2050 "Carbon Neutral" Vision

“SO-CN2050”

S**umitomo **O**saka **C**ement - **C**arbon **N**eutral **2050

December 1, 2020

SUMITOMO OSAKA CEMENT CO., LTD.

1. The Vision of
   Sumitomo Osaka Cement Carbon Neutral
   to 2050 (“SO-CN2050”)

2. The Target for reducing CO_2 Emissions
   to 2030

3. Action to challenge 2050 Carbon Neutral

1 2050 "Carbon Neutral" Vision "*SO-CN2050*"

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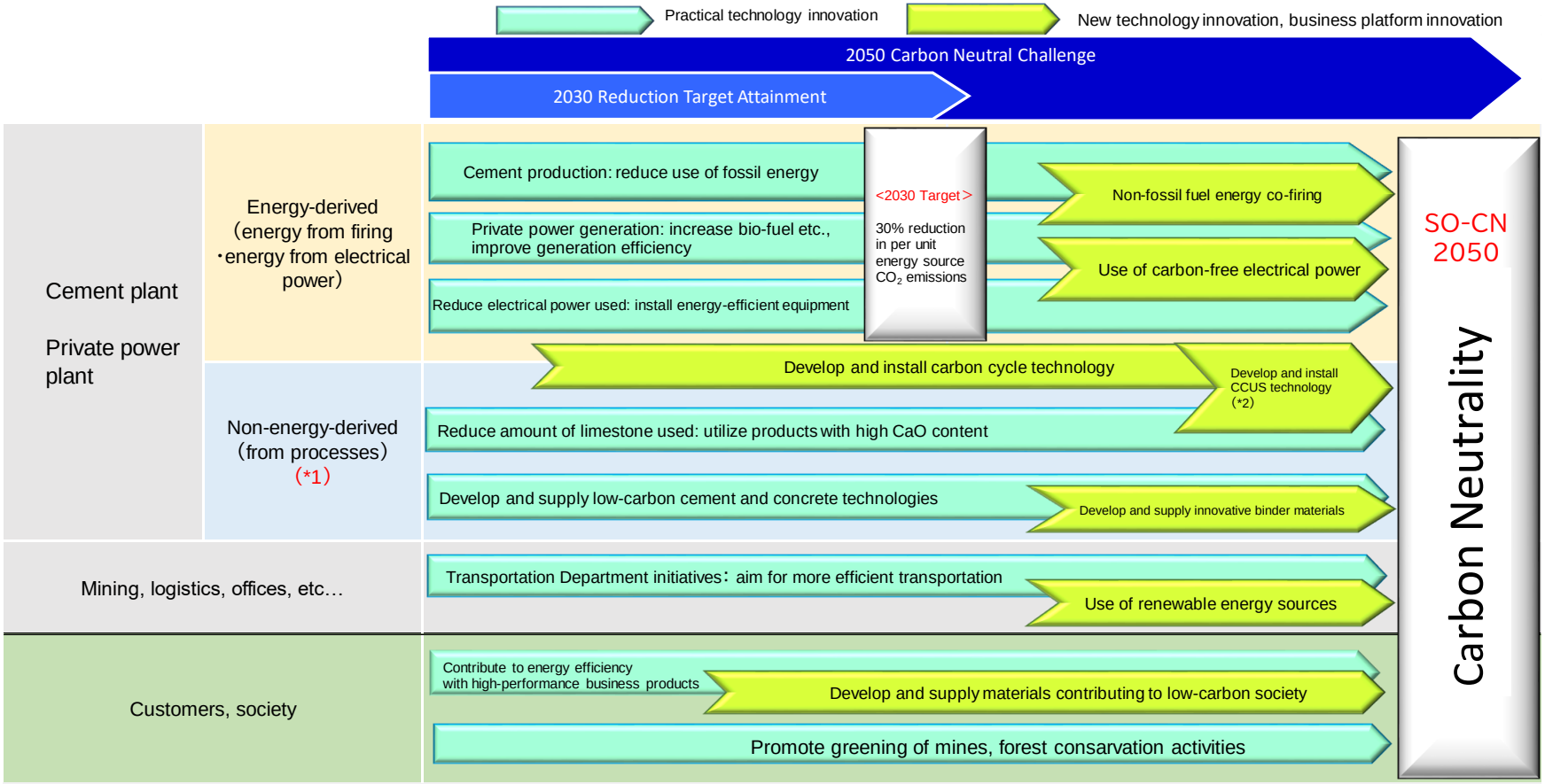
Along with the government policy and the target of carbon neutrality among the international community (CN) by 2050, Sumitomo Osaka Cement is aiming to reduce energy-derived CO_2 emissions as much as possible and think it important that how carbon neutrality can be achieved for overall CO_2 emissions including process-derived CO_2 emissions. Sumitomo Osaka Cement will implement all possible measures for reductions by innovation of own technologies and business framework and by all methods known in Japan and overseas to achieve carbon neutrality by 2050.



(*1) CO_2 released during high-temperature calcination of limestone ($CaCO_3$), the main ingredient cement. (*2) CO_2 capture, utilization and storage

2-(1) Target of CO_2 Emission Reduction in 2030

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Review of CO_2 emissions reduction achieved by the group of Sumitomo Osaka Cement

★ The alternative ratio of fossil energy and the amount of recycled materials used per production of one ton cement are ranked top-class in the domestic cement industry.

★ The private biomass power plant was installed first in the domestic cement plant, tying up with the project for maintaining and developing the local forest

<Alternative ratio of fossil energy>

2005 2019
17% → 28%

★ Two of our plants have already achieved more than 50% and one more than 40%

Average of Japanese cement Industry 19% (2018)

< Unit usage of recycled materials>

Amount of waste and by-products used per 1 ton of cement

2005 2019
447 kg/ton → 519 kg/ton

<Amount of wood biomass used*1>

2005 2019
58,000 tons → 417,000 tons

<Ratio of carbon-freed electric power*2 used>

2005 2019
8% → 22%

*1 Including the amount used in the on-site power generation
*2 Ratio of electric power used in production of cement which is generated by waste heat recovery and biomass power plants

Target 2030 : **"Reduction of energy derived CO_2 emissions per unit production of cement by 30% from the level of 2005 " *3**

*3 Equivalent to the amount of reduction in energy derived CO_2 emission by **approx. 45%** from the level of 2005

[Current plan for prevent global warming authorized by Japanese Government: 24% reduction in energy source CO_2 emissions compared to 2005 levels（12% reduction in industrial sector)]

2-(2) Actions to achieve 2030 target of reducing CO_2 emissions

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1) Maintaining the top-level of alternative ratio by further increasing recycled materials

More than 50% is the target alternative ratio of our cement plants in total

☞ More than 80% is the target alternative ratio of 4 kilns out of 8 kilns in 5 plants of Sumitomo Osaka Cement Group in total.

Tochigi Plant
1 kiln

Gifu Plant
2 kiln

Ako Plant
1 kiln

2) Reducing electrical energy consumption by minimizing thermal loss in process

Application of state of the art grinding process for raw materials

3) Reducing fossil energy used in on-site power plants

Increase in use of biomass fuel such as woodchips

3-(1) Policies leading toward 2050 (Cement Production)

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1) Achievement of "Zero" emissions of energy and process derived CO_2

Reducing use of fossil energy to the potential limitation

☞ CN tactics via further technical innovations
☞ Development of technology for co-firing non-fossil energy (NH_3, etc.)

Introducing technology for reducing process derived CO_2 emissions

☞ Development of technology for substituting limestone for recycled raw material containing Calcium

Advancing use of carbon-freed electric power

☞ Use of renewable energy sources

Developing technology for increasing supply of low-carbon cement and concrete

☞ Technology for increasing cement additives
☞ Extend market of blended cement

Developing technology and supply of innovative cementitious materials

☞ low-carbon footprint materials to replace clinker

Developing innovative technology for installing CCUS

☞ Including application of CCUS technology in the cement production process (utilizing waste materials containing Calcium as resources via carbon recycling)
☞ carbon recycling of flue gas by using hydrogen

3-(2) Policies leading toward 2050 (Other than Cement Division)

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2) Reduction of CO_2 emissions throughout supply chains and Contribution to shift carbon-free society

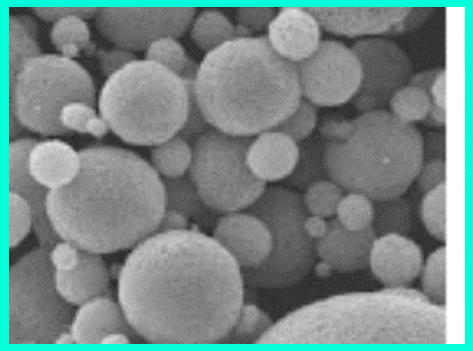
Encouragement for reduction of CO_2 emissions in logistic division and offices

- ☞ Use of clean energy for heavy machinery and transportation facility
- ☞ Use of renewable energy sources

(cement tanker)

Contribution to energy conservation with products in the High Performance Products Business

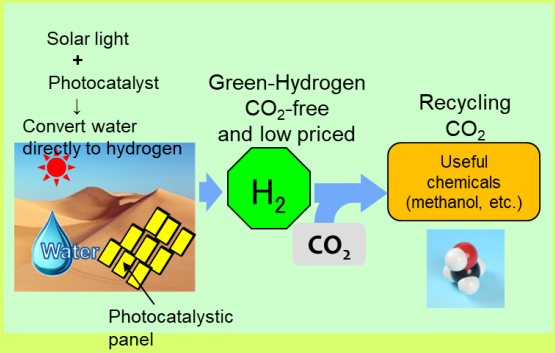
- ☞ Small, integrated optical communications devices
- ☞ Next-generation battery materials
- ☞ High-functional LED encapsulating materials



(material used in lithium-ion batteries)

Contribution to carbon-free society by developing new high-performance materials

- ☞ Supply materials used for photocatalytic panels for artificial photosynthesis



(schematic of artificial photosynthesis)

3-(3) Picture for reduction of CO_2 emissions to Carbon-Neutral (CN)

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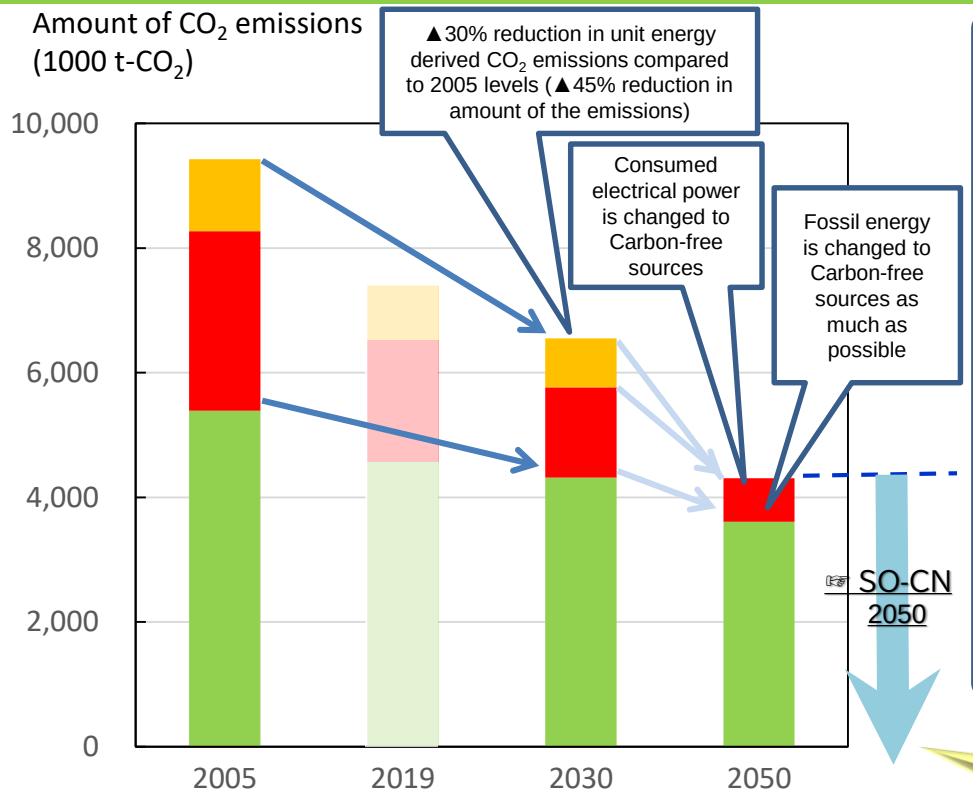

CO_2 from fossil energy

CO_2 from fossil energy for cement clinker burning

CO_2 from electrical energy

CO_2 from electrical power for cement production

Energy derived CO_2

Approx. 4 million tons of emissions in 2005

CO_2 from processes

Approx. 5 million tons of emissions in 2005

CO_2 released from calcium carbonate ($CaCO_3$) in limestone, which is the main ingredient of cement, by decarbonation to form calcium oxide (CaO)

* According to the definition by WBCSD (World Business Council for Sustainable Development), CO_2 from recycled materials, like biomass and wastes, are excluded from energy derived CO_2.

Strategy "SO-CN2050" **Challenges to achieve carbon neutral by taking all measures of technology innovation and business framework**	
Technological innovations	・Introduction of CCUS technology in cement production process (Reuse of Ca containing wastes by carbon recycle) ・Development of technology for co-firing non-fossil energy (NH3, etc.), etc.
Business framework innovations	・Carbon-free sources for consumed electrical power ・Carbon recycling of plant exhaust gas by using hydrogen, etc.
Contribution to CN	・Realize hydrogen-powered society by supplying materials for artificial photosynthesis photocatalysts, etc.

Introduction "Development of CCUS-related technology"

Technology to extract Calcium from waste materials,
and fix CO_2 to the Calcium by mineral carbonation

An innovative carbon recycling process is to extract calcium from a wide range of waste materials and to fix the CO_2 to the calcium by mineral carbonation. The carbonated materials can be reused.

Sumitomo Osaka Cement has started development of core technologies for CCUS system.

(NEDO selected as R&D project)