RICS POLICY PAPER

Decarbonising the built environment in India

Addressing operational and embodied carbon

November 2023

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Glossary

Term	Definition
Building life cycle	The BS/EN 15978 standard divides the building life cycle into four stages: • Stage A: Product and construction process • Stage B: Use • Stage C: End of life • Stage D: Benefits and loads beyond the system boundary. Each stage is further divided into modules.
Carbon emissions	Although carbon dioxide is only one among a number of greenhouse gases, the term 'carbon emissions' is used throughout this paper as a proxy for human-produced greenhouse gases.
Carbon intensity	The quantity of carbon emissions associated with an activity or product, often compared to its alternatives. For example, travelling by car is more carbon-intensive than travelling by train.
Embodied carbon	The total greenhouse gas emissions and removals associated with materials and construction processes throughout the whole life cycle of a building.*
Greenhouse gases (GHGs)	Constituents of the atmosphere, both natural and anthropogenic (human-created), that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere and clouds.
Life cycle assessment (LCA)	An assessment of the environmental impact of a product or service.
Net zero whole-life carbon building	A building where the sum total of all building-related greenhouse gas emissions over a building's life cycle, both operational and embodied, is minimised; meets local carbon, energy and water targets; and, with residual offsets, equals zero.*

Term	Definition
Net zero carbon operational energy building	A building where: • no fossil fuels are used • all energy use has been minimised • it meets the local energy use target • all energy used is generated on or off site using renewables that demonstrate additionality (they are newly built for this purpose), and • any residual direct or indirect emissions from energy generation and distribution are offset (see Offset carbon emissions).*
Offset carbon emissions	Reduced or avoided emissions meant to compensate for an equivalent quantity of emissions occurring elsewhere.
Operational carbon	The GHG emissions arising from all energy and water consumed by an asset in use, over its life cycle.*
Whole life carbon emissions	The sum total of all building-related greenhouse emissions, both operational and embodied, over the life cycle of a building, including its decommission. Overall whole life carbon building performance includes separately reporting the potential benefit from future energy recovery, reuse and recycling.*

* Definitions adapted from RICS' Whole life carbon assessment for the built environment, 2nd edition, 2023.

Introduction

The purpose of this paper is to discuss the need to decarbonise the Indian built environment, examine existing policies and recommend further interventions. The scope includes all emissions produced by the Indian residential, commercial building and infrastructure stocks, so both embodied carbon and operational carbon are included.

The built environment consists of real estate and infrastructure, and it impacts all aspects of human life, from homes and offices to factories and highways. According to McKinsey's 2023 report Building value by decarbonizing the built environment, the built environment is also responsible for about a quarter of the world's greenhouse gas (GHG) emissions. Decarbonising the built environment is challenging but feasible, and has the potential to generate significant value, but the government and industry must come together to scale solutions up.

India is currently one of the fastest growing economies in the world, home to almost one-sixth of the global population, and its pace of economic growth is an integral part of global development. India's development agenda faces several challenges, including climate change. India is committed to mitigating climate change by ensuring that economic growth and social development follow pathways that reach net zero emissions by 2070, as announced in 2021 at COP26 (see the Ministry of Environment, Forest and Climate Change (MoEFCC), India's long-term low-carbon development strategy).

Despite low per capita annual emissions at 1.8 tons of CO_2e (versus the USA at 14.7 and China at 7.6), India is the third-largest emitting country globally in terms of total national emissions. Therefore, to avoid the worst effects of climate change, India will need to play an essential role (see McKinsey's Decarbonising India).

It must also be recognised that India has contributed little to climate change historically. The Intergovernmental Panel on Climate Change's (IPCC) Sixth assessment report clearly noted that Southern Asia's contribution was only about 4% of historical cumulative net anthropogenic emissions between 1850 and 2019, even though the region now includes almost 24% of the global population. North America and Europe contributed almost ten times more to global cumulative emissions in this period, though they represent only about 13% of the global population (see MoEFCC, *India's long-term low-carbon development strategy*).

However, recognising that climate change needs global collective action, India has ratified the Paris Agreement for implementation in accordance with the principles of:

> 'equity and [...] common but differentiated responsibilities and respective capabilities, in the light of different national circumstances'. (Paris Agreement, Article 2.2)

These principles recognise that countries have different duties and abilities, but all have an obligation to address climate change, as enshrined in the United Nations Framework

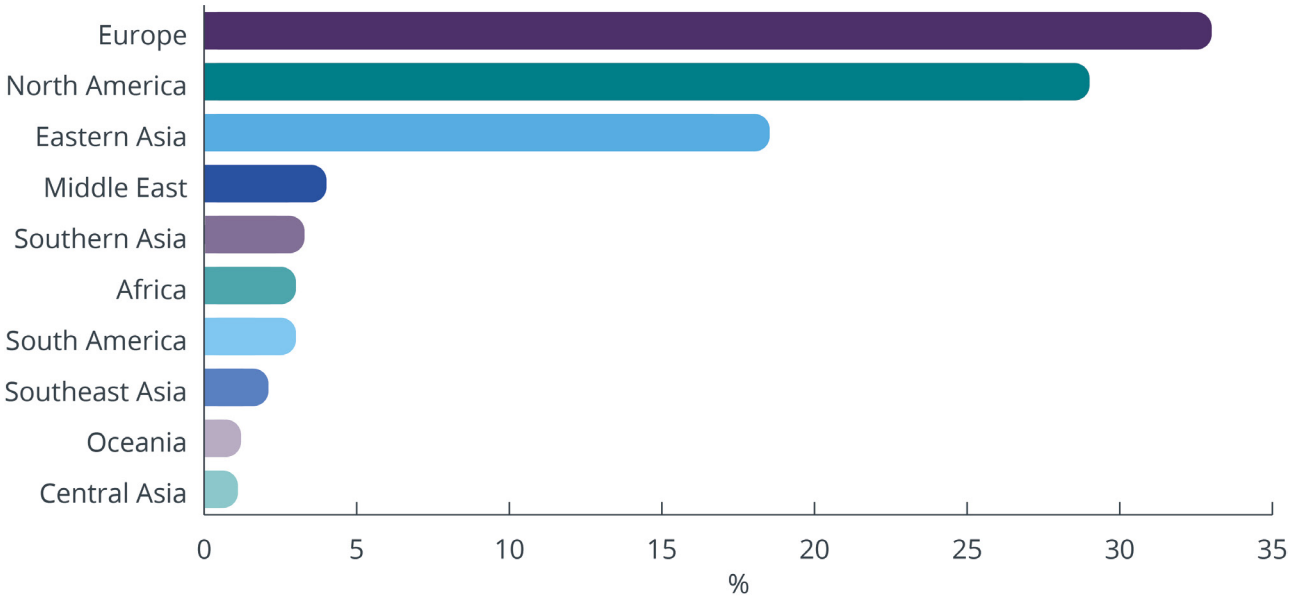

Figure 1: Cumulative CO_2 emissions from 1751 to 2017 by region
(*Source: based on Our World in Data's* CO_2 emissions*, calculated from the Global Carbon Project and Carbon Dioxide Analysis Center*)

Convention on Climate Change (UNFCCC) (see MoEFCC, *India's long-term low-carbon development strategy*).

India has taken various steps to meet its commitments under the Paris Agreement, including:

- establishing a national designated authority to implement Article 6 of the Paris Agreement and
- updating the nationally determined contribution (NDC) for 2030, which commits to:
  - reaching 50% of cumulative electric power installed capacity from non-fossil fuel-based energy sources and
  - achieving a 45% reduction in gross domestic product (GDP) carbon intensity from 2005 levels.

Current state of the built environment

According to data in the MoEFCC's India: third biennial update report (as submitted to the UNFCCC), the real estate and construction sectors account for 32% of total national GHG emissions, covering both operational and embodied carbon (see Alliance for an Energy Efficient Economy, Tackling embodied carbon from India's building sector).

India has already surpassed the UK to become the fifth largest economy in the world. The country is witnessing rapid urbanisation as millions of Indians move to cities in search of high-quality jobs, and construction is poised to be a major driver of long-term growth. According to the 2011 census, about 377 million people (31.14% of the total population) live in urban areas. This is projected to grow to about 600 million by 2031. While cities are engines of economic growth, they also contribute to more than 70% of India's GHG emissions, according to the Ministry of Housing and Urban Affairs' (MoHUA) National mission on sustainable habitat.

Currently, Indian buildings account for around one-third of total annual carbon emissions and are projected to emit seven times more carbon by 2050 compared to 2005 levels. However, forward-looking built environment players are increasingly backing the move towards net zero with ambitious sustainability commitments (see RMI India, India's building sector moonshot).

India's real carbon-saving potential lies in the assets that are yet to be built. Estimates suggest that about 70% of India's 2030 urban infrastructure (consisting of drinking water facilities, sanitation, sewage systems, electricity and gas distribution, urban transport and primary health services) is yet to be built, which highlights the need to minimise the associated embodied carbon (RMI India, *India's building sector moonshot*).

Currently, governments and private stakeholders are largely focused on reducing operational carbon emissions, while in comparison, embodied carbon remains more challenging to track, record and report. Across the life cycle of a project, typically 50–70% of total embodied carbon is emitted before completion. Of this, 85–90% of embodied 'upfront' emissions arise during the manufacturing stage, 7–10% during transportation and 3–5% during the construction stage (see KPMG, Embodied carbon management for global infrastructure). Thus, businesses need to effectively address carbon emissions throughout the life cycle of a building, from procurement to construction, maintenance and demolition.

Desired future state

India's 2015 NDC commitments included reducing GDP carbon intensity by 33–35% from 2005 levels and achieving a 40% share of cumulative electric power installed capacity from non-fossil fuel-based sources by 2030. In line with this, India's GDP carbon intensity had already reduced by 24% from 2005 levels in 2016 (see MoEFCC, *India's long-term low-carbon development strategy*).

In August 2022, India updated its NDC to reach net zero emissions by 2070, committing to:

- meeting 50% of India's cumulative electric power installed capacity from non-fossil fuel-based sources by 2030 and
- reducing GDP carbon intensity by 45% below 2005 levels by 2030 (see MoEFCC, *India's long-term low-carbon development strategy*).

In India, embodied and operational carbon emissions from the built environment are estimated to have a share of 40% and 60%, respectively. This is primarily due to the prominent use of carbon-intensive building materials such as concrete and steel (Alliance for an Energy Efficient Economy, *Tackling embodied carbon from India's building sector*). However, more detailed studies are needed to estimate embodied emissions across the building life cycle in typical Indian projects to get a clearer picture and take informed policy decisions for future constructions.

Current and planned policy measures

India has deployed a range of a policies to decarbonise its built environment. The most relevant initiatives are described below.

The National Building Code of India, 2016

This comprehensive building code is a national instrument that provides guidelines for regulating construction activities across the country. First published in 1970, the revised 2016 code was released to reflect contemporary international practices. It serves as a model code for adoption by all agencies involved in regulating building construction works in India.

The National Building Code of India (NBC) contains:

- administrative regulations
- development control rules
- general building requirements
- fire safety requirements
- stipulations regarding materials, structural design and construction (including safety)
- building and plumbing services
- sustainability requirements and
- asset and facility management guidelines.

The NBC is included in municipal construction regulations in most Indian states, making it mandatory and enforceable.

The updated NBC has incorporated the Energy Conservation Building Code (ECBC) through a new chapter entitled 'Approach to sustainability' (MoEFCC, *India: third biennial update report*), which sets minimum energy standards for new commercial buildings. The ECBC only applies to new constructions and does not cover existing buildings and renovation projects (MoHUA, *National mission on sustainable habitat*).

Eco Niwas Samhita

Eco Niwas Samhita (ENS) is the energy-conservation code for residential buildings. ENS part 1 has been developed to set minimum building envelope performance levels to limit heat gain (in warm climates) and heat loss (in cold climates) and to ensure adequate natural ventilation and daylighting. ENS part 2 provides minimum requirement(s) for building services and electromechanical and renewable energy systems for new residential buildings.

ENS is applicable to all residential projects built on plots greater than 500m^2. State adoption of the ECBC and ENS is voluntary; so far, 17 state governments have mandated the ECBC (MoEFCC, *India: third biennial update report*).

Star rating of commercial buildings

The Bureau of Energy Efficiency has developed a voluntary star rating programme for existing buildings, based on energy usage expressed in kWh/m^2/year. This programme rates buildings on a scale of 1–5 stars, where a 5-star building is the most efficient. Star label requirements for office buildings, business process outsourcing, hospitals and shopping malls have been developed. As of August 2020, a total of 264 buildings had been rated under different categories of commercial buildings (MoEFCC, *India: third biennial update report*).

Green Rating for Integrated Habitat Assessment

The Green Rating for Integrated Habitat Assessment (GRIHA) stipulates guidelines for new buildings. GRIHA was adopted as a national rating system for green buildings by the Government of India in 2007. It assesses the performance of buildings against specific national benchmarks, evaluating environmental performance over a building's life cycle. Based on established energy and environmental principles, the rating system seeks to strike a balance between established and emerging practices, both national and international. The following stages and aspects of the life cycle have been identified for evaluation.

- The pre-construction stage, which covers intra- and inter-site issues such as proximity to public transport, type of soil and land use, flora and fauna on the land before construction activity starts, natural landscape and land features.
- Building planning and construction stages, which cover issues of resource demand, recovery and reuse, and provisions for occupants' health and well-being. The primary resources that are considered in this stage are land, water, energy, air and vegetation.
- The building operation and maintenance stage, which covers issues of operation and maintenance of building systems and processes, monitoring and recording of energy consumption, occupants' health and well-being and issues that affect the global and local environment.

The adoption of GRIHA on a large scale will benefit the community at large by reducing carbon emissions, energy consumption and the use of natural resources. More specifically, some of the benefits of achieving a high GRIHA rating are:

- reduced energy consumption without sacrificing comfort levels
- reduced destruction of natural areas, habitats and biodiversity
- reduced soil loss from erosion
- reduced air and water pollution (with direct health benefits)
- reduced water consumption
- limited waste generation due to recycling and reuse
- reduced pollution loads
- increased user productivity and
- enhanced image and marketability.

Initiatives of the Ministry of Housing and Urban Affairs

The Ministry of Housing and Urban Affairs (MoHUA) has been promoting new and emerging technologies in the construction sector through several initiatives such as Pradhan Mantri Awas Yojana, the Atal Mission for Rejuvenation and Urban Transformation and the Smart City Mission.

The Global Housing Technology Challenge under Pradhan Mantri Awas Yojana

The objective of the Global Housing Technology Challenge (GHTC) is to identify innovative construction technologies, replacing conventional practices and building materials that are heavily polluting. Typically, conventional construction systems (such as brick and mortar) are slow paced, energy intensive, dependent on virgin resources and have a large carbon footprint. Fifty-four emerging technologies were identified for the construction of housing units on a large scale. Six pioneering projects of about 1,000 houses each (together with the necessary infrastructure) using six distinct technologies identified under the GHTC have been planned and financed so far. Future technologies will be supported, fostering an environment of research and development in the country through incubation and acceleration support at prestigious Indian academic institutions and the Council of Scientific & Industrial Research lab.

The Atal Mission for Rejuvenation and Urban Transformation

The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) scheme is an initiative to provide basic civic amenities to urban areas in order to improve quality of life, with a major focus on poor and disadvantaged strata of the population. The scheme includes the following (see MoHUA, *National mission on sustainable habitat*).

- The replacement of conventional lights with LEDs: 6.2 million streetlights have been replaced with LED lights, out of a targeted 9.8 million. This is estimated to save around 1.35 billion kWh units of energy per year and reduce about 1.1 million tonnes of CO_2 emission per year.
- An energy audit of water pumps and the replacement of inefficient pumps: this has been completed in 370 cities (27 states/union territories), with 11,567 pumps (in 26 states/union territories) being identified for replacement.

The Smart City Mission

The Smart City Mission (SCM) is a joint initiative between the central and state governments. Its objective is to develop cities that provide core infrastructures, clean and sustainable environments, and give a decent quality of life to their citizens through the application of 'smart solutions'.

The SCM aims to drive economic growth and improve quality of life through comprehensive work on the social, economic, physical and institutional pillars of a city. The focus is on sustainable and inclusive development, creating replicable models that other aspiring cities can follow. One hundred cities have been selected for development as smart cities through a two-stage competition.

In the case of greenfield development (over 250 acres) or brownfield redevelopment (over 50 acres), at least 80% of new buildings are required to be energy efficient in accordance with existing codes such as the ECBC and ENS. A minimum 10% of a city's energy needs must be met through solar-powered facilities.

The National Mission on Sustainable Habitat

The National Mission on Sustainable Habitat (NMSH) is one of eight national missions under the National Action Plan on Climate Change, which was released by the Prime Minister in 2008. The NMSH has identified five thematic areas:

1 energy and green building

2 urban planning, green cover and biodiversity

3 mobility and air quality

4 water management and

5 waste management.

Key mitigation and adaptation strategies to facilitate the development of sustainable habitats have also been recommended under each thematic area.

The green credit programme

This is a planned policy measure by the MoEFCC, and the draft programme is out for public consultation as of June 2023. It is proposed that the programme be launched at a national level to leverage a competitive market-based approach for green credits, thereby incentivising voluntary environmental action from various stakeholders.

A green credit is a singular unit of an incentive provided for a specified activity that delivers a positive impact on the environment. Each credit will be assigned monetary value, which can then be sold on a trading platform. Green credits will arise from a range of sectors and entities, ranging from small to large scale – such as individuals and private sectors, industries and organisations.

To begin with, green credits will be made available to individuals and entities who are engaged in selected activities and who undertake environmental interventions. Some of the selected sectors include green cover through tree plantation, promoting water conservation, sustainable building, infrastructure and more. These green credits will be made available for trading on a domestic market platform. An activity that generates green credits under the programme may also receive carbon credits from the same activity under a future carbon market.

Retrofitting existing buildings

Founded in 2009, Energy Efficiency Services Limited (EESL) is promoted by the Ministry of Power, Government of India, as a joint venture of four public-sector companies: NTPC Limited, Power Finance Corporation Limited, REC Limited and POWERGRID Corporation of India Limited. EESL is implementing a buildings energy efficiency programme to retrofit commercial buildings in India in order to reduce their energy consumption. In August 2017, the Government of India issued instructions to all its departments and ministries to ensure that all buildings become energy efficient. To date, EESL has completed energy-efficiency projects in 10,344 buildings, including railway stations and airports. Energy audits show energy saving potential of up to 30–50% in these buildings, thanks to major interventions in lighting and air-conditioning systems (MoEFCC, *India: third biennial update report*).

Gap analysis

First, India needs a more focused approach to decarbonise its built environment. The real estate and construction sectors account for 32% of the total national GHG emissions, but the NDC does not have specific targets for carbon reduction related to the built environment.

Currently, as part of the policy landscape of the real estate and construction sectors in India, decarbonisation initiatives like AMRUT, the ECBC and ENS mostly aim to reduce operational carbon, with very little focus on embodied carbon; for example, the ECBC and ENS measure building performance based only on the operational phase and do not consider embodied carbon. This is a significant gap in Indian policy, given the forecasted increase in new construction in the coming decades. Unless embodied carbon is regulated, India will likely spend a large share of its carbon budget on upfront emissions that could otherwise be progressively reduced through policy intervention. However, it will be undeniably challenging to address embodied carbon in a fast-growing built environment such as that of India.

India lacks national standards for embodied carbon assessment and reporting, such as the third International Cost Management Standard and RICS' Whole life carbon assessment (WCLA), as well as professional guidance to reduce embodied carbon. Even globally, existing certifications, regulations and standards mainly focus on carbon reporting and benchmarking in the operational phase, and only a handful address embodied carbon through practices such as recycled material use, waste reduction and material efficiency, for example, Nollco2, BREEAM, PAS 2080: *Carbon management in buildings and infrastructure*, DGNB and IFC Edge. Research suggests that only less than 5% of globally available frameworks address embodied carbon reduction in construction projects (KPMG, *Embodied carbon management for global infrastructure*). Initiatives like the GHTC are helping to identify the latest technologies and sustainable building materials, but there is a need to push these practices on a larger scale, considering India's size.

With regards to operational carbon emissions, the current forms of the ECBC and ENS are not sufficient to address climate change. This is because they measure and regulate building performance only through energy (i.e. kWh/m^2/year), without the use of a carbon metric. While reducing energy consumption is key to lowering associated emissions, a carbon metric (i.e. $kgCO_2eq/m^2$/year) is necessary to understand the climate impact of the operational phase of a building. Consequently, it is impossible to evaluate whether the current levels of performance that are mandated by the ECBC and ENS can be aligned with decarbonisation targets, or even representative of a reasonable level of performance in the Indian context.

Moreover, according to MoEFCC's *Third biennial update report*, only 17 states have so far adopted the ECBC and/or ENS; therefore, the level of control on energy use (and relative emissions) from new buildings in the remaining states remains a serious concern.

Carbon emissions come from all phases of the construction process, from carbon emission material production processes and suboptimal technology choices to inefficient building design, construction practices and energy use after construction is completed. There is a need to industrialise low carbon emitting technologies and materials (i.e. produce and implement them at scale with a focus on quality, cost and time to market). There is also a need to push on a much wider scale schemes like star ratings that focus on reducing emissions from existing buildings.

Recommendations

Policy interventions are needed from the central Indian government and state governments, but local authorities and the private sector also have key roles to play.

- The construction industry should adopt and scale up low carbon technologies and materials. As detailed in McKinsey's 2023 report *Building value by decarbonizing the built environment*, there are 22 opportunities to reduce operational carbon emissions by up to 90% and embodied emissions by up to 60% if these are implemented at scale.
- Cities are also engines of economic growth, and it is estimated that 75% of India's GDP in 2030 will be generated in urban regions. It is evident that these regions will contribute even more to total carbon emissions, as buildings account for more than 40% of India's total energy consumption in cities (MoEFCC, *India's long-term low-carbon development strategy*). Exploring and encouraging sustainable urban design will be critical in the context of reducing emissions from expanding cities.

In terms of how to reform existing policies to enable emissions reductions across the life cycle of buildings and infrastructure, RICS recommends the following actions to the central and state governments and national bodies.

1 **Address operational carbon through building regulations**.

   – A national body, such as the Bureau of India Standards (BIS), should improve existing buildings codes (e.g. the NBC) to address operational carbon from the initial design stage of new buildings. This means introducing measurement of building performance through carbon emissions as a complementary metric to energy consumption.

   – State governments should formulate comprehensive guidance for retrofitting existing buildings through passive measures.

2 **Address operational carbon through efficient building managemen**t.

   – State governments should mandate the measurement and reporting of energy use and consequent emissions on an annual basis for large non-residential buildings. Successively, state governments should consider introducing fiscal incentives to owners and tenants in order to reduce energy use and carbon emissions from buildings through efficient management.

3 **Address embodied carbon through building regulations.**

- First, a national standard-setting body (e.g. the BIS) should establish a national methodology for assessing and reporting embodied carbon in new constructions, covering both buildings and infrastructure. RICS's WLCA provides a detailed methodology for the measurement and reporting of embodied carbon, which could be adapted to suit the Indian context.

- Second, the central government should mandate the measurement and reporting of embodied carbon in all its construction projects above a specific size, using the established methodology. This would allow the collection of suitable data to evaluate the typical levels of embodied carbon across different building and infrastructure types.

- Successively, the central government should introduce maximum limits for embodied carbon, at least for large projects, which should be verified both at the design stage and post-completion. Limits should be established on the basis of good practice benchmarks, and then progressively increased to align with science-based climate trajectories.

- To support these actions, there is a need for a national database and reporting platform for carbon emissions from the built environment to be established, similar to the Built Environment Carbon Database initiative that is taking place in the UK. Lack of access to product-level carbon data is one of the major barriers to WLCA adoption on a large scale. In order to mandate WLCA for new constructions, the government will need to support the industry by providing reliable sources of data for the carbon footprint of construction products. Moreover, the results of WLCA mandated by law will need to be submitted digitally and publicly accessible in order to facilitate the activity and promote transparency.

Delivering confidence

We are RICS. Everything we do is designed to effect positive change in the built and natural environments. Through our respected global standards, leading professional progression and our trusted data and insight, we promote and enforce the highest professional standards in the development and management of land, real estate, construction and infrastructure. Our work with others provides a foundation for confident markets, pioneers better places to live and work and is a force for positive social impact.

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