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CENTER FOR STUDY OF SCIENCE, TECHNOLOGY & POLICY

Policy Strategies to **Decarbonise the Buildings Sector**

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Contributors: Kunal Jagdale, Ramya Natarajan, Sarah Khan

Editor: Garima Singh

Designer: Alok Kumar Saha

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Center for Study of Science, Technology and Policy

Bengaluru

18, 10th Cross, Mayura Street,
Papanna Layout, Nagashettyhalli,
RMV II Stage, Bengaluru - 560094,
Karnataka (India)

Tel.: +91 (80) 6690 2500
Email: cpe@cstep.in

Noida

1st Floor, Tower-A,
Smartworks Corporate Park,
Sector 125, Noida - 201303,
Uttar Pradesh (India)

Introduction

The Sustainable Alternative Futures for India (SAFARI) model (Kumar et al., 2021) estimates that the buildings sector—directly and indirectly, through its interlinkages with industry and power sectors—accounts for around 30% of India's annual energy demand and 26% of the nation's greenhouse gas (GHG) emissions. With the increasing rate of urbanisation and the associated infrastructure development, this is expected to rise further.

For limiting global warming to 1.5 °C above pre-industrial levels, India's fair share of the remaining carbon budget has been estimated to be around 89 Gt CO_2e (Climate Equity Monitor, 2024). A study by the Center for Study of Science, Technology and Policy (CSTEP) found that in a business-as-usual (BAU) scenario, the direct and indirect emissions from the buildings sector alone will exceed this national budget by 2070.

The study explored alternative pathways for remaining within the budget and we presented two broad approaches in our report "Pathways to Steer India's Buildings Sector Towards a Net-Zero Future" (CSTEP, 2024). Of these, one is a buildings-led decarbonisation scenario (BLS), where the focus is on interventions solely within the buildings sector, and the other is an industry-led decarbonisation scenario (ILS), where the focus is on industries that have linkages with the buildings sector (like cement, steel, aluminium, and power). BLS—which entails a higher uptake of energy-efficient appliances and rooftop photovoltaics, and incorporates passive design strategies—could lead to a substantial reduction in buildings sector emissions, cumulatively using up 72% of the remaining carbon budget by 2070 (as against the overshoot seen in the BAU scenario).

In this policy brief, we examine the gaps and challenges in the existing policy landscape and put forth recommendations for operationalising the BLS pathway. We categorise our analyses into three buckets—existing buildings, new buildings, and city-level action plans.

Existing Buildings

Energy benchmarking has been attempted at different levels and geographies in India, but there is neither a standardised platform nor a comprehensive database on the sector.

Advancing energy benchmarking through a single platform

Initiate a single online platform for collating the existing buildings database and benchmarking studies, and introduce a voluntary data disclosure programme to create awareness among building owners. The platform would interlink the collated data with the prevailing indices to bring about comprehensive data transparency in the buildings sector. Further, owing to the dynamic nature of the voluntary data disclosure programme, this platform can also be utilised for research, baseline improvement, and periodic energy benchmark revisions.

Initialising a single platform, along with the voluntary data disclosure programme, involves the following steps:

a. Collating the existing benchmarking studies

Utilise the rich insights gained from previous benchmarking studies, including notable case studies such as that on the USAID ECObench tool launched in 2014 (Sarraf et al., 2014). Additionally, leverage regional studies, such as those conducted in the city of Kochi, the state of Andhra Pradesh, and the Union Territory of Puducherry, to inform the programme's framework. These case studies provide valuable lessons and benchmarks for diverse building typologies.

b. Incorporating green buildings data

Increase the programme's depth by incorporating data from green building databases as a second tier of informative content. While green ratings serve as an initial benchmark, they may not comprehensively reflect actual energy efficiency practices.

c. Establishing a voluntary data disclosure programme

Develop and implement a nationwide voluntary programme led by the relevant authority, encouraging building owners to disclose energy consumption data. The initiative can draw inspiration from similar successful programmes worldwide, such as the US Environmental Protection Agency's ENERGY STAR Portfolio Manager, which is a free interactive online tool that helps users measure and track energy consumption, thereby enabling the identification of investment priorities and verification of improvements over time. Opening up the platform to the public and allowing building owners to voluntarily disclose their data can facilitate comparisons with similar structures in the same climate zone and highlight success stories of buildings that have significantly improved energy efficiency, providing real-world examples of the programme's impact.

d. Linking the data with prevailing indices

A competitive assessment can be created by linking the benchmarking data with yearly energy awards at the state level and state energy-efficiency index at the national level for better quality assessment.

e. Using energy benchmarking as a yardstick

Buildings that meet the set benchmarks can be rewarded with complimentary units based on their patterns of energy consumption, rather than through blanket strategies like providing free units to all, irrespective of energy-efficient practices. Additionally, these buildings can be given a specific star rating that reflects their performance, as is being done under Australia's National Australian Built Environment Rating System (NABERS) and National House Energy Rating Scheme (NatHERS) (Commonwealth of Australia, 2022; Government of New South Wales, 2024).

Inducing behavioural change through energy-conscious bills

In BLS, the key emphasis is on incorporating thermal comfort considerations in policy formulation. The increasing use of air conditioners (ACs)—even where unnecessary (ignoring actual thermal comfort requirements)—will increase the electricity demand for space cooling. This demand surge from the indiscriminate use of cooling appliances will exceed the actual need to maintain thermal comfort (which is based on the building envelope characteristics), by 2050. Addressing this issue mandates a shift in behaviour towards mindful AC usage. Utilising behavioural insights, data analytics, and consumer engagement to encourage sustainable energy practices aimed at emission reduction is crucial for driving these changes.

Energy-Conscious (EC) Bills:

An EC bill is a vital tool for inducing behavioural change for energy optimisation. We recommend introducing EC electricity bills that utilise data analytics to provide consumers with detailed insights into their energy usage. To enhance the effectiveness of EC bills, a comparative analysis of energy consumed by neighbouring households can be incorporated, drawing inspiration from the EC electricity bills in developed countries like Australia and Singapore. Figure 1 provides an illustrative example of an EC bill.

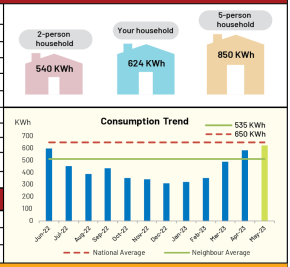
DISCOM Logo | **DISCOM Name** | Bill Date
Distribution Circle - Area name | Bill Number
Consumer Name
Consumer ID | Due Date
Billing Address

Billing Information

Units Imported (KWh)		Units Exported (For RTPV Consumer)	
Present reading	xxxx	Present reading	xxxx
Previous reading	xxxx	Previous reading	xxxx
A: Total units imported	xxxx	B: Total units exported	xxxx

C: Total Billed Units (A–B) xxx KWh

D: Consumption charges (CC) without subsidy	Rs.xxx
E: CC charges with subsidy	Rs.xxx
F: Fixed charges without subsidy	Rs.xxx
G: Fixed charges with subsidy	Rs.xxx
H: Other charges	Rs.xxx
I: Bill amount without subsidy (D + F + H)	Rs.xxx
J: Bill amount with subsidy (E+ G + H)	Rs.xxx
K: Advance amount	Rs.xxx
L: Adjusted amount	Rs.xxx
M: Outstanding amount	Rs.xxx
N: Total payable amount (J - K + L + M)	Rs.xxx



Previous Month Payment	
Bill month	xxxx
Bill amount	xxxx
Bill status	Paid

Meter Details

Meter No.	Initial Reading	Final Reading	Factor	Billed Units	Period	Meter Status
xxxx	xxx	xxx	1	xxx	1	A

Important Notice

AD

Saving Tips

Customer Care - xxxxxxxxxx

Figure 1: Sample energy-conscious electricity bill

The EC bills can also be informed by the experience of successful domestic pilots, such as the one conducted by BSES Rajdhani Power Limited (BRPL) in Delhi, where a territory-wide Home Energy Reports (HER) programme was initiated in collaboration with Oracle Utilities to showcase the positive impact of behavioural interventions on energy efficiency (Sachar et al., 2019). The distribution companies (DISCOMs) in the energy-benchmarked states are likely to have an edge in implementing the programme. Figure 2 presents the key steps for operationalising EC bills.

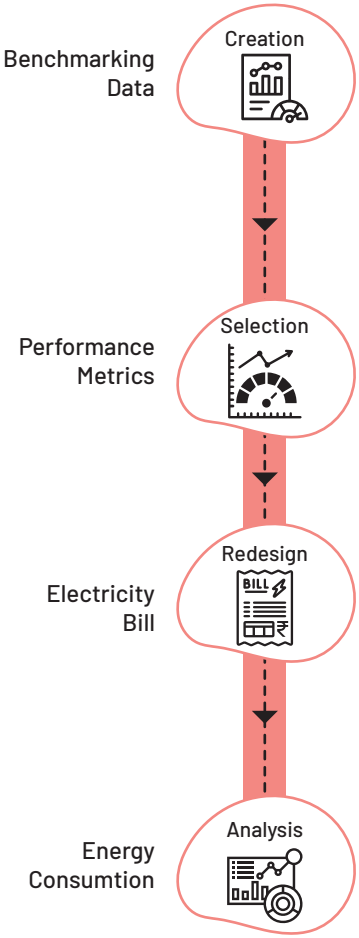


Figure 2: Steps for implementing EC bills

The following points should be noted while operationalising EC bills:

- In states where energy benchmarking is done, the concerned authority should create performance metrics on the basis of energy performance index. In other states, performance metrics like "state average" or "neighbourhood average" can be developed, based on climate type, category of residence, and energy consumption.
- Using these performance metrics, the existing electricity bills should be redesigned to reflect historical energy consumption, facilitate comparison with benchmark values, and provide energy-saving tips.
- A feedback mechanism that includes rewards (incentives or discounted tariffs) and recognition (certificates or ratings) should be developed to encourage energy savings.

New Buildings

Various policies and building codes have been formulated to promote sustainable construction of new buildings. However, their implementation has been challenging due to the complexity of the codes, diverse demographics, and a shortage of skilled professionals.

Strengthening the implementation of building codes

Our report identifies passive design as a crucial lever that can reduce buildings sector emissions by 12% in 2070, compared to the BAU scenario. As the building codes are a means to achieve this goal, we recommend strengthening their implementation through the following measures:

a. Modifying the scope of code compliance

The provision to modify the scope of Energy Conservation Building Code (ECBC) at the state level should be utilised to its maximum potential. Some states have modified the scope of ECBC according to state-specific requirements; for example, Chhattisgarh has reduced the connected load to 50 KW and the contract demand to 60 kVA. It has also included an additional clause for built-up area (greater than 1000 sqm) to cover major commercial buildings (Government of Chhattisgarh, 2023). Similarly, Telangana made

the code compulsory for certain building types, such as multiplexes, hospitals, hotels, and convention centres, irrespective of their built-up area (NRDC, 2018). Other states can take a cue from these steps and make appropriate changes in their next amendments.

b. Developing an online code compliance system

Telangana was the first state to address the complexities of building construction clearances for code compliance. The state established the Development Permission Management System (DPMS)—an online platform that integrates ECBC compliance into the application for construction permits—which was instrumental in overcoming the limited enforcement capacity of urban local bodies (ULBs) for ECBC compliance. DPMS expedites the building permission process and makes it transparent and accountable. This model can be replicated by other cities and states.

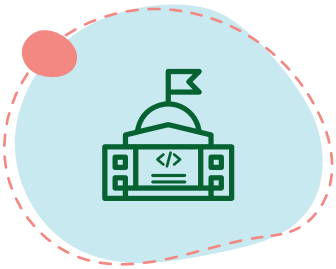
c. Improving the capacity of skilled professionals

The lack of skilled professionals and empanelled third-party accessors (TPAs) have posed a major roadblock in the implementation of codes. Governing authorities, like the Bureau of Energy Efficiency (BEE), can introduce a national certification programme for building auditors to provide them with accreditation for code compliance. As building codes are being modified at the state level, provisions can be made to train these certified auditors according to the state's requirements to create a pool of skilled workforce.

d. Linking the code-complaint buildings with star-rated buildings

As the codes are deemed mandatory, incentives can be offered at the incremental performance levels through a "Rewards and Recognition" mechanism. An important step towards developing such a system would be to fill the gap between the energy-efficiency statuses of upcoming buildings and existing buildings. This can be done by linking the recognition of star-rated buildings with that of code-compliant buildings after the substantiation of a building's energy performance by TPAs. For instance, Telangana offers a mandatory single-star rating for code compliance for all commercial buildings.

e. Including codes in government schemes for market transformation



Successful government schemes like the Pradhan Mantri Awas Yojana (PMAY) could mandate Eco Niwas Samhita (ENS) compliance for all affordable housing schemes. This would create a demand for a skilled workforce and sustainable materials to meet the ENS code compliance norms, which will drive the market towards more energy-efficient residential buildings.

Incorporating the above recommendations will improve the overall implementation of building codes. Developing tangible benefits, which offer a better return on investment—both in terms of money and time savings—would motivate building owners to adopt the codes. This, in turn, would improve the energy performance of the building, thereby garnering support for energy benchmarking in the future. Providing a premium to energy-efficient buildings would help to promote circularity as well.

City-Level Action Plans

According to the Climate Smart Cities Assessment Framework (CSCAF), currently, all cities are required to create city-level climate action plans. CSCAF includes 126 cities, of which, some have already published their action plans and others are still working on them. While this is undoubtedly a positive step, there are obstacles; for instance, embodied emissions in buildings are presently undefined, requiring reforms to incorporate frameworks for the estimation of embodied carbon during the preparation of these city-level action plans.

Inclusion of embodied emissions in city-level climate action plans

The proposed city-level climate action plans under the latest CSCAF emphasise the promotion and adoption of green buildings under the "energy and building" section. However, due to the qualitative nature of parameters, these plans do not explicitly address the embodied emissions stemming from construction materials and methods of construction. Resolving this requires integrating a comprehensive approach that addresses embodied emissions into the CSCAF, which would reflect in the city action plans, thereby helping cities to make informed decisions and contribute actively to emission-reduction goals. Promoting sustainable

construction practices and developing India-specific material emission databases, alongside improvements in operational efficiency, will help in moving towards a net-zero buildings sector.

The following measures can pave the way for better city action plans:

a. Creating an India-specific embodied emissions database

Collaborate with research institutions, governmental bodies, and industry stakeholders to establish a dedicated India-specific embodied emissions database. While existing tools like GaBi, Ecoinvent, and the Edge database (Ecoinvent, 2024; GaBi Databases, 2021; IFC, 2016;) provide data on construction materials, there is a significant gap in the availability of comprehensive data regarding the entire life cycle of buildings. Thus, it is crucial to develop a comprehensive database encompassing embodied emissions across all stages of a building`s life cycle.

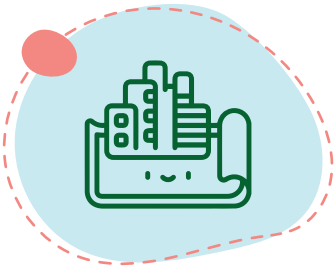
b. Introducing mandatory data disclosure policy for manufacturers

Bring in a policy that requires manufacturers to disclose the embodied carbon footprint of their construction material. Such transparency will empower builders, architects, and policymakers to make informed choices, encouraging the industry to prioritise low-carbon alternatives and contribute to the overall emission-reduction goals.

c. Incorporating innovative construction technologies

The upcoming technologies have substantial decarbonisation potential (for instance, prefabricated building technology can reduce carbon emissions by 15.6%). To further operationalise these technologies, separate testing facilities for alternative materials would be needed, along with fast-tracking of legal approvals for employing such technologies. Identifying and addressing their limitations would also be crucial for improving circularity in cities.

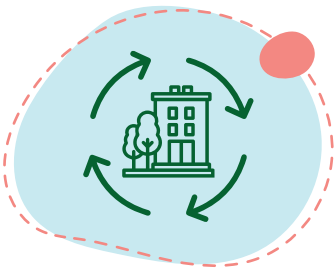
d. Promoting innovative city-level plans



The "Zero Carbon Buildings Action Plan" developed for Nagpur (Kashikar et al., 2023) includes strategies and actions to reduce embodied emissions from buildings. These actions are informed by the local context and involve transformative measures. Authorities should promote similar initiatives and make provisions to include them in CSAF, which will encourage other cities to adopt similar plans and accelerate the journey towards net zero through cities.

e. Developing standardised life-cycle-assessment methodology

Develop and endorse a standardised life-cycle-assessment (LCA) methodology tailored to the Indian context. The methodology should consider the unique characteristics of the construction industry in India and facilitate consistent and comparable assessments of embodied emissions from various materials.



The need to decarbonise India's buildings sector cannot be overstated, given its significant contribution to energy demand and GHG emissions. The findings from the SAFARI model underscore the urgency of taking decisive action in this regard, to align with global climate goals.

The strategies proposed in this policy brief range from advancing energy benchmarking and inducing behavioural change to strengthening building code implementation and enhancing city-level action plans for explicitly including embodied emissions. However, their effective implementation will require collaborative efforts from government bodies, industry stakeholders, and the public, emphasising the need for collective commitment and action towards a greener and more resilient future.

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CENTER FOR STUDY OF SCIENCE, TECHNOLOGY & POLICY

Bengaluru

#18, 10th Cross, Mayura Street, Papanna Layout,
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Noida

1st Floor, Tower-A, Smartworks Corporate Park,
Sector 125, Noida 201303, Uttar Pradesh (India)

www.cstep.in | +91-8066902500 | cpe@cstep.in | @cstep_India