Linesight | RICS

Building a decarbonization culture into India's construction industry

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Introduction

For India, where construction output has almost doubled in the past 13 years and CO_2 emissions* have increased by 1.8 times, there is a fundamental challenge in finding climate mitigation solutions that do not constrain growth. Construction companies may hold the key.

In 2022, the UN Environment Programme released figures estimating the construction industry to be responsible for about 37% of the world's carbon dioxide (CO_2) emissions. CO_2 is a type of greenhouse gas that — when in balance — protectively blanket Earth's atmosphere. Human activities that increase CO_2 emissions are a significant driver of climate change.[1]

In the year prior to the UN report, the Government of India had already announced the country's goal of net-zero emissions by 2070.[2] But as the International Monetary Fund has more recently noted, the country's current growth trajectory will lead to an anticipated 41% increase in greenhouse gas emissions from 2022 to 2030.[3]

Could a greener construction industry focused on reducing embodied carbon emissions be the basis for turning that trend around?

*Annual CO_2 emissions from the burning of fossil fuels and industry.
For 2023 CO_2 emissions are estimated based on Global Carbon Budget 2023

1 - Climate Change Indicators (arcgis.com)
2 - PIB Delhi- Net Zero emission target, posted on 03 Aug 2023
3 - IMF: A framework for climate change mitigation in India

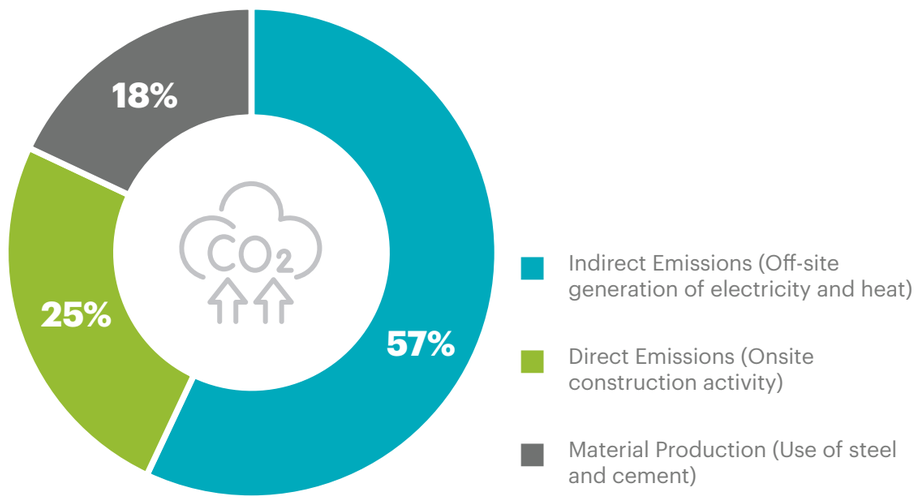
Decarbonizing construction globally

Efforts to decarbonize construction globally have historically focused on having more efficient heating, cooling and lighting in finished buildings — known as operational emissions.

Less of a focus has been on the emissions associated with production, distribution, use and demolition/disposal of building materials, known as embodied emissions.

In 2019, the Intergovernmental Panel on Climate Change's (IPCC's) sixth assessment report showed that 75% of most CO_2-eq emissions associated with construction came from offsite activities.

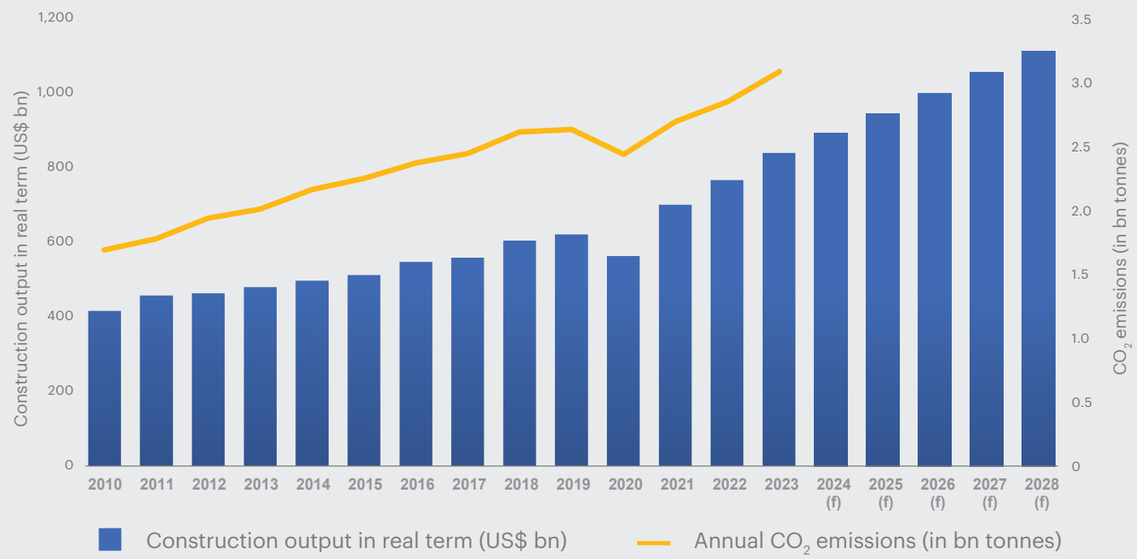
Breakdown of CO_2-eq emissions in construction industry



The challenge of decarbonization in India's construction sector

India is projected to be one of the fastest-growing large economies, with the construction industry being one of the key contributors. In the last 13 years, India's construction output (in real terms) has almost doubled, and during the same period, annual CO_2 emissions increased by 1.8 times. India's construction sector is forecast to increase construction output by 24% between 2024 and 2028 with a corresponding increase in CO_2 emissions.

Construction output vs annual CO_2 emission growth



Source: Global Data, IEA,Global Carbon Budget-2023, CO_2 emissions from the burning of fossil fuels and industry. For 2023 CO_2 emissions are estimated based on Global Carbon Budeget 2023

Embodied v operational energy

EMBODIED ENERGY
Refers to the total energy consumption (not limited to CO_2) required to produce a building from raw material extraction to construction to operations to disposal.

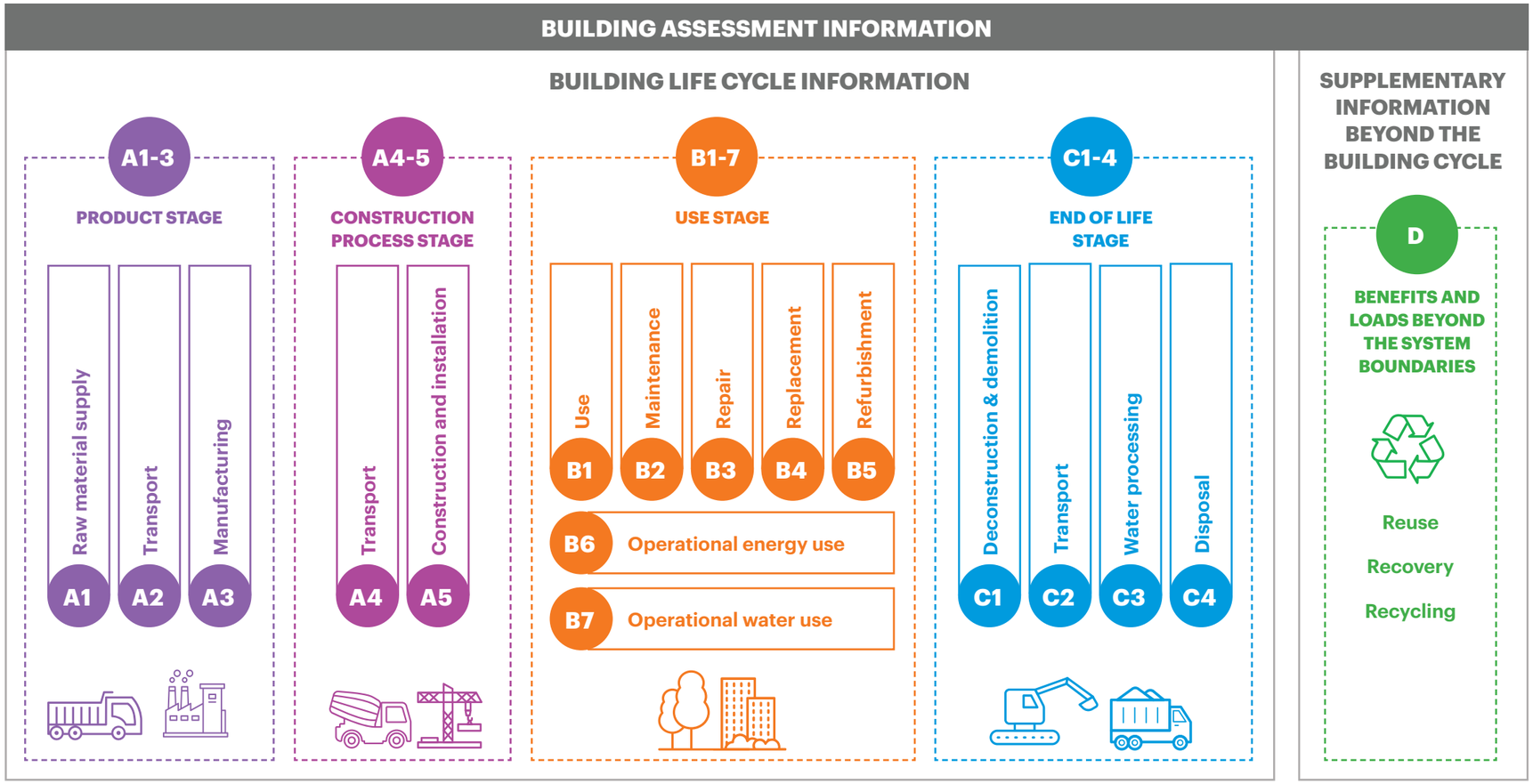
EMBODIED CARBON
Emissions generated throughout the lifecycle of building materials, encompassing extraction, manufacturing, transportation, construction and demolition (depending on the disposal method).

OPERATIONAL CARBON
Emissions released during the 'Use Stage' of a building, including heating, cooling, and lighting.

Both embodied and operational carbon emissions significantly contribute to the overall carbon footprint of the Indian building and construction industry, with a ratio of approximately 40:60.[4] India, like other countries, has largely been concentrating its efforts on mitigating operational carbon emissions.

Meanwhile, demand for cement and steel — i.e., heavy contributors to embodied carbon emissions — is expected to increase to 1,360 million tonnes and 755 million tonnes by 2050, up from 328 million tonnes and 99 million tonnes of material in 2019, respectively.[5]

Embodied carbon and operational emissions



4 - Alliance for an energy efficient economy
5 - The Energy and Resource Institute (TERI), International Energy Agency (IEA), World Business Council for Sustainable Development (WBCSD)

Identify, quantify and mitigate

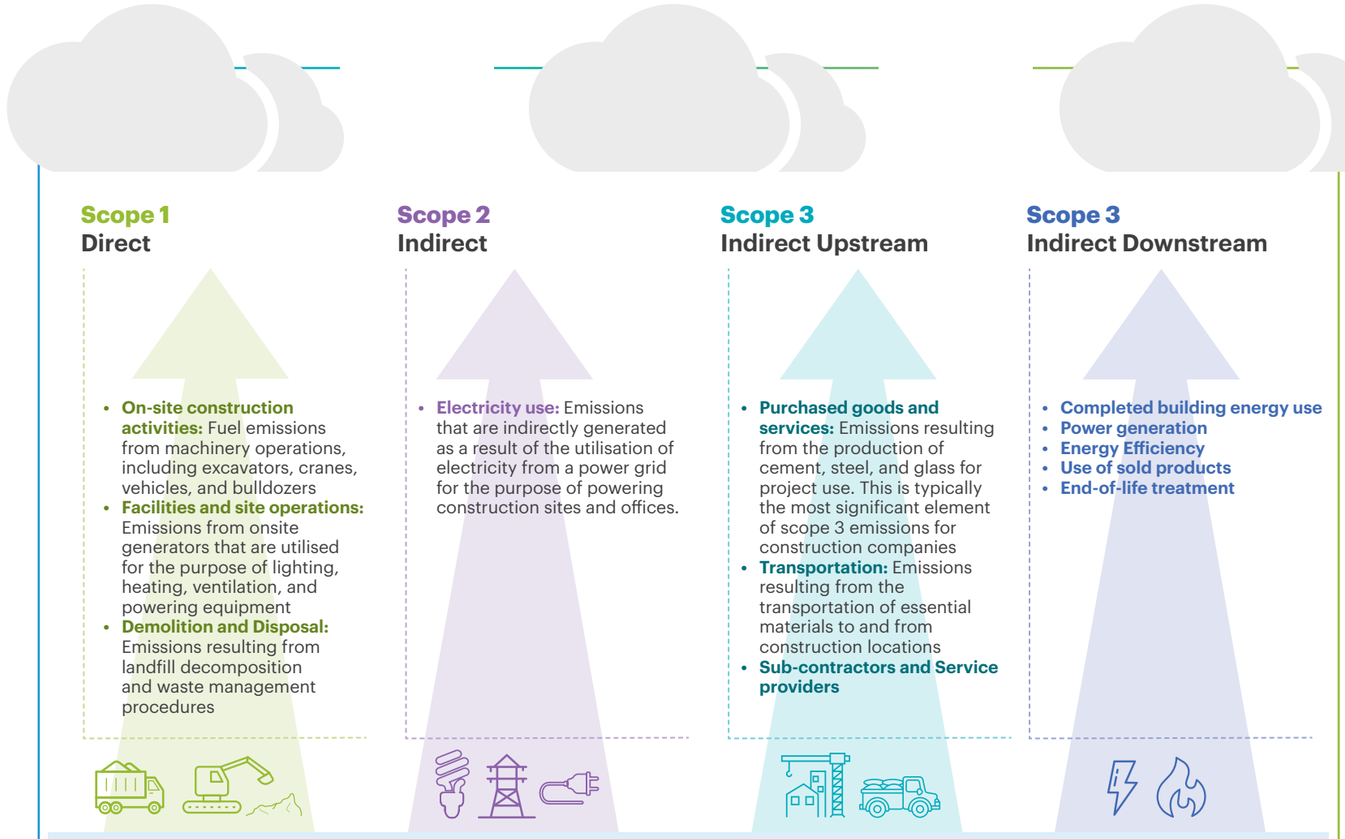
Construction companies have a prime opportunity to adopt a whole-of-lifecycle approach to their builds that will mitigate both operational and embodied carbon emissions. Three key elements of this approach are 'Identify', 'Quantify' and 'Mitigate'.

Identify

Identifying the carbon footprint in the Indian construction industry involves a comprehensive assessment of emissions. The construction industry significantly contributes to the carbon footprint through various stages and processes, from material extraction to building operations.

To effectively reduce emissions, it is crucial that construction companies first understand and measure the types of emissions they generate, both directly in their operations and indirectly through their value chain. This will demonstrate the amount of financial or operational influence companies have over their portion of emissions.

Carbon accounting measurement categorisation	
Scope 1	on-site production activities where a company is assumed to have full operational control
Scope 2	off-site production inputs that are then transported and sold to the company
Scope 3	Indirect emissions upstream and downstream where mitigation relies on collaboration and value-chain engagement



Source: Climate Clamp, Climate Partner, CDP Techincial Note: Relevance of Scope3 Categories by Sector, Construction companies sustainability reports

The majority of construction emissions are classified as Scope 3, including materials production, transportation, and supplier activities. Though difficult to measure and manage, these emissions can be reduced by choosing locally sourced materials and suppliers. Although Scope 3 emissions are the largest contributors to a construction company's carbon footprint, it is equally important to consider Scope 1 and 2 emissions where a company may have better control and influence.

Quantify

Embracing science-based targets not only provides a well-defined roadmap but also fosters credibility and keeps pace with evolving global standards. When regulatory frameworks mandate transition planning, these targets offer a robust and transparent framework for emission reduction.

It is imperative for construction firms to prioritize the development of actionable plans that are both quantifiable and grounded in scientific principles.

The Science Based Targets initiative (SBTi), recognized as a key authority in corporate emission reduction, is actively crafting tailored guidance for the construction industry. Adhering to SBTi's guidance enables companies to not only contribute meaningfully to emissions reduction but also enhance their operational resilience and reputation.

Once targets are established, it is important to understand the various principles, methodologies, and tools aimed at quantifying the carbon emissions through the lifecycle.

1. PRINCIPLES

- **Life cycle thinking and system boundaries:** Embodied carbon computation considers environmental impacts throughout a material's life cycle, from extraction to disposal or recycling. Defining the system boundaries is essential to determine which life cycle stages and environmental impacts are included in the assessment.
- **Data quality and transparency:** High-quality and transparent data are essential for accurate embodied carbon computations. This includes life cycle inventory data on energy consumption, raw material extraction, and transportation.
- **Allocation methods:** When multiple products or materials are produced from the same process or input, allocation methods are used to distribute the environmental impacts among the different products or materials.
- **Carbon accounting:** Quantifying the carbon emissions associated with materials throughout their life cycle, including both direct and indirect emissions
- **Uncertainty analysis:** Acknowledging and quantifying uncertainty in the results is essential, given the variability in data sources, assumptions, and system boundaries.

2. METHODOLOGIES AND TOOLS

Life Cycle Assessment (LCA), guided by ISO 14040 and ISO 14044, is a comprehensive methodology for evaluating the environmental impacts of materials throughout their life cycle, including embodied carbon emissions, while environmental product declarations (EPDs) provide standardized and verified reports offering transparent information on the environmental impact of building materials, including embodied carbon emissions.

Various tools are available for estimating and assessing embodied carbon emissions, including embodied carbon calculators like EC3, Tally, and CarbonCOST Estimator,etc; life cycle assessment software such as One Click LCA, SimaPro, OpenLCA, and GaBi,etc; and sector-specific tools tailored to industries like concrete, steel, and timber, such as CSHub Tools for Concrete, and Steel360 Database for Steel Products,etc.

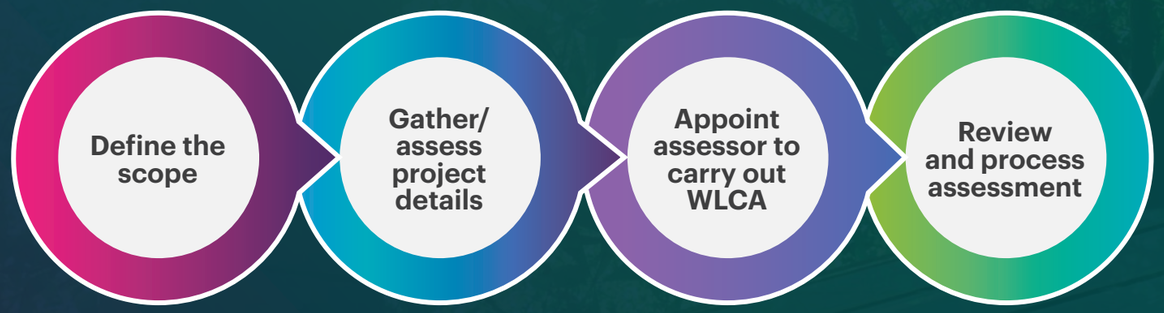
There are also comprehensive databases and directories available that provide lifecycle inventory data for materials, case studies, and best practices on life cycle assessment, as well as databases for available sustainable products. A few examples of these include Ecoinvent, the Indian Life Cycle Data Portal (ILCDP) by FICCI, and the CII-GreenPro ecolabelled product database.

RICS

The RICS Whole Life Cycle Assessment (WLCA) methodology offers a comprehensive framework that establishes a global standard for conducting whole life cycle carbon assessments for built environment projects and assets. This methodology marks a revolutionary change in carbon measurement practices: instead of only considering carbon emissions during construction, it evaluates all stages of a built asset, from its conception and design to construction, operation, and eventual decommissioning.

WLCAs provide insights into regulatory compliance, risk mitigation and long-term cost efficiency over the whole life cycle of a built asset and beyond. It can also be used to implement changes and monitor the effectiveness of these measures over time. As a project progresses, the accuracy of the data used improves at each stage, which in turn provides the opportunity to reduce carbon emissions.

Undertaking a WLCA involves following a structured method for measuring the carbon footprint of a built asset throughout its life cycle. WLCAs are broken down into the following steps.



Refer to WLCA client-guide for more details

Mitigate

Once baselining is done and sustainable goals are set, the next step is to identify a suitable mitigation strategy. The Indian construction industry, being one of the fastest growing in the world, requires a multipronged approach based on available global best practices and local context. Here are a few focus areas to consider:

1. SUSTAINABLE DESIGN

- **Addressing embodied emissions by:**
  - Choosing low-carbon building materials like recycled steel, fly ash concrete, and GGBS in cement and concrete.
  - Choosing raw materials and production locally helps reduce transportation emissions.
  - Reusing materials and reducing demolition waste.
- **Addressing operational emissions by:**
  - Using renewable energy and establishing energy efficient systems within buildings by reducing reliance on fossil fuel energy use.

2. POLICY SUPPORT AND GREEN BUILDING STANDARDS

In recent years, India has concentrated on reducing operational carbon in buildings, supported by various standards, policies, and regulations. However, there is now an emerging need to address embodied carbon to create an ecosystem that can fully support the construction industry.

Several standards advocate for green buildings and sustainable principles, including, but not limited to:

Standards, codes, and policy frameworks	Description
INDIAN STANDARDS	
ECBC (Energy Conservation Building Code)	Promotes energy efficient design and construction standards for commercial and institutional buildings
NBC (National Building Code of India)	Building guidelines for environmentally responsible construction practices, ensuring safety, efficiency, and resource conservation
IGBC (Indian Green Building Council)	Benchmark setting and certifications of green building practices in India
GRIHA (Green Rating for Integrated Habitat Assessment)	Benchmark setting for construction practices and reducing the environmental impact of buildings
INTERNATIONAL STANDARDS	
RICS (WLCA) Whole Life Cycle Assessment	Comprehensive framework that establishes a global standard for conducting whole life cycle carbon assessments for built environment projects and assets
EIA (Environmental Impact Assessment)	It assesses the potential environmental effects of proposed projects, ensuring informed decision-making
ISO 14001: Environmental Management Systems	Organisational framework for efficient resource use and waste reduction
LEED (Leadership in Energy and Environmental Design) by USGBC	Benchmark setting for building construction and operation, promoting energy-efficient, green building concepts and environmentally friendly practices
EDGE (Excellence in Design for Greater Efficiencies) by IFC (International Finance Corporation)	Promotes sustainable development by certifying buildings that significantly reduce energy, water, and material resource use, encouraging eco-friendly construction and operational practices
ISO 50001: Energy Management Systems	Organisational framework for energy efficiency, GHG reduction.
BREEAM (Building Research Establishment Environmental Assessment Method) certifications by BRE (Building Research Establishment)	Assess and certify sustainability performance of buildings

3. IMPROVE WASTE MANAGEMENT PRACTICES

- **Construction waste recycling:** Encourage implementation of robust waste management plans to recycle and reuse construction and demolition waste.
- **On-site waste segregation:** Set up systems for on-site segregation of waste materials to facilitate recycling and reduce landfill use.
- Embrace circular economy principles by designing buildings for disassembly and reusing materials in new construction projects.

4. ENHANCE CONSTRUCTION TECHNIQUES

- **Modular and prefabricated construction:** Use modular and prefabricated construction methods to improve efficiency, reduce waste, and lower emissions from on-site activities.
- **Efficient construction machinery:** Deploy energy-efficient machinery and equipment to reduce fuel consumption and emissions during construction.
- **Low-impact construction practices:** Employ techniques like minimal excavation and soil stabilization to reduce environmental disruption and emissions.
- **Efficient Logistics:** Use digital tools to optimize logistics and supply chain management, reducing transportation emissions and ensuring just-in-time delivery of materials.

5. EDUCATE AND TRAIN STAKEHOLDERS

- **Training programs:** Develop and offer training programs for architects, engineers, builders, and workers on sustainable construction practices and technologies.
- **Awareness campaigns:** Conduct awareness campaigns to highlight the benefits of green building and sustainable practices among stakeholders and the public.

6. MONITORING AND REPORTING

- **Carbon footprint assessment:** Regularly assess and monitor the carbon footprint of construction projects using tools like LCA.
- **Transparent reporting:** Maintain transparency in reporting emissions and sustainability metrics and use this data to set targets and track progress.

7. IMPLEMENT DIGITAL SOLUTIONS

Digital solutions can help companies achieve significant performance and emissions improvements at a number of points in the life of a build:

Design and planning optimization

Building Information Modelling (BIM): Enables precise planning, energy modelling and Life Cycle Assessment to optimize material use and minimize embodied carbon.

Data analytics and AI: Optimizes construction processes, identifies inefficiencies, and assists in sustainable design by maximizing natural light and ventilation.

Real-Time Monitoring and Automation

Smart construction technologies: Includes IoT sensors that monitor real-time energy use, automation, and robotics that enhance precision and reduce material waste and energy consumption.

Digital twin technology: Offers real-time monitoring, scenario simulation, and predictive maintenance to maintain performance and energy efficiency.

Environmental Control Automation (ECA): Manages environmental conditions efficiently, adjusting HVAC and lighting systems to reduce unnecessary energy consumption.

Material and Resource Efficiency

3D printing: Allows for precise material application and customizable designs that optimize material use and structural integrity.

Efficient logistics management: Optimizes supply chain management to reduce transportation emissions.

8. GREEN FUNDING

While there is a massive opportunity in investing in the green construction industry in India, traditional funding mechanisms often do not adequately address the unique needs and challenges associated with environmental sustainability. **Hence, green financing is emerging as a mechanism that supports investments in environmentally sustainable activities and products.**

In India, this concept is gradually gaining traction with support from government and the finance sector. Last year, the Reserve Bank of India introduced a framework for banks for acceptance of green deposits and financing.[6]

6 - Reserve Bank of Inida: Framework for acceptance of green deposits

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Linesight

India is projected to be one of the fastest-growing large economies, with the construction industry being integral to this journey. Decarbonizing India's construction sector needs to be the highest priority from both the public and private sector in order to build a more sustainable future.

Ameya Gumaste
Executive Director and Country Head, India - Linesight

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RICS

Whole Life Carbon Assessment standard forms the foundation of our industry's objective to establish near zero-emissions and resilient buildings. RICS has recently released the second edition of Whole Life Carbon Assessment Standard (WLCA) that aims to help manage carbon budgets, reduce lifetime emissions, and deliver a net-zero future for the built environment. RICS is ready to support the government and industry by promoting consistent measurement standards, enabling well-informed decision-making, and evaluating progress in decarbonization endeavours.

Ashwani Awasthi
Managing Director, South Asia - RICS

Conclusion

India's construction industry has the potential to emerge as a global sustainability leader by adopting a comprehensive approach to reducing carbon emissions both in the embodied as well as in the operational phases of carbon emissions.

Construction companies have a significant role to play in that process. By minimizing both embodied and operational carbon through life cycle assessments, using digital tools, and embracing green certifications, companies can help accelerate the transition to a sustainable future.

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About Linesight

Linesight has been delivering professional construction consultancy services and strategic support across a range of sectors since 1974. We have earned a reputation as a world leader in our field – a global network of local experts, providing faster project delivery, maximum cost efficiency and the best value for our clients.

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About RICS

As a globally recognised professional body, 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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