

Feature Carbon Neutral Initiatives and Information Disclosure Based on TCFD Recommendations

Chugoku Electric Power Group Carbon Neutral 2050

—Shifting gears as we aim to achieve a decarbonized society

In February 2021, the Chugoku Electric Power Group announced that it would work toward becoming carbon neutral by the year 2050.

To respond to the expectations of our stakeholders, at the Chugoku Electric Power Group we are currently engaged in efforts to reduce our environmental impact based on the S + 3E policy (Safety + Energy Security, Economic Efficiency, Environment). Elsewhere, we are working to mitigate climate change, which is a key issue in our Group Corporate Vision.

As Japan makes moves toward becoming carbon neutral by the year 2050, we will work together as a Group toward the same goal, and in turn endeavor to achieve sustainability for our future society.

Further, as a business with firm roots in the Chugoku region, we will collaborate with our communities to achieve carbon neutrality in local areas.

Targets

We will strive to be carbon neutral by 2050

- ◆ We proceed with the decarbonization of energy.
- ◆ We contribute to the development of local community through striving to be carbon neutral.
- ◆ We promote technological development for carbon neutral.

◆ We proceed with the decarbonization of energy.

○ As we aim to become carbon neutral by 2050, we will actively make use of decarbonized power sources, including renewable energy, and drive the decarbonization of our energy business.

◆ We contribute to the development of local community through striving to be carbon neutral.

○ Carbon neutrality by 2050 is a common goal for the whole of society. We will thus engage in various initiatives with local governments and businesses in the Chugoku region.

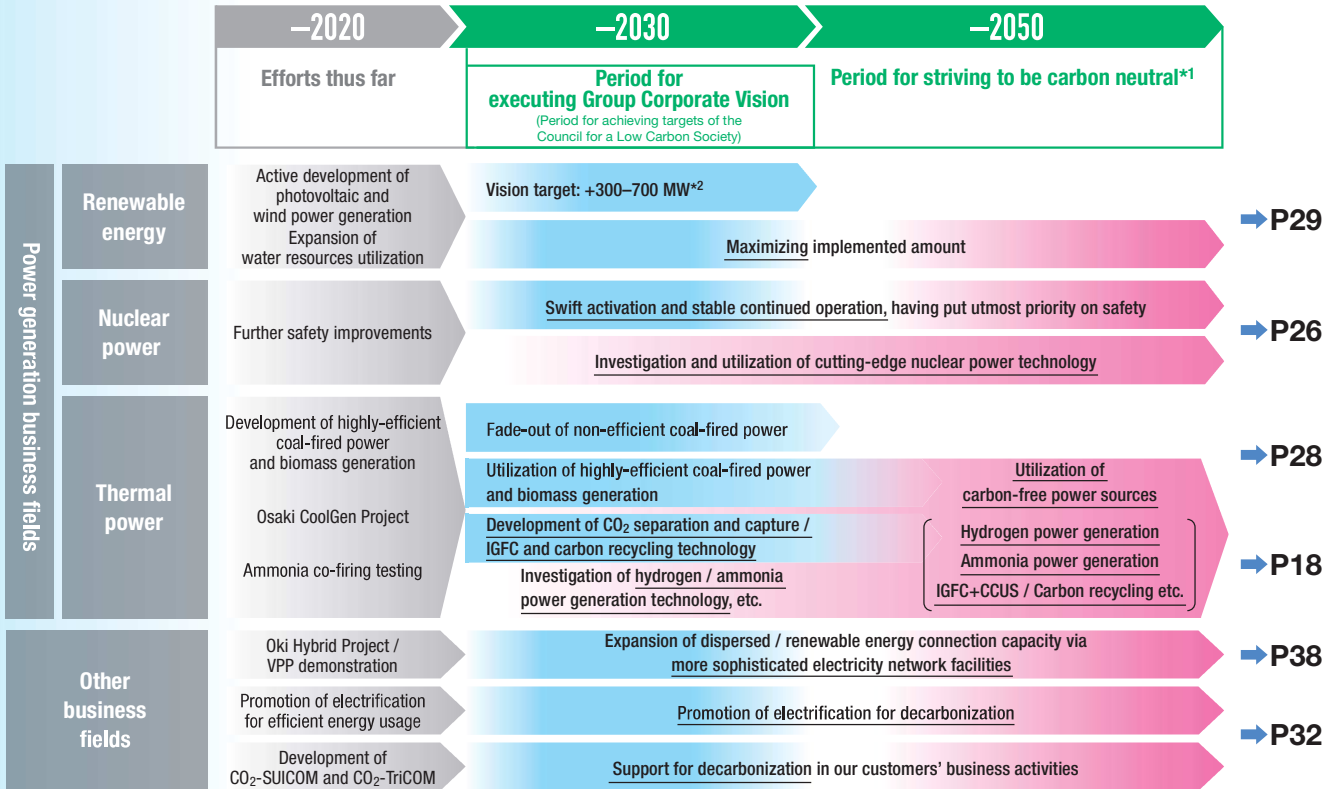
○ Through our efforts to become carbon neutral, in addition to providing services in diverse sectors, such as energy supply/use and information and telecommunications, we will collaborate with local governments and businesses who are engaged in their own efforts to contribute to regional development.

◆ We promote technological development for carbon neutral.

○ Innovative technological development will be essential in achieving carbon neutrality.

○ To date, we have pioneered the adoption of new technologies to help solve environmental issues and other social problems. Looking ahead, we will work not only as a Group, but look to collaborate with different industries and sectors through corporate alliances, joint research with universities, and more.

Road map to being carbon neutral by 2050



*1 We will sequentially utilize those items deemed to be commercially feasible based on cost reductions and the progress of technology development and the like. We will utilize carbon offset technology and the like for the CO₂ emitted from power stations as of 2050.

*2 Aiming to achieve this through efforts throughout the Group both in Japan and overseas.

Renewable Energy

- Among other efforts, through development of bottom-mounted offshore wind power and the acquisition and replacement of mega solar power plants after the feed-in-tariff scheme ends, we will aim to newly introduce 300–700 MW of renewable energy by 2030, which is one of the targets set out in our vision. We will also make efforts to introduce extra amounts of renewable energy.
- Furthermore, in anticipation of 2050, we are engaged in efforts to introduce floating offshore wind power. Technological development is currently underway on floating offshore wind power, which is thought to have higher potential than bottom-mounted offshore wind power.
- The Chugoku Electric Power Group's pumped storage hydroelectric power plants have a higher generation capacity than those of other companies. Using this characteristic, we will use surplus power from renewable energy sources to operate these pumped storage hydroelectric power plants, and in turn further increase the amount of renewable energy used.

Nuclear Power

- Nuclear power is an already practical option that can drive decarbonization. With safety as our foremost priority, we will focus our efforts on early launch and continued, stable operation.
- Working toward carbon neutrality in 2050, we will undertake development on our new location in Kaminoseki.

Thermal Power

- Alongside launching operations at the state-of-the-art Unit 2 of our Misumi Power Station, we will look to start operations at Units 2 and 3 at our Shimane Nuclear Power Station, and gradually shut down our

aging thermal power plants. On the operational side, we will proactively work to reduce CO₂ through mixed-fuel combustion using biomass and other means. Elsewhere, through demonstrations as part of the Osaki CoolGen Project, we will steadily undertake technological development for an IGFC with CO₂ separation and capture functions, as well as carbon recycling technologies.

- Ahead of 2050, in addition to hydrogen and ammonia power, we will look to combine carbon capture, utilization, and storage (CCUS) technologies with carbon recycling technologies, and make maximum efforts to mobilize all of our technological options.
- Elsewhere, as part of our efforts to create zero-emission thermal power, in principle, other than projects which have already commenced, we will refrain from new development of conventional coal-fired thermal power plants.

Other Business Fields

- In anticipation of further implementation of renewable energy, we will work to enhance our electricity network facilities, as well as the introduction of mechanisms that make effective use of existing grid facilities.
- Through a range of different activities, we will aim to further promote electrification, which has been positioned by the government as a promising means of decarbonization. These include our all-electric home recommendations, our partnerships with car manufacturers to popularize electric vehicles, and our proposals to upgrade to high-efficiency electric equipment.
- Through new services that use renewable energy, such as zero-CO₂ emission electricity plans and power purchase agreements for solar power self-consumption, we will support customers' efforts aimed at decarbonization.

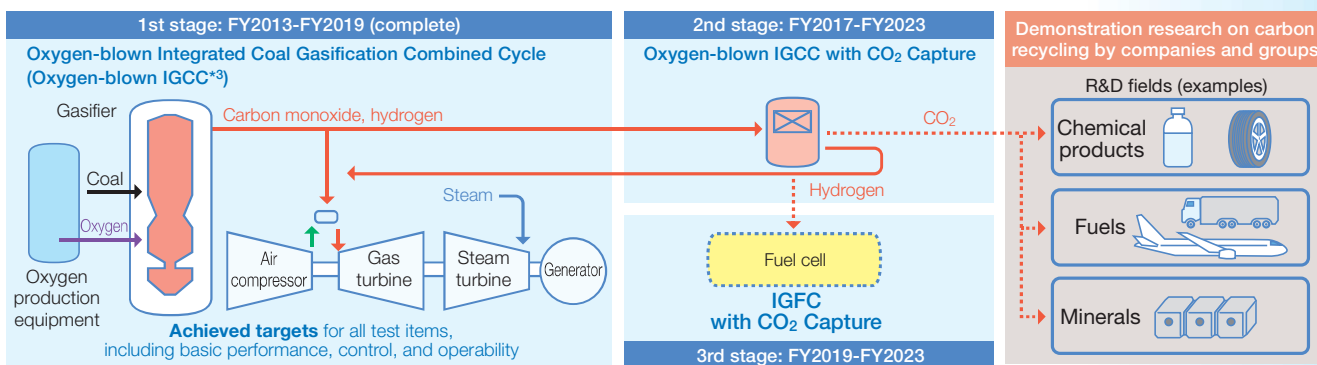
Main Initiatives Aimed at Carbon Neutrality

Promotion of the Osaki CoolGen Project

Through Osaki CoolGen Corporation, established jointly with Electric Power Development Co., Ltd., we are conducting demonstration tests to realize innovative low-carbon coal-fired thermal power combining an integrated coal gasification fuel cell combined cycle (IGFC*1) with CO₂ separation and capture.

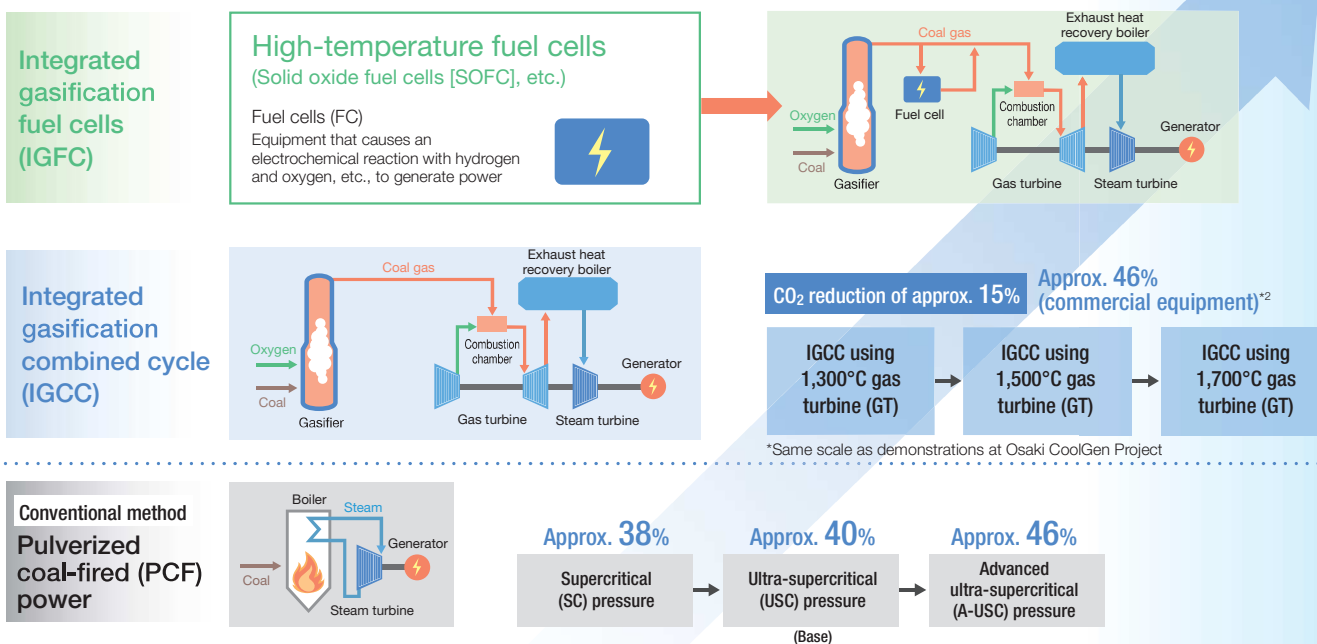
Compared to conventional ultra-supercritical coal-fired thermal power plants, this power generation technology drastically improves power generation efficiency, and can reduce CO₂ emission volumes by approximately 30% from the moment of application. Further, as the technology can efficiently separate and capture CO₂ from the fuel gas prior to combustion, it can contribute to huge CO₂ reductions when combined with CCUS and carbon recycling technologies.*2 As a result, it is predicted to become an excellent option for achieving carbon neutrality.

Also, the Ministry of Economy, Trade and Industry (METI) has designated Osakikamijima in Hiroshima Prefecture as a base for demonstrations and research on carbon recycling, and Osaki CoolGen Corporation is planning to supply the separated and captured CO₂ to companies and groups conducting research on carbon recycling. As part of this initiative, we will undertake two R&D projects on carbon recycling: R&D on concrete that makes effective use of CO₂, and development of a gas-to-lipid bioprocess.



*1 Technology that combines fuel cells (FC) with IGCC to further improve generating efficiency. *2 Technologies to utilize separated and captured CO₂ and store it underground, etc. *3 Technology whereby oxygen is used to gasify coal, yielding a product gas with H₂ and CO as its main constituents, which is used to drive gas turbines alongside steam turbines in combined cycle generation.

A Roadmap for Technological Development of High-efficiency Coal-fired Thermal Power



Figures represent power generation efficiency (Power transmission end/Higher heating value [HHV] standard)

*1 Approx. 67% for power generation end *2 Approx. 53% for power generation end

Created based on the Technology Source Document, Next-generation Thermal Power Road Map, Ministry of Economy, Trade and Industry

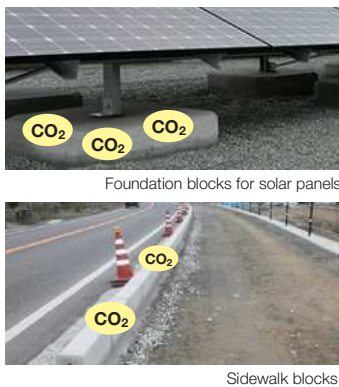
Experimental Research on Carbon Recycling (1) — R&D on concrete that makes effective use of CO₂ (CO₂-SUICOM)

In tandem with Kajima Corporation and Denka Company Limited, at Chugoku Electric we have developed an environmentally friendly concrete, CO₂-SUICOM.

CO₂-SUICOM makes use of a special admixture (composed of slaked lime, an industrial waste product), coal ash, and other materials to reduce the amount of cement used. In addition, CO₂-SUICOM can absorb and solidify CO₂ during the manufacturing stage to drastically reduce CO₂ emissions. In absorbing the maximum amount of CO₂, CO₂-SUICOM can lower actual CO₂ emissions derived from the materials to below zero. While CO₂-SUICOM is already being used for blocks and other factory-produced concrete products, challenges remain in using CO₂-SUICOM for reinforced concrete and concrete placement work at construction sites.

In anticipation of CO₂-SUICOM's further use in construction materials, in 2020, Chugoku Electric, Kajima Corporation, and Mitsubishi Corporation were commissioned by the New Energy and Industrial Technology Development Organization (NEDO) and are now conducting joint research and development.

- Winner of the Chairperson's Award (Excellence Award) at the 13th Eco-Products Awards (received in FY2017)
- Winner of the FY2014 Environment Minister's Award for Global Warming Prevention Activities



Expand scope of application

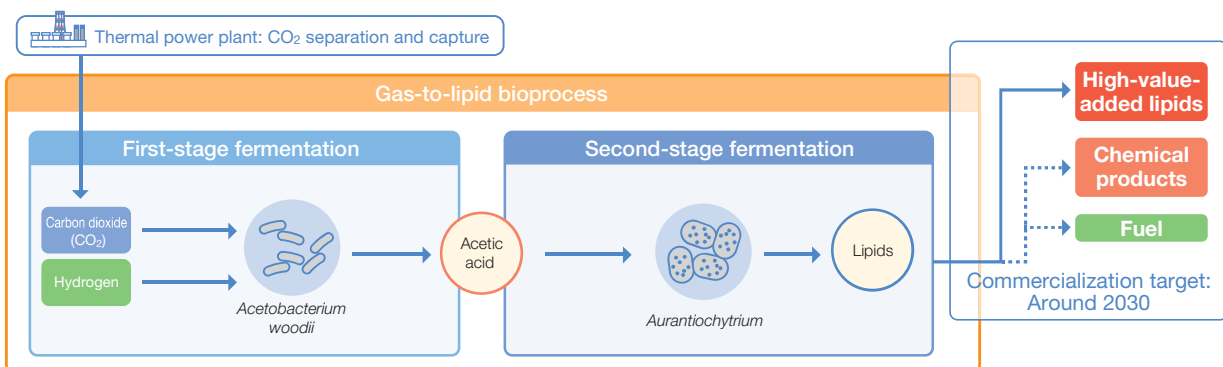
Commercialization targets 2024–2026



Experimental Research on Carbon Recycling (2) — Development of a gas-to-lipid bioprocess

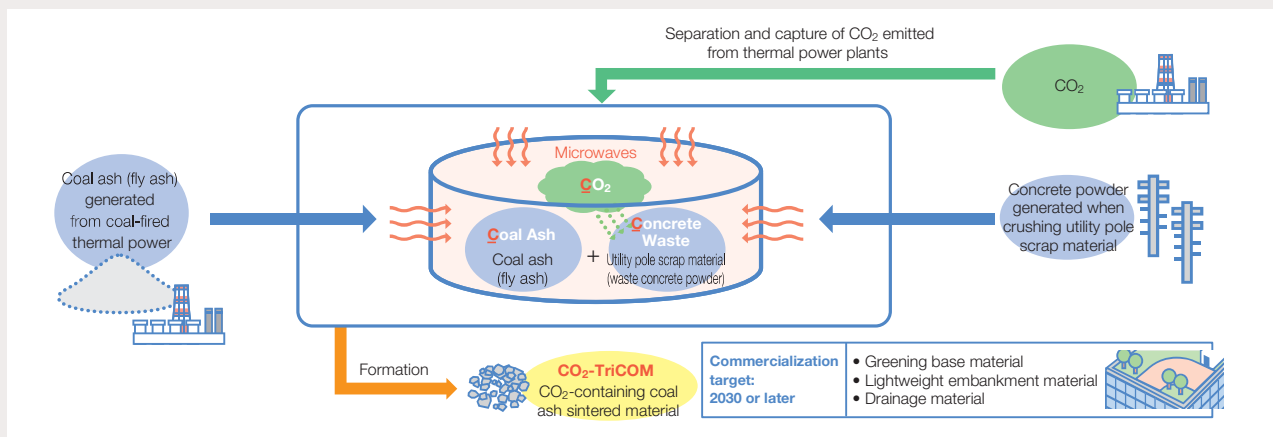
Having been commissioned by NEDO in 2020, we are currently working with Hiroshima University to develop a bioprocess for CO₂ recycling. Taking advantage of the fermentation functions of two microorganisms, the aim is to develop a technology that can use the hydrogen and CO₂ emitted from thermal power plants to produce high-value-added lipids for the manufacture of cosmetics and health products.

- Formation process**
- (1) Acetic acid-producing bacteria are fermented to reduce and solidify CO₂ using hydrogen in order to generate acetic acid.
 - (2) Oleaginous microorganisms are then fermented to generate lipids from the acetic acid in (1).



Experimental Research on Carbon Recycling (3) — Development of “Triple C” recycling technology (CO₂-TriCOM)

Commissioned by NEDO in 2020, we are currently working alongside Hiroshima University and our group company Chugoku Koatsu Concrete Industries Co., Ltd. to develop a “Triple C” recycling technology (CO₂-TriCOM) to reuse CO₂, coal ash and other materials for civil engineering. CO₂-TriCOM is a technology that mixes CO₂, coal ash and scrap materials from utility poles (a by-product of our electricity business). The mixture is sintered using microwaves, and CO₂ is solidified into the sintered material in the process. This revolutionary carbon recycling technology incorporates CO₂ into waste material to generate an entirely new product. We hope to establish the technology in 2–3 years’ time, and are currently working to ensure its early implementation.



Examination of Hydrogen and Ammonia Power Generation Technologies

As the country works toward becoming carbon neutral by 2050, hydrogen and ammonia have been attracting attention as fuel sources that do not emit CO₂ when combusted.

At Chugoku Electric, we will also examine various power generation technologies as we aim to utilize hydrogen and ammonia in our coal-fired thermal power systems and LNG-combined-cycle generation systems.

Trials of Ammonia Mixed-fuel Combustion at the Mizushima Power Station

In July 2017, we undertook trials of ammonia mixed-fuel combustion at the coal-fired Unit 2 of our Mizushima Power Station—the first trials in Japan for a business-use power plant. (Mixed-fuel combustion rate: Approx. 0.6% at 155 MW operation; approx. 0.8% at 120 MW operation)

In the mixed-fuel combustion burner, ammonia nozzles were positioned around the circumference of a central pulverized coal nozzle, with the ammonia released in a circular motion. This ensured that the ammonia flames created a spiral shape around the pulverized coal flame, extending the range of combustion, facilitating a longer combustion time, and in turn preventing incomplete combustion.

In addition to verifying the complete combustion of ammonia, we also confirmed that mixed-fuel combustion had no adverse impacts on other existing plants. It was also found that there were no significant differences in nitrogen compound levels compared to coal-fired combustion, thus confirming that ammonia mixed-fuel combustion can be undertaken within environmental standard values.

