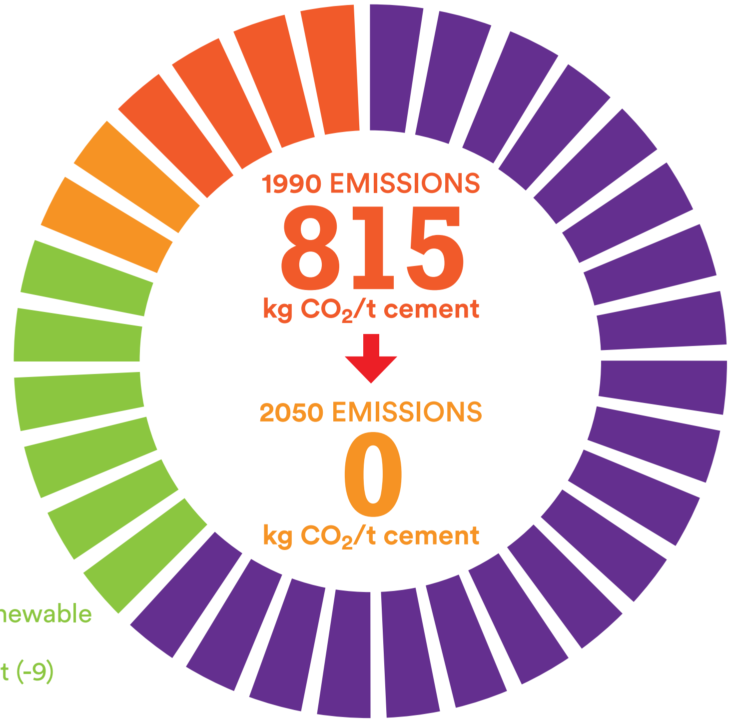
The 5Cs approach

The sectoral strategy of this new **Roadmap** is based on ***the 5Cs Approach***, proposed by the European association of cement manufacturers (Cembureau) and which promotes the collaboration of the entire value chain Clinker – Cement – Concrete – Construction – (re)Carbonation to make the vision of climate neutrality a reality.
For each of the **5Cs**, the areas that allow for significant emissions reduction are identified, as well as the key technologies that allow us to do it, along with the necessary policy levers to drive this transformation.

This i show we will achieve climate neutrality in the cement industry by 2050

-9% Construction + (re)Carbonation
-72 kg CO_2/t cement:
· Improvement in energy efficiency in constructions
· CO_2 capture in built environment (-72)

-5% Concrete
-45 kg CO_2 /t cement:
· Cement reduction in concrete (-40)
· Neutral transport (-5)



-66% Clinker
-539 kg CO_2/t cement:
· Decarbonated raw materials (-25)
· Biomass Fuels (-120)
· Thermal efficiency (-84)
· Low carbon clinker (-18)
· Use of hydrogen and electrification (-20)
· Carbon Capture, Utilization and Storage (CCUS) (-272)

-20% Cement
-159 kg CO_2 /t cement:
· Additives. Reduction of clinker in cement (-114)
· Higher efficiency and renewable electricity supply (-36)
· Neutral internal transport (-9)

The path to stop climate change

*The **European Green Deal** defines a project for an equitable society in which citizens, industry and biodiversity can prosper hand in hand, transforming climate and environmental challenges into opportunities in all areas and thus achieving a just and inclusive transition for all.*

Within this commitment, the cement industry is recognized as essential, since it supplies a series of essential value chains that contribute to economic growth, making it more sustainable and meeting societal needs more efficiently from the environmental, social and economic view.

+ Info versió en català:

+ Info versión en español:

+ Info english version:

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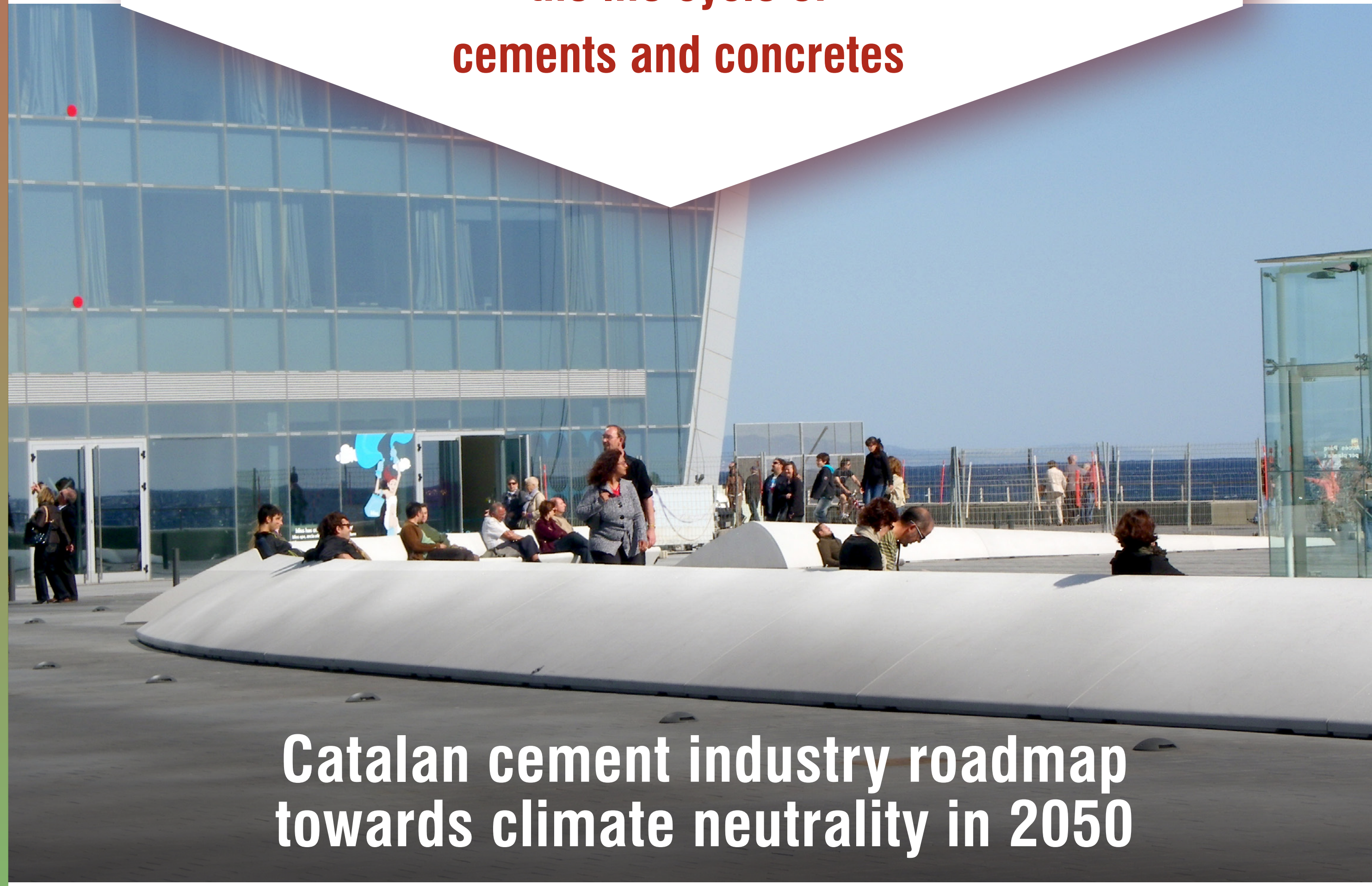
Ciment Català

The methodology to achieve a zero carbon footprint throughout the life cycle of cements and concretes



Catalan cement industry roadmap towards climate neutrality in 2050

Cementing the European Green Deal

Ciment Català

This is how we will be able to reduce CO_2 emissions in clinker

Use of decarbonated raw materials

Waste materials and by-products from other industries can be used to replace some of the limestone, a good example of industrial symbiosis. These materials, among others, can include recycled concrete from demolition waste, air-cooled slag and waste lime.

Biomass and zero fuel emissions (use of hydrogen and electrification)

In producing cement, we simultaneously recover energy and recycle minerals from a variety of waste streams (Co-processing) and use biomass. Co-processing places the cement industry at the heart of circular economy, and plays a key role in terms of waste management in local areas and municipalities.

The use of alternative fuels, totally or partially composed of biomass, in cement factories has an immediate positive impact on their carbon footprint. Unlike fossil fuels, CO_2 emitted by biomass fuels has been previously absorbed from the atmosphere, so they are considered neutral when accounting for emissions.

In addition, research is ongoing, although it is at an early stage, to use electrical heating, plasma or solar energy to calcine raw materials. Combined with the use of hydrogen and biomass fuels for the clinker process, this could result in near zero fuel CO_2 emissions.

New low carbon clinkers

New types of clinkers requiring less limestone in their composition and less energy input, are being developed. Examples of these include Sulpho-Aluminate Clinker (SAC) and Belite based clinkers.

Thermal efficiency

Improvements can still be made to the thermal efficiency of some of our kilns through converting preheater and other kiln types to precalciner kilns and by recovering heat from the cooler.

Carbon Capture, Utilization and Storage (CCUS)

In recent years, significant research has been undertaken at a pilot scale level to optimize reagent and membrane capture techniques. Trials are underway to find ways of concentrating CO_2 in the gas stream in order to make carbon capture more efficient and cost-effective. Captured CO_2 can then be transported to geological formations (such as empty or depleting oil and gas fields, or deep saline aquifers), where it is permanently stored.

Other permanent CO_2 capture techniques include the use of recycled concrete aggregates and minerals (such as olivine and basalt), namely mineral carbonation. Algae can also be used to absorb CO_2 and grow biomass, which can later be used to fuel the kiln or for agricultural or biochemical applications.

This is how we will be able to reduce CO_2 emissions in cement

Low clinker cements

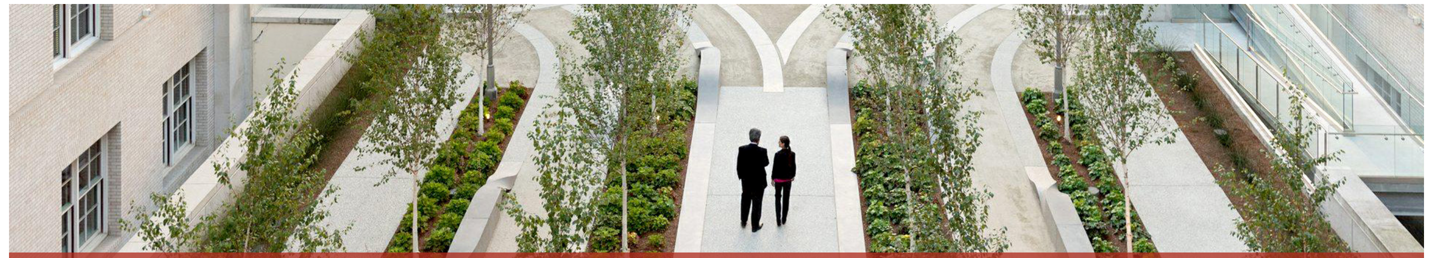
40% of the total substitutes of clinker are natural pozzolans, (volcanic natural materials) and limestone. Other non-traditional substitutes such as calcined clay and silica are being assessed, and there is also research on other materials which could be used in the future such as pozzolan materials from waste streams and slag from other industries.

Efficient and renewable electricity consumption

Electrical efficiency can be improved by changes to the preheater design on the kilns and improved grinding. By 2050, it is expected to double the electrical energy consumption at cement plants after incorporating Carbon Capture technology

Carbon neutral cement transport

There is significant research ongoing at present for industrial scale vehicles for both within the quarry and plant and on-road ones, which includes hybrid vehicles using electricity. Gradually, current fleets will be replaced by vehicles with electric motors, hydrogen or both.



This is how we will be able to reduce CO_2 emissions in (re)carbonation

Re-carbonation in the built environment

Re-carbonation occurs naturally in all concrete and mortar infrastructure. It can be estimated that 20% of process CO_2 emissions of cement used are absorbed during the life of the structure. An additional 3% can be added at the end of its life due to concrete crushing.

Enhanced re-carbonation of recycled concrete

Recycled concrete aggregates have a higher surface area and can absorb more easily CO_2. It has been shown that this process can be accelerated by using exhaust gases from a cement kiln which have a higher CO_2 content and are also at a higher temperature.

Carbonation of natural minerals

Some natural minerals such as olivine and basalt when crushed can also be re-carbonated when exposed to air or kiln exhaust gases. Once carbonated, these materials can be used as clinker substitutes.

This is how we will be able to reduce CO_2 emissions in concrete

Digitalization, improved mix design and new admixtures

Digitalization offers significant opportunities to reduce CO_2 emissions from concrete. Improved data and data processing will enable builders to get the exact amount of cement and concrete delivered on site to get the job done and avoid production scraps. Digitalization will also help monitor concrete during transport and ensure it is poured correctly, maintaining performance and avoiding possible excessive consumption.

Transport

One of the biggest sources of CO_2 emissions related to concrete production is transport to the job site and the energy needed to pump concrete to where it is needed. It is assumed that by 2050 all transportation will be handled by zero emissions vehicles (electric, hydrogen or a combination of both).

This is how we will be able to reduce CO_2 emissions in onstruction

Energy efficiency in buildings

Between 80 and 90% of the environmental impacts of a building occur during its use stage. Buildings that leverage the thermal mass properties of concrete can cut energy use by 25% and up to 50%. This thermal mass can also be incorporated into re-use of buildings.

Concrete used in buildings

Research is currently underway to look at ways of reducing embodied carbon of construction materials. This must be done ensuring that it does not lead to premature structural failures and guarantees the durability and working life of a structure. Improvements in building construction can also be done using 3D printing.

Design for adaptability and disassembly

Office building structures are often designed for multiple use, so an office block can be converted to an apartment building if the demand for office space in the area declines. The durability and longevity of concrete perfectly lend themselves to such adaptations to the changing needs of the market. In addition, our sector is also keen to explore the "design for deconstruction" model where a building is conceived at origin with the objective to disassembly at end of life.