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# The new build opportunity: reducing the emissions from constructing and operating new buildings by decarbonising steel and cement and better building design

## The importance of reducing embodied carbon:

- 20% of building-related global emissions – 2.6 GtCO<sub>2</sub> – arise from the energy and materials used to construct new buildings.<sup>1</sup> These emissions are referred to as “embodied carbon”.
- Since global building floor area is expected to more than double by 2050, annual embodied emissions will increase rapidly unless the carbon intensity of construction is reduced.
- Under a business-as-usual scenario, total embodied emissions from building an additional 140 bn m<sup>2</sup> of global floor space could amount to 75 GtCO<sub>2</sub> between now and 2050, or 40% of the remaining carbon budget compatible with limiting global warming to 1.5°C. And as heating is electrified and grids are decarbonised, these embodied emissions will account for an increasing share of an individual building’s total emissions over its lifetime. Alongside actions to reduce operational emissions, a strong focus on opportunities to reduce embodied emissions is therefore essential.

## It is possible to achieve net-zero steel, cement and concrete by 2050:

- By far the biggest source of embodied carbon is the production of material inputs to construction, in particular cement/concrete and steel.
  - The *Mission Possible Partnership’s* sector transition strategies show that it is possible to fully decarbonise these so-called “hard to abate” sectors by 2050, using technologies available today, such as electricity or biofuels for high-temperature heat supply, the application of carbon capture, utilisation and storage (CCUS), green hydrogen, and increasing steel recycling.
- If steel, cement and concrete production are fully decarbonised by 2050, annual new embodied emissions will fall close to zero for buildings built in 2050 and later, and total cumulative emissions from building construction between today and 2050 could be reduced from 75 GtCO<sub>2</sub> to 40 GtCO<sub>2</sub>.
- But this remaining 40 GtCO<sub>2</sub> would still use up about 20% of the remaining carbon budget compatible with limiting global warming to 1.5°C.<sup>2</sup>

## Other critical actions to reduce embodied carbon from new construction:

- It is, however, possible to further reduce cumulative embodied emissions between now and 2050 to ~30 GtCO<sub>2</sub> by:
  - Reducing the amount of materials needed in new buildings through lightweight building design.
  - Building less in the first place, for example, reducing vacancy rates (e.g., in China), extending building lifetimes, and improving urban planning to reduce the amount of wider construction needed (e.g., roads and public infrastructure).
  - Using alternative low-carbon materials, including bio-based ones such as timber, bamboo and hempcrete.
    - These materials capture carbon while they are growing and can store this sequestered carbon throughout their use in buildings. They can have significantly lower whole-life carbon impacts than steel and cement - as long as they are dealt with properly at end-of-life and as long as crops are replanted.
    - These materials cannot be used in all cases or construction projects (e.g., timber is currently only suitable for low- to mid-rise buildings), but where applicable can typically offer similar stability, safety and durability.
    - There are, however, limits to the sustainable supply of biomass. It is not therefore prudent to assume these materials can deliver a more than small (e.g., up to 10%) reduction in concrete use by 2050.<sup>3</sup>

<sup>1</sup> IEA (2023), *The energy efficiency policy package: key catalyst for building decarbonisation and climate action*.

<sup>2</sup> Systemiq analysis for ETC; Mission Possible Partnership (2023), *Making Net Zero Concrete and Cement Possible*; Mission Possible Partnership (2022), *Making Net Zero Steel Possible*.

<sup>3</sup> ETC (2021), *Bioresources within a net-zero economy*.

- These actions would, however, be even more important if the decarbonisation of concrete and steel production occurred at a slower pace than assumed in the MPP pathways noted above.

### Priority actions to tip the dial:

1. Apply carbon pricing to the production of steel, cement and concrete.
2. Regulate that all new construction and large renovation projects must complete whole-lifecycle carbon assessments. This will help improve how embodied carbon is measured and increase the data that policymakers and industry have to make decisions.
3. Set minimum requirements for the lifecycle emissions of a new building, ensuring developers take steps to reduce the embodied carbon of construction and build more efficient new buildings that require less energy to operate.

