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High Performance Buildings in India

Status Paper

High Performance Buildings in India
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High Performance Buildings in India

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Abbreviations

A

ADB	Asian Development Bank
ACEEE	American Council for an Energy-Efficient Economy

B

BEE	Bureau of Energy Efficiency
BEEP	Buildings Energy Efficiency Programme
BIS	Bureau of Indian Standards
BR18	Denmark's Building Codes

C

CEFC	Clean Energy Finance Corporation
CRISIL	Credit Rating Information Services of India Limited
CREDAI	Confederation of Real Estate Developers' Associations of India

D

DSM	Demand-Side Management

E

EC Act	Energy Conservation Act
ECBC	Energy Conservation Building Code
ECG	European Commission Green Deal
EEM	Energy Efficient Mortgage
EIB	European Investment Bank
ENS	Eco-Niwas Samhita
EPC	Energy Performance Contracting
EPBD	Energy Performance of Buildings Directive
EPA	Environmental Protection Agency
EPI	Energy Performance Index
ESCerts	Energy Savings Certificates
ESPC	Energy Savings Performance Contracting
ETS	Emissions Trading System

FAR	Floor Area Ratio
FiTs	Feed-in Tariffs
GBCI	Green Building Certification Institute
GCF	Green Climate Fund
GRIHA	Green Rating for Integrated Habitat Assessment
HDFC	Housing Development Finance Corporation
HPBs	High-Performance Buildings
HVAC	Heating, Ventilation, and Air Conditioning
IAQ	Indoor Air Quality
IBEF	India Brand Equity Foundation
ICAP	India Cooling Action Plan
IECC	International Energy Conservation Code
IEA	International Energy Agency
IFC	International Finance Corporation
IGBC	Indian Green Building Council
LEED	Leadership in Energy and Environmental Design
MEPS	Minimum Energy Performance Standards
MNRE	Ministry of New and Renewable Energy
MoEFCC	Ministry of Environment, Forest, and Climate Change
MoHUA	Ministry of Housing and Urban Affairs

N

NBC	National Building Code
NDC	Nationally Determined Contribution
NHB	National Housing Bank
NMEEE	National Mission for Enhanced Energy Efficiency
NMSH	National Mission on Sustainable Habitat
NZEBs	Net Zero Energy Buildings
NPEBs	Net Positive Energy Buildings

O

OBEP	On-Bill Energy Program
OBF	On-Bill Financing
OBR	On-Bill Repayment

P

PACE	Property Assessed Clean Energy
PAT	Perform, Achieve, and Trade
PRGFEE	Partial Risk Guarantee Fund for Energy Efficiency

S

SUNREF	Sustainable Use of Natural Resources and Energy Finance

T

TERI	The Energy and Resources Institute
TPSSL	Tata Power Solar Systems Limited

UJALA	Unnat Jyoti by Affordable LEDs for All
UNFCCC	United Nations Framework Convention on Climate Change
VCFEE	Venture Capital Fund for Energy Efficiency
WGBC	World Green Building Council

600 million Indians will live in urban areas by 2030, expanding the real estate market to

$1 trillion

Source: India Brand Equity Foundation (2025). Indian Real Estate Industry Analysis

By 2050, this could rise to

$6 trillion

Source: Colliers. (2023, August 24). Indian real estate: Fostering equity and fueling economic growth.

Executive Summary

India’s Building Sector: A Moment of Risk and Opportunity

Indian cities are on the cusp of one of the largest construction waves in history. By 2030, 600 million Indians will live in urban areas[1], expanding the real estate market to USD 1 trillion[2]. This could rise to USD 6 trillion by 2050; crucially, three-quarters of the buildings that will exist in 2050 are yet to be built. The way this new urban stock is delivered will shape India’s economy, cities, and climate footprint for generations.

Risks and Opportunities in India's building boom

Risks in India's building boom

Opportunities in India's building boom

The risk is clear. India's building sector already consumes about 32% of the country's electricity and produces nearly 28% of its greenhouse gas emissions[3]. If the projected new build follows today's conventional, energy- and emissions-intensive pathways, India will lock in decades of:

- Inefficient, high-operating-cost assets;
- Mounting strain on energy and water infrastructure;
- Deeper fossil fuel dependence and associated price volatility;
- Heightened vulnerability to climate events; and,
- A growing mismatch between climate pledges and actual performance.

At the same time, this immense build-out is a once-in-a-generation opportunity. With the right choices in design and operations, every new building can secure:

- Reduced energy and water demand;
- Lower lifecycle costs;
- Improved public health via better indoor environments;
- Renewable energy integration and grid stability;
- Emissions in line with national climate goals; and,
- The competitiveness of cities and businesses.

Encouraging Progress- and the New Frontier of Verified Performance

Over the last two decades, green-certified buildings have delivered measurable energy and water savings, faster leasing, higher occupancy, and rental premiums. Smart buildings have extended these gains through automation, advanced controls, and real-time monitoring. The market has responded: nearly two-thirds of the Grade A office space in the country- and 80% of new Grade A stock added in the last five years- now carry green certification[4].

However, as adoption deepens and expectations rise, leading developers, investors, and occupiers are converging around a clear expectation: verified operational performance.
This shift is propelled by:

Business priorities

- Safeguarding long-term asset value as markets price in 'brown discounts'
- Lowering and stabilising O&M costs for owners and occupiers
- Creating tangible differentiation in a crowded real estate sector
- Providing robust, auditable ESG evidence

Investor and tenant expectations

- Corporate tenants are now contracting for proven operational savings
- Investors increasingly demand performance data to de-risk portfolios and unlock green finance
- Global ESG frameworks are seeking verified outcomes, not just design claims

Policy and regulatory action

- New building codes and incentives are exploring how to embed measurable operational metrics
- Fiscal and procedural benefits are increasingly tied to verified outcomes
- Mandates for annual public disclosure of building energy and water performance are becoming stronger

This broad-based shift, across business, finance, and government, marks a new era: in Indian cities, buildings are progressively being valued not only for how they are designed, but for how they actually perform, every single day.

High Performance Buildings - The Promise

High Performance Buildings (HPBs) bring together the most effective design, technology, and operational practices to deliver exceptional, verified performance. Efficiency, comfort, and resilience are locked into day-to-day operations, ensuring these benefits are sustained throughout a building's life. Crucially, building to HPB standards does not cost more upfront than conventional construction, but yields significantly better financial returns over time.

Designed to be two to four times more resource-efficient than typical new construction, HPBs routinely achieve 50% to 75% reductions in both energy and water use through high-performance envelopes, advanced systems, substantial renewable integration, and continuous, data-driven optimisation.

This transforms design ambition into guaranteed outcomes, delivering deeper savings, greater comfort, heightened resilience, stronger asset value, faster payback, and, overall, more value for every stakeholder group.

Businesses

- Protect long-term asset value
- Reduce and stabilise O&M costs
- Improve leasing velocity, occupancy, and rents

Government

- Accelerate national climate and energy targets
- Ease pressure on urban infrastructure
- Optimise public spend on infrastructure
- Spur skilled jobs and green tech creation

Communities

- Healthier, safer, more comfortable spaces
- Greater resilience during climate events and outages
- New opportunities for skilled, local employment

The Planet

- Deep, scalable cuts in emissions and water use
- Building demand patterns that enable faster and more stable renewable energy integration

Scaling Up HPBs

India's commercial HPB stock is conservatively estimated at 1–1.5 billion sq. ft., concentrated in Tier-1 markets such as Delhi NCR, Mumbai, Bengaluru, Hyderabad and Chennai. This estimate is grounded in mapping advanced certifications, verified datasets, and cross-referencing Grade A inventories adjusted for operational performance.

While this represents a start, mainstreaming HPBs will require sustained, coordinated reflection on the following:

- **National definition and standards**:
  - » Establish measurable operational benchmarks
  - » Integrate benchmarks into ECBC, state bye-laws, and urban planning codes
  - » Mandate public disclosure of Energy Performance Index for large buildings

- **Performance-linked finance:**
  - » Tie concessional loans, green bonds, FDI incentives, and tax breaks to independently verified outcomes
  - » Provide priority lending status to HPB projects

- **Regulatory and policy coordination:**
  - » Articulate a synergistic business, energy, climate and social case
  - » Identify a suite of synergistic policy and regulatory responses
  - » Align operational benchmarks with regulatory and policy indicators

- **Capacity and skills:**
  - » Train architects, engineers, and facility managers in HPB design, operation, and retrofitting
  - » Support domestic innovation in materials, systems, and digital tools

- **Retrofit pathways:**
  - » Offer fiscal incentives and outcome-based contracting to upgrade existing stock
  - » Prioritise high-consumption, high-impact segments

- **Public sector leadership:**
  - » Mandate HPB benchmarks in all new government buildings
  - » Publish operational data to set benchmarks and foster market-wide uptake

Mainstreaming HPBs will require sustained, coordinated reflection on:

National definition and standards

Performance-linked finance

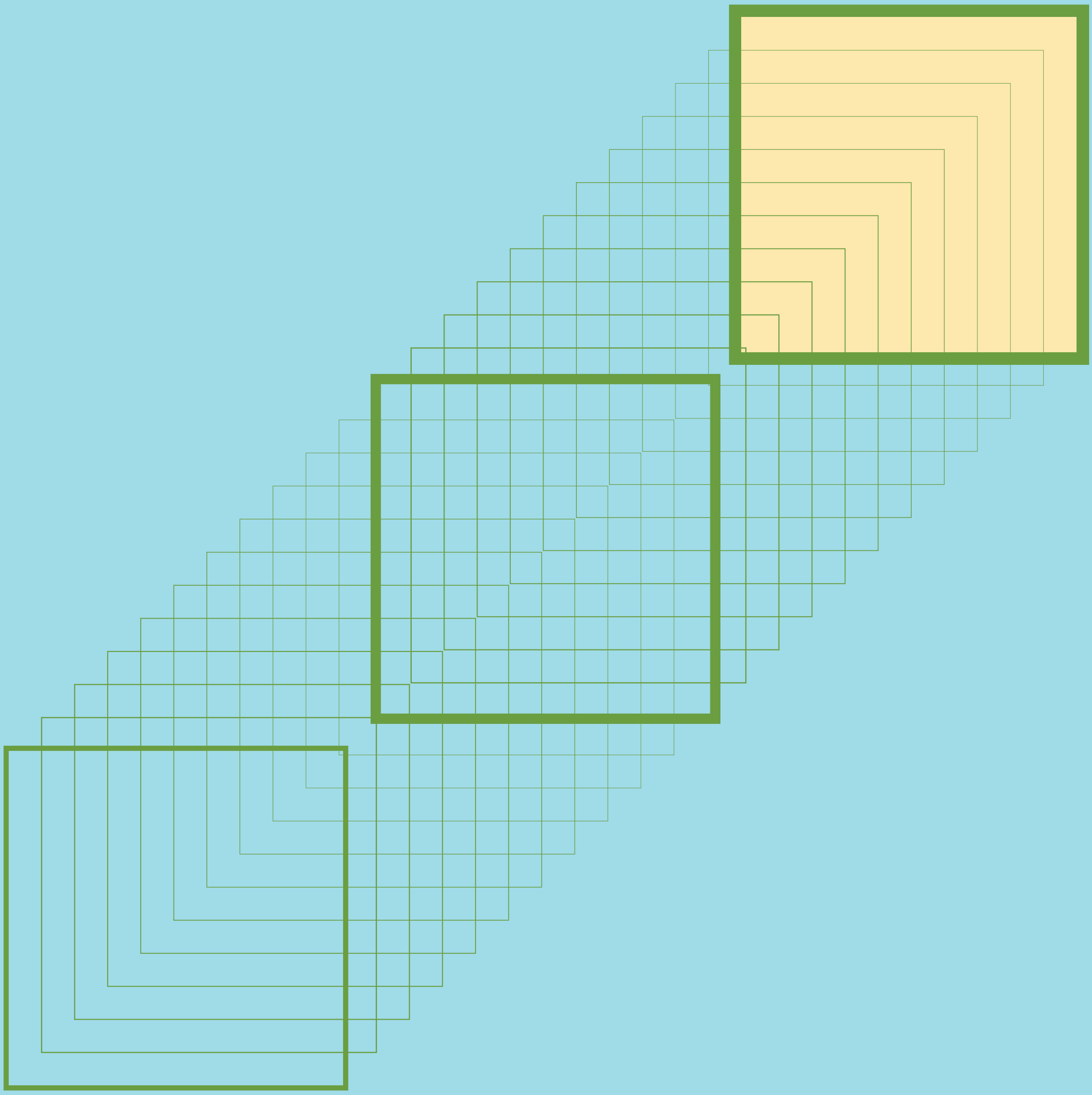
Capacity and skills

Regulatory and policy coordination

Retrofit pathways

Public sector leadership

Measures to mainstream HPBs



40%

of energy-related greenhouse gas (GHG) emissions is produced by the building and construction sector

Source: Embodied Carbon - World Green Building Council. (2025, April 16).

HPBs are designed to optimise energy efficiency, environmental performance, and occupant wellbeing while minimising lifecycle costs

1 Background

The 21st century presents a convergence of challenges related to climate change, energy consumption, and sustainable development. Globally, the building and construction sector accounts for nearly 40% of energy-related greenhouse gas (GHG) emissions, making it a critical area for climate intervention.[5] As nations seek to balance economic growth with environmental sustainability, there is a compelling case for High Performance Buildings (HPBs), given the energy efficiency, emissions reduction, and resource optimisation benefits they offer. For India, where rapid urbanisation intersects with ambitious climate targets, HPBs are not just desirable, but essential.

Global Context: Climate and Energy Imperatives

Urbanisation is accelerating globally, with cities projected to house two-thirds of the global population by 2050, and driving increased demand for buildings and infrastructure.[6] In 2021, buildings accounted for over 30 % of total global energy use and nearly 10 Giga tonnes of CO_2($GtCO_2$) of emissions, highlighting the urgent need for sustainable practices in the building sector.[7] The International Energy Agency (IEA) underscores buildings as a cost-effective pathway to decarbonisation, recommending energy-efficient technologies, sustainable materials, and renewable energy integration. HPBs align with several United Nations Sustainable Development Goals (SDGs), particularly **SDG 11** (Sustainable Cities and Communities), **SDG 7** (Affordable and Clean Energy), and **SDG 13** (Climate Action).

SDG 7

Ensure access to affordable, reliable, sustainable and modern energy for all

SDG 11

Make cities and human settlements inclusive, safe, resilient and sustainable

SDG 13

Take urgent action to combat climate change and its impacts

Image Credits:
Shakib Uzzaman, Unsplash

Indian Context: Urbanisation, Climate Commitments, and Energy Demand

India’s urban population is expected to reach 600 million by 2030, fueling rapid infrastructure expansion.[8] Concurrently, India aims to achieve net-zero emissions by 2070 and reduce emissions intensity by 45% by 2030, as outlined in its Nationally Determined Contributions (NDCs). However, estimates show that between 60% and 75% of the building stock projected for 2050 remains unbuilt. Current conventional construction practices contribute significantly to rising energy demand and emissions.[9] The sector’s electricity consumption is projected to grow by 6% annually, driven by increased air conditioning use.[10] HPBs present a transformative opportunity to curb energy demand while enhancing occupant comfort and sustainability.

HPBs can reduce energy consumption by up to 50% compared to conventional structures through advanced technologies, renewable energy systems, and sustainable design

High Performance Buildings: A Strategic Imperative

HPBs are designed to optimise energy efficiency, environmental performance, and occupant wellbeing while minimising lifecycle costs. They can reduce energy consumption by up to 50% compared to conventional structures through advanced technologies, renewable energy systems, and sustainable design. In addition to environmental benefits, HPBs offer cost savings for developers, enhance occupant productivity, and align with government climate policies, strengthening economic resilience and energy security.

Despite their advantages, HPB adoption in India faces barriers such as policy fragmentation, the myth of high initial costs, and limited awareness. Initiatives such as the Energy Conservation Building Code (ECBC), and rating systems such as Green Rating for Integrated Habitat Assessment (GRIHA) and Indian Green Building Council (IGBC) have laid the groundwork, but a more integrated approach is needed, and strengthening financing mechanisms and stakeholder collaboration will be crucial to scale-up.

About the Status Paper

This Status Paper dwells on the current landscape of HPBs in India, offering insights into their benefits, and articulates a policy, regulatory, and financing pathway for its widespread adoption. It is intended to prompt a broader reflection, catalyse multi-stakeholder engagement towards transforming India's real estate sector into a model of sustainability, and stimulate a set of deliberations to identify a suite of supportive policy, regulatory, and financing elements.

HPBs can reduce energy consumption by

25 – 50%

and water consumption by

30 – 50%

HPBs align with global sustainability goals while adapting to local environmental, social, and economic contexts.

2 High Performance Buildings: An Introduction

2.1 What are High Performance Buildings?

HPBs are structures meticulously designed to maximise resource efficiency, cost effectiveness, and occupant wellbeing. These buildings optimise energy, water, materials, and indoor environmental quality throughout their lifecycle. By adhering to or exceeding benchmarks set by Indian standards such as the ECBC and the National Building Code (NBC), HPBs achieve a level of performance unmatched by conventional buildings. Compared to a **typical commercial building**—which often consumes around **140–180 kWh/m²/year** for energy[11] and **45 litres/day/person** for water use[12]—HPBs can reduce:

- **Energy consumption by 25% to 50%** (Factor 2 to Factor 4 improvement)
- **Water consumption by 30% to 50%**, depending on design, operations, and occupancy patterns

These performance levels not only cut operational costs, but also significantly lower environmental impact, making HPBs a strategic choice for climate-aligned real estate development.

HPBs integrate cutting-edge technologies such as high-performance windows, advanced insulation, efficient lighting, and heating, ventilation and air-conditioning (HVAC) systems, smart controls, water-efficient fixtures, and comprehensive building management systems. Continuous monitoring and performance verification ensure sustained efficiency, making HPBs a cornerstone of long-term sustainability. Moreover, HPBs align with global sustainability goals while adapting to local environmental, social, and economic contexts.

2.1.1 Key Features of HPBs

HPBs stand apart through a holistic approach that emphasises **efficiency, sustainability, resilience, and occupant wellbeing**. These principles are not limited to new construction—**they can be effectively applied to existing buildings** through retrofitting and upgrades, which is crucial in a country like India where a large share of the building stock is already built.

- **Optimised Energy Use**: Integration of renewable energy sources, high-efficiency systems, and passive design strategies significantly reduces energy demand and operational costs

- **Water and Material Efficiency**: Adoption of water conservation measures such as rainwater harvesting, greywater reuse, and use of low-carbon, durable materials reduce operational and embodied impacts

- **Superior Indoor Environmental Quality**: Improved ventilation, daylighting, acoustic design, and thermal comfort lead to healthier and more productive indoor environments

- **Smart Building Integration**: IoT-enabled systems and automated controls allow real time monitoring and adaptive management of lighting, HVAC, and plug loads to optimise comfort and efficiency

- **Resilience to Climate and Disruption**: Designed for long-term adaptability, HPBs maintain performance and occupant safety during climate extremes or grid disruptions

- **Collaborative, Multidisciplinary Design**: Integration of architecture, engineering, and building science ensures seamless functionality, and high performance from concept to operation

- **Performance Monitoring and Benchmarking**: Continuous data-driven tracking ensures that buildings stay on track with energy, water, and comfort goals over time

- **Retrofitting Existing Buildings for High Performance**: Retrofitting offers a cost-effective pathway to transform older buildings into high-performing assets

By integrating advanced technologies with sustainability principles, HPBs establish a benchmark for environmentally responsible, adaptive, and user-centric buildings.

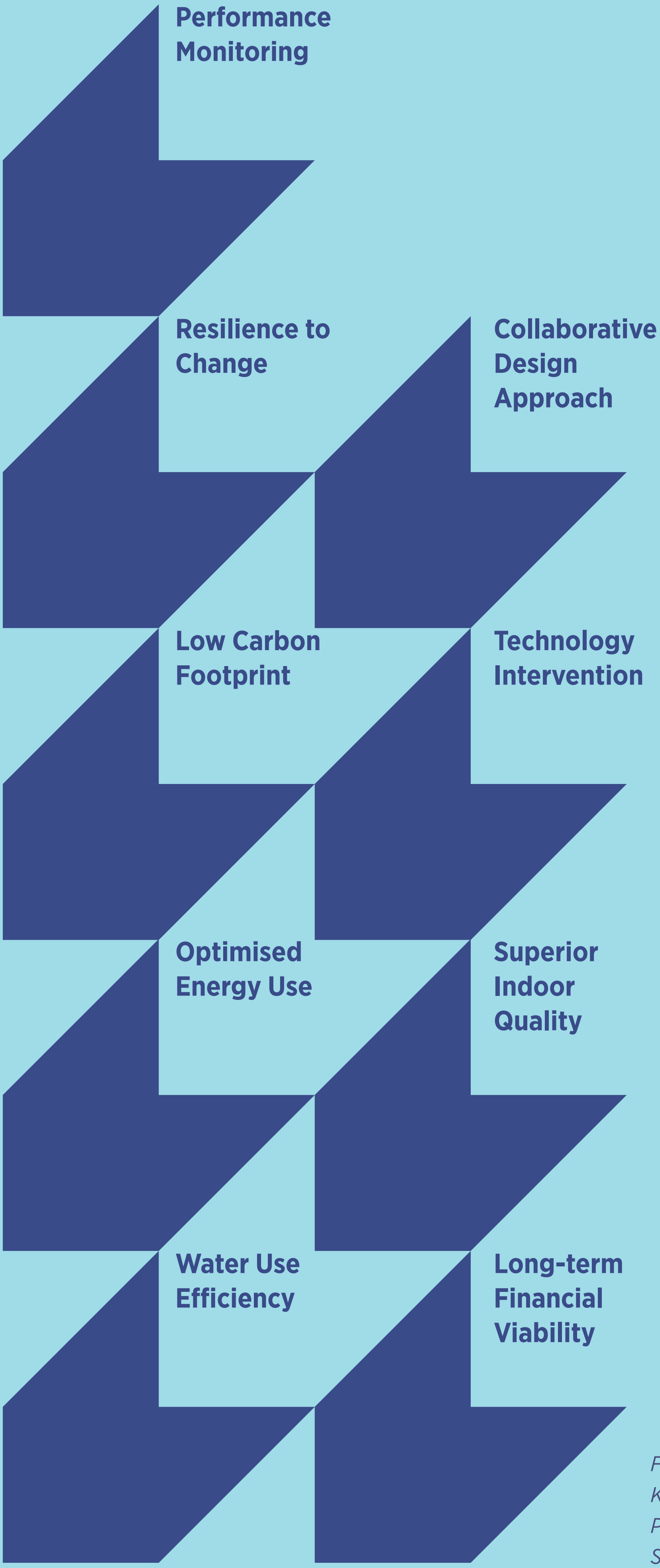


Figure 1:
Key features of High Performance Buildings
Source: IIHS, 2025

2.1.2 HPBs, Green Buildings, and Smart Buildings

While terms like green buildings, smart buildings, and high-performance buildings are often used interchangeably, HPBs represent a convergence of these concepts, offering a comprehensive approach that addresses the full spectrum of building performance.

1. **Green Buildings:** Focus on sustainability, resource efficiency, and minimising environmental impact through design elements like energy-efficient systems, low-carbon materials, and water-saving technologies. They aim to reduce a building's ecological footprint by emphasising sustainable site selection, materials, energy, and waste management.

   HPBs go further by integrating performance metrics across multiple dimensions, such as energy use, indoor air quality, thermal comfort, and acoustics. They prioritise occupant-centric design, considering how systems and features enhance comfort, health, and productivity.

2. **Smart Buildings:** Leverage automation, sensor technologies, and data analytics to optimise operations, improve energy efficiency, and enhance user comfort. These systems adjust lighting, heating, and cooling based on real-time data.

   HPBs incorporate these technologies, but ensure they are adaptive and resilient. The emphasis lies on the synergy between smart technology and sustainability, ensuring cohesive system functionality to achieve environmental goals while addressing user needs.

3. **Balanced Approach:** HPBs represent the best of both green and smart building strategies, striving to be environmentally responsible, operationally intelligent, and user-friendly. By focusing on performance outcomes, HPBs set higher standards in energy efficiency, resource conservation, indoor environmental quality, and resilience, promoting long-term health, comfort, and performance.

   Further, HPBs prioritise resilience, adapting to challenges such as climate fluctuations and evolving urban landscapes. They are designed to manage extreme weather events, ensure resource independence, and maintain operational continuity during disruptions.

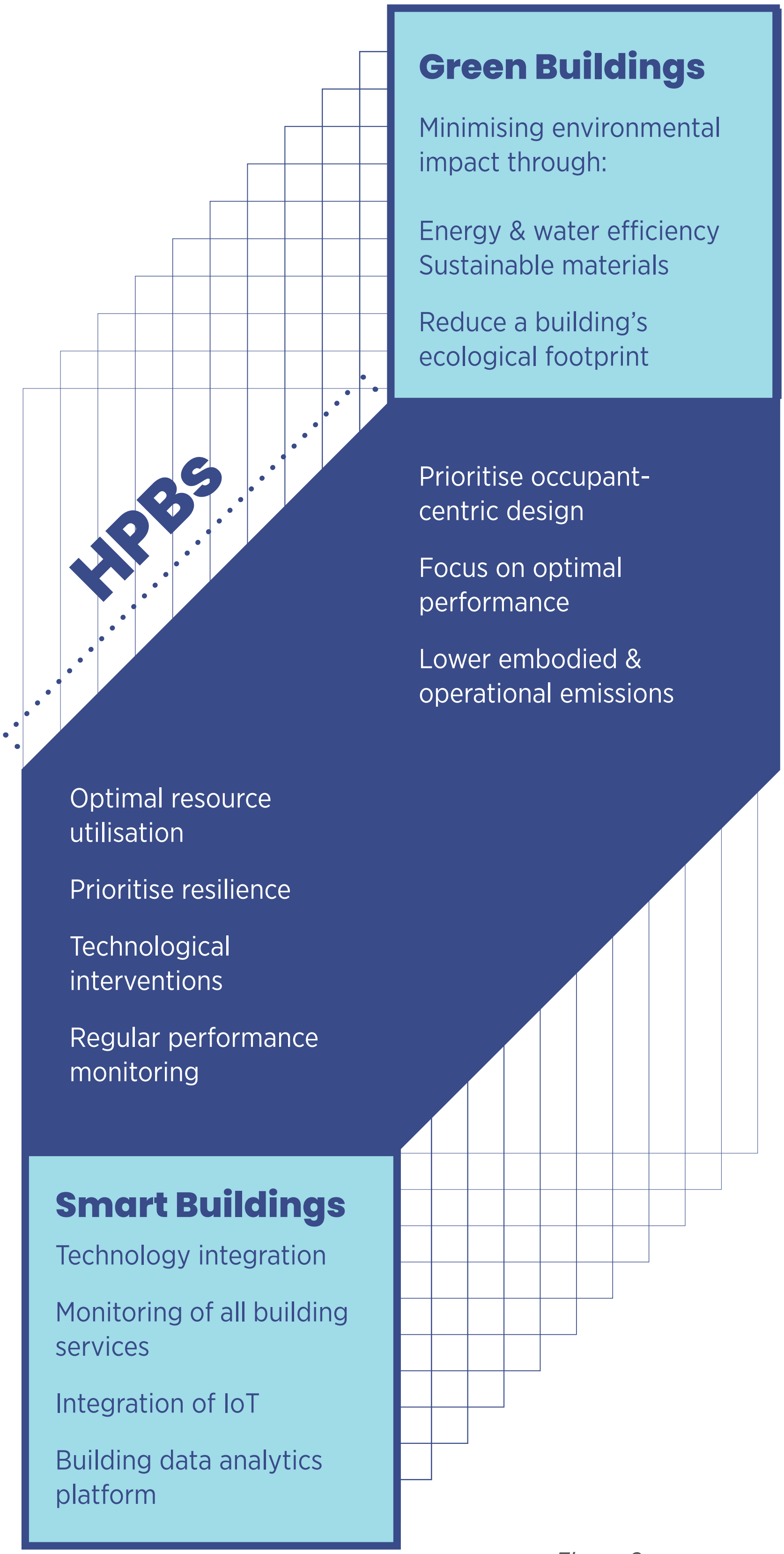


Figure 2:
Features of HPBs, green buildings, and smart buildings
Source: IIHS, 2025

2.2 Why Should India Promote HPBs?

2.2.1 India: The Real Estate Sector Context

India's real estate sector is a critical economic pillar, contributing approximately 7-8% to the nation's GDP,[13] and projected to reach a market size of USD 1 trillion by 2030[14]. However, this rapid growth poses significant environmental and resource challenges. According to the Third Biennial Update Report to the United Nations Framework Convention on Climate Change (UNFCCC), the real estate and construction sector accounts for 32% of total emissions[15], driven by high energy consumption, urban heat island effects, and increasing demand for water and materials.

HPBs can shift this trajectory by enhancing energy efficiency, reducing emissions, and conserving resources, all while improving urban liveability. HPBs offer multi-dimensional benefits across environmental, economic, and social domains, aligning with India's sustainable development goals.

2.2.2 The Energy and Climate Case

India's building sector consumes nearly 40 % of the country's total energy, and contributes 28% of carbon dioxide emissions[16]. With urbanisation projected to reach 40 percent by 2030[17], energy demand is expected to double, intensifying sustainability challenges. HPBs offer a critical solution by reducing operational energy by 30-50%[18] through advanced insulation, energy-efficient HVAC systems, smart lighting and controls. Many also integrate renewable energy sources, such as rooftop solar panels which can generate 20-50% of their energy needs[19], thereby reducing reliance on fossil fuels. On the water front, HPBs mitigate urban water scarcity by lowering water use by 20-30% through rainwater harvesting, greywater recycling, and efficient fixtures. Infosys campuses, for instance, save more than 100 million litres[20] of water annually using these systems. Designed for long-term adaptability, HPBs are more resilient to climate-related challenges including extreme heat, irregular rainfall, and grid instability. By lowering emissions, conserving resources, and enhancing resilience, HPBs directly support India's climate goals under the Paris Agreement and its commitment to achieve net-zero emissions by 2070—offering a scalable model for sustainable urban development.

India's building sector consumes nearly 40 % of the country's total energy, and contributes 28% of carbon dioxide emissions

Source: Bureau of Energy Efficiency. (2024). India energy scenario for the year 2023–24. Ministry of Power, Government of India.

2.2.3 The Business Case

HPBs offer transformative financial benefits, making them a sound business proposition for developers, investors, and occupants. Energy efficient systems such as high-performance HVAC, LED lighting and advanced building envelopes reduce energy consumption by 30–50%, leading to significant energy savings.[21] Renewable energy systems also can offset 20–50 % of energy demand, further lowering costs. Green certifications like LEED, GRIHA and IGBC increase property value by 10-15%[22], and attract environmentally conscious tenants, achieving 20% faster lease-up rates.[23] It also achieves high rental premiums, ranging from 7-11% - 7.1% in the U.S. and Canada (for green-certified, class A office stock across 8 major markets), 11.6% in London (for green certified office stock) and 9.9% in Asia (green-certified, class A office stock, across 9 major markets in Asia).[24] HPBs also account for increased productivity and occupant comfort: superior indoor air quality, natural lighting, and thermal comfort enhance productivity by 6-16%.[25] With growing alignment to ESG criteria, HPBs are increasingly favoured by green finance institutions—reflected in India's green bond market exceeding USD 20 billion in 2023[26]- further reinforcing their long-term investment appeal.

2.2.4 Social Case

HPBs contribute significantly to the country's social development goals of urban liveability, promoting wellbeing and enabling inclusive growth. Efficient HVAC systems and access to natural lighting have been shown to improve employee productivity by 8-11%[27], while green roofs, shaded areas, and open spaces reduce urban heat island effects by 2-4°C, enhancing outdoor comfort.[28] By incorporating universal design principles, HPBs ensure accessibility for all, fostering diverse ecosystems. Additionally, the green building movement is a major driver of employment, with the potential for India to generate three million green jobs by 2030[29] across construction, energy services, operations and maintenance. However, realising the full potential of HPBs also depends on occupant behaviour—active engagement in energy-conscious practices, appropriate use of building systems, and responsiveness to feedback from smart controls are essential to sustain long-term performance and maximise social and environmental benefits.

HPBs

Energy and Climate Case

- Energy efficiency: 30-50% reduction
- Renewable integration: 20-50% of energy needs met
- Water conservation: 20-30% reduction
- Climate resilience

Business Case

- Operational cost savings: 30-50%
- Property value and marketability: 10-15% increase in property value and 20% faster lease up rates
- Productivity and occupant benefits: 6-16% increase
- Investor confidence and green finance: Green bond market exceeded $20 billion by 2023

Social Case

- Enhancing employee well-being: 8-11% increase in productivity
- Supporting urban liveability: 2-4°C reduction in UHI effect
- Advancing inclusivity
- Creating green jobs: 3 million by 2030

Figure 3:
The energy and climate, business, and social case for HPBs
Source: IIHS, 2025

2.3 Chapter Highlights

1 HPBs optimise energy, water, and resource use, achieving cost-effectiveness and sustainability throughout their lifecycle.

2 HPBs combine green and smart building strategies to address energy efficiency, occupant comfort, and resilience holistically.

3 HPBs reduce energy consumption by 30–50%, support renewable integration, and enhance climate resilience, contributing to India's net-zero goals.

4 HPBs offer economic and social benefits, including cost savings, improved productivity, inclusivity, and green job creation.

As of 2024, India's total, green-certified building stock under IGBC, GRIHA, and LEED frameworks exceeds 15 billion square feet, with IGBC alone accounting for 12.3 billion.

Source: Indian Green Building Council. (n.d.).IGBC Indian Green Building Council, GRIHA Council. (n.d.).Green Rating for Integrated Habitat Assessment (GRIHA), U.S. Green Building Council. (n.d.).LEED project directory.

It is projected that 40% of India's building stock in the next 20 years is yet to be constructed.

Source: Council on Energy, Environment and Water (CEEW). (2024). Building a Climate-Conscious India: Scalable solutions for a low-carbon built environment.

3 HPBs in India: Current Scale, Spread, and Opportunity

3.1 Approach to Estimating HPBs in India

Estimating the scale and potential of HPBs in India is a complex task, primarily due to the absence of a uniform definition and the lack of publicly available design or performance data. While there has been notable progress in the adoption of sustainable and energy-efficient building practices, the term ‘High Performance Building’ remains loosely defined in the Indian context, limiting the accuracy of quantification efforts.

In the absence of standardised metrics or consistent post-occupancy performance data, this analysis adopts a pragmatic approach by using proxy indicators. Specifically, it uses the stock of certified green buildings as a surrogate for HPBs - projects rated under frameworks such as the Energy Conservation Building Code (ECBC), GRIHA, IGBC, and Leadership in Energy Environment and Design (LEED) are considered. Within this subset, an informed approximation is applied to isolate the percentage of buildings that have achieved the highest certification levels - typically indicative of superior energy and environmental performance. While this introduces an element of estimation, it enables a reasoned and data-informed assessment of HPB potential in India’s built environment.

3.1.1 The Role of Energy Performance Index (EPI)

The Energy Performance Index (EPI), expressed in kilowatt-hours per square metre per year (kWh/sq.m/year), presents an ideal metric to define and evaluate HPBs. By quantifying a building's annual energy consumption relative to its floor area, the EPI offers a clear, measurable indicator of operational efficiency.

Buildings achieving an EPI below 100 kWh/sq.m/year are typically recognised as highly energy-efficient, making this threshold a practical benchmark for identifying HPBs. However, the benchmarks will vary as per typology and usage patterns.

India's commercial HPB footprint, including both certified and non-certified buildings, is estimated at approximately 1–1.5 billion square feet.

3.2 HPBs in India: Status and Spread

India has made significant progress in adopting HPBs as part of its sustainable development and energy efficiency goals. The concept of HPBs, though relatively new, has gained traction due to rising awareness of climate change, government initiatives, and market demand for green and energy-efficient infrastructure.

3.2.1 Square Footage of HPBs in India

India's commercial HPB footprint, including both certified and non-certified buildings, is estimated at approximately 1–1.5 billion square feet. This estimate is based on the approach outlined earlier, which combines green-certified project data with informed assumptions about non-certified sustainable buildings.

As of 2024, India's total, green-certified building stock under IGBC[30], GRIHA[31], and LEED[32] frameworks exceeds 15 billion square feet, with IGBC alone accounting for 12.3 billion. Industry trends indicate that commercial typologies—offices, malls, hospitals, and institutional buildings—constitute 30–40% of this area. This corresponds to approximately 1.08 billion square feet of highest level certified commercial HPBs.

HPBs in India are predominantly concentrated in urban areas, with Tier-1 cities leading both in the number of projects and total built-up area.

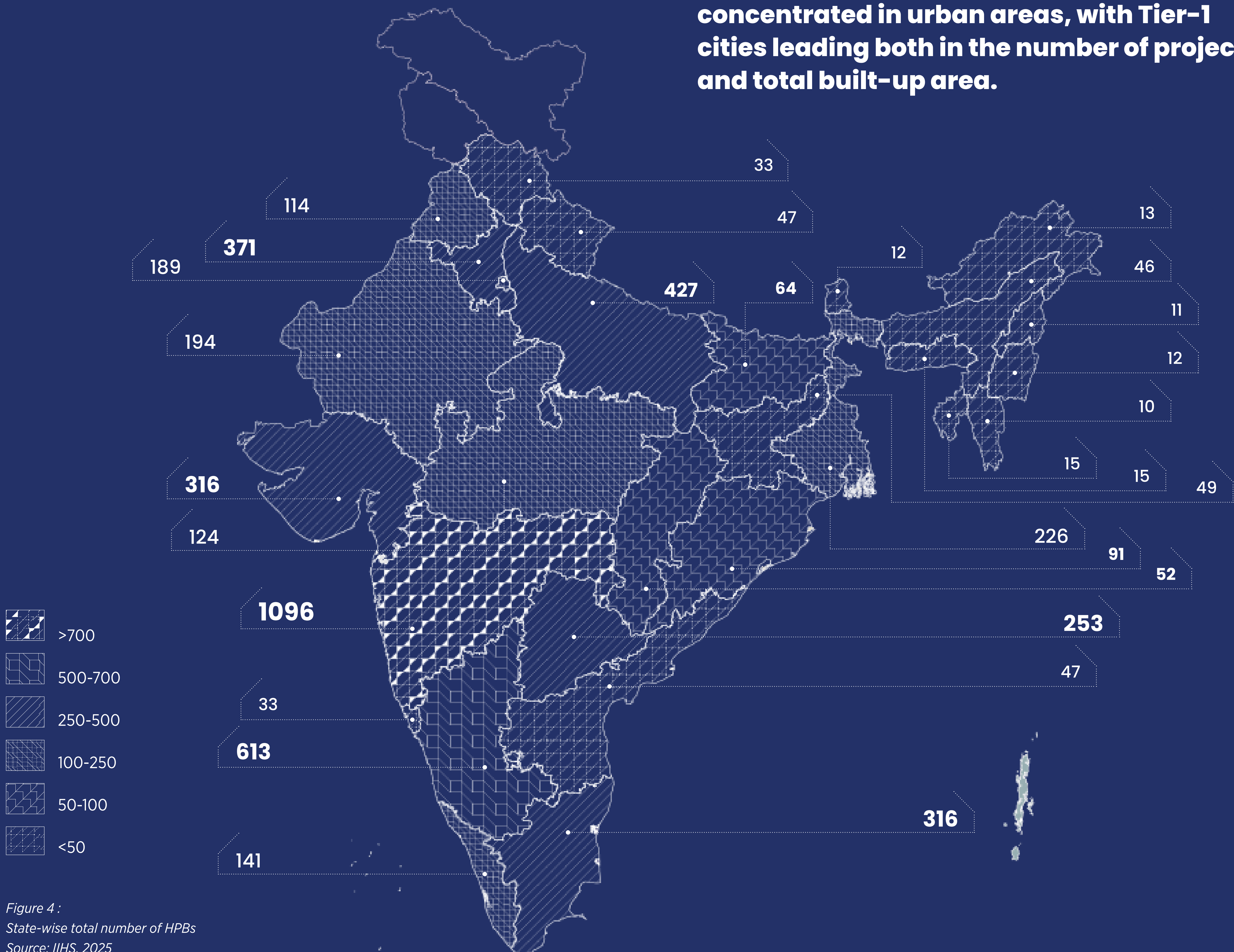


Figure 4 :
State-wise total number of HPBs
Source: IIHS, 2025

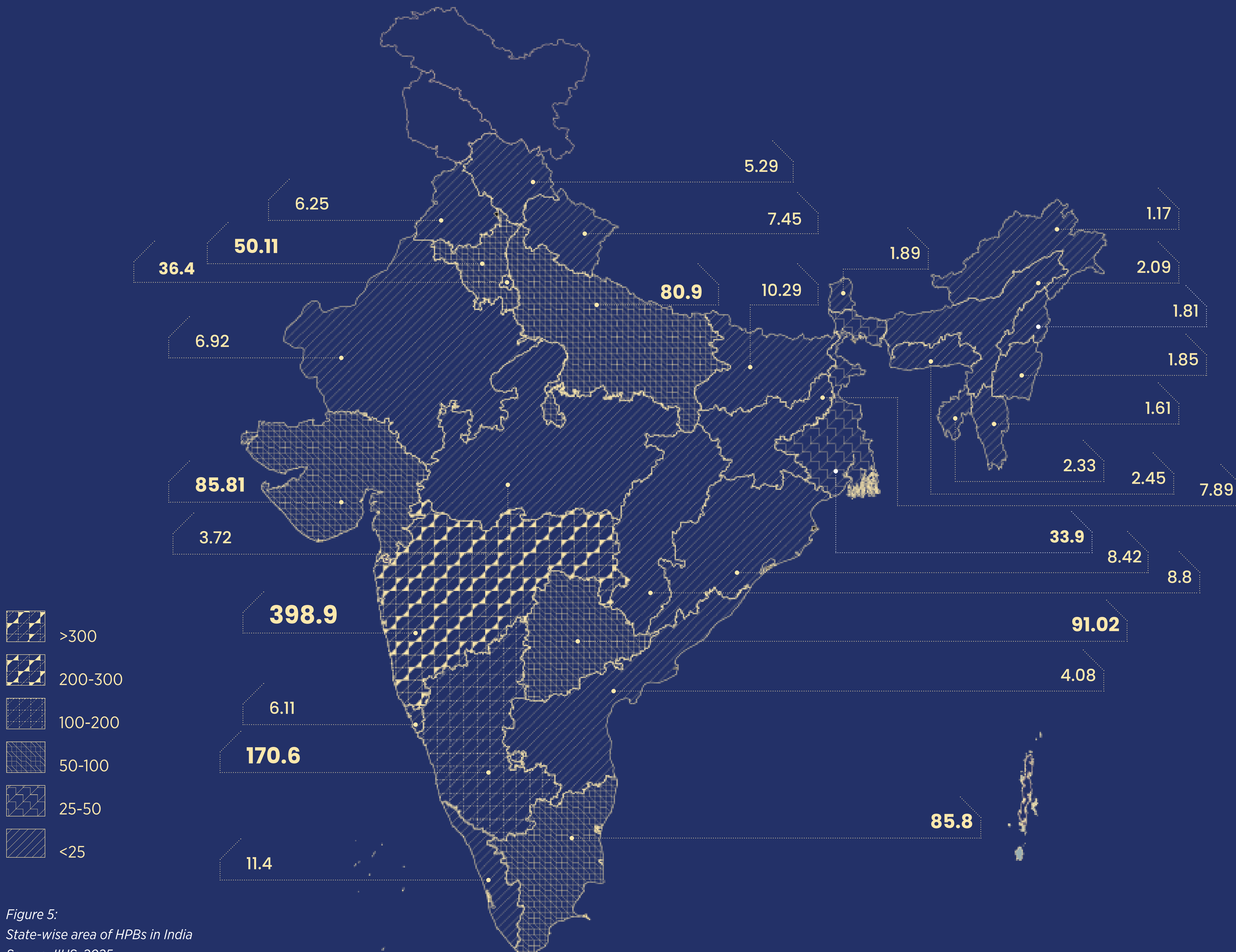


Figure 5:
State-wise area of HPBs in India
Source: IIHS, 2025

In addition, approximately 30-40 million square feet of commercial space is covered by the Bureau of Energy Efficiency's (BEE) star labeling programme, which emphasises energy efficiency and operational energy performance.

Further, non-certified commercial HPBs that incorporate sustainable design and operational practices without formal certification are assumed to add another 5–10% over the certified commercial HPB area. This contributes an additional 70–80 million square feet, resulting in an overall estimated commercial HPB footprint of 1–1.5 billion square feet in India.

3.2.2 Geographical Spread

HPBs in India are predominantly concentrated in urban areas, with **Tier-1 cities** leading both in the number of projects and total built-up area. However, Tier-2 cities have started to witness growth in green construction, driven by local government initiatives and private sector participation.[33]

Geographical spread of HPBs in India

Northern Region

Delhi, Gurugram and Noida dominate with a significant number of HPBs, covering large commercial spaces and institutional buildings

Western Region

Mumbai, Pune and Ahmedabad lead, with Pune standing out due to incentives such as Floor Area Ratio (FAR) benefits

Southern Region

Bengaluru, Hyderabad and Chennai dominate, with IT parks, residential complexes, and commercial hubs

Eastern Region

Kolkata and Bhubaneswar are emerging as hubs for sustainable construction, though their adoption rate is relatively slower compared to other regions

3.2.2.1 Key Cities where HPBs Exist

Metropolitan cities like **Mumbai, Bengaluru, Delhi NCR, Hyderabad** and **Chennai** host a significant share of India's HPBs.[34] These cities benefit from proactive government policies, developer interest, and higher demand for sustainable construction by corporations and residents. For example, IT hubs in **Bengaluru** and **Hyderabad** such as Infosys, Wipro and TCS have integrated HPB principles to reduce energy use, enhance employee wellbeing, and align with global ESG commitments. Mumbai's commercial real estate market has seen a surge in energy efficient office towers in areas like Bandra-Kurla Complex (BKC) and Lower Parel. Delhi NCR has promoted large-scale adoption through initiatives like ECBC compliance and performance-driven public sector buildings. Chennai's industrial and institutional campuses are increasingly investing in sustainable design and retrofitting, supporting India's broader climate goals. These urban centres are leading by example, demonstrating how HPBs can scale in dense, high-growth environments while delivering environmental, economic, and social value.

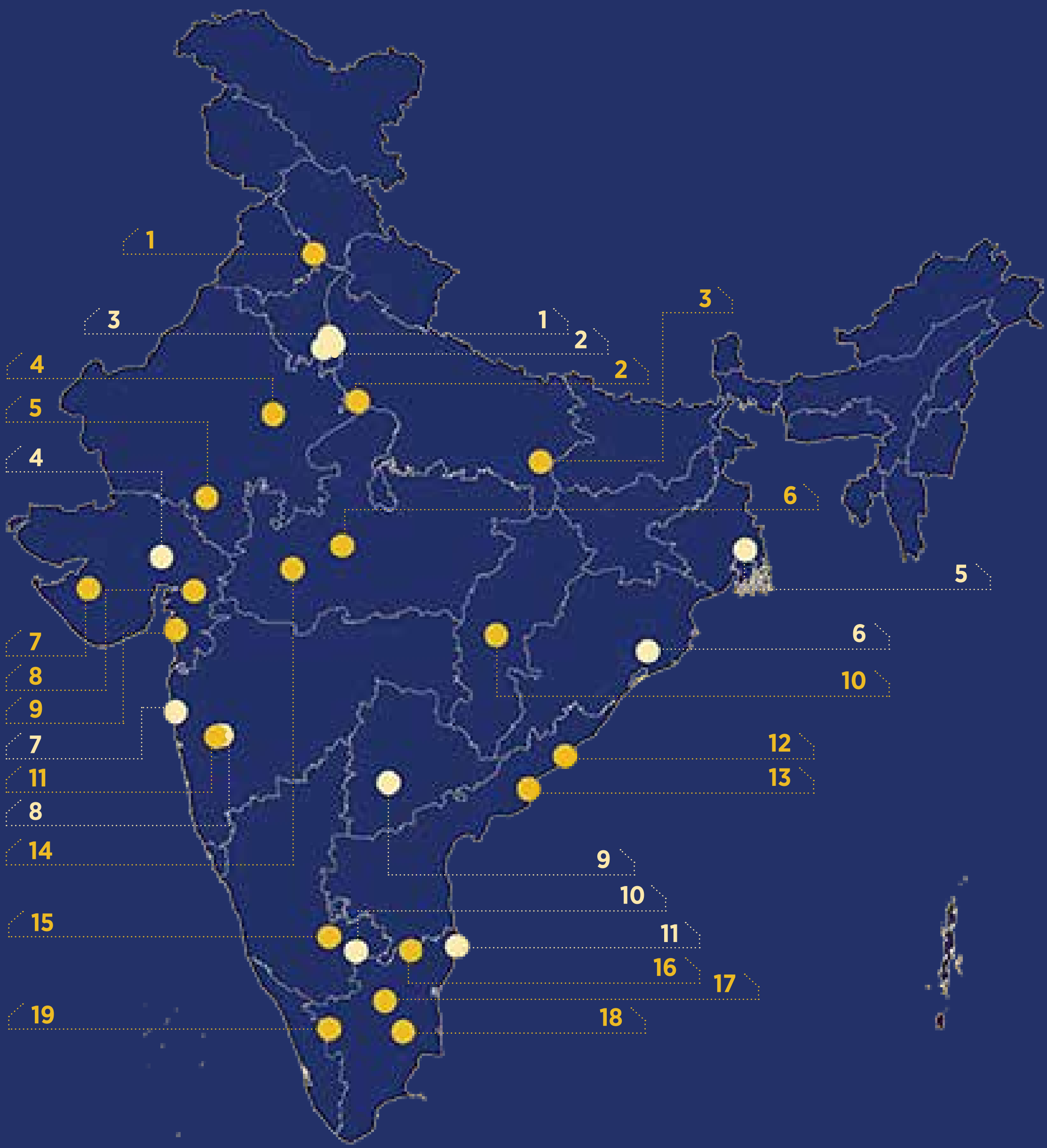


Figure 6:
Geographical spread of HPBs and key cities
Source: IIHS, 2025

Key Major Cities

1. New Delhi
2. Noida
3. Gurugram
4. Ahmedabad
5. Kolkata
6. Bubaneshwar
7. Mumbai
8. Pune
9. Hyderabad
10. Bengaluru
11. Chennai

Cities with High Growth Potential

1. Chandigarh
2. Agra
3. Varanasi
4. Jaipur
5. Udaipur
6. Bhopal
7. Rajkot
8. Vadodara
9. Surat
10. Raipur
11. Pimpri-Chinchwad
12. Vishakapatnam
13. Kakinada
14. Indore
15. Tumakuru
16. Vellore
17. Salem
18. Tiruchirappalli
19. Coimbatore

3.2.2.2 Major Promoters of HPBs

Corporate Sector: Leading IT companies like **Infosys, Wipro** and **TCS** have been at the forefront, developing energy-efficient campuses and office buildings

Real Estate Developers: Companies like **Godrej Properties[35], Tata Housing** and **Brigade Group** are actively involved in building green-certified projects

Public Sector: Projects like the **Indira Paryavaran Bhawan** in Delhi and the **Atal Akshay Urja Bhavan** showcase the government's commitment to promoting HPBs

India's HPB landscape is evolving rapidly, with key stakeholders driving innovation and sustainable development. This momentum reflects a promising future for green and energy-efficient buildings across the country.

3.3 Opportunity

India's current HPB footprint is estimated at 1–1.5 billion square feet. With approximately 3 lakh square feet of commercial floor space being constructed daily,[36] the country is expected to witness one of the largest commercial and residential building booms globally. It is projected that 40% of India's building stock in the next 20 years is yet to be constructed[37].

This rapid expansion will significantly increase energy demand, making it essential to optimise energy use in both upcoming and existing building stock. Urgent measures are required to enhance energy efficiency, implement sustainable design practices, and integrate renewable energy solutions to meet the growing demand sustainably.

3.4 Chapter Highlights

1. The Energy Performance Index (EPI), measured in kWh/sq.m/year, is key to identifying HPBs. Buildings with an EPI of below 100 are highly energy-efficient.

2. India hosts over 8,000 green-certified projects covering ~10 billion square feet, with HPBs concentrated in Tier-1 cities like Delhi NCR, Mumbai, Bengaluru, Hyderabad, and Chennai. Adoption is growing in Tier-2 cities, driven by government incentives and market demand.

3. Corporate leaders (Infosys, Wipro), real estate developers (Godrej Properties, Tata Housing), and public sector buildings (Indira Paryavaran Bhawan) are setting benchmarks for energy efficiency and sustainability.

4. The building sector holds significant potential for incorporating HPBs, as 40% of the building stock in the next 20 years is yet to be constructed.

High Performance Buildings serve as benchmarks for integrating sustainability into design and operations, aligning with India's energy and climate goals while offering long-term financial and environmental resilience as a strategic advantage for stakeholders.

4 Select Case Studies of HPBs in India

4.1 Approach to Case Studies

The case studies focus on HPBs across India, chosen based on their innovative design strategies, energy and water efficiencies, and adherence to national and international green certifications. The approach includes assessing measurable sustainability outcomes such as energy savings, operational efficiencies, and reduced environmental impact.

Each example demonstrates a clear business value proposition by highlighting operational cost savings, enhanced occupant productivity, and increased brand value. These buildings serve as benchmarks for integrating sustainability into design and operations, aligning with India's energy and climate goals while offering long-term financial and environmental resilience as a strategic advantage for stakeholders.

The select cases are as follows:

1. **Infosys Crescent Building, Bengaluru**
2. **Atal Akshaya Urja Bhavan, New Delhi**
3. **Suzlon - One Earth, Pune**
4. **Akshay Urja Bhawan HAREDA, Panchkula**
5. **Milestone Experion Centre, Gurugram**

4.2 Case Study 1: Infosys Crescent Building, Bengaluru

Location	Bengaluru
Project Cost	INR 309.72 Cr (INR 4,535/sq.ft)
Climate Zone	Temperate
Total Floor Area (sq.m)	63,450
Typology	Office, New Construction
Year of Completion	2019
EPI (kWh/m2/year)	70
Certificate	LEED Platinum Certified
Details	G+9, 3 Basements
Occupants	7,000 Occupants & 8-hour use[38]

Key Features

Energy Savings HVAC	Passive strategies reduced cooling demand by 20%, used radiant baffle cooling system; 50% more efficient with 100% fresh air
Energy Savings Lighting	Demand reduced by 30% using passive strategies, achieved low LPD in office spaces of 4.84 W/m^2 and outdoor landscape of 0.17 W/m^2
Emissions Reductions	4,718 tCO_2e. Carbon offsets projects are also implemented
Water Usage	Domestic - 54.18 m^3/day[39] with efficiency factor 2, Cooling - 11.27 m^3/day
Water recycling and RWH	RWH collects 5 lakh litres annually, 100% waste water recycling
Renewable energy Contribution	Rooftop 260 kWp solar PV, 80% of demand met by on-site and off-site renewables

Interventions and Business Case

Design Interventions:

- Building form provides the benefit of mutual shading
- Window to Wall Ratio (WWR) of 33% is covered with double-glazed windows with 0.2 Solar Heat Gain Coefficient (SHGC)
- 75% of the area daylit[40] (using narrow floor plate)
- Efficient insulation and climate-based shading
- Low U-Value of roof exceeding Super ECBC requirement

Construction Interventions:

- Complete building with 25,000 precast elements[41]
- Reduced construction waste and water use[42]
- Building materials with low environmental impact

Operational Interventions:

- Central Command Centre serves to remotely monitor operational data[43]
- Integrated monitoring station for all building services and 24x7 real-time monitoring
- Integration of real-time weather data and water

Business Case:

Return on Investment (ROI): INR 40-50 million annual energy savings enable a 6-8 year payback period for sustainable interventions.

Workforce Health and Retention: Improved air quality and daylighting boost employee satisfaction, reduce absenteeism, and aid talent retention in the competitive IT sector.

Scalable Design: Modular, precast technology provides a replicable framework for future IT campuses, reducing costs in subsequent projects.

Compliance and Incentives: Exceeding Super ECBC standards mitigates regulatory risks and unlocks energy efficiency incentives.

Risk Mitigation: 80% renewable energy reliance shields against price fluctuations and power outages, ensuring seamless operations.

4.3 Case Study 2: Atal Akshaya Urja Bhavan, New Delhi

Location	New Delhi
Project Cost	INR 228.47 Crore[44]
Climate Zone	Composite
Total Floor Area (sq.m)	38,147
Typology	Office, New Construction
Year of Completion	2022
EPI (kWh/m2/year)	47
Certificate	LEED Platinum Certified[45]
Details	G+8 Floors, 3 Basements
Architect	Edifice Consultants[46]

Key Features

Energy Savings HVAC	The hybrid cooling system (215 TR each) combines traditional and radiant chillers, using water-cooled screw-chillers and ceiling pipes. It improves efficiency by 33%, eliminating large air handling units
Energy Savings Lighting	Offices on the 3rd-8th floors maximise light, views, and privacy. Lighting power density is 3.77 W/sq.m in offices and 1.07 W/sq.m in parking
Water Usage	In the operational phase, water will be supplied by Delhi Jal Board. The total freshwater requirement will be approx. 59 KLD & 46 KLD during summer & monsoon seasons respectively[47]
Water recycling and RWH	Harvesting rainwater and treating 28 KLD of wastewater in a 30 KLD STP, recycling 25 KLD for flushing, cooling, horticulture, and air washers[48]
Renewable energy Contribution	A 6,038.5-sq.m solar roof shades the terrace and south wall, generating 1100 kW and 19 lakh units annually, exceeding daily consumption (5,126.6 kW-hr)

Interventions and Business Case

Design Interventions:

- The passive strategies include north-south axis orientation, Glass Fiber Reinforced Concrete (GFRC) jalis on west façade for cross ventilation, 90% daylight in regularly occupied spaces, and ACC for thermal insulation[49]
- The east facade is a double wall constructed with ACC for thermal insulation. This cavity wall is filled with 200-mm thick glass wool insulation

Construction Interventions:

- Use of improved technology/ materials than a conventional building[50]

Operational Interventions:

- The building management system is programmed to limit the load, featuring an integrated plant optimiser for controlling and reducing power consumption and refrigeration capacity (ton of refrigeration-TR)[51]
- It also features demand control ventilation with CO2 and temperature sensors

Business Case:

Energy and Operational Efficiency: The hybrid cooling system boosts energy efficiency by 33%, cutting government costs.

Showcasing National Leadership: As a net-positive energy office, the building supports India's climate goals and global renewable initiatives.

Long-Term Cost Reduction: Rainwater harvesting and full wastewater reuse reduce municipal water reliance and cut costs.

Boost to Renewable Sector: Solar PV and hybrid cooling boost demand for domestic renewable tech.

Policy Model: This project sets a model for energy-efficient government buildings, cutting public infrastructure's carbon footprint.

4.4 Case Study 3: Suzlon – One Earth, Pune

Location	Pune, Maharashtra
Project Cost	INR 405 Crores[52]
Climate Zone	Composite
Total Floor Area (sq.m)	70,865
Typology	Office, New Construction
Year of Completion	2009
EPI (kWh/m2/year)	55.86
Certificate	GRIHA 5 Stars, LEED Platinum
Details	Low-rise Campus
Architect	Christopher Charles Benninger

Key Features

Energy Savings HVAC	Water Cooled Variable VRV, reduced the AC load by 40%. Short occupancy zones use indirect evaporative cooling system. 30% higher ventilation rates as compared to ASHRAE standards[53]
Energy Savings Lighting	All desks have LED lights, with 1850 m LED strips for external lighting. VFDs, LEDs, and sensors are IBMS-controlled, reducing energy use and cutting costs by up to 20%
Emissions Reductions	CO_2 sensors monitor and regulate levels in occupied areas and workstations
Water Usage	Total peak water requirement is 250 cum/day
Water recycling and RWH	100% sewage greywater is recycled for flushing, landscaping, and cooling. 100% rainwater is harvested, with a 1,000 cum tank collecting 3 days' rainfall. Raw water treatment: 120 cum/day; STP: 120 cum/day
Renewable energy Contribution	Installed capacity of solar energy: 13.44 KW. Installed capacity of wind energy: 18 windmills of 4.75 kW each 2.5 lakh kWh of electricity generated annually

Interventions and Business Case

Design Interventions:

- Efficient HVAC, lighting, and design cuts installed load from 6.5 MVA to 4 MVA[54]
- Natural ventilation, daylighting, and strategic orientation reduce thermal loads, with buildings shading each other

Construction Interventions:

- Column and beam leave a cut enclosed by horizontal louvers that enable cross ventilation and also keep out direct sunlight
- Courtyards to regulate indoor temperature

Operational Interventions:

- The building employs complex building management systems. Lighting of individual offices is controlled by combined daylight and occupancy sensors
- Connected load is 4 MVA, with a 2.3 MVA peak demand
- Energy efficient systems (Variable Frequency Drives (VFD), Light Emitting Diodes (LED) are centrally controlled via Integrated Building Management System (IBMS), keeping demand lower than NBC and ASHRAE standards

Business Case:

Global Benchmarking: With GRIHA 5-star and LEED Platinum certifications, Suzlon leads in sustainability, drawing global partners and investors.

Energy Cost Savings: INR 100 million annual savings from HVAC and net-zero operations strengthen Suzlon's finances and competitiveness.

Corporate Social Responsibility (CSR): Suzlon's zero-energy campus reinforces its renewable mission and boosts stakeholder trust.

Resource Circularity: Rainwater harvesting and sewage recycling ensure resource circularity, cutting costs and water risks.

Operational Branding: The campus serves as a business asset and corporate showcase for sustainability-focused clients and investors.

30%–40% reduction in operating cost, due to energy savings and water savings at 30%[55]

Source: Suzlon One Earth In News

4.5 Case Study 4: Akshay Urja Bhawan HAREDA, Panchkula

Location	Panchkula, Haryana
Project Cost	INR 11 crore[56]
Climate Zone	Composite
Total Floor Area (sq.m)	5,111
Typology	Office, New Construction
Year of Completion	2012
EPI (kWh/m2/year)	17
Certificate	GRIHA 5 Stars
Details	G +2, 1 Basement[57]
Architect	Elements Architects

Key Features

Energy Savings HVAC	A mist system is installed in the central atrium for cooling of controlled and passive zones. The south face has solar chimneys to aid ventilation in some of the non-AC spaces
Energy Savings Lighting	South glazing provided with horizontal shades. Almost no east and west openings. Reasonable north glazing with vertical shading. Efficient lighting with 25% reduced energy use
Emissions Reductions	CO2 Credits 308 tonnes/year
Water Usage	Annual reduction in water consumption with respect to GRIHA benchmark is 70% through efficient fixtures
Water recycling and RWH	A 6.25-litre rainwater storage tank has been designed in the basement to collect water from the roof and courtyard. Effluent Treatment Plant (ETP) plant is installed to treat greywater collected from kitchen and toilet; treated water is reused for horticulture
Renewable energy Contribution	A 42.5 KW SPV plant (with 5 KW BIPV positioned above the courtyard) has been installed. A solar water heater of 600 litre capacity has been installed for cooking and bathing purposes

Interventions and Business Case

Design Interventions:

- Orientation and placing of windows in north–south direction
- Thermotic roofing tiles have been used to reflect maximum solar radiation back to the sky, which reduces heat ingress from the roof
- Cavity walls with XPS foam insulation have been constructed in the east and west facade of the building

Construction Interventions:

- Cavity walls with PUF insulation, double-glazed windows, aerated concrete blocks, insulated roof tiles, Thermotech roof tiles

Operational Interventions:

- Thermal comfort conditions in apex zones are always maintained through mechanical air conditioning
- A mist system is installed in the central atrium for cooling of controlled and passive zones. Chilled water supplied at a higher temperature of 15°C[58]

Business Case:

Energy and Operational Efficiency: 61% energy reduction compared to GRIHA benchmarks, achieving an Energy Performance Index (EPI) of 17 kWh/m^2/year

Long-Term Cost Reduction: No municipal water supply required after monsoon, 25% reduced energy consumption using energy efficient lights

Policy Model: Serves as a template for ECBC implementation in state-level buildings, influencing Haryana's 2023 amendment to mandate ECBC compliance for all public projects

4.6 Case Study 5: Milestone Experion Centre, Gurugram

Location	Gurgaon
Climate Zone	Composite
Total Floor Area (sq.m)	22,916
Typology	Commercial, New Construction
Year of Completion	2018
EPI (kWh/m2/year)	67.04
Certificate	Platinum LEED Pre-Certified[59], GRIHA 5 star
Details	G+11, 3 Basements[60]
Architect	Sandeep Chawla

Key Features

Energy Savings HVAC	40-45% savings through energy-efficient fixtures VFDs
Energy Savings Lighting	Demand reduced–34% of the total living area is day-lit, ECBC compliant energy efficient artificial lighting system
Other Energy Savings	Reduction of 73.17% in the embodied energy by using fly ash bricks for masonry construction
Water Usage	Reduction of 66.31% in building water through water efficient fixtures
Water recycling and RWH	STP of Moving Bed Biofilm Reactor (MBBR) technology of 106 kLD for treatment and reuse of wastewater on site, underground RWH tank, groundwater recharging pits, an efficient drip irrigation system to achieve 85% water usage efficiency
Renewable energy Contribution	Rated capacity of 136 kWp solar PV was installed on site with RE Capacity of 38,000 kWh/annum

Interventions and Business Case

Design Interventions:

- Orientation (N-S) for optimum daylight
- WWR–based on GRIHA guidelines
- Maximum daylight through north façade
- Strategic positioning of services and utilities
- The building envelope with low-U values to minimise cooling load

Construction Interventions:

- Fly-ash content in PPC cement and fly-ash bricks
- Gypsum for internal wall plastering
- Locally available stones for external hardscape works, including Kota stone for internal staircases
- Aluminum in structural glazing, which is highly recyclable
- Recycled materials such as broken tiles, wooden panels, shutters, frame, and tiles, which are all GRIHA-certified
- More than 50% of the low energy materials are installed in the building

Operational Interventions

- VFDs with all the pumps and chillers with efficient Coefficient of Performance (COP) and cooling towers to consume optimised load
- All motors of pumps and equipment are IE2 as per ECBC norms or BEE-star-rated

Business Case:

Energy and Operational Efficiency: 50.34% reduction in energy consumption compared to GRIHA benchmarks, achieving an Energy Performance Index (EPI) of 67.04 kWh/m^2/year

Long-Term Cost Reduction: 66.31% reduction in water consumption via efficient fixtures and a 106 kLD STP for wastewater reuse, eliminating municipal water dependency, 73.17% reduction in embodied energy, reduced electricity bills by 50% than conventional buildings

Policy Model: This sets a template for ECBC compliance in private commercial developments, influencing Gurgaon's urban building bye-laws

Infosys Crescent Building, Bengaluru
Image Credits: Umang Shah, Ridham Gajjar, Arun Sreenivasan

4.7 Chapter Highlights

1 **Infosys Crescent Building, Bengaluru:** Precast, energy-efficient office building with radiant cooling, 80% renewable energy use, and full water recycling—achieves 40–50% energy and significant water savings.

2 **Atal Akshay Urja Bhawan, New Delhi:** Net-positive government HQ with passive design, radiant cooling, 1 MW solar PV, advanced BMS, and 100% water recycling—sets a benchmark in sustainable public buildings.

3 **Suzlon One Earth, Pune:** Zero-energy corporate campus powered by wind and solar, with advanced HVAC, daylighting, and full water reuse—achieves 30–40% lower operating costs.

4 **Milestone Experion Centre, Gurgaon:** Daylight-optimised commercial building using recycled materials, efficient HVAC and lighting, on-site solar PV, and advanced water management—delivers 40–45% energy, and 71% water savings.

5 **Akshay Urja Bhawan HAREDA, Panchkula:** A GRIHA 5-star, ECBC-compliant government building featuring advanced insulation, passive cooling, and a 42.5 kW solar PV system. It achieves 61% energy and 70% water savings through innovative envelope design, mist cooling, and comprehensive rainwater harvesting.

These projects exemplify leading-edge green building strategies, with major reductions in energy, water, and environmental impact.

The Energy Conservation Building Code was the first comprehensive standard to set minimum energy performance criteria for new buildings and retrofits.

5 Current Policies and Financing Incentives for HPBs in India

5.1 The Foundations: Energy First, Then Climate

India's climate policy emerged from a strong energy-centric foundation. Until the late 2000s, national discourse on sustainability was dominated by concerns over energy access, security, and economic growth. A turning point came in 2008 with the launch of the National Action Plan on Climate Change (NAPCC)[61], which formally integrated climate change into national planning. But the groundwork for this shift had been laid over several decades.

India's focus on energy conservation began in the 1970s, spurred by the global oil crisis. Early efforts prioritised awareness campaigns via print and radio, with petroleum receiving primary attention, while electricity and demand-side management received limited focus. In the late 1980s, the Energy Management Centre (EMC) was established under the Ministry of Power, supported by the World Bank and United Nations Development Program (UNDP), to promote energy efficiency.

Buildings began to feature initially as targets for electricity savings, and eventually as central to India's low-carbon development strategy.

A major institutional milestone came with the Energy Conservation Act (EC Act) of 2001[62], which transformed EMC into the Bureau of Energy Efficiency (BEE).[63] The Act introduced critical tools such as appliance labelling, the Energy Conservation Building Code (ECBC), designation of Designated Consumers, and the creation of an Energy Conservation Fund.[64]

Momentum continued with the Electricity Act of 2003[65], the National Electricity Policy (2005)[66], and the Integrated Energy Policy (2006)[67]. These policies introduced mandatory energy audits for power-intensive industries, encouraged demand-side management, differential tariffs, appliance labelling, and promoted renewable energy sources.[68]

Although these policies did not explicitly address climate change, they marked a growing institutional awareness of the link between energy, efficiency, and sustainability. Buildings began to feature in this narrative—initially as targets for electricity savings, and eventually as central to India's low-carbon development strategy.

5.2 The Early Experiments: Green Building Ratings

The year 2001 marked the beginning of the green building movement in India, with the establishment of the Indian Green Building Council (IGBC) by the Confederation of Indian Industry (CII). Recognising the need for a rating system tailored to India's diverse climates and building types, The Energy and Resources Institute (TERI) developed GRIHA (Green Rating for Integrated Habitat Assessment) in 2005. The Ministry of New and Renewable Energy (MNRE) adopted GRIHA as the national rating system for green buildings in 2007.

As voluntary rating systems, both IGBC and GRIHA played a crucial role in raising awareness, building capacity, demonstrating the feasibility of green buildings, and preparing the Indian market for the adoption of sustainable construction practices.

A major milestone came in 2003 when the CII-Godrej Green Business Centre in Hyderabad became the first building in India to achieve a LEED rating.[69] IGBC initially acted as the local facilitator for certifying Indian buildings under the LEED International framework developed by the U.S. Green Building Council (USGBC).

To better suit local needs, IGBC launched an adapted version of LEED for India. The first version—LEED India Version 1.0—was introduced in October 2006.

5.3 Climate Enters the Frame: the 2008–2010 Shift

Key policy shifts since the early 2000s have helped align the construction sector with broader energy and climate goals in sight, albeit initial movements were geared towards structural standards and resource optimisation.

The transition began in 2004 when the Ministry of Housing and Urban Affairs (MoHUA) introduced the Model Building Bye-Laws (MBBL)[70]. Developed in response to the 2001 Gujarat earthquake, the MBBL integrated provisions that went beyond structural safety to address environmental performance. Key inclusions included rainwater harvesting, wastewater recycling, solar-assisted water heating, and barrier-free design for public buildings.[71] By 2023, 22 States and Union Territories had revised their building bye-laws to incorporate these provisions.

In 2005, the National Building Code (NBC) was revised to recommend that urban local bodies integrate energy efficiency into design and construction practices. This included technical guidelines for daylight integration, electrical standards, and HVAC systems, laying a technical foundation for green building norms.

In 2006, BEE launched the Standards & Labelling (S&L) programme[72] to influence consumer behaviour through appliance energy ratings. This initiative was pivotal in driving energy efficiency in homes and commercial spaces. As of 31 March 2023, the S&L programme covered 34 appliances—14 under mandatory labelling, and 20 under voluntary schemes.[73]

Infosys Crescent Building, Bengaluru
Image Credits: Umang Shah, Ridham Gajjar, Arun Sreenivasan

The policy landscape took a decisive turn in 2007 with the launch of the Energy Conservation Building Code (ECBC). It was the first comprehensive standard to set minimum energy performance criteria for new buildings and retrofits. It introduced two compliance pathways—prescriptive and whole-building performance—designed to accommodate India's diverse climatic conditions. This marked the first time energy efficiency was addressed holistically at the building level.

Simultaneously, the National Urban Housing and Habitat Policy (NUHHP) of 2007[74] emphasised the need for energy-efficient and sustainable housing, especially in the affordable segment. The policy also advocated for solid waste management and renewable energy integration, reinforcing the centrality of sustainability in urban planning.

A major inflection point came in 2008 with the launch of the National Action Plan on Climate Change (NAPCC). This strategic framework introduced eight national missions, including the National Mission on Sustainable Habitat (NMSH)[75] and the National Mission on Enhanced Energy Efficiency (NMEEE).[76] For the first time, buildings became integral to India's climate strategy.

Under NMSH, launched in 2010, MoHUA focused on improving urban sustainability through energy-efficient construction, urban planning, effective waste management, and legal frameworks for sustainable habitat standards.[77] NMEEE, launched in 2011, aimed to scale up energy efficiency through innovative market mechanisms, financial platforms, and performance-based frameworks.[78] Both missions created new pathways for integrating energy and climate considerations into India's urban development agenda.

By 2011, ECBC became mandatory in eight States, including Delhi, Maharashtra, Uttar Pradesh and Tamil Nadu. It began to shape State-level construction norms and Municipal planning, even though national enforcement was still evolving.

MoHUA revised the Model Building Bye-Laws in 2016. The new MBBL incorporated comprehensive provisions for rooftop solar photovoltaic (PV) systems), green building standards, and universal accessibility, ensuring a more inclusive and sustainable built environment.

Subsequently, NBC was updated again in 2016, adding a dedicated chapter on sustainability, while ECBC was revised in 2017, followed by the release of ECBC Rules in 2018, making the code enforceable in many jurisdictions.

Together, these reforms reflect a strategic policy evolution—from piecemeal energy interventions to an integrated climate-responsive framework. India's built environment is now positioned as a key contributor to national energy efficiency targets and climate goals.

Infosys Crescent Building, Bengaluru
Image Credits: Umang Shah, Ridham Gajjar, Arun Sreenivasan

5.4 Tracking the Ratings Journey: From Niche to Necessary

Between 2008 and 2010, India's green building certification systems became institutionalised, aligning with the country's emerging climate policy. Initially, green ratings were focused on the commercial sector, where energy comprises a large share of operational costs, allowing developers to leverage certifications for premium pricing.[79]

In 2008, IGBC launched the Green Homes Rating, extending its reach to the residential sector, recognising that the goal of a sustainable built environment could not be achieved without addressing housing.[80] Meanwhile, the GRIHA framework, developed by TERI and adopted by MNRE, continued to grow, emphasising India's climatic context and the need to address resource use and environmental pressures.

IGBC initially administered the LEED India rating, adapted from the U.S. Green Building Council's framework. However, this responsibility was later transferred to Green Business Certification Inc. (GBCI), after which IGBC launched its own independent rating systems suited to Indian conditions.[81] Both IGBC and GRIHA expanded their offerings and gained wider adoption across commercial, residential, and industrial projects.

Despite these advancements, several challenges hindered implementation, including fragmented governance across energy, water, and waste sectors, weak enforcement, limited on-site verification, and minimal penalties for non-compliance—often resulting in gaps between intent and execution.[82]

To incentivise adoption, governments introduced measures such as fast-track approvals, property tax rebates (e.g., property tax rebates for adopting eco-friendly practices by Pimpri-Chinchwad Municipal Corporation in 2011)[83], FAR and coverage relaxations (e.g., FAR relaxations for certified buildings by Jaipur Development Authority in 2014[84]), and low-interest loans.

By the early 2020s, GRIHA had certified 0.93 billion sq. ft. over 3,869 projects[85], while IGBC had certified 12.3 billion sq. ft. across 14,510 projects[86]. At the same time, international rating systems like Well Building Standard (WELL), Excellence in Design for Greater Efficiencies (EDGE), Building Research Establishment Environmental Assessment Method (BREEAM), and Green and Eco-friendly Movement (GEM) gained traction, while new domestic frameworks emerged—such as BEE's Commercial Star Rating, and Central Public Works Department's (CPWD) Green Habitat Accomplished Rating (GHAR) in 2021.

By the decade's end, India's green building focus expanded from individual structures to system-level approaches, emphasising net-zero transitions, neighbourhood-scale planning, and city-level certifications, signalling a broader integration of sustainability in the built environment.

2001
- The Energy Conservation Act, 2001
- IGBC

2002
- The Bureau of Energy Efficiency (BEE)

2003
- Electricity Act, 2003

2004
- Model Building Bye-Laws, 2004

2005
- National Electricity Policy, 2005
- National Building Code

2006
- LEED India
- BEE Standard & Labelling (S&L) Programme
- Integrated Energy Policy (IEP) 2006

2007
- National Urban Housing and Habitat Policy (NUH & HP 2007)
- GRIHA
- Energy Conservation Building Code (ECBC), 2007

2008
- Pune Municipal Corporation Eco-Housing
- NAPCC

2009
- BEE Star labelling of existing commercial buildings
- Bachat Lamp Yojana (BLY) 2009
- Karnataka Energy Renewal Policy

2010
- National Mission for Sustainable Habitat (NMSH) - 2010
- EC (Amendment) Bill 2010
- India-Switzerland: Funding provided to BEE for building energy efficiency project

2011
- National Mission for Enhanced Energy Efficiency - NMEEE
- Fast Track environmental clearance for green building projects Pimpri Chinchwad Municipal Corporation, 2011

2012
- Municipal Corporation Greater Mumbai - MCGM Eco Housing 2012
- Greater Hyderabad Municipal Corporation, 2012
- India-Germany

2013
- Energy Efficient Solar/ Green Building 2013
- Development of Solar Cities 2013
- Ministry of Urban Development Notification, Delhi Division, 2013

2014
- Off-Grid and decentralised solar application MNRE, 2014 (Phase 2)
- Grid Connected rooftop & small power plants 2014,
- Karnataka Solar Energy Policy
- Jaipur Development Authority

2015
- National Determined Contribution (NDC) - India 2015, Ujala Scheme
- Kolkata Municipal Corporation (Building) Rules 2009 Amendment

2016
- National Building Code - NBC 2016
- Partial Risk Guarantee Fund for Energy Efficiency
- Model Building Bye Laws 2016
- Maharashtra Solar Energy Policy, 2016
- The Punjab Municipal Green Buildings Incentives Policy
- New Town Kolkata Development Authority Act, 2007 amendment
- Pune Municipal Corporation
- Public Works Department (PWD), Government of Maharashtra
- Greater Noida Industrial Development Area Building Regulations 2016

2017
- Perform, Achieve and Trade (PAT) Scheme (Hotels) 2017
- Buildings Energy Efficiency Programme (BEEP) 2017
- EESL Super-Efficient Air Conditioning Programme (ESEAP)
- SUNREF - Affordable Green Housing India Programme
- Venture Capital Fun for Energy Efficiency (VCFEE)
- Clean Cooling Collaborative or The Kigali Cooling Efficiency (K-CEP)
- ECBC (Revised) 2017
- Andhra Pradesh, Jharkhand, Himachal Pradesh and Pune Municipal Corporation

2018
- ECBC Rules 2018
- Haryana Building Code - 2017 amendment
- Eco-Niwas Samhita
- International Energy Agency

2019
- S&L Residential
- Nearly Zero Energy Buildings (nZEB)
- The India Cooling Action Plan (ICAP) supported by IEA's E4 programme
- CPWD's Green Habitat Accomplished Rating or GHAR
- The Rajasthan Investment Promotion Scheme, 2019 (RIPS-2019)
- Rajasthan integrated Building regulations 2017 Amendment

2020
- Punjab Urban Planning and Development Building (Amendment) rules
- Unified Development Control and Promotion Regulations for Maharashtra State.

2021
- Tamil Nadu Industrial Policy 2021
- Local Self Government Department - Green Rating and Green Building Certification of Buildings in Kerala – Guidelines
- Tamil Nadu Data Centre Policy 2021
- Eco Niwas Samhita (NMS) 2021 / (ECBC-R),
- Shunya Labeling for NZEBs and NPEBs 2021
- Draft National Electricity Plan 2021

2022
- Electricity amendment bill, 2022
- EC amendment Act 2022
- ENS Tool launched by BEE
- Tamil Nadu Integrated Townships Development Policy, 2022
- Uttar Pradesh Tourism Policy 2022-2032
- Scheme of Assistance to Promote green Building in Gujarat State

2023
- HDFC -Sustainable Finance Framework December 2023
- Tamil Nadu Tourism Policy 2023
- Goa Land Development and Building Construction (Amendment) Regulations, 2021

2024
- Eco-Niwas Samhita (ENS) 2024 - Energy Conservation and Sustainable Building Code Residential 2024
- Tata Power Solar Systems Limited (TPSSL)

Regulatory / Laws / Legislations
Policies / Programs
Ratings / Guidelines / Code
Incentives/ Financial assistance
International Co-operation

Figure 7 :
Evolution of energy-efficient building initiatives in India
Source: IIHS, 2025

5.5 Opportunities and Gaps

India has made remarkable strides in promoting HPBs, and several opportunities remain to further enhance these efforts and unlock their full potential.

5.5.1 Addressing Identified Gaps

Strengthening Definitions and Metrics:
A clear and universally recognised definition of HPBs, alongside mandatory adoption of the Energy Performance Index (EPI), presents an excellent opportunity to establish consistent benchmarks for energy efficiency.

Enhancing Compliance: Improving enforcement mechanisms, including introducing meaningful penalties for non-compliance, can boost adherence to energy efficiency standards and encourage widespread adoption.

Expanding Focus to Existing Buildings: The potential for energy savings in existing buildings is vast. Retrofitting offers a tremendous opportunity to elevate the performance of the existing building stock to HPB standards.

Raising Awareness: Educating developers, builders, and consumers about the tangible benefits and practical requirements of HPBs provides an avenue to foster greater acceptance and adoption of sustainable building practices.

5.5.2 Actionable Opportunities for Growth

Policy Integration and Standardisation: Harmonising HPB policies across States ensures uniform adoption and enforcement, enabling a cohesive and impactful national approach.

Boosting Financial Incentives: Increasing the availability of subsidies, tax rebates, and green financing options opens pathways for stakeholders to invest in and adopt energy-efficient technologies and practices.

Empowering through Knowledge: Comprehensive awareness campaigns and capacity-building programmes empower stakeholders, equipping them with the skills and information needed to transition effectively to HPBs.

Fostering Retrofitting Innovations: Encouraging innovative retrofitting solutions, coupled with financial support for upgrading existing buildings, can unlock untapped energy-saving potential, and extend the benefits of HPBs to a broader range of structures.

By seizing these opportunities and leveraging India's existing progress, the nation can accelerate its journey toward a sustainable and energy-efficient built environment, contributing significantly to environmental and economic goals.

5.6 Chapter Highlights

1

A legal framework for energy efficiency has been established, incorporating:

- The Energy Conservation Building Code (ECBC)
- The Perform, Achieve, and Trade (PAT) scheme
- Oversight by the Bureau of Energy Efficiency (BEE)

2

Several States and Municipalities offer incentives to promote green-certified buildings and energy-efficient practices, including:

- Subsidies
- Tax rebates
- Floor Area Ratio (FAR) allowances

3

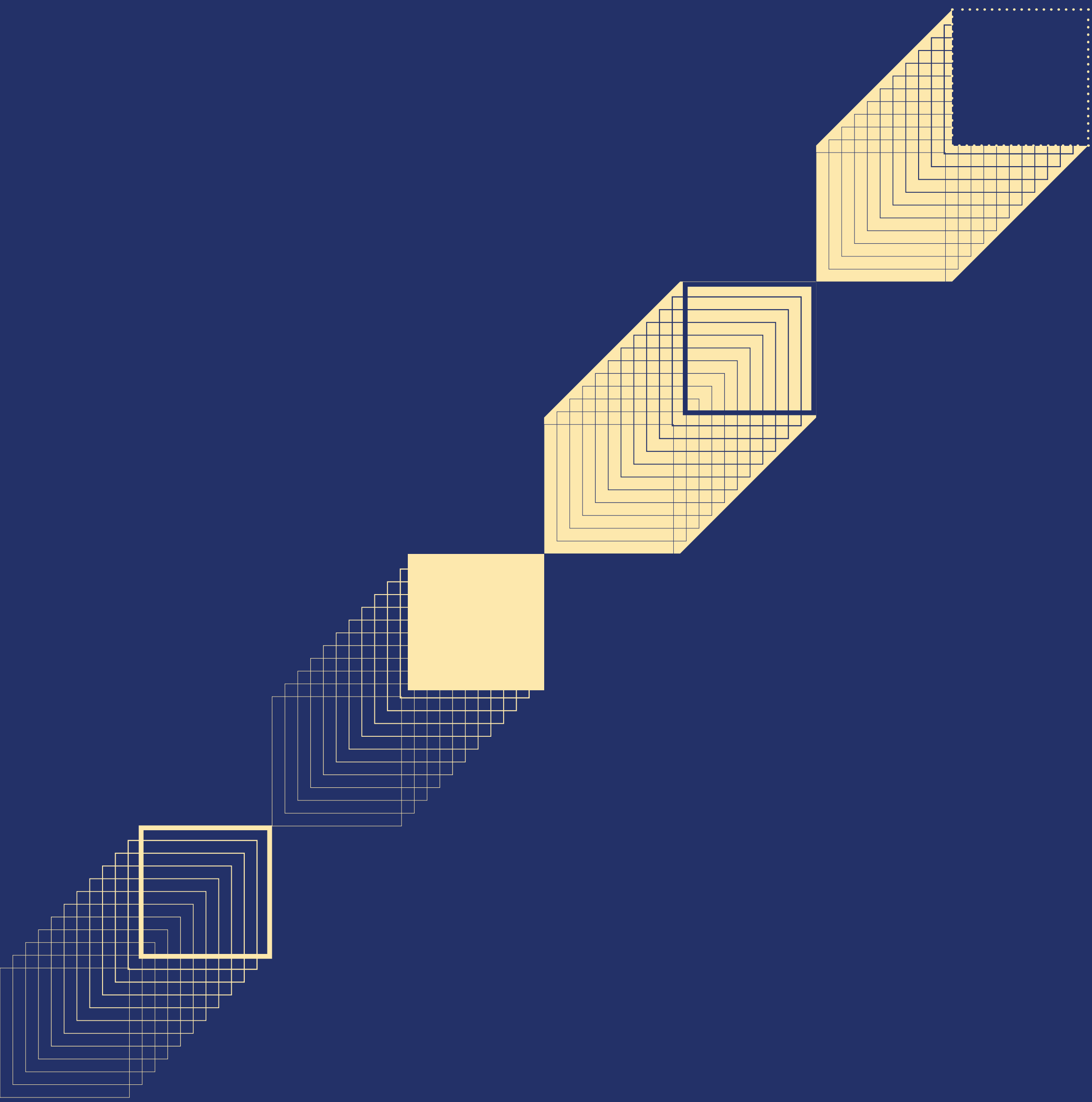
Challenges hindering comprehensive energy efficiency include:

- The lack of a clear definition for High-Performance Buildings
- The absence of a mandatory Energy Performance Index for all buildings

4

Opportunities for improvement:

- Harmonising HPB policies across States to ensure uniform adoption and enforcement



The HPB transition can offer benefits beyond energy savings and resource conservation, and includes tangible economic, financial, social, and environmental benefits.

6 Way Forward

The analysis presented in the preceding chapters underscores a business case for HPBs, and maps the broader policy, regulatory, institutional, and financial sector responses at the interface of sustainability, climate, energy, and the buildings sector. What emerges is a clear demand to align policy, regulatory, institutional, and financial sectors with the buildings sector, to enable a new market-based equilibrium.

One of the key challenges is bridging the divide between private and public imperatives: while buildings are largely created by the private sector for profit, the policy and related ecosystem has a public mandate. The financial sector engages with both. This chapter presents a rubric to help identify 'sweet spots' for synergy. In doing so, the following questions must be considered:

- **Are there global experiences that can be leveraged?**
- **Who are the key actors that we need to engage with, and why?**
- **What engagement framework could facilitate synergistic alignment across identified stakeholders, and how?**

These questions are examined through an analytical frame driven by energy, carbon, productivity, and employment gains in the context of HPBs, around which actor alignment is desirable.

6.1 Global Insights: What Can India Learn?

In the late 20th and early 21st centuries, several countries actively addressed the challenges of promoting green buildings and high performance buildings through progressive policies, codes, and financial incentives. Globally, stringent building bye-laws, energy codes, and sustainability standards have played a central role in shaping efficient built environments.

The European Union Green Deal sets a target for climate neutrality by 2050[87], mandating energy-efficient building design and retrofits. The Energy Performance of Buildings Directive (EPBD)[88] requires zero-emission buildings for new construction. Germany's Energy Saving Ordinance (EnEV) introduced strict efficiency standards—its latest amendment increased construction costs by 3.2% but reduced primary energy use by about 25%.[89] Denmark's BR18 code also enforces high sustainability standards in construction.[90]

In the United States, the International Energy Conservation Code (IECC)[91] governs energy performance in both residential and commercial buildings, while ASHRAE 90.1[92] and the International Green Construction Code (IgCC)[93] provide advanced frameworks for commercial energy efficiency.

Beyond regulations, many countries are aligning urban planning, green financing, and carbon pricing mechanisms to accelerate the adoption of sustainable buildings:

- **Singapore's BE Transformation GFA Incentive Scheme** offers additional floor area for green-certified developments.[94]

- **Copenhagen**'s **carbon neutrality plan by 2025** embodies energy retrofitting and efficiency mandates.[95]

- **Green bonds** from agencies like the **European Investment Bank (EIB)** and **World Bank** finance energy-efficient schools, hospitals, and housing.[96]

- The **International Finance Corporation (IFC)** issues green bonds supporting certifications like **EDGE**.[97]

- **France** requires minimum green certifications for projects funded by its sovereign green bonds.[98]

- **Germany's KfW Bank** provides grants for energy-efficient construction and retrofits.[99]

- **Australia's CEFC** offers green loans for building energy performance improvements.[100]

These efforts highlight that a **mix of clear national policy**, **financial instruments**, **urban planning integration**, and **public-private collaboration** can enable a high-performance built environment. The detailed cases analysed are provided in the Annex for reference.

Singapore's BE Transformation GFA Incentive Scheme offers additional floor area for green-certified developments

Germany's KfW Bank provides grants for energy-efficient construction and retrofits

Copenhagen's carbon neutrality plan by 2025 through energy retrofitting and efficiency mandates

Green bonds from agencies like the European Investment Bank (EIB) and World Bank finance energy-efficient schools, hospitals, and housing

The International Finance Corporation (IFC) issues green bonds supporting certifications like EDGE

France requires minimum green certifications for projects funded by its sovereign green bonds

Australia's CEFC offers green loans for building energy performance improvements

Global Best practices on the Adaptation of Sustainable Buildings

Copenhagen's Carbon Neutrality Plan by 2025 and Climate Plan 2035

Even though Copenhagen did not achieve its ambitious target of becoming carbon neutral by 2025, it achieved 75% emission reductions on 2005 levels[101], by focusing on energy production, **energy consumption,** mobility and **city administrative initiatives**. The approaches, initiatives, and achievements in the building sector which contributed to these achievements are:

- Energy consumption
  - Reduced heat and electricity consumption in buildings—heating 98% of the buildings using a district heating system that leverages residual heat from electricity generation, including combined heat and power (CHP) plants and waste incineration plants.
  - Established 'Energy Leap', a partnership between real estate companies, building owners, and administrators in Copenhagen.[102] This partnership brought in key actors in the real estate sector for knowledge sharing and exchange of experiences. It encouraged large building owners to make big energy savings and lead the way for others.
  - In the Energy Leap partnership, building owners and landlords ensured the properties were energy efficient, and administrators made optimisation potential visible to owners, recruited partners, and communicated results. Other interest groups too could contribute to knowledge sharing, raising challenges to the political level, recruiting, and disseminating results. [103]
  - Enforcement of building codes and energy codes, with contractors encouraged to build green rooftops and walls.
- **City administration initiatives:** Reduced energy consumption from street lighting and municipal buildings by 40%, installed solar panels on municipal buildings, and sustainable procurement. Flagship initiatives include new requirements for non-road mobile machinery in construction projects the City of Copenhagen is involved in.

Climate Plan 2035 for the City of Copenhagen is under preparation, which aims to further reduce the city's CO_2 emissions and demonstrate how cities can work ambitiously on tackling the global climate crisis.[104]

Green Finance Mechanisms by Australia’s Clean Energy Finance Corporation (CEFC)

- Commercial Building Upgrades: Concessional finance supports for upgrades like smart technology integration, and solar installation in commercial buildings through partnerships with property developers.[105]

- To accelerate energy savings in Australian commercial property sector, CEFC has developed a range of offerings, partnering with other financial institutions to provide finance for retrofits.

- They launched innovative finance mechanisms like Environmental Upgrade Agreement (EUA)[106] where building owners get competitive long-term finance to meet the up-front capital needs of retrofit projects.

- Improving the life of existing buildings and reducing vacancies of 20–30 year-old B and C grade commercial properties in Australia, by financing through real estate investment companies.

- Increasing access to solar for commercial property through different programmes which focus on power purchase agreements and solar leasing arrangements, and help overcome major solar investment barriers by removing the up-front cost and payback issues for customers.[107]

- Timber Building Programme: An alternative building material promotion programme for the net zero transition, focusing on medium and large-scale building construction. [108]

- Collaborations and sectoral partnerships with rating agencies, green building councils, financial institutions, and sustainability groups to establish high standards and benchmarks. Initiatives include guides on electrification of buildings, and showcasing best practices. [109]

6.2 Key Actors in the HPB Transition

Drawing from Indian case studies and global insights, this section identifies five key stakeholder groups driving HPB transformation:

Table 1: Key stakeholders in the HPB transition
Source: IIHS, 2025

Business Stakeholders	• Builders • Developers • Architects • Design consultants • Real estate agencies • Product manufacturers
Energy Stakeholders	• BEE • MoP • ESCOs • RE Agencies • Utilities • Equipment manufacturers
Climate Stakeholders	• MOEFCC • Carbon credit markets • Climate finance institutions
Financial Stakeholders	• Banks • Financial institutions • Investors • Green/ climate finance providers
Regulatory Stakeholders (other than energy sector)	• Government agencies • ULBs and development authorities • Regulatory bodies like RERA • Building certification agencies

The HPB transition can offer benefits beyond energy savings and resource conservation, and includes tangible economic, financial, social, and environmental benefits. Identified stakeholders can be mapped to the benefits of transitioning to High Performance Buildings. The figure below maps the potential benefits of each stakeholder group:

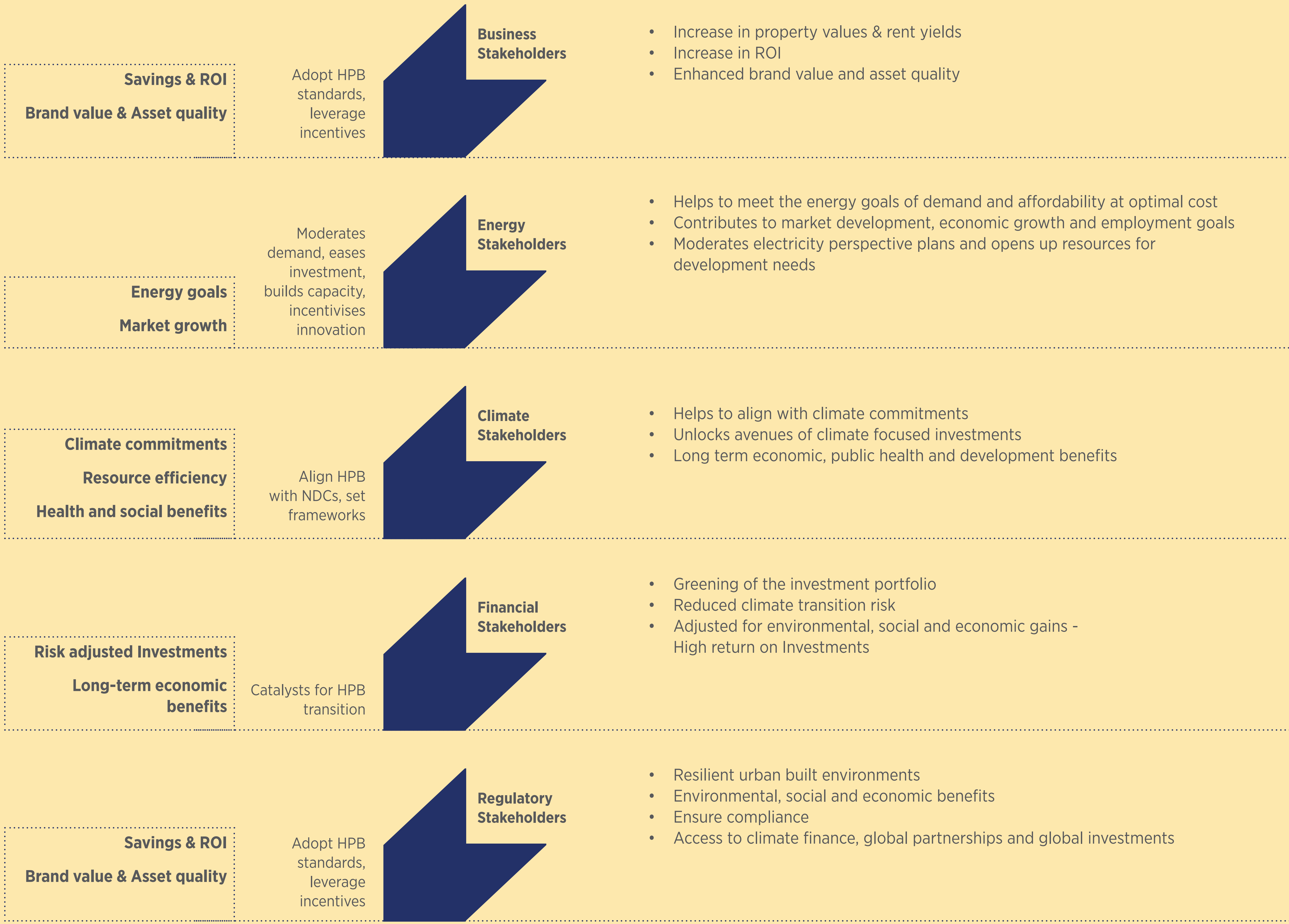


Figure 8:
How can an archetype HPB transition benefit different stakeholders?
Source: IIHS, 2025

Business stakeholders such as builders and developers can shape the market as they are the core decision makers in transforming the industry. Their voluntary commitments and actions towards responsible construction practices can help them take the lead. They can obtain highest class certifications from the existing green certifications and advocate for higher standards and commitments. Similarly, energy and climate stakeholders can set the environments (through policy, market mechanism technology adoption etc.) and lead the market to help the nation meet its climate and energy goals. Financial stakeholders can act as catalysts in the market by creating green building finance products that favour/ help builders and developers. The government, as a regulatory stakeholder, plays a key role in the HPB transition. They can catalyse, facilitate, and regulate the industry by adopting high-performance measures in all new public buildings and retrofitting existing building stock, and create a supportive incentive model and ensure compliance.

The following section identifies the role, action points, and benefits associated with key stakeholder groups:

Business Stakeholders

Table 2: Business stakeholders: Role, action points, and benefits

Role	Pivotal drivers/ core decision makers in steering the Indian built sector towards a high performing and sustainable phase.
Potential Action Points	• Adopt high energy standards and low embodied energy materials in buildings • Ensure compliance with energy codes and leveraging incentives • Obtain certifications to demonstrate commitments towards climate and resource efficiency • Focus on operational efficiency and regular monitoring of building performance • Integrate smart technologies for continuous monitoring of building performance
Benefits	• Higher property values and rental yields • Provisions to leverage incentives such as property tax rebates, additional FSI, and fast track approvals • Offset in operational expenditure such as energy, water, and maintenance costs • Creates brand value and reputation in early adoption of HPB standards • Opportunity to establish themselves as pioneers in the sector, and lower non-compliance risks

Energy Stakeholders

Table 3: Energy stakeholders: Role, action points and benefits

Role	Leaders to create environment with energy codes/ technical standards and ensure accessibility and compliance.
Potential Action Points	• Mandate ECBC compliance across the country • Make ECBC (and ENS for residential) mandatory and enforceable in all States • Empower ULBs with implementation authority, tools (digital compliance systems and third-party verifications) • Support capacity building at all levels by rolling out targeted training and accreditation programmes for architects, engineers, builders, and ULB officers, tied to ECBC enforcement, building design tools, and HPB compliance • Technology development and support through innovative research and development • Electricity regulators (Central Electricity Regulatory Commission (CERC)/ State Electricity Regulatory Commissions (SERCs)) must use tariff structures to send long-term price signals that reward energy-efficient buildings and technologies through time-of-day pricing, demand-based tariffs, or lower wheeling charges for high-performing buildings • Bodies like the Central Electricity Authority (CEA) must integrate building energy efficiency into load forecasting, integrated resource planning (IRP), and grid investment strategies to avoid future supply–demand mismatches and ensure grid resilience • Regulators and system operators must create frameworks that allow High Performance Buildings to interact with the grid by enabling demand response, thermal storage incentives, and flexible load management protocols
Benefits	• Market development and growth (HVAC, lighting, renewables), creating demands for energy efficient equipment drives innovation and local manufacturing options (E.g. Make in India initiative) • Aligning towards the national energy goals—more sustainable and less carbon intensive real estate growth • Creates more investment opportunities in the market • Boosts market demand for energy-efficient technologies, driving innovation and local manufacturing • Advances national energy and climate goals by enabling low-carbon, sustainable real estate growth • Attracts green investments by lowering operational risks and improving asset performance • Creates green jobs across the building and energy sectors, fuelling a skilled, future-ready workforce • Enhances energy security by reducing peak demand and improving grid resilience

Climate Stakeholders

Table 4: Climate stakeholders: Role, action points, and benefits

Role	Strategic anchors of the industry to ensure climate goals and commitments are met through the HPB transition.
Potential Action Points	• Align transitions in the built environments with NDCs and NAPCC • Develop a national HPB transition roadmap with clear milestones which can be integrated to urban development strategies • Launch more incentive options similar to fast-track Environmental Impact Assessment (EIA) clearances for pre-, green-certified projects
Benefits	• Significant contributions to achieve India's climate commitments such as the NDC and NAPCC • Enhanced emission reduction, resource efficiency, and climate resilience • Long-term economic and public health benefits through reduced emissions, improved air quality, and healthier urban ecosystems

Financial Stakeholders

Table 5: Financial stakeholders: Role, action points, and benefits

Role	Catalysts for energy-efficient transformation of the built environment through performance-based capital deployment and risk-adjusted investment strategies.
Potential Action Points	• Link financial incentives, such as tax rebates, subsidies, or fast-track approvals, to measurable building performance (energy savings, verified outcomes) • Ensure accountability by tying climate impact to financial returns, enabling performance-linked finance and de-risked lending models • Recognise HPBs as an investible asset class, similar to how nature-based solutions are being mainstreamed in sustainable finance • Government financial institutions and other FIs must mobilise affordable capital for green real estate, enabling upfront investments with long-term environmental and economic payoffs • Expand access to green bonds, blended finance, and ESG-aligned real estate portfolios to unlock large-scale transformation
Benefits	• Opens up new green business and lending opportunities for banks, Non-Banking Financing Companies (NBFCs), and institutional investors • Helps manage and reduce climate-related financial risk while improving portfolio resilience • Delivers high long-term returns through lower default rates, higher asset valuations, and improved occupancy, making HPBs a preferred class for sustainable investment

Regulatory Stakeholders (other than energy sector)

Table 6: Regulatory stakeholders: Role, action points, and benefits

Role	Accelerators in HPB adoption and improved governance.
Potential Action Points	• Ensuring enforcement of codes and standards, shaping policies • Promote green/ high-performing buildings through financial incentives • Invest in training, capacity building, digital compliance systems, and third-party verification • Create a unified and outcomes-based rating framework; harmonise existing and emerging systems under a national outcomes-based green building framework, aligned with climate goals and backed by real performance data • Develop a green building data infrastructure for tracking energy, carbon, and performance metrics of certified buildings, linked to State and Municipal planning systems • Update government procurement norms and Schedules of Rates (SoRs): Mandate inclusion of low-carbon and resource-efficient technologies in government building projects • Facilitate an environment for retrofitting of existing building stock
Benefits	• Resilient urban built environments mean reduced climate risks and improved health and safety • Environmental and economic impact through promoting sustainability and resource conservation • Can obtain recognition in sustainable real-estate market leadership through mainstreaming HPBs • Well-regulated markets can attract investors and international agencies, facilitating access to climate finance and global partnerships

6.3 HPBs as a Strategic Value Proposition

The analysis presented in this chapter highlights key points for deliberation. Global experience shows that the commercial building sector relies on targeted policy measures, such as mandating end-use metering, creating transparent data infrastructure for building performance, inducing data-driven behaviour change and regular revisions of energy and building codes. These actions are generally feasible within the business ecosystem, but may not fit into the broader 'public' ecosystem, which aim to drive incremental improvements across the entire value chain. To bridge this gap, it is essential to recognise links across the actor configuration identified, and discover enabling conditions and levers. Emerging questions for further exploration include:

- **How do financial institutions and markets enable large-scale HPB deployment?**
- **What fiscal incentives will catalyse HPB realisation? What gains emerge, and in what form?**
- **How can regulatory frameworks incentivise HPB deployment?**
- **What is the role played by governance norms such as standards in the HPB space?**
- **Should HPB deployment be legally mandated?**
- **What is the incremental calculus, for multiple actors, to enable HPB realisation? How does one imagine the policy architecture to work in this context, and what policy nudges could enable it?**
- **What is the role played by urban regulators and systems in enabling HPB ecosystem, and in what ways? Is there evidence to demonstrate economic value through HPBs within the urban policy framework?**

Finally, as articulated in the earlier part of this analysis, there are two challenges that we need to address. First, there is a need to expand the business, energy, climate, and social case for HPBs, particularly the interlinkages, its nature, and form. Second, having expanded on these multiple dimensions underpinning HPBs, there is an urgent need for re-crafting the policy, regulatory, and financing response which would enable maximising individual and collective outcomes across the multiple elements identified above.

Annex

Annex 1: Global Policies Supporting Energy Efficiency

Specific Examples of Global Policy Initiatives

Policy Interventions	Examples
Building Energy Codes and Standards	**United States:** **The International Energy Conservation Code (IECC):** Covers both residential and commercial buildings, regulating energy conservation in heating, ventilation, lighting, water heating, appliances and building systems[110]. **ASHRAE 90.1 Standards:** Covers only commercial buildings with four or more stories[111]. **Green Conservation Code (IgCC):** Enhances energy savings in addition to regulating site, materials, and indoor air quality[112].
	European Union: **Energy Performance of Buildings Directive (EPBD)[113]:** A directive for member nations aimed at cutting energy use, encourage renovation of worst-performance buildings across Europe. The revised directive makes zero-emission buildings the new standard for new buildings.
Urban Planning Policies	**Singapore:** **(BE Transformation GFA) Incentive Scheme[114]** *(under the Green Mark Scheme):* Developers/building owners of private projects will enjoy up to 3% additional GFA beyond the Master Plan Gross Plot Ratio (GPR) for delivering the highest certified building (e.g. GM Platinum SLE standards) in their building development on private sites of at least 5,000 sq.m GFA.
	Copenhagen: **Carbon Neutral Capital by 2025 -** Initiatives include energy retrofitting in the renewal of urban areas and buildings, new construction to be of highest specification of energy efficiency, and reducing energy consumption of municipal buildings.

Incentives for Renewable Energy Integration	**Germany:** **Renewable Energy Act (EEG) 2000-Feed-in Tariffs (FiTs)[115]:** Guarantees owners of renewable power generators a fixed rate for each kilowatt-hour of renewable energy over a period of 20 years. Led to vast growth of renewable energy production over the years.
	United States: **Solar Investment Tax Credit (ITC)[116]:** Provides tax incentives to homeowners and business entities and offers a 30% tax credit for individuals installing solar systems on residential properties, as outlined in Section 25D of the tax code. Meanwhile, the Section 48 commercial credit applies to solar systems installed on customer-sited commercial properties and large-scale utility solar farms.

Annex 2: International Financing Initiatives for Energy Efficiency

Financing Mechanisms for HPBs

Financing Mechanisms	Examples
Green Bonds	
Multilateral Organisations and Development Banks	**The European Investment Bank (EIB)** issues green bonds to support energy-efficient construction.
	The World Bank issues green bonds that finance projects like energy-efficient schools and hospitals in developing countries[117].
	International Finance Corporation (IFC)[118] Issues green bonds directly to fund sustainable building certifications under the EDGE programme covering commercial buildings, healthcare facilities, and retrofitting existing buildings. It also includes financial institutions covering sectors like green housing, renewable energy, and energy efficiency.
	Asian Development Bank (ADB): Supports green infrastructure projects, including HPBs. For example, $500 million loan to support India's economic growth by promoting environmentally sustainable infrastructure in December 2024[119].
Governments and Sovereign Entities	**France:** **Issuance of sovereign green bonds in 2017[120]** which are used to fund environment friendly projects. For building sector projects, it became mandatory to achieve minimum LEED, BREEAM, German Sustainable Building Council (DNGB) or High Environmental Quality (HQE) certifications for buildings to be declared as eligible for the use of proceeds. This led to builders opting for higher certifications for their projects which eventually have higher energy savings**.**
	Germany: Germany issued its inaugural green bond of EUR12 billion in 2020[121]. There is a budget allocated for providing advice on energy efficiency for all end users, such as private households, small and medium-sized enterprises and public authorities. Advice is provided on topics such as increasing energy efficiency and the use of renewable energies (e.g. energy saving, insulation, modern heating technology) or optimising heating systems.

Green Loans and Mortgages

<table>
<tr><td rowspan="3">Green Loans</td><td>European Investment Bank (EIB) – EU Member States allows homeowners to borrow between €5,000 and €75,000 at low interest rates for up to 10 years, facilitating comprehensive energy efficiency and renewable energy upgrades[122].</td></tr>
<tr><td>German KfW Bank programmes (from 2005-06) “Energy-efficient Refurbishment” and “Energy-efficient Construction” funded by federal grants, are the most significant providers of financial incentives for more energy efficiency in the German housing sector[123].</td></tr>
<tr><td>Australia:
Clean Energy Finance Corporation (CEFC) provided a $100-million green loan to Mirvac for constructing energy-efficient commercial and residential buildings across Australia. With an additional support to incorporate a minimum 7.5-star Nationwide House Energy Rating Scheme (NatHERS) rating and operate with net zero carbon emissions.
Also Invested in an innovative new affordable build-to-rent (BTR) strategy managed by AXA IM Alts. [124]</td></tr>
<tr><td>Energy-Efficient Mortgages</td><td>Lower rates for homebuyers purchasing HPB-certified properties[125]
Federal Housing Administration (FHA) Energy Efficient Mortgage Program (EEM insures a borrower’s FHA-insured mortgage used to purchase or refinance a principal residence, and the cost of energy efficient improvements to be made on the home. The borrower only needs to qualify for the loan amount used to purchase or refinance a home and does not need to qualify for the portion of the loan to be used to finance the energy efficient improvements.</td></tr>
</table>

Carbon Pricing Mechanisms

<table>
<tr><td rowspan="2">Carbon Pricing Mechanisms</td><td>European Union:

The EU Emissions Trading System (ETS)[126] includes energy-intensive buildings in its scope. A separate emissions trading system will be created by the EU, for buildings and road transport to put a price on emissions from these sectors, by 2027.</td></tr>
<tr><td>Canada:

Carbon price mechanism puts a price on carbon emissions through a carbon tax. It proves to be the most powerful incentives where the governments encourage companies and households to pollute less by investing in cleaner technologies and adopting greener practices[127].</td></tr>
</table>

Annex 3: Case Studies of Policy and Financing Success

Policy and Financing Case Study of Germany

Case of Germany: Market Leadership in Energy-Efficient Buildings.

Germany's success stems from a comprehensive policy and financing framework:

Policy Initiatives	About Scheme	Impact
The Energy Saving Ordinance (EnEV)	A central instrument within German energy and climate protection policies. Aims to ensure that the targets of the Federal Government's energy policies are achieved. • Stringent energy efficiency standards • Regulates energy performance certificates • Limits internal requirements of heated and air-conditioned rooms • Regulates heating and air conditioning The ordinance defines structural and heating system standards for buildings and specifies the energy efficiency for new buildings and the refurbishment of existing buildings. EnEV is based on the Energy Saving Act (EnEG); its effectiveness is further supported by other standards and laws such as the Renewable Energies Heat Act[128]. It has been developed by the Federal Ministry of Transport, Building and Urban Development and Federal Ministry of Economics and Technology, where it is implemented by Federal states. The Verification and Enforcement Authority is Building control authority (local level)	The latest amendment (in 2017) of the EnEV has increased the cost of construction by an average of 3.2% and led to an approximate reduction in primary energy requirement of 25%.

Revision of the Buildings Energy Act, EU Energy Performance of Buildings Directive (EPBD) and Minimum Energy Performance Standards (MEPS):	The Buildings Energy Act (GEG) provides for minimum performance standards for certain trigger points such as the renovation or replacement of a heating system. They improve plannability on the way to a climate neutral building stock, while their further development is to be based on the requirements of the EU Buildings Directive (EPBD)[129].	It is expected to initiate the transition away from fossil fuel heating and provide planning certainty for property owners, the housing industry, and industry(steel, chemical, cement, lime, glass,) and trade.
	Rollout of the Efficiency House 55 (EH 55) as the new standard for primary energy requirements.	Future minimum energy efficiency standards for buildings must be geared towards achieving greenhouse gas neutrality by 2045.
Financial Support		
The KfW Development Bank offers low-interest loans and grants for energy-efficient construction.	**'KfW Efficiency House' standard** Germany's Reconstruction Loan Corporation (KfW) provides financial support for retrofitting/ modernising buildings to make it more energy-efficient, and for buyers who are investing in an energy-efficient home. KfW provides funding for the construction of new residential buildings that meet the 'Efficiency House 40, 55 or 70' standards.	

Policy and Financing Case Study of United States

Tax Incentives and Federal Programmes

Type	About Scheme	Impact
Tax Credits	**45L New Energy Efficient Home Tax Credits[130]:** It is a valuable federal tax credit that is available to builders and developers who construct new residential properties that meet specific energy-efficient criteria[131]. The Inflation Reduction Act of 2022 (IRA) amended and extended 45L (Internal Revenue Code Section 45L) to increase the tax credit to up to $2,500 per unit for homes that meet ENERGY STAR certification and up to $5,000 for homes achieving the Department of Energy's (DOE) Zero Energy Ready Home (ZERH) certification.	By meeting the eligibility criteria, builders and developers can not only save money but also contribute to a more sustainable future. These credits provide financial incentives that help builders and developers offset the cost of incorporating energy-efficient features into their construction projects.
	Energy efficient commercial buildings deduction: Tax deduction option for commercial building owners who install new equipment aimed at improving energy efficiency of the property can claim a tax reduction. There are two pathways, one for the commercial building property and another for the retrofit building property.	This allows the builders to upgrade their property to energy efficiency with scope of meeting more criteria and receiving more tax benefits.
Green Building Rating	**ENERGY STAR certification[132]** is a programme created by the US Environmental Protection Agency (EPA) to identify and promote energy-efficient products and buildings. Products that earn the ENERGY STAR certification have been tested and verified by independent third-party laboratories to meet strict energy efficiency guidelines.	**Certification is done annually,** so buildings must maintain energy efficient performance to maintain their ENERGY STAR status each year[133]. The surface area of buildings certified by Energy Star has increased by over a billion square feet every year in the past decade and a half.

Green Building Rating	**LEED (Leadership in Energy and Environmental Design)[134]:** LEED certification provides a framework for healthy, highly efficient, and cost-saving green buildings, which offer environmental, social and governance benefits. LEED certification is a globally recognised symbol of sustainability achievement, and backed by an entire industry of committed organisations and individuals paving the way for market transformation**.**	It makes properties more valuable, with a growing number of **building owners seeing a 10% or greater increase in asset value.** LEED buildings have reported almost **20% lower maintenance costs** than typical commercial buildings, and **green building retrofits typically decrease operation costs by almost 10% in just one year.** As of April 2024, the surface area of buildings with a Platinum LEED certificate, the highest sustainability level, amounted to **626 million square feet.**

End Notes

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Glossary

Greenhouse Gases

The release of gases such as carbon dioxide, methane, and nitrous oxide into the atmosphere. These gases trap heat, contributing to global warming and climate change. Major sources include fossil fuel combustion, deforestation, and industrial processes.

Source: Intergovernmental Panel on Climate Change (IPCC)

Indoor Air Quality (IAQ)

The condition of air within buildings, impacting the health and comfort of occupants. It is influenced by pollutants like volatile organic compounds (VOCs), dust, mould, and carbon dioxide. Poor IAQ can lead to respiratory issues, allergies, and other health problems. Source: U.S. Environmental Protection Agency (USEPA)

Heating, Ventilation, and Air Conditioning (HVAC)

Stands for Heating, Ventilation, and Air Conditioning. It refers to the systems used to regulate temperature, humidity, and air quality in indoor spaces. HVAC systems provide thermal comfort and maintain air quality by circulating and filtering air, controlling temperature, and ensuring proper ventilation.

Source: U.S. Department of Energy

Building Management System (BMS)

A centralised digital platform that automates the control of energy efficiency and enhances occupant comfort. It oversees and manages various electrical and mechanical services, including heating, ventilation, and air conditioning systems, as well as lighting. Additionally, it can integrate other essential services, such as security, access control, elevator operations, and safety systems.

Radiant Cooling

A technology that works by absorbing heat emitted from the surrounding space through cooled surfaces such as floors or ceilings. When the cooling system is applied to the floor, it is known as radiant floor cooling, while cooling via the ceiling is typically achieved using radiant panels, often found in residential settings.

Source: U.S. Department of Energy

Green Financing

Loans or investments that support activities benefiting the environment, such as buying eco-friendly products, funding sustainable projects, or developing green infrastructure.

Source: UN Environment Programme

Energy Conservation Building Code (ECBC)

A building energy code that sets energy performance standards for different building components, tailored to specific climatic regions. By applying these standards, a building's energy demand is reduced without compromising occupant comfort, health, productivity, or the building's functionality.

Source: Bureau of Energy Efficiency, Ministry of Power, Government of India.