five pre-dominants green building rating agencies are

- CII-IGBC (Indian Green Building Council)
- TERI-GRIHA (Green Rating for Integrated Habitat Assessment)
- USGBC-LEED (Leadership in Energy and Environmental Design)
- IFC-EDGE (Excellence in Design for Greater Efficiencies)
- Assocham-GEM: (Green and Eco-friendly Movement)

State Level Stakeholders: At state level, urban development department, energy department and PWD provides recommendations for ECBC amendments, notifies ECBC compliance mandate, update Schedule of Rates (SoRs) (including energy efficient materials) and building byelaws (in case of unified building byelaws). Further State Designated Agency (SDA) is formulated by BEE which should include State ECBC implementation Committee. State ECBC cell is also posted under SDA. SDA is a statutory body constituted at State level and acts as the nodal agency which coordinates and cooperates with BEE at central level. ECBC cell provides support for implementation through training and capacity building. It also assists in amendment of ECBC according to their local requirements which are further incorporated in building byelaws through a notification by state government or incorporated in online building approval process. As stated in ECBC rules, State ECBC implementation Committee would provide recommendations to National ECBC implementation committee, review EAB's performance and assist in capacity building of professional.

City Level Stakeholders: At local level, ULBs/Development authority and Town planning authority ensures compliance by document verification, providing recommendations for ECBC and also notifying ECBC mandate in case of city level byelaws (in case of unified building byelaws this notification role is vested with state) As stated in ECBC rules, Energy Managers and Energy Auditors (Buildings) (EAB) would be selected by BEE. EAB would be an organisation/firm/company fulfilling the eligibility criteria laid by BEE. It will play an important role in building construction approval process by providing consultation assistance (if required), inspecting building plans at design stage, visiting building site and verifying compliance at construction and completion stages. A compliance certificate would be provided by EAB to owner /developer under intimation to ULBs/ Development Authority and SDA (at completion stage). This would be submitted to ULBs/DA for construction approval and occupancy certificate.



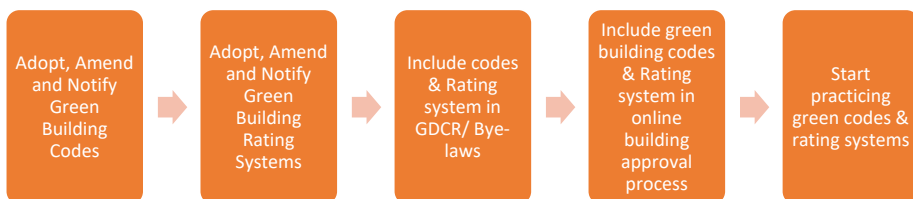
Photo Credits: Milind Kaduskar on Unsplash

2

Implementing actions at city level

2.1. Measure 1 : Inclusion of latest provisions of codes & green building rating systems in the general development control regulations (GDCR) / building bye-laws.

Creating polices as well as relevant laws and regulations for effective implementation of green building criteria's in both new and existing building construction is the key for mainstreaming green and ensuring its faster adoption. Other key step in this regard, is the inclusion of latest provision of green building codes & rating systems in the GDCR and Building Bye-laws. It is important to note that adoption of green building codes & rating systems is voluntary in nature, but becomes mandatory in state and cities after notification in General Development Control Regulations/ Building Bye-laws.



Suggested strategies for cities:

Cities should start adopting green building codes and rating systems in their local general development control regulations and building bye-laws by formally notifying and including in the general development control regulations (GDCR) / building bye-laws.

Cities need to include green building code & rating system compliance checks in the GDCR & Bye-laws. But mere inclusion in GDCR/ Byelaws does not assure implementation on ground. It requires robust policies mechanism, institutional set-up and implementation capacity. Further steps include measurement, verification and monitoring.

Green building compliance can be ensured at the local level by mandating its compliance certificate submission in the online building approval system, as one of the documents to be submitted to ULBs/Development Authority for building approval. Other key step is that the schedule of rates document should also to be updated by Public Works Department (PWD), including the green building materials which may be used as a reference document in construction of a building.

Key tasks for cities:

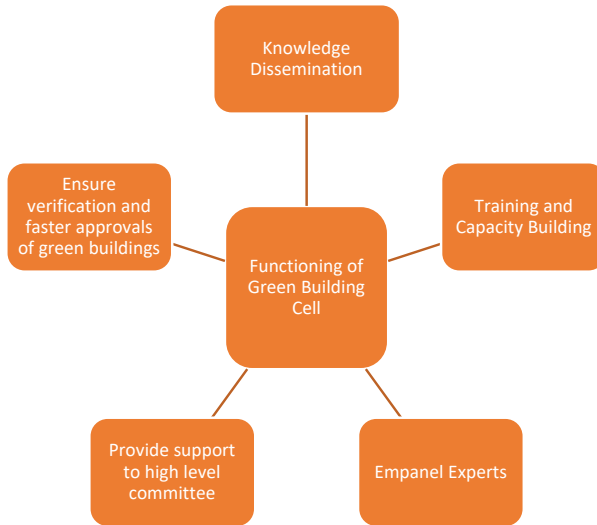
- Check the status of green building implementation at the state level. If the state has notified and included green building codes & rating systems in the development control regulations and building /bye-laws. Cities should initiate process of green building implementation through notification of green building codes (ECBC & ENS) & green building rating system (IGBC, GRIHA, LEED, EDGE, GEM).
- If the state has not notified green building codes & rating systems, the urban local bodies should adopt and notify the relevant applicable code provisions as requirements in the general development control regulations or in the building bye-laws, in collaboration with the urban development authorities and the state urban development department.

2.2. Measure 2: Functioning of Green Building Cell at the Urban Local Bodies level.

Creating a dedicated team of professional within the urban local bodies, to facilitate green building promotion and adoption is crucial to provide a much-needed support system to boost green buildings in cities. Formation of green building cell at the urban local body level is required to facilitate development and distribution of knowledge dissemination products, create public awareness on green buildings, empanel green building vendors and ensure verification and faster approvals of green buildings.

Green building cell bring technical expertise and help cities incorporate and enforce green building codes & rating systems in the GDCRs & building bye-laws. Green building cells will also help in creating green building awareness through promotional activities, capacity building and training. It will also work with local public and private developers to develop green building demonstration to showcase how a green compliant building is designed, constructed and operated, also demonstrate green design concepts, execution strategies, materials & technologies, operation & maintenance measures etc.

Green building cell also help urban local bodies to strengthen the green building compliance technically and in preparing necessary documents, day-to-day interaction with all stakeholders to help them with green building promotion and adoption.



Suggested strategies for cities:

Cities should establish a green building cell at the local urban bodies level to provide technical assistance and ensure effective promotion, adoption, implementation and enforcement of green building in their respective cities. This is the first and foremost step

to initiate green building promotional activities in cities. Formation of a green building cell may require approval from standing committee of the urban local body. In case there are any major financial implication or budgetary approval required for their smooth functioning of a green building cell that is beyond the power of the commissioner. It will be approved by the standing committee.

Preferred composition of a Green Building Cell:

- Architects, Planners, Engineer's.
- Certified Green Building Professionals
- Certified BEE Energy Auditors (building) & BEE Master Trainers

Key tasks of a green building cell:

Knowledge Dissemination

Step 1:

- Develop green building promotion and communication strategy and accordingly create knowledge dissemination products for creating green building awareness including green building guidelines for design, material and construction technologies.
- Develop and disseminate green building awareness products like ready reckoners/ tip-sheets, create monthly/ quarterly newsletter on key green building topics.
- Develop all green building policies, documents, promotional products, endorse compliance tools for green building simulations i.e. energy, daylight simulation, prepare detailed annual budgets required for green building promotion in city.
- Develop strategies and products for public awareness campaign, mass publicity including audio-visual presentations, advertisements, hoarding, bill-boards etc.

Step 2:

- Facilitate development of demonstration/ pilot projects at the city level in collaboration with public and private developers to showcase green building concepts.
- Document the same in the form of a case study booklet. Case study booklet may also feature best practice projects from pan India as well as international case studies of green buildings.
- Upload case study document on ULB website/ web-page

Step 3:

- Develop green building competitions & quizzes, design award programs to reach out to wider audience and create awareness on green building concept to motivate and encourage its faster adoption.
- Develop an online/ offline library on green building rating guides, codes, manuals, reference books, journals etc. and make it accessible to all concerned stakeholders.
- Develop dedicated website or a webpage on ULB's website dedicatedly on cities green building initiatives.
- Develop social media pages e.g. Facebook, Twitter, YouTube, Instagram etc.).
- Frequently update website/ webpage/ social media pages with latest information on green building promotional activities, information on all past, on-going and upcoming events and projects. Website/ webpage should have free downloadable versions of all knowledge dissemination products.
- Sign MOU's with Industry Associations like National Real Estate Development Council (NAREDCO), Confederation of Real Estate Developers' Associations of India (CREDAI), Builders Association of India (BIA) for disseminating knowledge to wider stakeholders

Empanel Experts

Step 1:

- Select and empanel green building vendors i.e. material suppliers & technology solution providers. Or alternately endorse green building vendors approved by government institutions like Building Materials Technology Promotion Council (BMTPC) or Green Building Rating Agencies like IGBC & GRIHA

Step 2:

- Prepare list of approved material & technology vendors and their materials/ products

Step 3:

- Upload the list of approved vendors on the ULBs green building website/ webpage.

Training & Capacity Building

Step 1:

- Develop training & capacity building modules for conducting training & capacity building sessions targeted at various stakeholder.
- Develop training modules based on target audience including architects, engineers, planners, developers, government officials, material & technology suppliers, home buyers, students etc.
- Collaborate with architecture & planning institutes, engineering colleges, professionals' councils like Council of Architecture (COA), Indian Institute of Architects (IIA) to introduce green building concepts and training modules in academic curriculum

Step 2:

- Develop training material including agenda, presentations, exercises, hand-outs, feedback forms etc. To start with, cities should start conducting monthly or quarterly capacity building and training sessions.
- Design training module including its agenda, content, duration (half-day, one/two/ three day) and as well as mode (online/ offline) and other logistics.

Step 3:

- Develop training calendar and start conducting training sessions for various stakeholders.

Provide support to high level committee

Step 1:

- Green building cell should work in close coordination with a high-level committee to provide technical assistance to high level committee, ULB officials, smart city officials by providing hand-holding in all green building related activities as well as provide support to all local agencies at the city, state and national level for green building promotion and adoption.

Step 2:

- Provide regular feedback and recommendation to the high-level committee in regards to promotion of green and energy efficient buildings in the city, based on their experience of day-to-day coordination with all concerned stakeholders.

Step 3:

- Help high level committee set-up green building promotional targets for the city based on feedback and recommendations

Ensure verification and faster approvals of green buildings

Step 1:

- Develop green building compliance and enforcement procedure
- Develop green building measurement and verification system

Step 2:

- Integrate green building compliance and enforcement procedure in the online building approval system.
- Integrate green building measurement and verification system in the online building approval system.

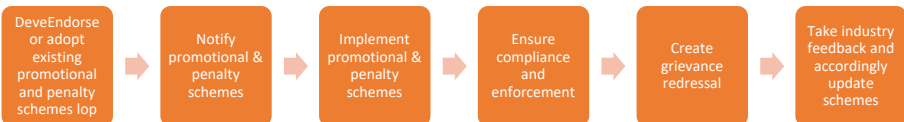
Step 3:

- Create awareness regarding compliance, enforcement, measurement and verification system among relevant stakeholders through training and capacity building sessions and start practicing the same.

2.3. Measure 3: Promotional & Penalty Schemes

Green building promotional schemes (incentives) and penalties are widely adopted to facilitate the adoption and growth of green buildings in the country. Green building incentives should be designed to benefit all key stakeholders in order to encourage and motivate them for going green.

Cities can adopt from wide range of available incentives both fiscal or non-fiscal, already practiced by various states in India. Penalties should also be imposed for non-compliance of green building norms as stipulated by green building codes & rating systems. Green building penalties will ensure green building enforcement and minimise violations.



Suggested strategies for cities

Cities should check if green building promotional and penalty schemes are available or is being already practiced at the state level, if yes, cities should simply endorse and notify it and start practicing by integrating it in the online building approval system.

In case there are no promotional and penalty schemes notified and practiced at state level, cities should develop their own scheme based on best practices and notify it and start practicing it by integrating it in the online building approval system.

Key tasks

- Endorse or adopt existing promotional and penalty schemes if available at state level or else design new schemes (promotional & penalty).
- Notify promotional & penalty schemes and start implementing it by integrating it in the online building approval system.
- Ensure implementation, monitoring, compliance & enforcement. It is also important to create awareness about such scheme among all relevant departments and key stakeholders to encourage them to adopt & practice it.
- Create grievance redressal system, for addressing all issues related to promotional & penalty schemes.
- Take industry feedback on promotional and penalty schemes and accordingly update/ modify its schemes.

2.4. Measure 4: Functioning of High Level Committee

Implementation of green buildings policy requires coordination at many levels and among different municipal departments and other levels of government. Through the formation of the high level committee dedicatedly for green buildings and green building cell, cities can address potential barriers to green buildings including inter-departmental coordination and conflicts by regularly engaging with all concerned departments & their senior officials.

Government leadership accompanied by strong communication efforts by the high level committee and green building cell in regards to green building concepts and its benefits, at the city level, will go a long way in inspiring confidence among all stakeholders and will facilitate easy adoption of green buildings.

Preferred composition of a high-level committee:

High level committee should include both key and non-key members

Key members may include

- ULB's commissioner/ Smart City Commissioner.
- Architects, Engineers.
- Building industry associations.
- Representative from Bureau of Energy Efficiency, Green Rating Agencies

Non-key members may include

- Green building city champions,
- Green Material & Technology Vendors
- Academia & Think Tanks etc.

In addition to high level committee, cities should also create sub-committees like

- Steering committee to guide and also keep track of all green building related activities.
- Technical committee to provide green building technical input and advice.
- Grievance redressal committee to address all issues related to green building adoption, implementation, enforcement, monitoring & verification.

Key tasks

- Set-up targets for promotion of green and energy efficient buildings.
- Ensure code compliance and enforcement at city level by providing guidance & support to the green building cell.
- Conduct weekly/ monthly/ quarterly progress meetings to ensure green building promotion and adoption is on track.
- Explore synergies with similar programmes and identify opportunities for joint ventures, public private partnerships for green building promotion and adoption.
- Seek feedback, recommendations from green building cell & other key stakeholders and accordingly strategies future course of action.
- Provide update on city level progress, feedback and recommendations to State/ National Level Agencies.

3

Interactive Exercise

The aim of the exercise is to make participants aware of key stakeholders as well as key tasks in regards to green building promotion and adoption at both macro & micro level i.e. at the national, state and city level. The exercise is divided in four sub activities as mentioned below.

- **Stakeholder Mapping:** Relevant stakeholders (primary, secondary and tertiary) who play a key role or can influence the promotion of green and energy efficient buildings at national, state and city level.
- **Task Mapping:** Key tasks need to be identified based on priority (priority 1, 2 & 3), as required for smooth promotion, adoption, implementation and verification of green and energy efficient buildings at the national, state and city level.
- **Task Mapping for formation of green building cell (task prioritizing activity):** Key tasks undertaken by a green building cell, need to be identified (priority-wise), required for promotion of green and energy efficient buildings at the city level.
- **Task Mapping for formation of high level committee for green buildings (task prioritizing activity).** Key tasks undertaken by a high-level committee (Green Buildings), need to be identified (priority-wise), required for promotion of green and energy efficient buildings at the city level.

The training exercise is designed using Miro online collaborative whiteboard platform as it allows multiple users to work on a single screen together and have opportunity to brainstorm using digital sticky notes. The participant's views can be collected and responses can be discussed during the exercise using various communication features of the Miro-board including chat, verbal discussion etc. Such exercises help participants learn new software skills that will help them to effectively facilitate online workshops or meetings where collaborative working is the key.

3.1. Activity 1: Stakeholder Mapping

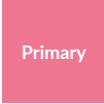

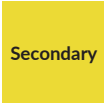



Objective: The aim of this activity is to identify key stakeholders including organizations, departments, institutions or individuals who play a key role or can influence the promotion of green and energy efficient buildings at national, state and city level. Participants were asked to identify & map primary, secondary & tertiary stakeholders of the green building sector and arrange them in order of national, state and city level. Participants were asked to drag and drop relevant stakeholder tags from the tags list provided on the activity board and arrange them as primary, secondary and tertiary stakeholder for nation, state and city level.

Outcome: Participants were made aware of all key green building sector stakeholders including government and private organizations, individuals, industry experts and associations, consultants, academia, think tanks etc. and their role in the green building sector at the national, state and city level.

Activity 1: Template

INSTRUCTIONS

1. Select stakeholder tags and arrange them as Primary, Secondary & Tertiary at National, State and City Level.
2. Ensure same colour stakeholder tags are not placed one over the other
3. Ensure two different tags are not overlapping and all tags are placed with each box limit.
4. Use "Blank Tags" to add more stakeholders and place it in the relevant boxes
5. Time allocated for this activity is maximum 15 Minutes

LEGEND		BLANK TAGS
 Primary	Key organisations, agencies, departments, institutions or individuals at National, State & City	
 Secondary	Key organisations, departments, institutions or Individuals working under primary stakeholder or supporting primary stakeholders	
 Tertiary	Key organisations, departments, institutions or Individuals working under secondary stakeholder or supporting secondary stakeholders	

NATIONAL	STATE	CITY
Primary	Primary	Primary
Secondary	Secondary	Secondary
Tertiary	Tertiary	Tertiary

Stakeholder Tags

Green and Eco-friendly Movement (GEM)	Green Building Certification Inc. (GBCI)	Central Public Works Department (CPWD)	Bureau of Energy Efficiency (BEE)	Indian Green Building Council (IGBC)	Urban Local Bodies (ULBs)
Smart City Limited	High Level Committee	GRIHA Green Rating for Integrated Habitat Assessment (GRIHA)	Public Works Department (PWD)	Bureau of Indian Standards (BIS)	Ministry of Housing and Urban Affairs (MoHUA)
US Green Building Council	Urban Development Departments	State Designated Agencies (BEE)			
Energy Conservation Building Code Cell	National Real Estate Development Council (NAREDCO)	Green Building Cell	Architects/Planners	Energy Conservation Building Code Cell	Town and Country Planning Organization
Public Works Departments (PWDs)	Builders Association India	Engineers	Building Materials & Technology Promotion Council (BMTPC)	Housing Boards	Development Authorities
Private/ Public Developers	Confederation of Real Estate Developers' Associations of India (CREDAI)	Town and Country Planning Departments			
Engineering Colleges	IGBC Local Chapter	Green Material and Technology Vendors	Architecture & Planning Institutions	Green Building City Champions	Bi-lateral/ Multi-lateral Agencies
Think Tanks	Building End-Users	GRIHA Regional Chapters	Indian Institute of Architects	Council of Architecture (COA)	

3.2. Activity 2: Task Mapping:

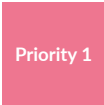

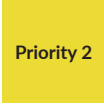

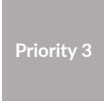

Objective: The aim of this activity is to identify & map key tasks priority wise (i.e. priority level 1/2/3), as required for smooth promotion, adoption, implementation, enforcement, monitoring and verification of green buildings at the nation, state and city level. Participants are required to choose tasks tags from the tags list provided on the activity board and place them in the relevant priority level (1/2/3) boxes provided on the board for national, state & city level.

Outcome: Participants were made aware of all key tasks undertaken at national, state & city level required for smooth promotion and adoption of green buildings, based on priority.

Activity 1: Template

INSTRUCTIONS

1. Select task tags and arrange them priority wise (for promotion of green and energy efficient buildings) at the National, State and City Level.
2. Ensure same colour stakeholder tags are placed one over the other
3. In case a particular task is required to be performed at multiple levels, place the task in all relevant boxes.
4. Ensure two different tags are not overlapping and all tags are placed with each box limit.
5. Use "Blank Tags" to add other tasks and place it in the relevant boxes
6. Time allocated for this activity is maximum 15 Minutes

LEGEND		BLANK TAGS
 Priority 1	Key tasks that needs to be performed. at the first step in regards to green building promotions	
 Priority 2	Tasks performed after priority 1 tasks.	
 Priority 3	Tasks performed after priority 1 t& 2 asks.	

NATIONAL	STATE	CITY
Priority 1	Priority 1	Priority 1
Priority 2	Priority 2	Priority 2
Priority 3	Priority 3	Priority 3

Task Tags

Develop & Update Green Building Rating Systems	Establish Energy Conservation Cell	Create & Conduct Steering Committee & Sub Committees Meetings	Develop & Update Green & Energy Efficient Building Codes	Create Pool Of Certified BEE Energy Auditors (Building)	Include Green Codes & Rating Systems in General Development Control Regulations/ Building Bye-laws
Establish Eco Niwas Samhita Cell	Establish High Level Committee (Green Buildings)	Establish Green Building Cell	Develop & Update Green Building Codes	Amend and Notify Green & Energy Efficient Building Codes	Integrate Green Codes & Rating Systems in the online building approval system
Adopt and Notify Green Building Rating Systems	Empanel Green Certified/ Accredited Green Building Professionals	Appoint BEE, State Designated Agency			
Develop & Publish Knowledge Dissemination Products	Develop/ Endorse Compliance Tools & Compliance Software's	Develop Green Building Implementation Guidelines	Empanel BEE Certified Energy Auditor (Buildings)	Amend and Notify Green & Energy Efficient Building Codes	Integrate Green Codes & Rating Systems in the online building approval system
Certify Green Material & Technology Vendors	Develop Green Building Rating System User Guides, Manuals & Tip Sheets	Develop Green Building Compliance & Enforcement Procedures	Develop Capacity Building & Training Module	Develop Awareness Strategy and Activities	Develop & Notify Green Building Promotional & Penalty Schemes
Revise Public Works Department Schedule of Rates	Create Grievance Redressal Mechanism	Set-up Green and Energy Efficient Building Monitoring & Verification System	Create Pool of Certified/ Accredited Green Building Professionals and Consultants	Develop Green and Energy Efficient Building User Guides, Manuals & Tip Sheets	
Enforce Adoption of Code & Green Building Rating Systems	Conduct Awareness Activities	Conduct In-house Capacity Building & Training	Sign MOU's with Building for Green Building Promotions	Start Knowledge Dissemination Activities	Start Practicing Promotional & Penalty Scheme
Conduct Monitoring & Verification	Conduct Stakeholders Capacity Building & Training	Address Grievances	Develop Bi-lateral/ Multi-lateral Programmes		

3.3. Activity 3a & 3b: Task Mapping Activity for Green Building Cell & High-Level Committee

Objective: To make participants aware of key tasks undertaken by a green building cell and a high-level committee (Green Buildings), formed at the ULB level for promotion of green and energy efficient buildings at the city level.

Activity 3a & 3b is designed as task mapping activities at a micro level i.e. prioritizing tasks that needs to be performed for smooth functioning of a high-level committee (Green Buildings) and a green building cell constituted at the urban local body level for promotion of green and energy efficient buildings.

In both activities, participants are need to select the colour coded priority tags (priority level 1,2 &3) provided on the activity board and place them in the blank boxes provided adjacent to randomly placed green building promotion tasks. The idea is to priorities tasks as priority task 1 priority task 2 & priority task 3.

Outcome: Participants are made aware of all key tasks that members of high level committee and green building cell have to undertake priority -wise at the city level in regards to green buildings promotion.

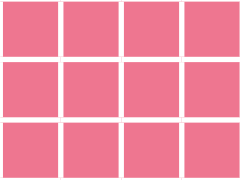
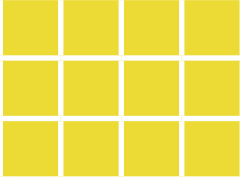
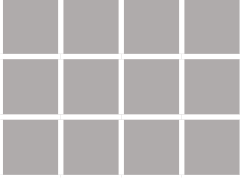
INSTRUCTIONS

1. Select colour coded tags (red – priority 1, yellow – priority 2, blue - priority) and place them in the box provided to the task based on the priority of the task required to be performed for smooth functioning of green building cell at ULBs level in regards to green buildings promotion.
2. Ensure same colour stakeholder tags are placed one over the other
3. Ensure two different tags are not overlapping and all tags are placed with each box limit.
4. Use "Blank Tags" to add other tasks and place it in the relevant boxes
5. Time allocated for this activity is maximum 10 Minutes

LEGEND

Priority 1 Task	Priority 2 Task	Priority 3 Task
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Activity 3A: Template and Results

Functioning of Green Building Cell	
Empanel Internal & External Green Building and Energy Efficiency Experts	<p>Priority Task 1</p> 
Develop Awareness and Training, Capacity Building Strategy	
Facilitate Inclusion of Codes & Green Building Rating Systems in Building Bye-laws	
Prepare Annual Budget for the Green Building Promotion Activates	<p>Priority Task2</p> 
Conduct Awareness and Training and Capacity Building Activities	
Update ULBs webpage/ website with updates on green building promotional activities	<p>Priority Task3</p> 
Establish Green Building Cell	
Empanel Green Building & Material & Technology	

4

Case Studies

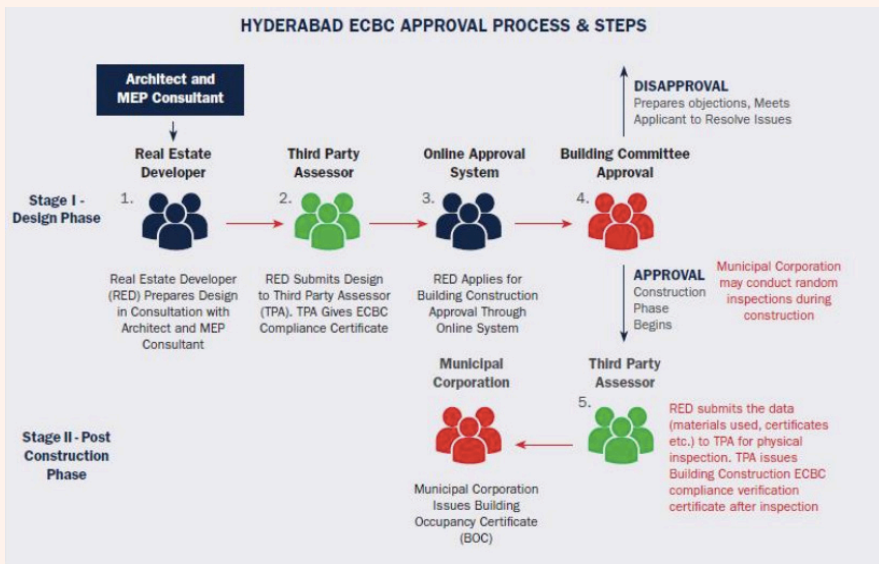
4.1. Telangana Energy Conservation Building Code (TSECBC) Guidelines

The states of Telangana have adopted a mandatory Energy Conservation Building Code (ECBC) for commercial buildings in 2014.

Telangana has also developed and notified ECBC guidelines with inclusion of latest ECBC Code 2017. The document is called TSECBC, 2017, it is a technical document developed to expedite the adoption of ECBC in the state of Telangana. The document is developed for real-estate developers, architects, consultant and other key stakeholders to facilitate them with code adoption and implementation.

To streamline and modernize compliance of the code, the Greater Hyderabad Municipal Corporation (GHMC) has developed an online ECBC compliance system. The Town and Country Planning Department, GHMC has integrated the ECBC compliance into the online development permission management system (DPMS) for buildings approval. This means that, if a developer wants to obtain a commercial building construction permission - a building application and ECBC compliance forms must be submitted through the online DPMS. GHMC became the first ULB in the country to be ECBC compliant (NRDC 2017).

Figure 7: Flow Chart of Online Compliance Procedure followed by the Greater Hyderabad Municipal Cooperation



Green building code promotion and adoption Initiatives by other states

States/ UTs including Andhra Pradesh, Karnataka, Gujarat, Punjab, Kerala and Delhi are also leading the green building movement by making strong commitments and trying to create awareness amongst government officials and other stakeholders, and further amending their bye-laws, revising public works department (PWD) and schedule of rates (SoRs), facilitating green building promotion, adoption & implementation through a dedicated ECBC cell.

Andhra Pradesh ECBC (i.e. APECBC, 2017) is made mandatory for all commercial building approval in the state, that means all cities in the state of Andhra Pradesh have to adopt & enforce ECBC code compliance by default.

4.2. Green building promotional schemes (incentives) and penalty schemes practiced in India

Promotional (Incentive) Schemes:

Few of the existing green building promotional (incentives) practiced in India are as follows:

- Non-fiscal incentives like free of cost additional Floor Area Ratio (FAR)
- Fiscal incentives, rewards & award targeted at different stakeholders like reimbursement of green building certificate fee, property tax rebates, reduction in stamp duty, exemption in building scrutiny fee, rebate in development charges.

Detailed list of Green Building Promotional Schemes (Incentives) practiced in various states of India is as follows:

- **Haryana, Himanchal, Jharkhand, Maharashtra, Rajasthan, Punjab, Uttar Pradesh have following non-fiscal Incentives for Developers (For developing residential & non-residential IGBC/ GRIHA/ LEED Certified Projects)**
 - i. Additional free of cost green building Floor Area Ratio (FAR) in the range of 3% - 15%.
- **Punjab offer following fiscal incentives for developers (For developing residential & non-residential IGBC/ GRIHA/ LEED Certified Projects)**
 - i. - 100 % exemption of building scrutiny fee
 - ii. - 2.5%, 5%, 7.5% rebate in development charges
- **Rajasthan offer following fiscal Incentive for the Technology Supplier of Large Industries & MSME Units**
 - i. Reimbursement of 50% of amount paid to the suppliers for green process or technology adopted (excluding civil work) to obtain Green Building Rating for the Plant

- **Tamil Nadu offers following fiscal incentive for Building Developer/ Owner/ Consultants**
 - i. Reimbursement of 25% subsidy on total fixed capital investment of the project (excluding cost of land, land development, preliminary and pre-operative expenses and consultancy fees) for buildings which obtain Green Building Rating
 - ii. Andhra Pradesh
 - iii. - 25% subsidy on the cost of setting up or expanding industrial units, industrial parks, R&D projects, warehousing and logistics parks, subject to a limit of Rs. 1 Crore, for Green Building Certified industrial projects
 - iv. Provides incentive upto 50% of consulting charges, with a maximum limit of INR 2.50 lakh, for IGBC rated Industrial Buildings
- **Gujarat offers following fiscal for hotel & wellness building developer/ owner**
 - i. Reimbursement of 50% of certification fee, with a maximum limit of INR 10.0 lakh, to IGBC/ GRIHA/ LEED rated hotel / wellness resorts.
- **Andhra Pradesh offers following fiscal incentive to end-buyers (For Buying IGBC/ GRIHA/ LEED Certified Projects)**
 - i. Property Tax rebate for a period of 5 years from securing Occupancy Certificate
 - ii. 20% Reduction in Building Permit Fee
 - iii. One-time reduction of 20% on Duty on Transfer of Property (Surcharge on Stamp Duty), If the property is sold within three years.

Penalty Schemes

Few of the existing green building penalty scheme practiced in India are as follows.

- Building Demolition at developer/ clients expense for Non Compliance of National Building Code/ Bye-Laws
- Hefty Financial Penalty for Non Compliance of Green Buildings Certification after availing Green Building Additional Free of cost Floor Area Ratio (FAR)
- No Occupancy Permit: Non Issuance of Occupancy Certificate in case of non-compliance of mandatory green building norms as stipulated in the GDCR/ Building Bye-laws

Key departments offering promotional and penalty schemes in India includes following:

- Urban Development Departments
- Town & Country Planning Departments
- Industrial Departments
- Municipal Cooperation's

4.3. State Level Energy Conservation Building Code (ECBC) Committee formed at the Department of New & Renewable Energy, Government of Haryana (HAREDA)

HAREDA constituted a State Level ECBC Committee (STC) to recommend the amendments in the building bye-laws and to revise Haryana Schedule Of Rates (HSR) and incorporate Energy Conservation Building code (ECBC) and notified in the Gazette of Haryana Govt. They also constituted sub committees.

- **Sub-committee headed by the Chief Architect, Architecture Department and its key tasks is to amend the building bye.**
- **Standing technical committee headed by the Director General, HAREDA and its key tasks is to amend the Haryana Schedule of Rates**

Role of the committee is to make recommendations. HAREDA Committee recommended that building bye-laws of respective stake holder departments including development authority may be amended to include ECBC. Based on the recommendation, HAREDA took services of TERI for amending its building bye-laws for incorporating ECBC (HAREDA 2020).



Photo Credits: ammiel jr on Unsplash

5

List of Additional Materials

List of Readings for each Chapter including and not limited to

1. Climate Smart Cities Assessment 2.0.

- i. https://www.niua.org/csc/assets/pdf/key-documents/phase-2/CSCAF-2.0-Brochure_24042020.pdf
- ii. https://www.niua.org/csc/assets/pdf/CSCAF_2_Booklet.pdf
- iii. <https://heyzine.com/flip-book/31ddf6adfe.html#page/1>
- iv. Climate Smart Cities Assessment 2.0. Process Video
<https://www.youtube.com/watch?v=WHq7ZTtPrsk>

2. Green Buildings

- i. What is green building?
<https://www.youtube.com/watch?v=MyIOtsx3wDs>

3. Green Building Ratings

- i. EDGE
<https://edgebuildings.com/wp-content/uploads/2021/11/IFC0060-EDGE-Brochure-India-2021-11-03-FIN.pdf>
<https://gbc.org/press-kit-edge>
- ii. GRIHA
<https://www.grihaindia.org/about-griha>
- iii. Green Building Movement in India - The Journey Since 2001
<https://www.youtube.com/watch?v=ugGPJOQYs1A>

iv. Green buildings - The GRIHA way

https://www.youtube.com/watch?v=Fp-KRz_fNSc

v. GEM

https://www.green-assochem.com/cms.php?id=4&menu_id=8&title=about-gem-rating

vi. IGBC

<https://igbc.in/igbc/redirectHtml.htm?redVal=showAboutusnosign>

vii. USGBC

<https://everbluetraining.com/role-usgbc/>

4. Green building promotional schemes (incentives) practiced in India

i. <https://www.grihaindia.org/griha-incentive>

ii. <https://igbc.in/igbc/redirectHtml.htm?redVal=showGovtIncentivesnosign>

6

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- Eco-Niwas Samhita (2018), Eco-Niwas Samhita 2018 (Energy Conservation Code for Residential Buildings), Part 1: Building Envelop, Bureau of Energy Efficiency, Ministry of Power. Retrieved from https://www.econiwass.com/pdf/publication/ECBC_BOOK_Web.pdf
- EIAGUIDANCE MANUAL(2010). Environmental Impact Assessment Guidance Manual for Building, Construction, Townships And Area Development Projects, Ministry of Environment & Forests Government Of India, New Delhi, Administrative Staff College of India. Retrieved from http://environmentclearance.nic.in/writereaddata/Form-1A/HomeLinks/building-construction_may-10.pdf
- HAREDA (2020), Action taken by department/ HAREDA to implement ECBC in state, Department of New and Renewable Energy, Government of Haryana. Retrieved from <https://hareda.gov.in/action-taken-by-department-hareda-to-implement-ecbc-in-the-state/>

- Nandini Shandilya, Ashish Rao Ghorpade (2019) ECBC Compliance in Indian Cities- Handbook (Supporting Sustainable built environment under Smart City Mission), ICLEI- local governments for Sustainability, South Asia (ICLEI South Asia), Retrieved from <https://shaktifoundation.in/wp-content/uploads/2019/07/Handbook-ECBC-compliance-in-Indian-Cities.pdf>
- NRDC (2017), Telangana Energy Conservation Building Code (TSECBC) Guidelines, Retrieved from http://tsredco.telangana.gov.in/PDFs/ECBC/4_TS_ECBCGuidelines.pdf
- PIB (2021). National Action Plan on Climate Change (NAPCC), Ministry of Environment, Forest and Climate Change. Retrieved from <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2021/dec/doc202112101.pdf>
- O.P. Agarwal, Greening Indian Cities Through Efficient Buildings, WRI INDIA, MOHUA. Retrieved from https://www.niua.org/csc/assets/pdf/RepositoryData/Energy_&_Green_Building/Greening_Indian_Cities_through_efficient_buildings.pdf

7

Annexure

Activity 1: Results

NATIONAL	STATE	CITY
<p>Primary</p> <div>Green and Eco-friendly Movement (GEM)</div> <div>Green Building Certification Inc. (GBCI)</div> <div>GRIHA Green Rating for Integrated Habitat Assessment (GRIHA)</div> <div>Bureau of Indian Standards (BIS)</div> <div>Ministry of Housing and Urban Affairs (MoHUA)</div> <div>Bureau of Energy Efficiency (BEE)</div> <div>Indian Green Building Council (IGBC)</div> <div>US Green Building Council</div>	<p>Primary</p> <div>Urban Development Departments</div> <div>State Designated Agencies (BEE)</div>	<p>Primary</p> <div>Smart City Limited</div> <div>High Level Committee</div>

<p>Secondary</p> <p>Town and Country Planning Organizations</p> <p>Building Materials & Technology Promotion Council (BMTPC)</p> <p>National Real Estate Development Council (NAREDCO)</p> <p>Confederation of Real Estate Developers' Associations of India (CREDAI)</p> <p>Builders Association India</p>	<p>Secondary</p> <p>Town and Country Planning Departments</p> <p>Public Works Departments (PWDs)</p> <p>Energy Conservation Building Code Cell</p>	<p>Secondary</p> <p>Green Building Cell</p> <p>Architects/Planners</p> <p>Engineers</p> <p>Development Authorities</p> <p>Private/ Public Developers</p>
<p>Tertiary</p> <p>Indian Institute of Architects</p> <p>Council of Architecture (COA)</p> <p>Bi-lateral/ Multi-lateral Agencies</p>	<p>Tertiary</p> <p>GRIHA Regional Chapters</p> <p>IGBC Local Chapter</p>	<p>Tertiary</p> <p>Engineering Colleges</p> <p>Green Material and Technology Vendors</p> <p>Architecture & Planning Institutions</p> <p>Green Building City Champions</p> <p>Think Tanks</p> <p>Building End-Users</p>

Activity 2: Results

NATIONAL	STATE	CITY
<p>Primary</p> <div>Develop & Update Green Building Rating Systems</div> <div>Develop & Update Green & Energy Efficient Building Codes</div> <div>Develop & Update Green Building Codes</div>	<p>Primary</p> <div>Establish Energy Conservation Cell</div> <div>Adopt and Notify Green Building Rating Systems</div> <div>Establish Eco Niwas Samhita Cell</div> <div>Appoint BEE, State Designated Agency</div>	<p>Primary</p> <div>Create Pool Of Certified BEE Energy Auditors (Building)</div> <div>Create & Conduct Steering Committee & Sub Committees Meetings</div> <div>Include Green Codes & Rating Systems in General Development Control Regulations/ Building Bye-laws</div> <div>Integrate Green Codes & Rating Systems in the online building approval system</div> <div>Establish High Level Committee (Green Buildings)</div> <div>Establish Green Building Cell</div> <div>Empanel Green Certified/ Accredited Green Building Professionals</div> <div>Amend and Notify Green & Energy Efficient Building Codes</div>
<p>Secondary</p> <div>Develop/ Endorse Compliance Tools & Compliance Software's</div> <div>Develop Green Building Rating System User Guides, Manuals & Tip Sheets</div> <div>Develop & Publish Knowledge Dissemination Products</div> <div>Develop Green and Energy Efficient Building User Guides, Manuals & Tip Sheets</div> <div>Amend and Notify Green & Energy Efficient Building Codes</div> <div>Create Pool of Certified/ Accredited Green Building Professionals and Consultants</div> <div>Create Grievance Redressal Mechanism</div>	<p>Secondary</p> <div>Empanel BEE Certified Energy Auditor (Buildings)</div> <div>Amend and Notify Green & Energy Efficient Building Codes</div> <div>Develop Green Building Implementation Guidelines</div> <div>Develop & Notify Green Building Promotional & Penalty Schemes</div> <div>Develop Green Building Compliance & Enforcement Procedures</div> <div>Set-up Green and Energy Efficient Building Monitoring & Verification System</div> <div>Revise Public Works Department Schedule of Rates</div> <div>Set-up Green and Energy Efficient Building Monitoring & Verification System</div>	<p>Secondary</p> <div>Develop & Publish Knowledge Dissemination Products</div> <div>Develop Green Building Implementation Guidelines</div> <div>Empanel BEE Certified Energy Auditor (Buildings)</div> <div>Empanel BEE Certified Energy Auditor (Buildings)</div> <div>Integrate Green Codes & Rating Systems in the online building approval system</div> <div>Develop & Notify Green Building Promotional & Penalty Schemes</div> <div>Certify Green Material & Technology Vendors</div> <div>Develop Capacity Building & Training Modules</div> <div>Create Grievance Redressal Mechanism</div> <div>Develop Awareness Strategy and Activities</div>

Tertiary		Tertiary		Tertiary	
Develop Bi-lateral/ Multi-lateral Programmes	Conduct Awareness Activities	Start Practicing Promotional & Penalty Scheme	Conduct Stakeholders Capacity Building & Training	Sign MOU's with Building for Green Building Promotions	Start Knowledge Dissemination Activities
Sign MOU's with Building for Green Building Promotions	Conduct Stakeholders Capacity Building & Training	Conduct Awareness Activities		Start Practicing Promotional & Penalty Scheme	Conduct Monitoring & Verification
Enforce Adoption of Code & Green Building Rating Systems				Address Grievances	Conduct In-house Capacity Building & Training
				Conduct Stakeholders Capacity Building & Training	Conduct Awareness Activities

Activity 3A: Template and Results

LEGEND		
Priority 1 Task	Priority 2 Task	Priority 3 Task
Functioning of Green Building Cell		
Empanel Internal & External Green Building and Energy Efficiency Experts	<div style="background-color: #e91e63; width: 20px; height: 20px; margin: 0 auto;"></div>	<p style="text-align: center; margin: 0;">Priority Task 1</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> </div> <div style="display: flex; flex-wrap: wrap; justify-content: space-around; margin-top: 2px;"> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> </div> <div style="display: flex; flex-wrap: wrap; justify-content: space-around; margin-top: 2px;"> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #e91e63; width: 20px; height: 20px; margin: 2px;"></div> </div> <p style="text-align: center; margin: 10px 0 0 0;">Priority Task2</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> </div> <div style="display: flex; flex-wrap: wrap; justify-content: space-around; margin-top: 2px;"> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> </div> <div style="display: flex; flex-wrap: wrap; justify-content: space-around; margin-top: 2px;"> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 2px;"></div> </div> <p style="text-align: center; margin: 10px 0 0 0;">Priority Task3</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> </div> <div style="display: flex; flex-wrap: wrap; justify-content: space-around; margin-top: 2px;"> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> </div> <div style="display: flex; flex-wrap: wrap; justify-content: space-around; margin-top: 2px;"> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> <div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 2px;"></div> </div>
Develop Awareness and Training, Capacity Building Strategy	<div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 0 auto;"></div>	
Facilitate Inclusion of Codes & Green Building Rating Systems in Building Bye-laws	<div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 0 auto;"></div>	
Prepare Annual Budget for the Green Building Promotion Activates	<div style="background-color: #ffeb3b; width: 20px; height: 20px; margin: 0 auto;"></div>	
Conduct Awareness and Training and Capacity Building Activities	<div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 0 auto;"></div>	
Update ULBs webpage/ website with updates on green building promotional activities	<div style="background-color: #9e9e9e; width: 20px; height: 20px; margin: 0 auto;"></div>	
Establish Green Building Cell	<div style="background-color: #e91e63; width: 20px; height: 20px; margin: 0 auto;"></div>	
Empanel Green Building & Material & Technology	<div style="background-color: #e91e63; width: 20px; height: 20px; margin: 0 auto;"></div>	



सत्यमेव जयते

**Ministry of Housing and Urban Affairs
Government of India**