Institutional Framework for Energy Efficiency in India's Building Sector: Challenges, Opportunities and Ways Forward

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ABSTRACT

Buildings account for approximately 40% of global final energy consumption and one-third of energy-related CO_2 emissions. Recent assessments indicate that 2.55 billion m² of new floor space was constructed globally between 2022 and 2023 without mandatory energy-efficiency standards, potentially locking in decades of high energy demand. This challenge is particularly relevant for emerging economies undergoing rapid urbanisation. In India, where an estimated 86% of the building stock expected by 2070 is yet to be constructed, upcoming development presents a significant opportunity to integrate energy efficiency into the built environment.

To support this transition, India has established a comprehensive policy framework for building energy efficiency, including the National Building Code (NBC), Model Building Bye-Laws (MBBLs), and the Energy Conservation and Sustainable Building Code (ECSBC). However, despite their technical rigour and further strengthening through the Energy Conservation (Amendment) Act, 2022, their on-ground implementation remains constrained. As implementation involves multiple institutions across different levels of government, understanding the institutional structure is essential for effective policy delivery. Accordingly, this paper examines India's institutional architecture for building energy efficiency through policy review, institutional mapping, and stakeholder consultations.

The analysis reveals the distribution of responsibilities, coordination mechanisms, and stakeholder interactions across national, state, and local levels involved in advancing building energy efficiency. Drawing on international governance models, the paper proposes institutional strengthening measures including centralized coordination mechanisms, standardized compliance protocols, capacity-building initiatives, and accountability frameworks. The findings provide insights for India and other rapidly urbanising economies seeking to support effective implementation of building energy-efficiency policies.

Introduction

The global building sector continues to expand with alarming inefficiencies. Between 2022 and 2023 alone, 2.55 billion m² of new floor space were constructed worldwide without mandatory energy-efficiency standards, potentially locking in decades of excessive energy consumption and emissions (World Bank 2025). This pattern is particularly pronounced in emerging economies, where rapid urbanization drives unprecedented construction (Zhang et al. 2024), even as nations commit to ambitious climate targets.

The building sector accounts for nearly one-third of total final energy consumption in India (IEA 2026). With an estimated 86% of the building stock expected by 2070 yet to be constructed (NITI Aayog 2026, 29), current building practices will determine energy trajectories

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for decades. Unlike developed economies retrofitting existing stock, India has a strategic opportunity to integrate energy-efficiency considerations from the outset, potentially averting significant energy consumption. However, despite establishing comprehensive policy frameworks including the National Building Code (NBC), Model Building Bye-Laws, and the Energy Conservation and Sustainable Building Code (ECSBC), implementation remains constrained (NITI Aayog 2026). If India demonstrates that robust institutional frameworks and governance mechanisms can effectively translate energy codes into on-ground implementation, it could provide a replicable model for climate-aligned development across the Global South.

Research Objectives

This research is pivoted on three key objectives: (1) systematically map India's institutional architecture for building energy efficiency (2) assess fragmentation patterns, horizontally across ministries and vertically across governance tiers that constrain implementation; and (3) propose actionable institutional reforms grounded in international experience and adapted to India's federal structure.

Methodology

This study employs a mixed qualitative approach to examine the institutional framework for building energy efficiency in India. It begins with a systematic review of national policy frameworks, including the Energy Conservation Act, ECSBC for commercial and residential buildings, NBC, and Model Building Bye-Laws, along with relevant government reports and secondary literature, to trace the evolution and current governance landscape. Institutional mapping documents the roles, mandates, and formal coordination mechanisms across national, state, and local levels to understand how authority and responsibility are distributed. Expert interviews provide insights into coordination mechanisms, implementation effectiveness and gaps. Finally, a comparative analysis of international governance models is undertaken to identify institutional strategies that may be applicable to the Indian context. This approach enables a comprehensive understanding of India's institutional architecture for building energy efficiency and the identification of potential reform pathways.

India’s Building Energy Efficiency Imperative

India's building sector is expanding at an unprecedented scale: the country currently adds 0.9–1.0 billion m² of floor area annually, with building stock projected to grow twofold by 2050 and 2.5 times by 2070 relative to 2020 levels (NITI Aayog 2026). This rapid construction creates a critical window for intervention before energy-intensive infrastructure becomes locked in. Space cooling represents the fastest-growing energy end-use, with a projected ninefold increase in residential AC ownership by 2050, a trend that will significantly accelerate energy demand (IEA 2019). Urbanization compounds these pressures, with India's urban population projected to rise from 410 million in 2014 to 814 million by 2050, driving construction demand and material consumption: brick production is expected to double to 1.5–1.6 billion tonnes annually, while steel, cement, aluminum, and glass demand will rise substantially (United Nations 2025; NITI Aayog 2026). This expansion carries dual implications for energy: operational energy (OE) from building use and embodied energy (EE) from material production and construction. Both are set to rise sharply as floor space, cooling demand, and material consumption grow in tandem.

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Operational performance is improving as the grid turns cleaner and codes and appliances standards tighten, while EE in materials forms a growing share of a building's lifetime total. While this paper focuses on operational compliance, the same institutional architecture will increasingly need to govern embodied energy as well, widening the scope of what building codes must address and raising the stakes for effective implementation. Whether this unprecedented construction institutionalizes energy efficiency or energy-intensive patterns depends critically on effective policy implementation mechanisms examined in the following sections.

Policy Landscape for Building Energy Efficiency

India's policy landscape for building energy efficiency comprises national codes, technical standards, and building bye-laws designed to inform and enhance building practices. This section maps the key instruments, their evolution, scope and current adoption status.

National Building Code (NBC)

The National Building Code (NBC) of India, developed by the Bureau of Indian Standards (BIS), provides the foundational framework for building standards nationwide. First introduced in 1970, with subsequent revisions in 1983, 2005, and 2016, the NBC establishes comprehensive guidelines covering safety, structural design, fire protection, and sustainable construction practices (BIS 2016). The code is currently under revision with enhanced emphasis on energy efficiency, climate resilience, and green construction. At current, NBC provisions address building envelope design, natural ventilation, lighting standards, and HVAC system efficiency across India's diverse climatic zones. The NBC operates as a model code rather than a mandatory instrument. Enforcement occurs only when state governments or Urban Local Bodies (ULBs) formally adopt NBC provisions within their building bye-laws (BIS 2016), resulting in considerable jurisdictional variation. Within this institutional arrangement, the Model Building Bye-Laws (MBBL), issued by the Ministry of Housing and Urban Affairs (MoHUA), provide an administrative framework for incorporating NBC provisions into local land-use planning, development control, and municipal regulation.

Model Building Bye-Laws (MBBL)

To facilitate the uniform adoption of building codes at the local level, the Town and Country Planning Organization (TCPO), under MoHUA, issued MBBL in 2004 and revised them in 2016 (MoHUA 2016). The MBBL enables states and ULBs to formulate context-specific building regulations, providing administrative procedures, development control norms, and construction standards. MBBL 2016 incorporates sustainability provisions, including rainwater harvesting, wastewater reuse, rooftop solar photovoltaic installations, and mandatory electric vehicle charging infrastructure (MoHUA 2019). MoHUA periodically issues amendments and addendums to the MBBL framework to integrate evolving policy priorities and technical standards, enabling states to incorporate updated provisions into their building regulations without requiring a complete revision of bye-laws. Adoption occurs at both levels: states incorporate MBBL provisions into their planning frameworks, while ULBs embed them in municipal building bye-laws. While 33 states and union territories have adopted elements of the MBBL framework (PIB 2019), implementation varies widely.

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Energy Conservation and Sustainable Building Code (ECSBC) 2024 for Commercial Buildings

India's primary regulatory instrument for commercial building energy efficiency, the Energy Conservation Building Code (ECBC) was originally launched in 2007, updated in 2017, and most recently revised as the Energy Conservation and Sustainable Building Code (ECSBC) in 2024 (MoP 2024). Following the Energy Conservation (Amendment) Act 2022, ECSBC 2024 expands the scope to include embodied carbon, net-zero pathways, and circular economy principles.

ECSBC applies to commercial buildings with connected load ≥100 kW or contract demand ≥120 kVA. The code retains a tiered compliance structure: ECSBC (baseline - 25% energy savings), ECSBC+ (intermediate - 35% savings), and Super ECSBC (advanced - 50%+ savings), addressing building envelope, lighting, HVAC, electrical systems, water heating, and renewable energy integration (MoP 2024). As of 2024, 24 states have notified ECBC 2017, of which 20 have integrated it into state-level building bye-laws (AEEE 2024, 26), with the adoption of ECSBC yet to be done in any state.

Eco Niwas Samhita (ENS) 2024 or Energy Conservation and Sustainable Building Codes for Residential Buildings

Recognizing that residential buildings account for nearly 75% of the building sector's electricity consumption, the Bureau of Energy Efficiency (BEE) launched the Eco Niwas Samhita (ENS) in 2018 as India's first energy code for residential buildings. In December 2022, the Energy Conservation Act, 2001 was amended to mandate residential building energy codes for the first time and transition to integrated ECSBC. In line with this mandate, BEE released the ENS 2024 (Consolidated Version), which expands the scope of the code beyond the building envelope to include electromechanical systems, while strengthening provisions related to renewable energy integration and material efficiency.

The ENS applies to residential buildings constructed on plots of 500 m² or larger. To support state-level adoption and implementation, BEE established pilot ENS Cells in six states to provide technical assistance and capacity-building support (ETPI 2021). Adoption proceeds in stages, beginning with the drafting of ENS-aligned bye-law amendments, followed by state-level approval and formal notification by the state government. As of 2024, the code is under approval in six states and has been drafted in thirteen states and Union Territories, reflecting growing momentum toward mainstreaming residential energy efficiency nationwide (AEEE 2024, 9).

Complementary Instruments: Star Rating, Green Building Certifications, and PAT Scheme

Beyond prescriptive codes, India has developed market-based instruments. The BEE Star Rating Program, launched in 2009, rates commercial buildings on a 1-5 star scale based on actual energy performance (BEE 2025). Third-party green building certification systems, including the Green Rating for Integrated Habitat Assessment (GRIHA), Leadership in Energy and Environmental Design (LEED) India, and Indian Green Building Council (IGBC) ratings, have gained traction primarily in premium commercial real estate segments. Additionally, the Perform, Achieve, Trade (PAT) Scheme, which is India's market-based energy efficiency mechanism, administered by BEE under the Ministry of Power, includes hotels and commercial buildings

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consuming more than 500 Tons of Oil Equivalent (TOE) annually as designated consumers, mandating energy performance improvements with tradable energy savings certificates. As of PAT Cycle VI, 132 hotels are covered under mandatory efficiency targets (BEE 2025).

Adoption Status and Implementation Gap

Despite a comprehensive policy framework, implementation gaps remain systemic across all instruments. India's building energy efficiency policy landscape is summarised in Table 1.

Table 1: Summary of India's Building Energy Efficiency Policy Landscape

Policy / Code	Year	Issuing authority	Scope and applicability	Compliance status
National Building Code (NBC)	2016 (revision expected 2026)	Bureau of Indian Standards (BIS), Ministry of Consumer Affairs, Food & Public Distribution	All building types; model code	Voluntary; enforceable when adopted by states/ULBs
Model Building Bye-Laws (MBBL)	2016	Town and Country Planning Department, Ministry of Housing and Urban Affairs (MoHUA)	Template for state/ULB building regulations	Enforceable when adopted by states/ULBs
ECSBC for Commercial Buildings	2024	Bureau of Energy Efficiency (BEE), Ministry of Power	For new Commercial buildings ≥100 kW connected load or ≥120 kVA contract demand	Mandatory under EC Amendment Act 2022; enforceable when adopted by states/ULBs
ENS for Residential Buildings	2024	Bureau of Energy Efficiency (BEE), Ministry of Power	Residential buildings on plots ≥500 m² (state-adjustable threshold)	
BEE Star Rating	2007	Bureau of Energy Efficiency (BEE), Ministry of Power	Commercial buildings (voluntary)	Voluntary; modest uptake
Green Building Certifications	Various	Independent rating systems	All building types - new and existing	Voluntary; traction in premium segments
PAT Scheme	Ongoing (Cycle VI includes buildings)	Bureau of Energy Efficiency (BEE), Ministry of Power	Hotels and commercial buildings consuming >500 TOE annually	Mandatory for designated consumers; 132 hotels covered in Cycle VI

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State-level adoption patterns for the NBC, Model Building Bye-Laws, and Energy Conservation Codes reveal considerable heterogeneity. As land and urban development are state subjects under the Constitution, the central government cannot impose a uniform building code. Each state determines whether, when, and to what extent it adopts national codes, resulting in marked variation in coverage and stringency. For example, Rajasthan incorporated ECBC 2017 directly into unified building bye-laws with automatic adoption of future amendments, while Delhi and Tamil Nadu selectively integrated specific provisions without comprehensive notification (ETPI 2021). ENS implementation remains nascent, with most states still drafting or notifying provisions rather than enforcing them, and capacity for plan review and compliance verification still developing (ETPI 2021). Similarly, mechanisms such as the Star Rating Programme, green building certifications, and the Perform, Achieve and Trade (PAT) scheme are concentrated within limited market segments. The persistence of these implementation challenges across both mandatory and voluntary instruments suggests that the primary barriers are institutional rather than technical in nature, as examined in the following section.

Institutional Architecture and Implementation Challenges

Effective implementation of building energy efficiency policies requires coordinated action across multiple governance levels and institutional actors. This section maps India's institutional architecture, identifying the roles, mandates, and authority of key actors from national policy formulation to local enforcement, and examines the coordination gaps that constrain implementation.[1]

National Level Institutions

Bureau of Energy Efficiency (BEE). Established under the Energy Conservation Act, 2001, BEE serves as the nodal authority responsible for developing the Energy Conservation and Sustainable Building Code (ECSBC) for commercial and residential buildings. BEE's mandate encompasses code development, technical guideline formulation, compliance tool creation (such as the ECOnirman Whole Building Performance Tool), and coordination with State Designated Agencies (SDAs) to facilitate code adoption. BEE also provides training and capacity-building support to state and local stakeholders.

Building codes, however, represent only one component of BEE’s broader mandate under the Energy Conservation Act, which also covers appliances, industry, and other sectors. Within the building’s domain, BEE’s role is largely limited to code development and facilitation, as it lacks direct enforcement powers over building construction, which remains under state and local jurisdiction. ECSBC enforcement therefore depends on state governments notifying the code and incorporating its provisions into building bye-laws, processes over which BEE has limited formal authority.

Ministry of Power (MoP). As BEE's parent ministry, MoP sets national policy direction and legislative mandates related to energy efficiency. The Energy Conservation (Amendment) Act, 2022, which transitioned building energy codes from voluntary to mandatory and expanded their scope to include embodied carbon, was enacted under MoP's legislative purview.

[1] Citations in this section are limited to specific data and external sources, as the text primarily describes statutory institutional mandates and organizational structures.

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Bureau of Indian Standards (BIS). BIS develops the National Building Code (NBC), which serves as a model document. NBC provisions become enforceable only when adopted by state governments or urban local bodies within their building bye-laws.

Ministry of Housing and Urban Affairs (MoHUA). MoHUA publishes the Model Building Bye-Laws (MBBL) through the Town and Country Planning Organisation (TCPO). The MBBL serve as a template for states to develop context-specific building bye-laws.

Central Public Works Department (CPWD). CPWD, operating under MoHUA, serves as the primary construction agency for central government buildings. CPWD develops standardized specifications and Schedule of Rates (SoR) widely referenced by state Public Works Departments (PWDs). As a major public sector builder, CPWD's adoption of ECBC could demonstrate compliance and influence state-level practices. However, CPWD's engagement with ECBC remains limited.

State Level Institutions

State Designated Agencies (SDAs). All 36 states and union territories have designated SDAs, though their institutional forms vary: sixteen are Renewable Energy Development Agencies, seven are State Power Departments, seven are Electrical Inspectorates, four are Electricity Distribution Companies, and two states have standalone energy efficiency agencies (BEE 2025). SDAs are mandated to lead ECSBC/ENS notification, support stakeholder training, liaise with Urban Local Bodies (ULBs), implement demonstration projects, and coordinate with Urban Development Departments and PWDs.

However, SDAs face institutional constraints. While empowered to coordinate and promote codes, they cannot mandate procedural changes in building approval systems managed by Urban Development Departments and ULBs. SDAs organize training workshops but depend on Town and County Planning (TCP) Departments and ULBs for actual enforcement. The heterogeneity in SDA institutional forms complicates implementation, as SDAs embedded within Renewable Energy agencies or utilities often prioritize other mandates over building code enforcement.

ECBC / ENS Cells. BEE established dedicated ECBC Cells and ENS Cells in select states to provide technical support for code adoption (BEE 2018). These cells, typically housed within SDAs, organize training programs, develop implementation guidelines, and provide technical assistance to ULBs. However, these cells operate with limited dedicated staff and budgets, functioning more as focal points within SDAs rather than autonomous technical units.

Town and Country Planning Departments. TCP departments prepare city development plans, draft building regulations, and coordinate with MoHUA guidelines and NBC. They play a pivotal role in integrating ECSBC into state-level General Development Control Regulations (GDCRs), which guide ULB building approvals. In states where ECBC provisions have been incorporated into GDCRs, TCP departments serve as the institutional bridge between national codes and local enforcement (ETPI 2021). However, in states where TCP departments have not integrated energy codes, ULBs lack legal authority to mandate compliance even if the state has issued gazette notification. This creates a critical gap: notification alone does not translate into enforceability without corresponding amendments to development control regulations.

Urban Development and Housing Departments (UDDs). UDDs serve as apex policy bodies overseeing urban planning, local governance, and infrastructure development. They provide administrative oversight to ULBs and facilitate harmonization of ECSBC with local bye-

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laws. UDDs act as key stakeholders during code amendment processes, particularly for aligning energy codes with TCP regulations and engineering standards.

Public Works Department (PWD). PWDs design and construct government buildings, making them pivotal for demonstrating ECSBC compliance and institutionalising energy-efficient practices in public procurement. PWD specifications often reference CPWD standards, creating pathways for cascading ECBC adoption from central to state-level construction.

Local Level Institutions

Urban Local Bodies (ULBs). ULBs are the primary enforcement agencies for building codes. Through Town Planning Cells, ULBs scrutinize building plans, process permit applications, conduct site inspections, and issue completion certificates. This positions ULBs as the critical last-mile enforcement node. However, ULB capacity to verify ECSBC compliance is severely constrained. Most ULB departments lack staff trained in energy performance assessment, building envelope thermal analysis, or HVAC system efficiency evaluation. The technical expertise required to verify compliance exceeds conventional structural and safety-focused review. Without clear guidelines on incorporating energy code review into building approval workflows, ULB officials often approve plans meeting NBC structural standards while overlooking energy performance requirements. Institutional fragmentation between SDAs and ULBs exacerbates this gap. SDAs promote code adoption but lack authority over ULB building approval processes. ULBs report to state Urban Development Departments, not SDAs. SDAs conduct training workshops but cannot mandate procedural changes; ULBs control enforcement but receive inconsistent technical guidance and no performance accountability. In some states, Urban Development Authorities exercise building approval authority in designated areas, creating parallel systems with varying ECSBC awareness. Figure 1 synthesises the institutional architecture for building energy efficiency in India.

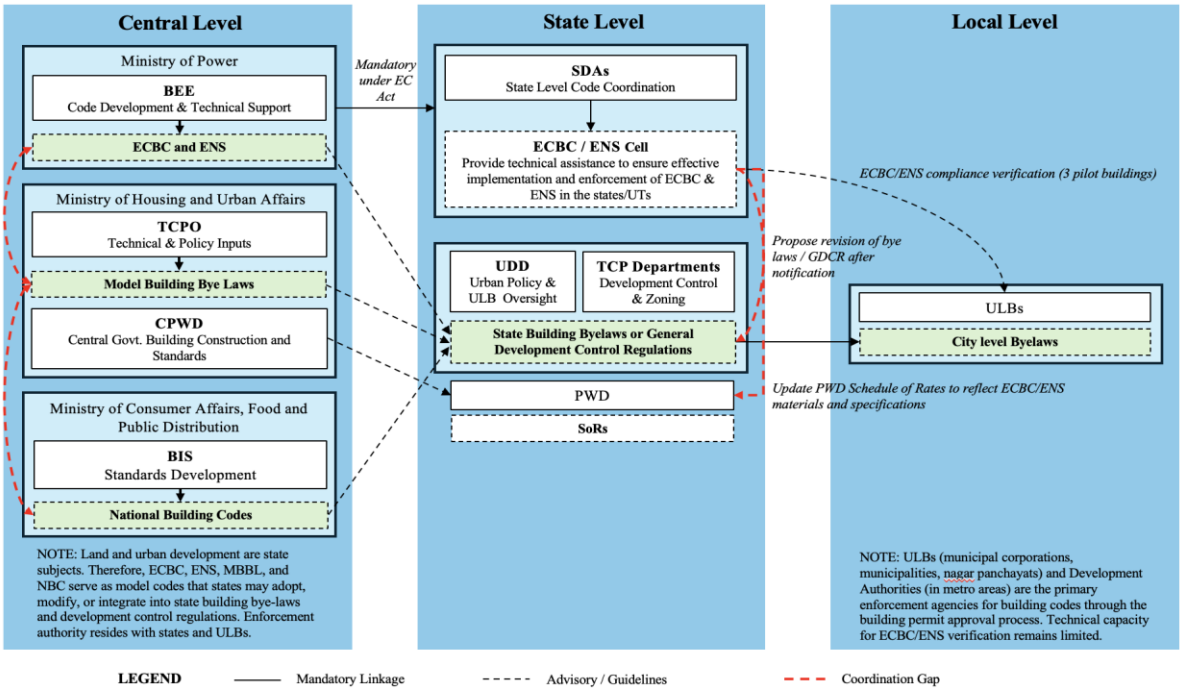

Figure 1. Institutional Architecture for Building Energy Efficiency in India. *Source:* Author.

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The above diagram illustrates three institutional coordination dimensions: horizontal coordination across key central ministries; vertical coordination across national, state, and local implementation agencies; and intra-state coordination among sectoral departments and agencies. Strengthening these coordination mechanisms is critical for ensuring coherent policy implementation and effective delivery of building energy efficiency objectives.

Implementation Challenges

This institutional mapping highlights key coordination and implementation challenges across national, state, and local levels. These include strengthening horizontal coordination among central agencies, enhancing vertical alignment across implementation tiers, and institutionalizing inter-departmental collaboration within states. Addressing these challenges through clearer institutional arrangements, strengthened capacities, and enhanced accountability mechanisms will be critical to improving policy implementation and achieving building energy efficiency objectives. The key implementation challenges emerging from this analysis are summarized below:

A. **Institutional Alignment Challenges:** Building energy efficiency governance spans multiple ministries and levels of government. While BEE under the Ministry of Power develops energy conservation codes, implementation and enforcement are undertaken by institutions operating within urban development and local governance frameworks under MoHUA and state governments. This division of responsibilities, rooted in India's federal structure, requires sustained coordination across ministries, SDAs, UDDs, and ULBs to support effective implementation.
B. **Building Permit and Energy Compliance Split:** Building plan approvals are administered by ULBs, while responsibility for overseeing energy code implementation rests with SDAs under the Department of Energy. This separation can create coordination challenges during plan review, particularly where energy compliance requirements are not fully integrated into building approval processes.
C. **Policy–Implementation Gap:** As of 2024, 24 states have notified ECBC, while adoption of ECSBC remains nascent. Despite the regulatory framework, compliance and enforcement remain uneven. Perceived upfront compliance costs are often not offset by incentives or market signals, while enforcement mechanisms remain limited. Experience from the solar photovoltaic sector suggests that adoption accelerates when regulations are complemented by clear economic benefits. Similarly, wider uptake of building energy codes is likely to depend on demonstrating tangible value through lower energy costs, enhanced asset performance, and improved thermal comfort and resilience (Kocakusak, Greenberg, and Andrews, 2024).
D. **Institutional Update Complexity:** Code revisions require coordinated action across multiple levels of governance. Updates issued by BEE must be reflected in state building bye-laws and local approval processes, often alongside revisions related to FSI, fire safety, and structural standards. The absence of a clearly defined transition pathway between successive code tiers can further contribute to implementation uncertainty and varying adoption timelines across jurisdictions.
E. **Capacity and Enforcement Constraints:** ULBs play a central role in code implementation but often face resource and staffing constraints. Energy compliance assessment is not consistently integrated into approval processes and digital systems,

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while enforcement and incentive mechanisms may be constrained by state regulations and municipal legislation. These factors can affect the consistency of code implementation.

F. **Code Complexity and Capacity Gaps:** ECSBC provisions require specialized expertise for interpretation and enforcement. However, familiarity with energy code requirements varies across architects, engineers, and ULB officials. Limited access to training, guidance materials, and compliance tools can constrain implementation, affecting the consistency and quality of compliance assessment.

Institutional Strengthening Measures: Lessons from International Experience

Countries with federal or quasi-federal governance structures have faced similar institutional challenges as India in implementing building energy efficiency codes across multiple tiers of government. However, several countries have successfully developed coordinated governance frameworks through strategic institutional arrangements. Rather than descriptive country profiles, this section presents the identified governance mechanisms mapped directly to each of the identified institutional challenges, alongside proposed learnings for application in India in Table 2. Each row maps identified implementation challenges in India to international mechanisms that have empirically resolved the same gap.

Table 2: Mapping of Identified Challenges to International Mechanisms

Identified Challenges	Country-Specific Mechanism Adopted	Learnings for India
Institutional Alignment Challenges	Singapore: A single ministry oversees the full chain from code to occupancy. The Building and Construction Authority (BCA) sits under the Ministry of National Development, which owns the code development, review, audit, and enforcement (BCA 2021).	Consolidate current inter-ministerial handoffs so one body owns the code-to-occupancy chain. Drawing from Singapore's model, the transferable principle for India is to make energy compliance a condition of plan approval and the occupancy permit, supported technically by the SDA, even where permits remain locally issued.
Building Permit and Energy Compliance Split	United States: The Authority Having Jurisdiction (AHJ) integrates plan scrutiny and energy compliance enforcement within a single local body (Hinge and Brocklehurst 2021).	Energy compliance verification should be a condition of plan approval, carried out by the same authority that issues the building permit, supported technically by the State Designated Agency (SDA).

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Identified Challenges	Country-Specific Mechanism Adopted	Learnings for India
Policy–Implementation Gap	United States: Under the Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA), USD 1.2 billion is tied to state code adoption and compliance rate reporting. States that lag lose competitive funding access (Energy.Gov, n.d.). United States: As per a federal housing finance mandate, the compliance obligation is routed through a finance channel, bypassing fragmented local permit systems. The mandate addresses potential gaps at a project level (HUD and USDA 2024). China: Under China's Five-Year Plan, compliance targets were embedded in local official performance metrics, driving design-stage compliance from 5% in 2001 to 95% in 2011. It converts a policy obligation into a career incentive (Bin and Nadel 2012).	Compliance improved when made a prerequisite for accessing federal housing finance, competitive grants, or career advancement. It was triggered not by code updates or awareness campaigns but by direct financial, institutional, or personnel-based consequences the actor could not forgo. For India, the financial and institutional levers should be prioritised, while the personnel-based lever, being specific to other governance systems, holds limited relevance.
Institutional Update Complexity	United States: The International Energy Conservation Code (IECC) follows a statutory three-year update cycle, with the U.S. Department of Energy (DOE) mandated to provide continuous technical support to states for adopting revisions, reducing the cascading burden of repeated amendments (DOE 2024; Hinge and Brocklehurst 2021). Australia: Australia's National Construction Code follows a triennial update cycle under which states must formally adopt the revised code or register a formal derogation, creating a structured and predictable amendment process rather than an open-ended cascade (ABCB 2022).	A statutory revision cycle with a binding adoption mechanism and predictable cadence lets industry, states, and ULBs prepare compliance workflows in advance, replacing an open-ended amendment cascade across gazettes, bye-laws, TCP regulations, and Schedules of Rates with a structured one.
Capacity and Enforcement Constraints	United States: Under the DOE's Resilient and Efficient Codes Implementation (RECI) program, USD 180 million in competitive grants was tied to measured compliance rate improvement, not activity outputs, and	Digital compliance portals, as proven in Telangana and Andhra Pradesh, automate the checking process. Accredited third-party assessors handle technical verification. Both

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Identified Challenges	Country-Specific Mechanism Adopted	Learnings for India
	directed building enforcement capacity at the state and local level (DOE 2024). United States: Under California's Home Energy Rating System (HERS), a four-stage mandatory process blocks the occupancy certificate without independent rater sign-off, with raters statutorily barred from financial ties to the developer, removing dependence on government staffing capacity (CEC 2022)	approaches scale enforcement without expert hiring, provided municipal acts grant ULBs the authority to withhold approvals and offer fiscal incentives.
	India: In Telangana and Andhra Pradesh, state-developed online compliance portals embed ECBC/ENS parameter checks directly into the building approval workflow, enabling officials to flag non-compliant submissions without requiring specialist technical knowledge, reducing dependence on specialist staff at the ULB level. (NRDC and ASCI 2018)	
Code Complexity and Capacity Gaps	United States: The International Code Council (ICC) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) separate code complexity from compliance through plain-language guides, climate-zone-specific toolkits, mandatory training for code officials, professional certification programs, and university-government research partnerships (ICC and ASHRAE 2018)	Complexity is separated from compliance through plain-language guides and compliance tools. Embedding energy code knowledge into university curricula builds capacity at the structural level, reducing dependence on repeated post-appointment training over time.
	Singapore: BCA sponsors university degree programs focused on building energy efficiency and mandates Green Mark training for all Qualified Persons and Professional Engineers involved in code compliance (BCA 2021)	

Discussion and Proposed Measures

The Energy Conservation (Amendment) Act 2022 strengthened the legislative basis for India's building energy codes, which are already technically sound. The principal opportunity now lies in institutional alignment: because implementation responsibilities are distributed across national, state, and local bodies, embedding clear ownership of compliance outcomes can

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strengthen the system considerably. The measures below, informed by discussions with sector experts, follow one organising principle, that compliance is most durable when attached to a transaction the actor is already completing, and fall into two phases.

Near-term measures by 2030. These measures work through executive notification, existing approval systems, and BEE's own certification rules, requiring no new primary legislation.

- Linking ENS compliance to India's Affordable Housing Scheme- Pradhan Mantri Awas Yojna (PMAY) subsidy release through a MoHUA notification. Since PMAY-linked developers are already pursuing approval, this uses an existing decision point and could bring a segment of affordable housing into the framework.
- Making ECSBC/ENS status a mandatory disclosure field in RERA registration, making performance visible to buyers and financiers within an established registration process.
- Mandating ECSBC compliance for CPWD-procured buildings through an executive order. As CPWD specifications cascade into state PWD Schedules of Rates, this can create a demonstration effect without simultaneous state action.
- Integrating ECSBC/ENS as a verified gate within AutoDCR, converting compliance from self-declaration into a system-checked approval condition. Already live across 50+ ULBs, including MCGM, and aligned with Telangana and Andhra Pradesh portals, Singapore's CORENET X, and US DOE work at PNNL, this adds a digital verification pathway without specialist hiring (BCA 2023; Wan and Feng 2024; NITI Aayog 2026).
- Requiring BEE Energy Auditor (Buildings) certification for occupancy certificates, introducing third-party verification at the occupancy stage without requiring every ULB to hire in-house technical experts.
- Establishing ECSBC and ENS cells within municipal corporations and development authorities, operating within the approval workflow as enforcement units rather than focal points alone.

Measures beyond 2030. These interventions require statutory action or structural change and mature over a longer horizon, building on the near-term foundation.

- Establishing a National Building Energy Efficiency Authority (NBEEA), it would function as a statutory cross-ministerial body for code harmonisation, national monitoring, and outcome-linked grant administration. Linking state grants to measurable compliance improvements would make compliance performance financially consequential for states.
- Creating a statutory Code Review Committee on a three-year cycle with automatic Model Building Bye-Law updates (MBBLs), would replace the current open-ended amendment cascade with a predictable process. A pre-announced pathway of progressively stricter code would help developers plan investments across future compliance cycles.
- It is proposed that greater coordinating responsibility for code implementation be vested in MoHUA. While BEE develops the codes, implementation runs through the urban-development and building-approval ecosystem. A stronger MoHUA role would align code development with delivery, from design approval through occupancy certification.

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- Integrating ECBC/ENS into Council of Architecture (CoA) and the All India Council for Technical Education (AICTE) curricula, would address the capacity gap at the point of professional formation rather than relying on repeated post-appointment training.
- Introducing verfied-performance incentives such as FSI (Floor Space Index) premiums for ECSBC+ buildings and property-tax rebates for ENS-certified construction once near-term verification infrastructure is in place. These incentives can link compliance with lower operating costs, improved market value, and greater demand for high-performance buildings.

Conclusion

This paper highlights the importance of institutional arrangements in supporting the implementation of building energy-efficiency policies in India. A recent NITI Aayog study projects commercial ECSBC compliance reaching 35% by 2070 under current trends, compared with 60% under scenarios incorporating stronger enforcement mechanisms and enhanced sub-national capacity (NITI Aayog 2026). The analysis suggests that the greatest point of leverage is a single principle: attaching compliance to a transaction the actor cannot avoid. The near-term measures already apply this principle without a new statute, while the National Building Energy Efficiency Authority is where it is eventually institutionalised, owning compliance outcomes end to end. Domestic experience in Telangana and Andhra Pradesh shows transaction-linked enforcement can be embedded in existing approval workflows before national restructuring is complete, while Singapore, China, and Australia show that durable compliance emerges where responsibility sits with institutions already holding authority. Though this paper addresses operational compliance, the same institutional architecture will be needed to govern embodied energy as that frontier grows. With most of India's 2030 building stock still to be built, the institutional choices made now will shape efficiency outcomes for decades, while offering insights for other rapidly urbanising economies seeking to strengthen the implementation of building energy-efficiency policies.

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AI Disclosure

AI-assisted tools used: ChatGPT, Grammarly.
Used for: Language and Grammar editing and reference formatting support
Extent: Light editing assistance
Human review: All content, analysis, and citations were reviewed and verified by the author.

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