Roadmap NET ZERO

Vision of the Brazilian Cement Industry to achieve emissions neutrality throughout its lifecycle by 2050.

abcp
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Main Guidelines

GHG Emissions in Brazil and the Contribution of the Cement Industry

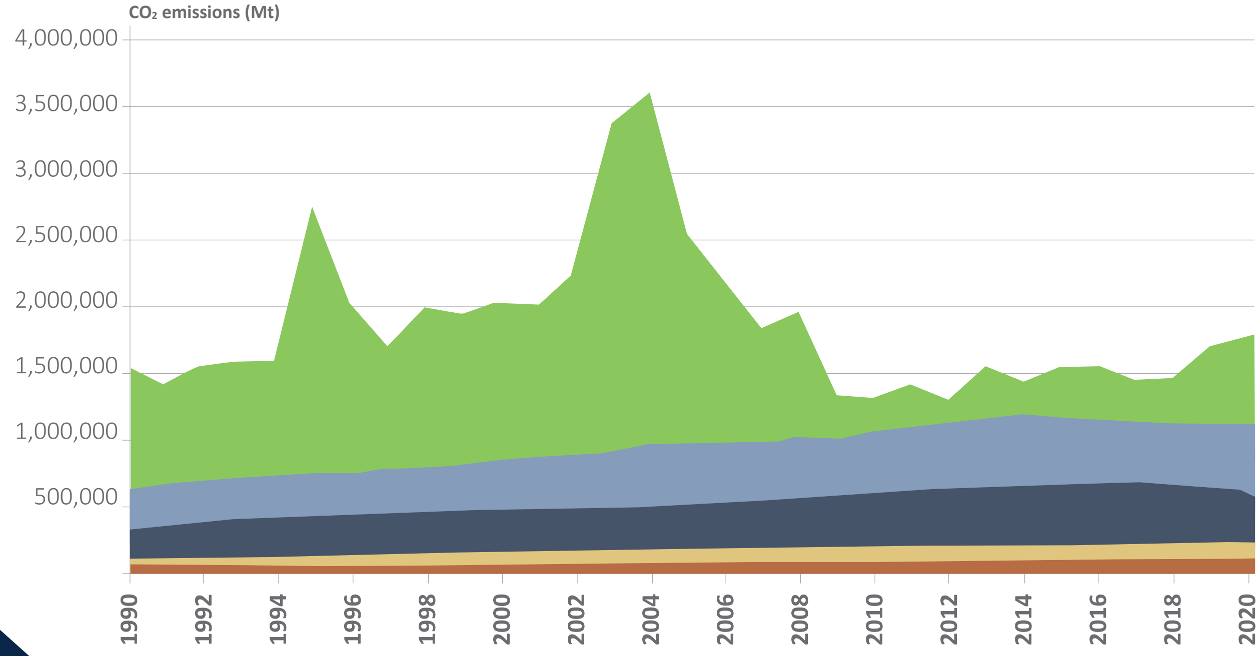
Cement is the main constituent of concrete, which is the second most consumed material in the world, after water.

Simultaneously, CO_2 emissions are inherent in its production process. The combination of a highly consumed and carbon-intensive product makes cement a major source of CO_2 emissions.

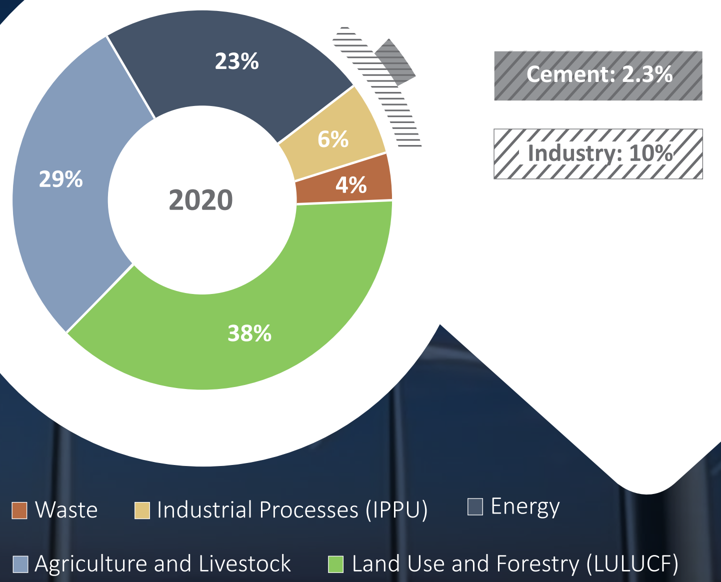
At the global level, **7%** of all man-made GHG emissions come from cement production.

In Brazil, due to actions that the sector has been implementing for decades, combined with the profile of the country's emissions, this share drops to a third of this rate, being equivalent to **2.3%** of total Brazilian emissions.

National Greenhouse Gas Inventory



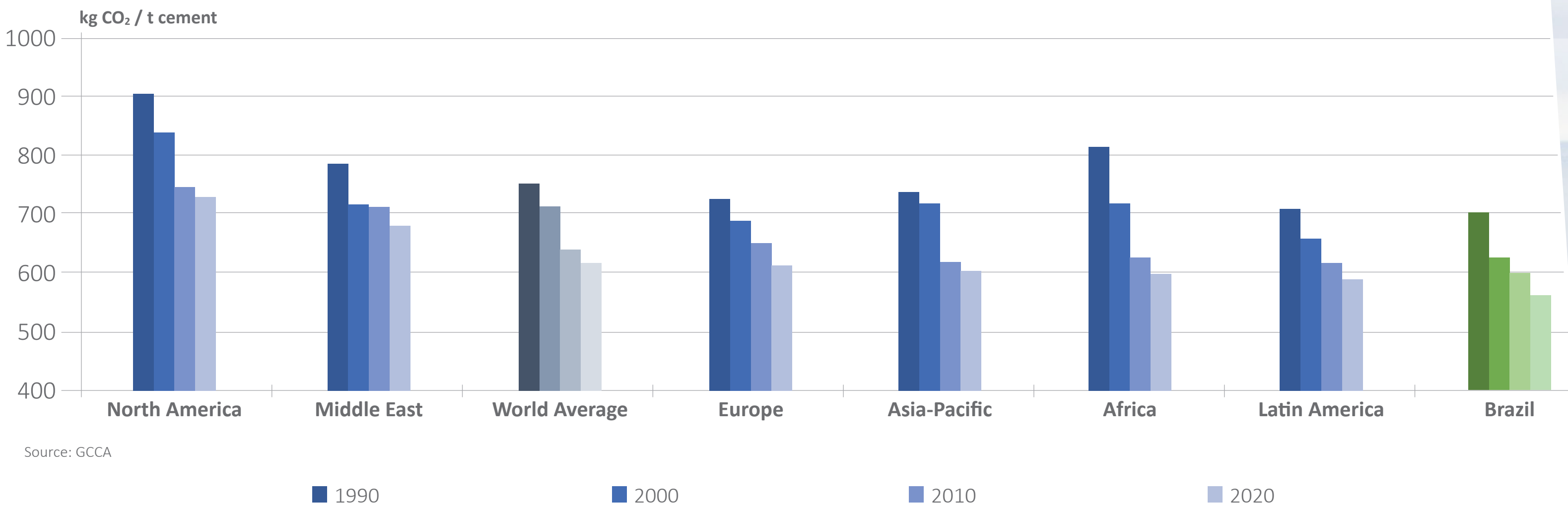
Source: MCTI



Historical advances: What has our journey been like?

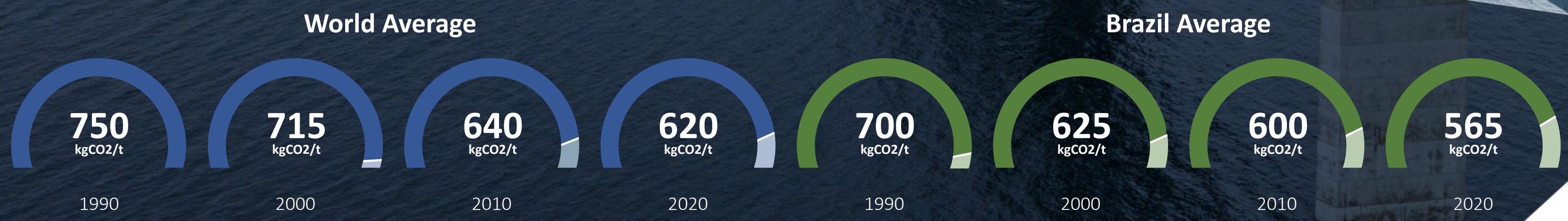
The **Brazilian cement industry** has been a leader at the international level for its **low CO_2 intensity** in its production process from the start of the recording of emissions by the sector, in 1990, to today.

CO_2 Intensity in Cement Production



Source: GCCA

Advancing further in its decarbonization requires much greater and more complex technical, financial, normative and regulatory challenges.



Historical advances: What has our journey been like?

The sector has been making significant efforts in a wide variety of areas – **by all companies and across all regions of the country** – which have helped place it among the most efficient and sustainable in the world.

Some examples of these initiatives include:

- Greater use of **Clinker Substitutes**, such as Steel Slag, Fly Ash, Limestone Filler or Calcined Clays;
- Replacement of Fossil Fuels with **Alternative Fuels**, such as Industrial and Municipal Waste, Tires and Agricultural Biomass;
- Measures for achieving **Thermal** and *Electrical Efficiency*.

CIPLAN
Clinker Substitutes
Replacement of clinker using calcined clays

APODI
Energy Efficiency
EfficiencyReducing electrical consumption through Waste Heat Recovery (WHR)

INTERCEMENT
Alternative Fuels
Replacement of fossil fuels with agricultural biomass

MIZU
Renewable Electrical Matrix
Electricity consumption from self-generated wind energy

LIZ
Alternative Fuels
Replacement of fossil fuels with waste tires

NACIONAL
Clinker Substitutes
Reuse of hot gases for drying blast furnace slag and increasing clinker substitutes

SUPREMO
Alternative Fuels
Use of industrial waste to replace non-renewable fossil fuels

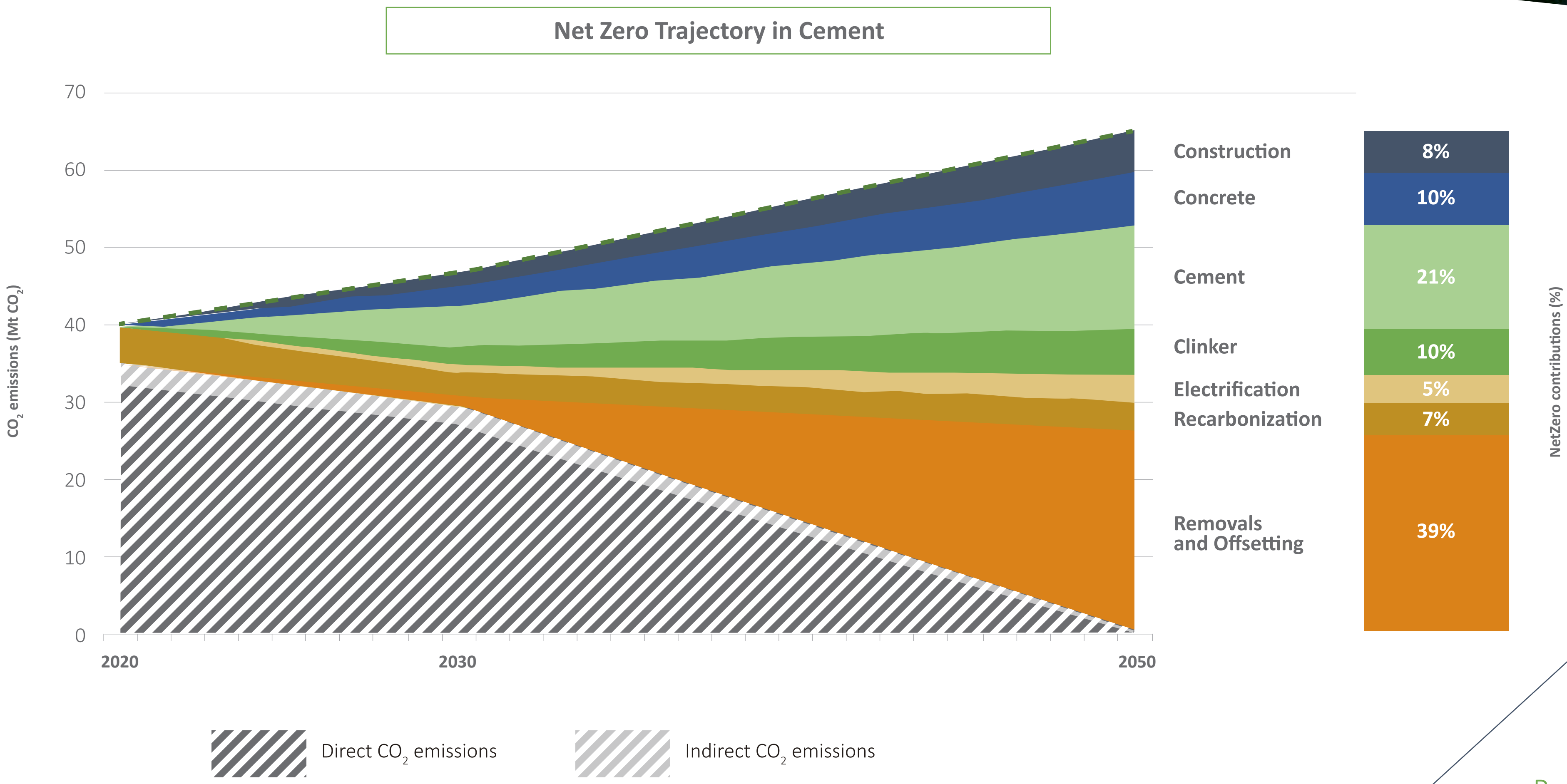
ITAMBÉ
Energy Efficiency
Use of specialized software to optimize thermal and electrical efficiency

VOTORANTIM
Alternative Fuels
Replacement of fossil fuels with municipal solid waste

Net Zero contributions by category by 2050

As a developing country, we have a major infrastructure and housing program to be built. This will require a substantial addition of cement.

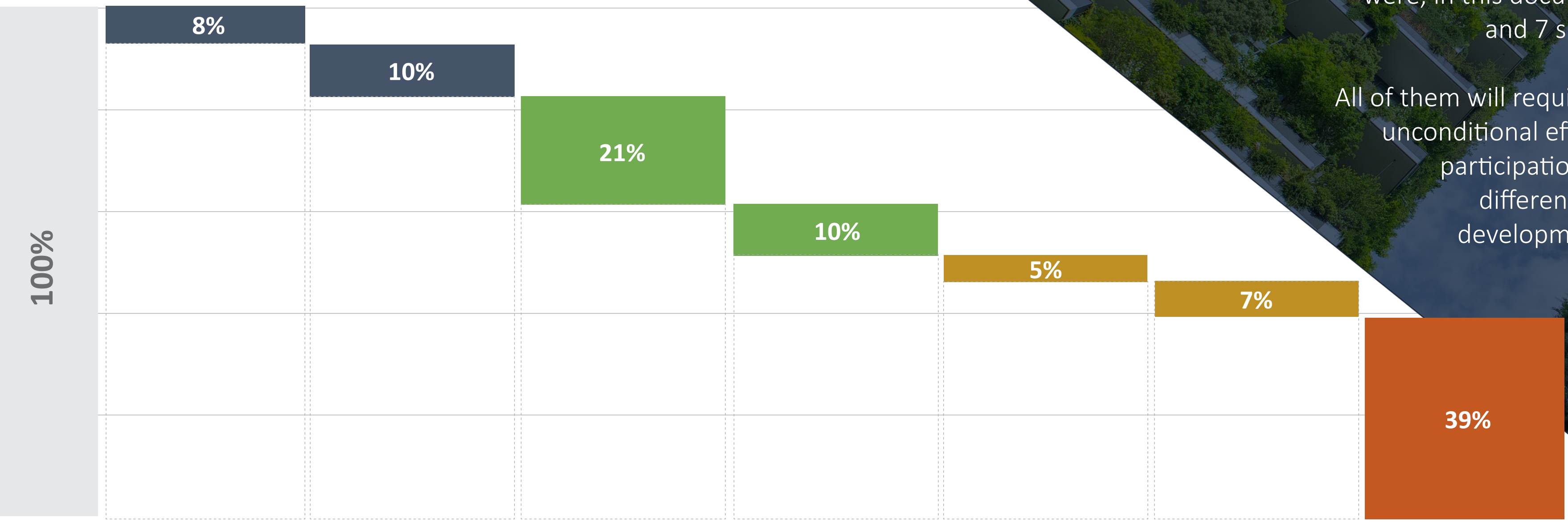
In our reference scenario, maintaining current conditions, we would shift from gross emissions totaling **40 million metric tons** of CO_2 in 2020 to **65 million** in 2050.



Net Zero Contributions by category by 2050

There is no silver bullet to mitigate emissions in the cement industry or achieve net-zero emissions, but rather a series of levers, with greater or lesser impact, which act to directly or indirectly to reduce the sector's emissions. Such alternatives were, in this document, grouped into 4 classes and 7 subcategories, as seen below.

All of them will require, far beyond the industry's unconditional effort and commitment, broad participation from governments at their different levels, construction agents, development agencies, representative entities and academia.



Dematerialization		Direct Reductions		Indirect Reductions		Removals and Offsetting
Construction	Concrete	Cement	Clinker	Electrification	Recarbonization	CCUS NbS Methanation
5Mt CO_2 reduction	7Mt CO_2 reduction	- 14Mt CO_2 reduction	- 7Mt CO_2 reduction	3Mt CO_2 reduction	5Mt CO_2 reduction	25Mt CO_2 reduction
45 $kgCO_2$/t cem	57 $kgCO_2$/t cem	119 $kgCO_2$/t cem	57 $kgCO_2$/t cem	28 $kgCO_2$/t cem	40 $kgCO_2$/t cem	220 $kgCO_2$/t cem

Although not all decarbonization levers presented here have an impact on reducing direct emissions from the cement industry, the table above expresses the potential reduction of each of them in both absolute and specific emissions.

Net Zero Contributions by category by 2050

Dematerialization		Direct Reductions		Indirect Reductions		Removals and Offsetting
Construction	Concrete	Cement	Clinker	Electrification	Recarbonization	CCUS NbS Methanation
8% CO_2 reduction	**10%** CO_2 reduction	**21%** CO_2 reduction	**10%** CO_2 reduction	**5%** CO_2 reduction	**7%** CO_2 reduction	**39%** CO_2 reduction
The logic behind design and construction optimization aims to reduce the consumption of concrete – and, subsequently, cement and clinker – through efficiency strategies in their use. One of the main means of achieving this is by ensuring that reducing CO_2 emissions becomes a design parameter in addition to the project's current parameters for quality, cost, speed, and specific customer requirements.	Greater efficiency in concrete production could play a key role in reducing cement emissions. The gradual migration of concrete preparation on site to industrial processes reduces waste and offers significant savings in CO_2 emissions, thanks to the optimization of mixing and improved quality control. The use of additives and improved aggregate processing represent additional opportunities.	Reducing the clinker content in cement represents one of the main alternatives for the sector to mitigate its emissions. The reduction of the clinker factor, based on the greater use of cement additions and clinker substitutes – mainly limestone filler and calcined clays, followed by steel slag and fly ash, which should have limited supply in the future – will play a key role in enabling the sector to achieve an effective reduction in its emissions.	The replacement of fossil fuels with alternative fuels with lower carbon intensity, such as industrial waste, municipal solid waste, agricultural biomass and, in the long term, green hydrogen, will have a significant impact on reducing clinker emissions. Lower energy consumption, through energy efficiency measures, will also have an additional effect, albeit to a lesser degree.	The growing and continued decarbonization of the country's electricity matrix – the cleanest and most renewable in the world – using renewable energies, such as wind and photovoltaics, will have an impact on reducing indirect emissions. Additional efforts to reduce electrical consumption in cement plants, such as process automation, artificial intelligence (AI) and waste heat recovery (WHR) for electricity cogeneration, should further accelerate this process.	At the same time that the cement production process emits CO_2 through the decarbonization of the raw material, the use of the product throughout its life cycle reabsorbs CO2 from the atmosphere, through concrete structures. This process, known as recarbonization, is beginning to be acknowledged by science as a key tool for reducing emissions.	Removals and offsetting will be critical to enable the sector to neutralize remaining emissions, such as: R&D of disruptive technologies such as Carbon Capture and Use or Storage (CCUS); Carbon removals from Nature-Based Solutions (NbS), through forest conservation projects; Emissions avoided by co-processing waste in cement kilns, which under normal conditions would decompose in landfills or dumps, generating methane.

Disclaimer

The results of this neutrality curve are based on shared visions in the Brazilian cement industry, consultations with different thematic committees, and other external stakeholders in the concrete and construction chain. These insights assisted in the development of the emissions projection model of the Global Cement and Concrete Association (GCCA) – a partner of this initiative – in its global Roadmap Accelerator Program.

The different potentials presented here are based on the composition of complex integrated scenarios, which may undergo updates and refinement. Each of them represents an indication of mitigation possibilities, aiming to guide decarbonization policies and efforts, inside and outside the sector. Achieving this, however, will require articulation and cooperation between different stakeholders throughout the lifecycle of cement and its value chain.

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