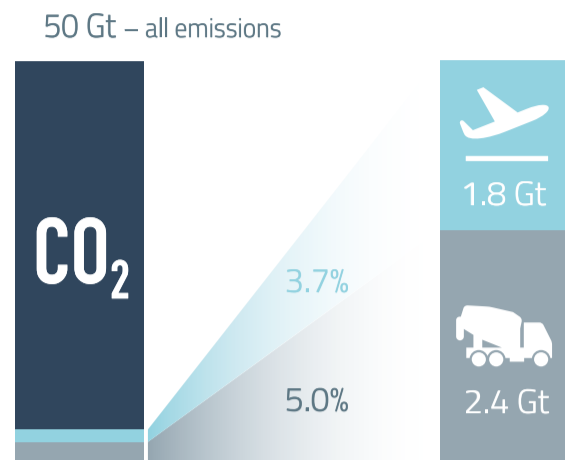


CEMENT & CLIMATE CHANGE

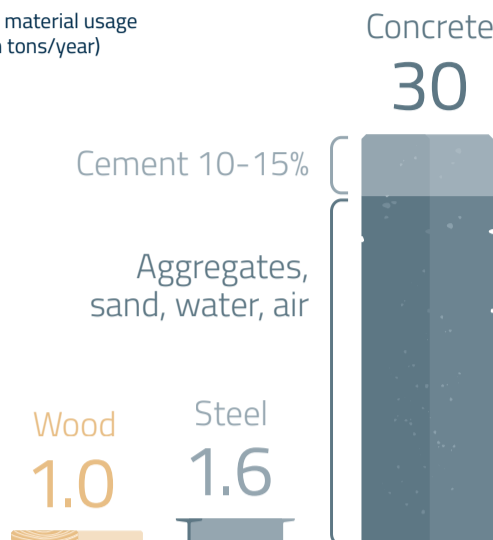
Cement production is among the largest emitters of CO₂.

Global emissions (Gt CO_{2,eq}/year)



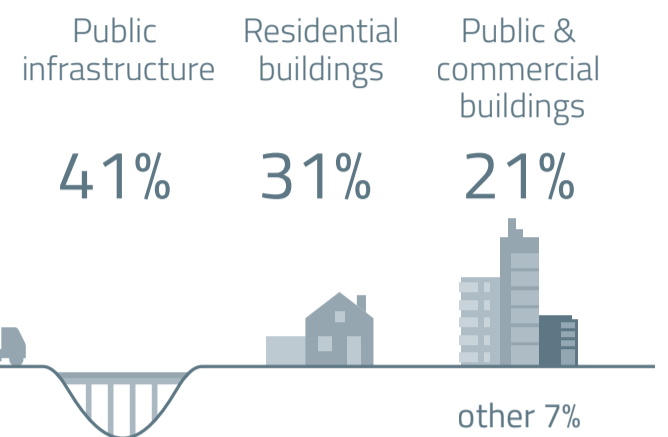
Cement is a critical element of concrete, the most widely used building material in the world.

Global material usage (billion tons/year)



Concrete (and therefore cement) is essential for critical infrastructure.

Distribution of concrete applications

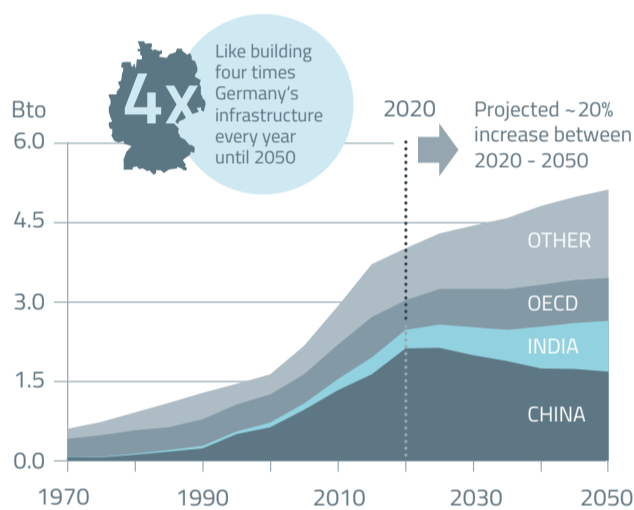


THE KEY CHALLENGES

Global cement demand

With global development, demand for concrete and therefore cement is expected to continue to increase.

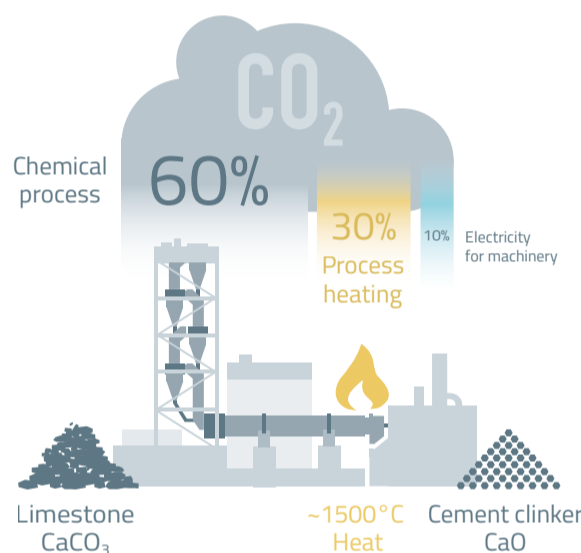
Global cement demand (billion tons/year)



Process emissions

60% of the emissions come from the basic chemical reaction.

Basic cement process and distribution of emissions



High-temperature heat

Hard to reach without fossil fuels - the low-carbon alternatives are not ready.

Selection of high-temperature industrial heat technologies for cement production

| Heat Source | Current share | Mature | Scalable* | Cost |
|----------------------------------|---------------|--------|-----------|------|
| ~1500°C heat from COAL, OIL, GAS | 92% | ✓ | ✓ | \$ |
| BIO MASS, WASTE | 8% | ✓ | ✗ | \$ |
| H ₂ | 0% | ✗ | ? | \$ |

*Considers resource availability (e.g. biomass) and geographical restrictions (e.g. concentrated solar).

THE MAIN SOLUTIONS

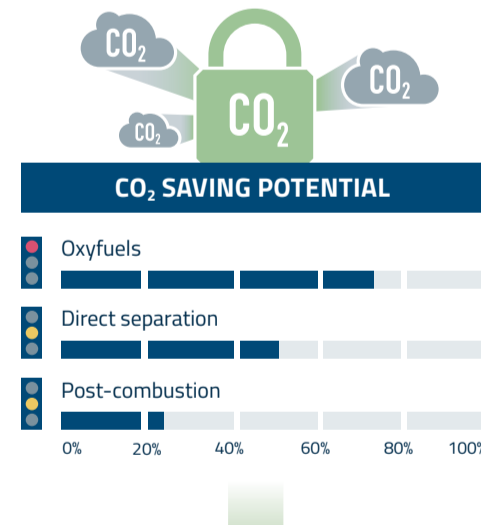
MATURITY LEVEL: ● Early stage, ● Intermediate, ● Mature

No silver bullet: we must combine non-mutually-exclusive options, especially those with the highest potential and commercial readiness.

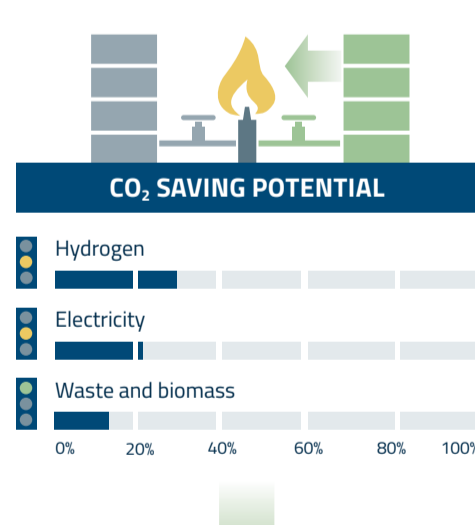
1 Reduce demand for concrete



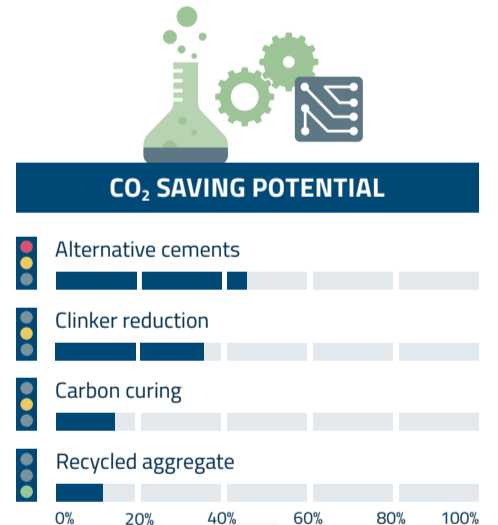
2 Capture, store, and use carbon



3 Substitute fossil fuels



4 Drive innovation



OUR RECOMMENDATIONS

- ✓ **Modernize building standards** to favor low-carbon materials and circular use
- ✓ **Promote low-carbon practices** in industry and curricula
- ✓ **Update building and infrastructure regulations** based on required performance, instead of prescriptions on material content

- ✓ **Accelerate CCUS R&D**, demonstration plants, infrastructure and early adoption
- ✓ **Develop the legal framework** for CCUS
- ✓ **Step up carbon pricing and emissions trading systems** to incorporate carbon's true cost and level the playing field

- ✓ **Boost supply of affordable clean power** and cut remaining incentives for fossil fuels
- ✓ **Drive R&D** in low-carbon, high-temperature heat for industrial processes
- ✓ **Set maximum carbon emissions** and advance upgrades from older combustion tech

- ✓ **Use public procurement** to stimulate low-carbon product demand and de-risk investment in innovation
- ✓ **Encourage a circular economy** by improving access to waste concrete for recycling

Sources: IEA, 2018; Allwood et al., 2019; Drenni et al., 2022; Energy Transitions Commission, 2018; Global Cement and Concrete Association, 2021

