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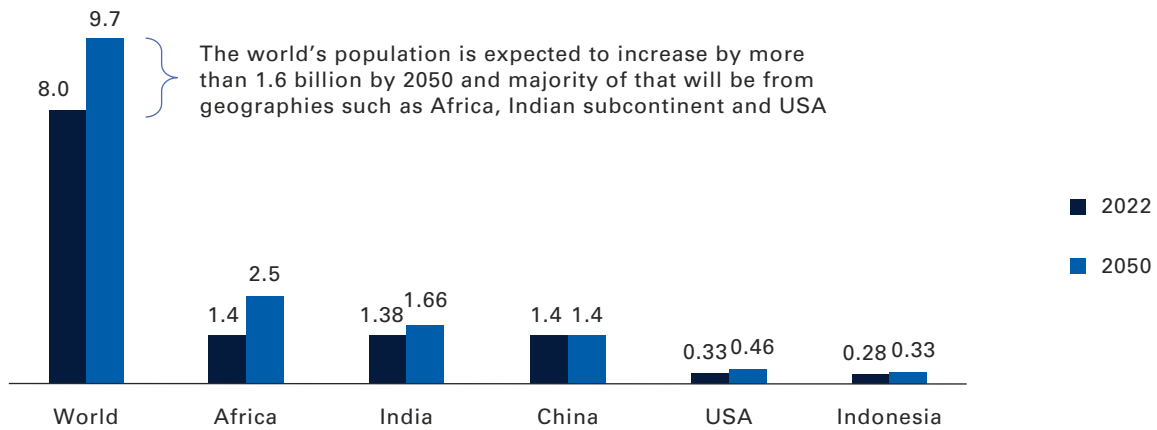
Increasing temperature due to embodied carbon - an imminent problem to solve




1.1 Expected temperature increase

The global population recently crossed 8 billion mark and is estimated to be approximately 9.7 billion by 2050⁶. Consequently, large-scale addition of urban and infrastructure development such as buildings, factories, warehouses, airports, ports, etc., will be required over the next three decades. This may lead to an increase in upfront carbon emissions equivalent to ~ 11 billion tCO₂e annually. Without stricter controls and actions around infrastructure development, we may face more than 100 gigatons of embodied carbon emissions by 2050, leading to a global temperature increase of more than 2°C.⁷

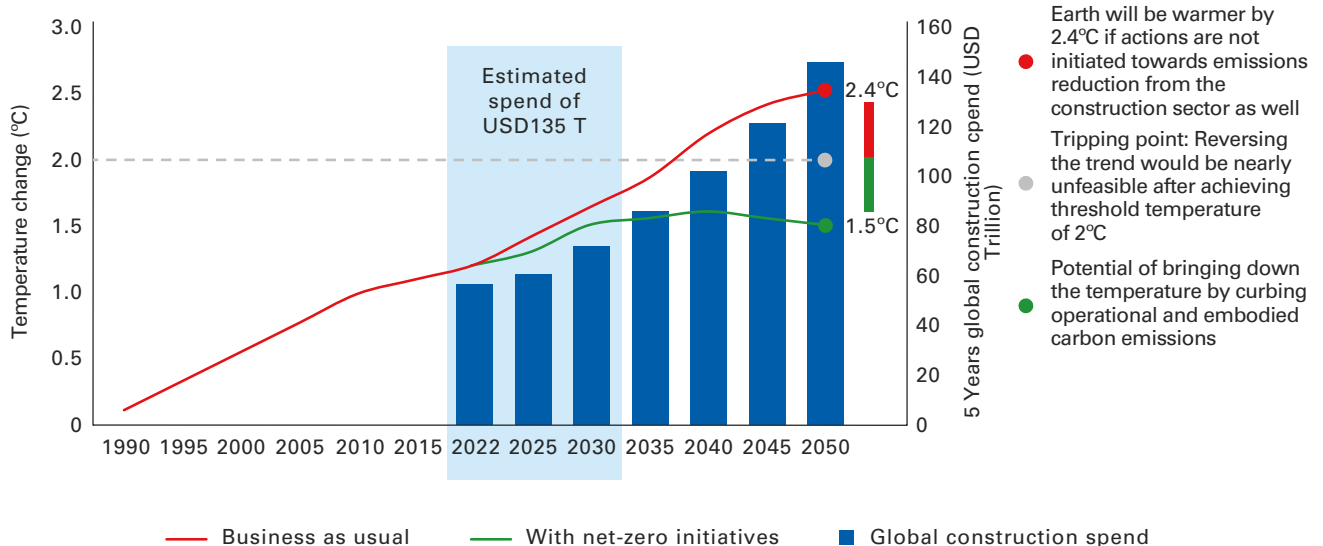
Population in billions



Global construction industry's next 8-10 years are critical with an estimated spend of around USD135 Trillion. It is imperative to have 'carbon conscious' thinking embedded in project planning and delivery, with immediate measures to be undertaken.



Climate change (Global temperature change scenarios)⁸



6. UN News, Global perspective Human stories, Economic Development, 11 July 2022

7. Based on analysis carried out by KPMG in India
 8. Report on World Population growth-2020 till 2050, Published by Statista, Sep 2021

1.2 Importance of managing embodied carbon

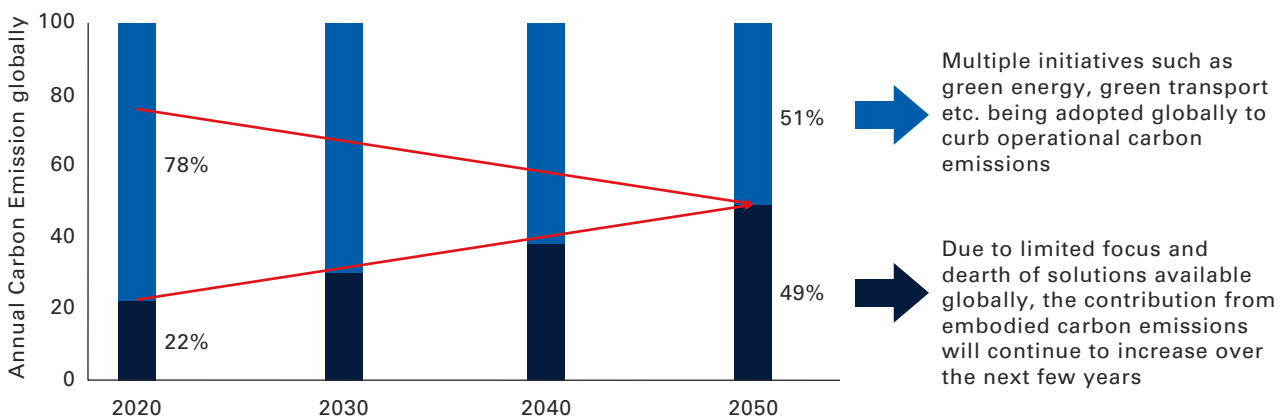
From 2020 to 2050, embodied carbon will be responsible for almost half of the new construction emissions⁹. Unlike operational carbon, which can be reduced over time with energy-efficient measures and renewable energy sources, embodied carbon emission is generally locked in once the asset is built.

While there are existing standards and initiatives taken to reduce operational carbon, only a few of the global assets being developed have considered the Whole Lifecycle Carbon Assessment (WLCA).

Embodied carbon remains an untapped area for carbon optimisation in capital projects. It may become an equal contributor as operational carbon over the next 30 years. In the current scenario, this requires strategies, policies, and actions to be initiated now with long term impact.



Projected increase in share of embodied carbon emission over next thirty years



Embodied carbon is conventionally more challenging to track and measure than operational carbon. The latter can be monitored by accessing the energy bills of consumers and manufacturers. Assessing embodied carbon from the finished product alone becomes an arduous task. For project development, it needs self assessment and process transparency across the material manufacturing process and its supply chain.

9. Bringing embodied carbon upfront, report by WGBC, 2019


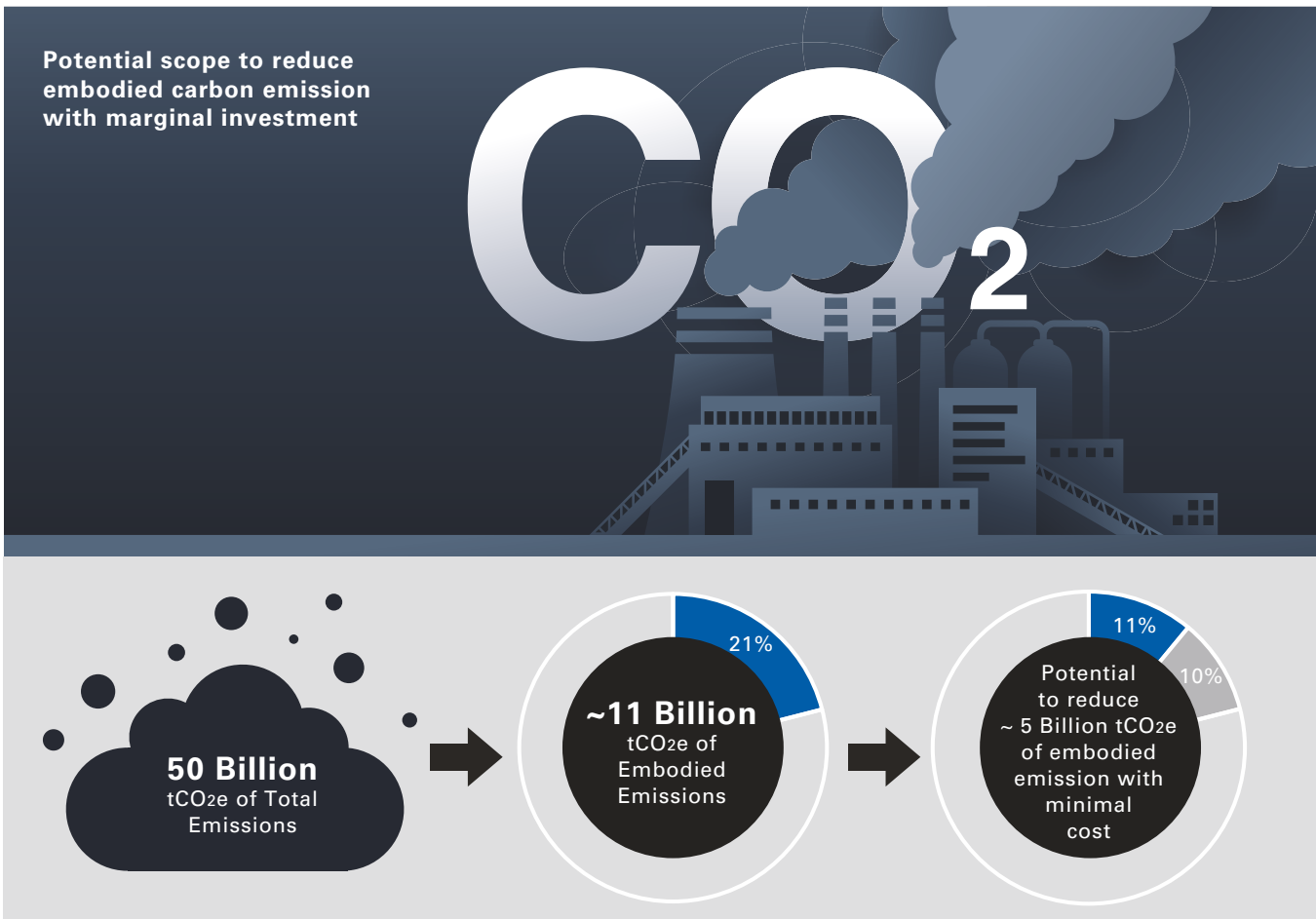
10. Based on KPMG in India secondary analysis over WGBC report on Bringing embodied carbon upfront

1.3 Potential to reduce embodied carbon

Continuous efforts towards localisation and self-reliance in major economies are resulting in new asset development in infrastructure sectors such as roads, buildings, and manufacturing. These sectors are key sources of carbon emissions not only during the asset operations phase but also its development phase. For example, the world will add 2.4 trillion sq. ft of new floor area in the building sector, equivalent to adding an entire New York City every month for 40 years.¹¹

Currently, the world emits ~ 50 billion tCO₂e of carbon emissions annually, of which, ~ 11 billion tCO₂e (22 per cent) comes from embodied carbon emissions from new infrastructure and building development. Through improved planning, design, and procurement decisions, we have an immediate opportunity to curtail ~ 5 billion tCO₂e embodied carbon emissions (roughly 45 per cent of total annual embodied carbon emission).¹²

From the construction industry alone, there is a significant potential to offset nearly 5 billion tCO₂e of embodied carbon annually, by implementing low carbon strategies. Studies suggest that this can be achieved with nil or marginal capital spend of only 0.5 per cent - 2 per cent of project cost depending on project location and type.

11. Why the Built Environment Architecture Report 2030.

12. Secondary research carried out by KPMG in India based on Reducing Embodied Carbon in Buildings: Low-Cost, High-Value Opportunities, report published by RMI, by Matt Jungclaus, Rebecca Esau, Victor Olgyay, and Audrey Rempher, 2021.



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Construction industry - major contributor to global warming



2.1 Expected growth in the global construction industry by 2050

The global construction industry is expected to grow from USD10 trillion in 2022 to USD34 trillion by 2050, with a CAGR of ~four per cent. It is expected to surpass the manufacturing sector in the current decade, with its estimated growth to reach around 29 per cent of the global GDP. This includes the construction of new assets as well as the restoration and renovation of aged infrastructure assets that make up about 25 per cent of the overall construction industry.

India, China, the U.S., and Indonesia stand out in the global construction landscape with a 58 per

cent share of total construction activity. Moreover, the construction sector in India, Africa, and Indonesia will grow at eight to ten per cent CAGR, making these geographies ripe for embodied carbon reduction by taking immediate measures.¹³ Meanwhile, economies such as the USA, China, and Europe, with a vast asset pool already in place, may instead explore opportunities for restoration and renovation.

Overall, the strategy to reduce embodied carbon will be unique to the infrastructure growth in the respective country.

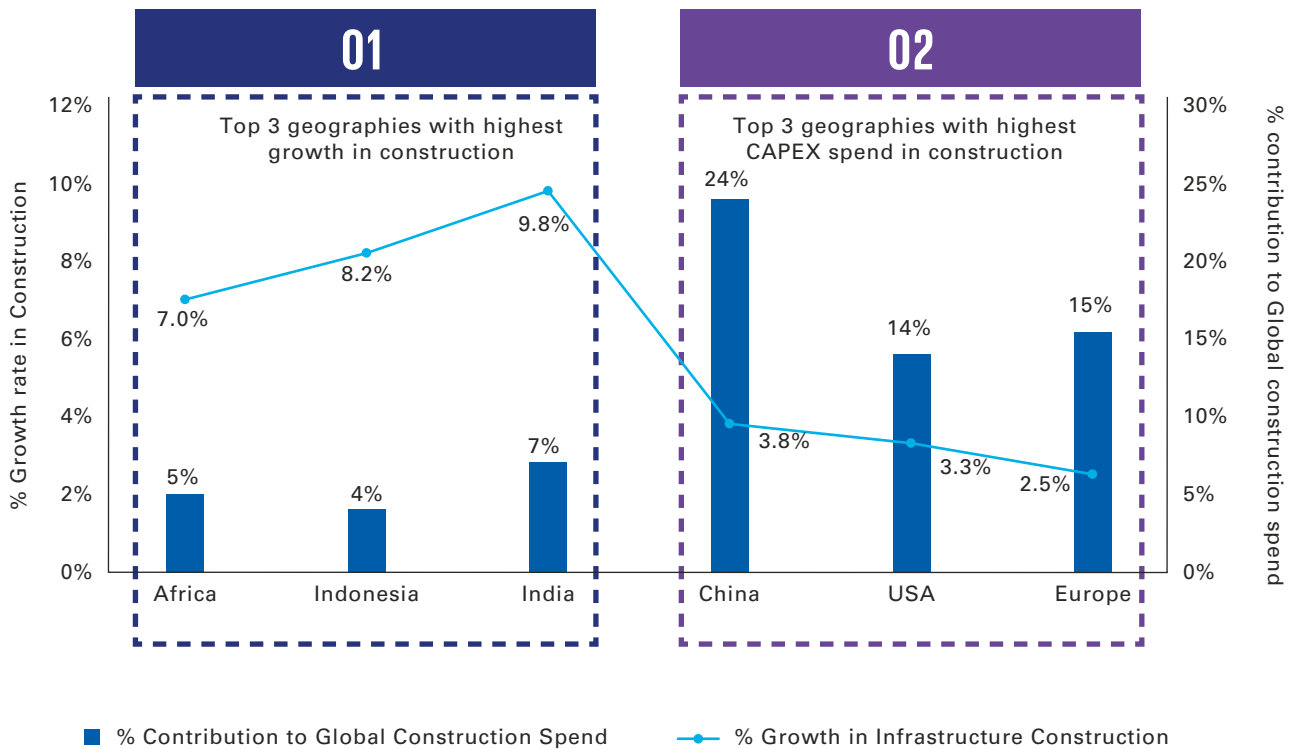
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India, Indonesia, and Africa have relatively substantial opportunities to reduce embodied carbon, given the growth potential in their construction sector.

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On the other hand, more than 50 per cent of capital projects will be built in large economies, allowing them to set global carbon reduction standards for others to follow.

Construction Sector – Geographical Analysis as of 2020^{13,14}



13. Future of Construction- A global forecast for construction to 2030 by Marsh & Guy Carpenter, September 2022.

14. Statista report on Africa growth till 2050, with analysis carried out by KPMG in India.

2.2 Key actions undertaken¹⁵

The opportunity to address carbon reduction is maximum in countries with the relatively higher infrastructure growth in the next 30 years. However, such geographies require increased efforts towards centralised or standardised policies for embodied carbon emissions from the construction industry.

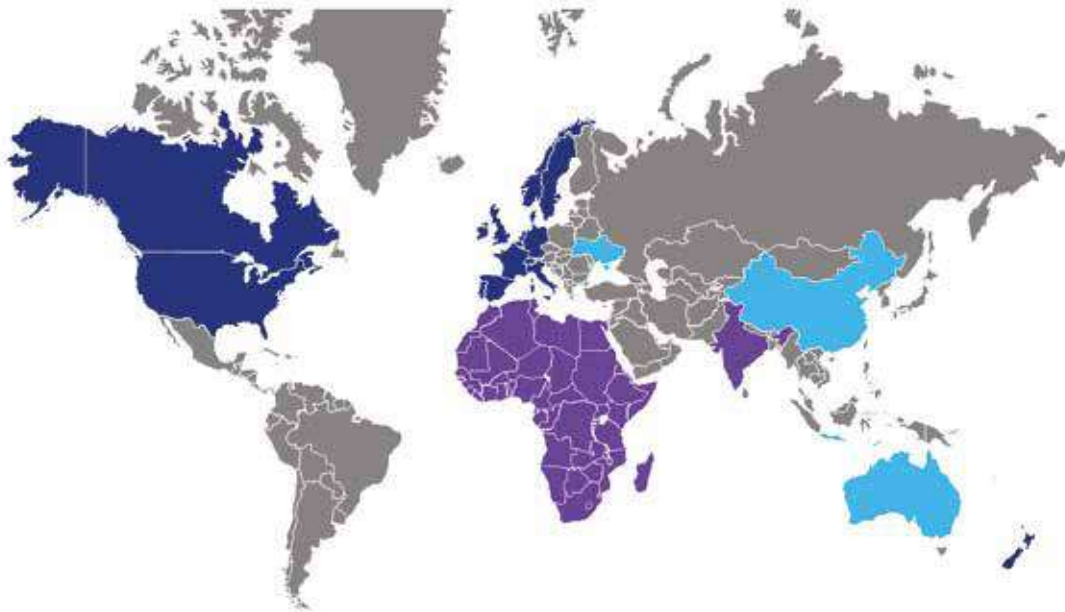
Across the globe, widespread disparity is evident in the carbon-related policies and initiatives vis-à-vis the respective countries' construction sector growth and proportionate global construction spend.



Initiatives being taken by geographies constructing ~20% of global infrastructure in the next 10 years

Geographies with > 8% construction sector growth have not yet implemented any policy

Geographies with > 50% global construction spend have not yet initiated any policy on embodied carbon



■ Policies being formulated or implemented

■ Geographies with high construction growth

■ Geographies with high construction spend

European Union

suggested a framework for sustainable buildings, which is in the initial stage of development and requires integration through regulations and policies.

Denmark

enforces Whole Life Carbon limits based on LCA tools to curb embodied carbon for upcoming buildings.

15. Based on secondary research carried out by KPMG in India on the actions taken globally:

- European Union: A Guide to European Building Policy – Key legislations and Initiatives
- Report from Building Performance Institute Europe
- Embodied carbon of Buildings and Infrastructure
- Climate Action 2050 – Report on Principles and goals of the German Government's Climate policy
- UK Government Procurement Policy note: Taking account of Carbon reduction Plans in the procurement of Major government contracts
- Inflation Reduction Act Will Further Bolster the Biden-Harris Administration's Buy Clean Initiative article dated 15th September 2022
- Federal Sustainability Plan: Report on Catalyzing America's Clean Energy Industries and Jobs
- Ministry for the Environment, New Zealand published Emission Reduction Plan- Chapter 12 Building and Construction
- Accelerating Decarbonisation of the Built Environment Sector – Embodied Carbon Pledge by Singapore Green Building Council
- Chapter of City of Vancouver
- Quebec Wood Charter
- Canada Green Building Council: Standard on Zero carbon design
- Canada Net Zero Emission accountability Act.