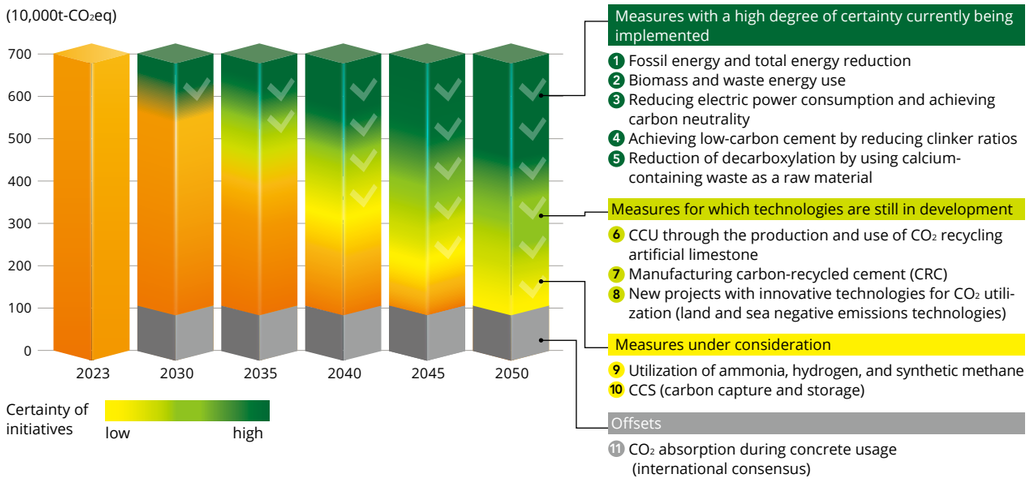
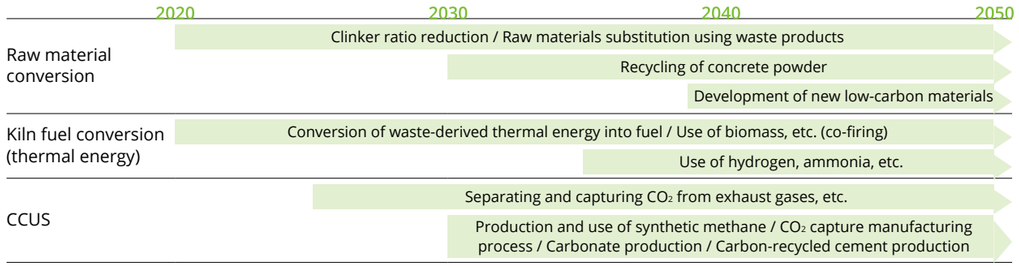
11 Steps to Carbon Neutrality by 2050

Achieving carbon neutrality in the cement industry requires a "reduction mix" that combines multiple measures. Our technology roadmap (see diagram below) shows the reduction mix measures divided into three stages, each corresponding with the phase of development. This roadmap was formulated with reference to national policies and roadmaps aimed at achieving carbon neutrality by 2050 (→P.62).

Our Technology Roadmap for Achieving Carbon Neutrality by 2050



[Reference] Excerpt from the Ministry of Economy, Trade and Industry's "Technology Roadmap for 'Transition Finance' in the Cement Sector" (March 2022)



Note: This roadmap was formulated with reference to national policies and international scenarios, and is consistent with the Paris Agreement.

Measures with a high degree of certainty currently being implemented

1 Fossil energy and total energy reduction
To reduce energy-related CO_2 emissions, we are introducing energy-saving and high-efficiency equipment, including state-of-the-art raw material mills at our cement plants.

2 Biomass and waste energy use
We are investing in related facilities at our cement plants, increasing our use of biomass and waste energy (waste plastics, waste tires, waste oil, etc.), and pursuing alternatives to fossil energy.

3 Reducing electric power consumption and achieving carbon neutrality
Approximately 80% of the electricity used at our cement plants is supplied by in-house power generation, and we are working to maximize the use of non-fossil energy sources such as biomass.

Our utilization of the coal-free power generated by the Tochigi Plant's biomass power plant means the electricity used at our head office is now essentially carbon neutral. Going forward, we will continue to explore further fuel conversion away from coal.

4 Achieving low-carbon cement by reducing clinker ratios
As a means of reducing clinker ratios, the industry is working in tandem to revise the JIS to raise the cap on minor mixed ingredients in cement from 5% to 10% (→P.62). We are also promoting the expansion of mixed cement use, such as by increasing the amount of blast furnace slag.

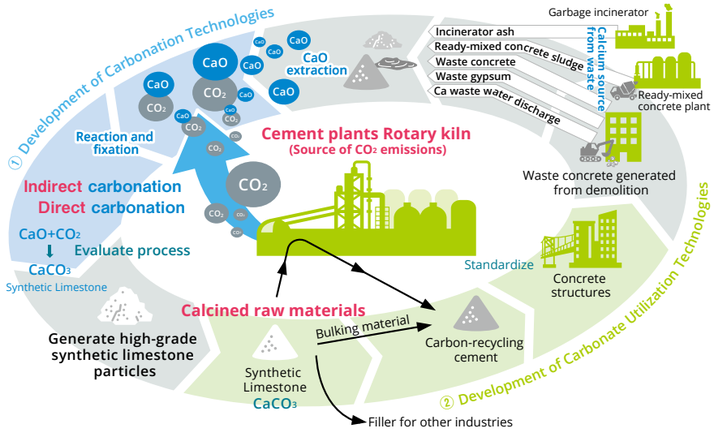
5 Reduction of decarboxylation by using calcium-containing waste as a raw material
We are reducing our use of limestone by collecting calcium-containing waste such as general incinerator ash, waste concrete, plasterboard, and waste gypsum board, and using those as "calcium-based raw materials with zero CO_2 emissions."

Measures for which technologies are still in development

With regard to the reduction of process-related CO_2, carbon capture, utilization, and storage (CCUS)—which captures CO_2 from exhaust gases for effective utilization—is indispensable.

6 CCU through the production and use of CO_2 recycling artificial limestone
In the "Establishment of Carbonation Chlorination Technology Using Various Calcium Sources," a project adopted by NEDO's*1 Green Innovation Fund,*2 as shown in the diagram below, we will achieve carbon capture and utilization (CCU) that extracts CaO from calcium-containing waste and recombines it with CO_2 in the exhaust gas from cement plants to produce artificial limestone ($CaCO_3$).*3 Looking ahead, we are initiating research on raw material utilization and market assessments for social implementation, aiming to mass-produce CO_2 recycling artificial limestone and promote its use across various industries, including construction, paper manufacturing, resins, and rubber (→P.54–57)

*1 New Energy and Industrial Technology Development Organization (NEDO) (→P.124)
*2 Green Innovation Fund (→P.124)
*3 R&D project with a total budget of ¥7.3 billion through 2030



7 Manufacturing carbon-recycled cement (CRC)
We will manufacture CRC using the recycled CO_2 artificial limestone produced in Step 6, and will market it to general contractors and secondary product manufacturers. At Expo 2025 Osaka Kansai, our CRC is being used in some of the buildings in the Sumitomo Pavilion (→P.57).

8 New projects with innovative technologies for CO_2 utilization (land and sea negative emissions technologies)
We will pursue new businesses utilizing cement plants and power plants. We will also consider initiatives to utilize CO_2 in the exhaust gases from biomass power plants for seedling cultivation and other agricultural and forestry purposes, as well as CO_2 sequestration using blue carbon derived from evolved seaweed bed propagation reefs. Through these efforts, we will create new businesses and propose next-generation carbon neutral solutions (→P.72–73).

Measures under consideration

9 Utilization of ammonia, hydrogen, and synthetic methane
We will study the development of a firing technology based on fossil energy and ammonia/hydrogen co-firing in cement kilns, and hope to put them into use by the latter half of the 2030s. We will also research the use of synthetic methane, produced by separating and recovering CO_2 from the exhaust gases of cement plants, for use as fuel.

10 CCS (carbon capture and storage)
CO_2 that cannot be effectively harnessed by carbon capture and utilization (CCU) must be stored underground (CCS), but there are issues regarding the scale of facilities and costs. Studies are currently underway in various regions, and national laws are being formulated. Since it will be necessary to establish a supply chain, we are beginning to conduct joint feasibility studies with our partners.

Offsets

11 CO_2 absorption during concrete usage (international consensus)
Concrete and cement products are rich in calcium, which is used for CO_2 mineral fixation, and are therefore promising sources for mineral fixation of atmospheric CO_2, i.e. negative emissions technologies (NETs). Evaluations are underway both domestically and internationally to determine whether concrete structures can absorb and fix atmospheric CO_2 throughout their lifespan. We have succeeded in the development and testing of a product that implements NETs, with an atmospheric CO_2 absorption and fixation rate more than twice that of ordinary cement, and are now on the verge of practical application (→P.56). In the future, we are looking into the possibility of offsetting CO_2 emissions by reaching agreement on a quantitative evaluation method.

CO_2 absorption by concrete (video)