

Building Materials and the Climate: Constructing a New Future **KEY MESSAGES**

Building materials are set to dominate emissions and must be decarbonised.

- Most climate action was dedicated to reducing “operational carbon” emissions of buildings (e.g., heating, cooling, lighting), set to decrease from 75 per cent to 50 per cent of the sector in coming decades.
- Climate action is needed to reduce “embodied carbon” emissions from production and deployment of building materials (e.g., cement, steel, and aluminium).
- To reach net-zero emissions in the construction sector, future materials must be procured from renewable/reusable sources.
- New materials should be extracted using renewable electrification, and carbon capture and storage methods that require further research and development.

A whole life-cycle approach to decarbonising the sector is critical.

- Impacts of material choices on human health and well-being, climate and ecosystems must be considered before the materials are even extracted, and then again at each phase of the building life cycle, from extraction to processing, installation, use and demolition.
- Access to reliable information, verification, and coordination across different stakeholders in the building sector – manufacturers, architects, engineers, builders and recyclers – is key.

Emerging economies can leapfrog current carbon-intensive building methods.

- Developed economies can devote resources to renovating existing ageing buildings, while emerging economies can shift to alternative low-carbon building materials.
- Binding commitments are needed to ensure the cooperation of producers, growers, designers, builders, and owners along the sector’s supply chain.

Nature-based solutions such as integrating living biomass systems in buildings bring multiple environmental benefits.

- Municipalities worldwide have recognised the benefits of integrating vegetated surfaces (green roofs and façades, indoor wall assemblies) to reduce urban carbon emissions and reclaim the benefits of nature lost through urbanisation: can generate up to 60 per cent energy savings compared with exposed concrete walls.
- Mandating use of vegetated surfaces to cover exposed concrete or asphalt would help naturally keep buildings cool, reduce energy consumption, and absorb storm water to reduce flooding, replenish water tables and urban biodiversity.

Three overarching strategies need to be implemented together to decarbonise building materials: avoid unnecessary extraction and production, shift to regenerative materials, and improve decarbonisation of conventional materials.

1. AVOID extraction and production of raw materials by galvanising a circular economy: building with less materials through better data-driven design, while maximising reuse/recycling of buildings.

- Avoiding unnecessary extraction and production requires rethinking the design of buildings, especially during planning and design.
 - Considering key circular economy design strategies, including digitalisation tools, “Design for disassembly” (decreasing 10-50 per cent of GHG emissions), and good maintenance (Renovation generates 50-75 per cent fewer emissions than new construction).
2. SHIFT to regenerative material practices wherever possible by using ethically produced low carbon bio and bio-based building materials (e.g., sustainably sourced bricks, timber, bamboo, agricultural and forest biomass), and help to incentivize biodiversity.
- The shift towards properly managed bio-based materials could lead to compounded emission savings of up to 40 per cent in the sector by 2050 in many regions.
 - Policy support and investment in the research and development of methods and standards are needed to ensure the upscaling of renewable bio-based building materials.
3. IMPROVE conventional building materials and processes through decarbonisation efforts in their production.
- The key priority is to decarbonise hard-to-abate industries that will continue to dominate in the building material market in the near term.
 - Priority materials for decarbonisation are concrete and cement, steel and iron, and aluminium (responsible for 23 per cent of overall global emissions today), plastics, glass, and bricks.

Moving towards a low-carbon future requires a cumulative change in how building materials are used and sourced, across the full spectrum of materials. It requires holistic application of the “Avoid-Shift-Improve” strategies to prevent the overuse of extracted raw materials and to facilitate the shift from non-renewable to renewable and secondary sources.

In addition, governments must develop ethical building material decarbonisation policies to ensure a just transition. It is also critical to consider sensitivity to local cultures and climates (for e.g., many cultures consider concrete and steel to be “modern” materials of choice). Last but not least, international action and radical collaboration aligning stakeholders across the lifecycle in the sector is necessary to harness collective impact.