



FY2022

Tokuyama TCFD Report

Disclosures Based on TCFD Recommendations

Governance

- Ⓐ Board's oversight of climate-related risks and opportunities
- Ⓑ Management's role in assessing and managing climate-related risks and opportunities

Strategy

- Ⓐ Climate-related risks and opportunities the company has identified over the short, medium, and long term; and Ⓒ the resilience of the company's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario
- Ⓑ Impact of climate-related risks and opportunities on the company's businesses, strategy, and financial planning

Risk Management

- Ⓐ Company's processes for identifying and assessing climate-related risks
- Ⓑ Company's processes for managing climate-related risks
- Ⓒ How processes for identifying, assessing, and managing climate-related risks are integrated into the company's overall risk management

Metrics and Targets

- Ⓐ Metrics used by the company to assess climate-related risks and opportunities in line with its strategy and risk management process
- Ⓑ Scope 1, Scope 2, and, Scope 3 greenhouse gas (GHG) emissions, and the related risks
- Ⓒ Targets used by the company to manage climate-related risks and opportunities and performance against targets



FY2022

Tokuyama Group supports the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) and has conducted repeated investigations into its climate risks and opportunities based on the TCFD recommendations. In FY2022, we further analyzed these risks and opportunities, strengthened our strategy, and clarified our metrics and targets. Tokuyama discloses its climate change efforts in line with the TCFD's four thematic areas that represent core elements of how companies operate: Governance, Strategy, Risk Management, and Metrics and Targets.

Governance	Strategy	Risk Management	Metrics and Targets
<ul style="list-style-type: none"> a Board Oversight b Management's Role 	<ul style="list-style-type: none"> a Risks and Opportunities; and c Resilience of Strategy b Impact on Organization 	<ul style="list-style-type: none"> a Risk ID and Assessment Processes b Risk Management Processes c Integration into Overall Risk Management 	<ul style="list-style-type: none"> a Climate-related Metrics b Scope 1, 2, 3 GHG Emissions c Climate-Related Targets

Governance

Tokuyama Group has identified climate change as one of its most significant management risks. Accordingly, contributing to global warming mitigation is one of the key objectives under its current Medium-Term Management Plan, which began in FY 2021.

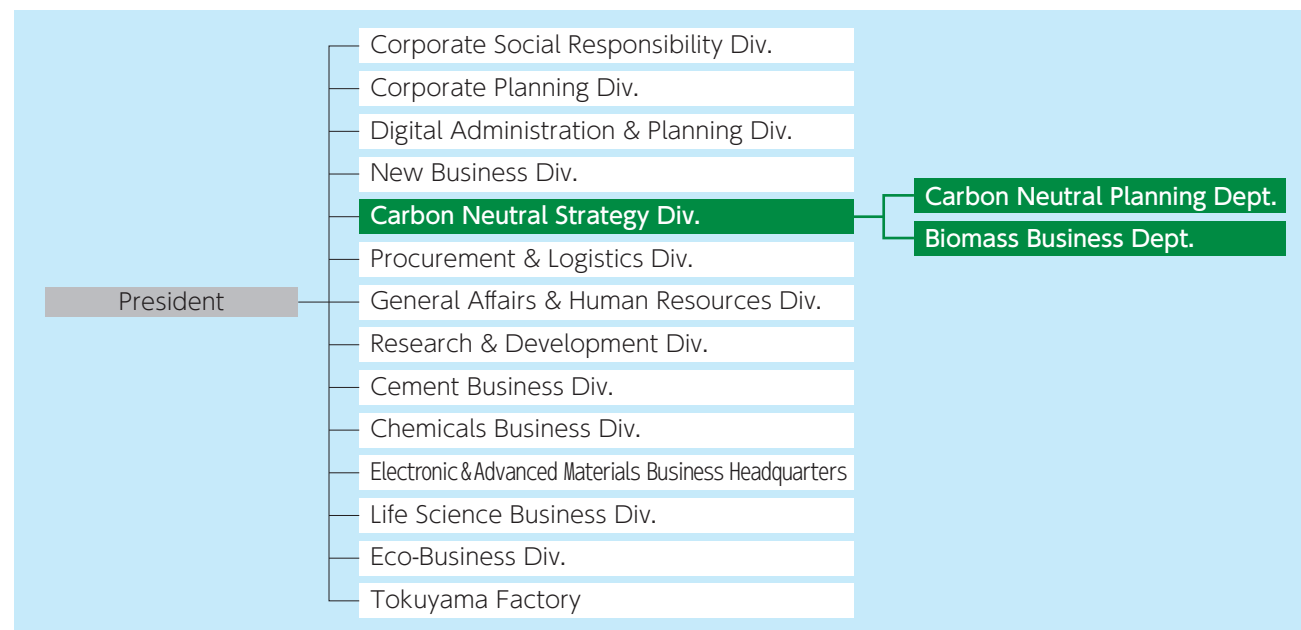
Two months after announcing our support for the TCFD recommendations in February 2021, we established Carbon Neutral Strategy Dept. directly under the president. With the transition from the concept stage to the implementation phase, Tokuyama has now accelerated its efforts by establishing Carbon Neutral Strategy Div., which has the status of an independent division.

Figure 1: Medium-Term Management Plan [FY2021 to FY2025]

1 Transform business portfolio	Increase growth businesses' share of consolidated net sales to over 50%
2 Contribute to mitigation of global warming	Expedite development/commercialization of next-gen energy technologies; reduce GHG* emissions 30%** by FY2030
3 Practice socially responsible management	Step up high-priority CSR initiatives to lay groundwork for further growth and realize our vision

* GHG : Greenhouse Gas
** Base year FY2019

Figure 2: Organizational Position of the Carbon Neutral Strategy Div.



Governance

- a Board Oversight
- b Management's Role

Strategy

- a Risks and Opportunities; and c Resilience of Strategy
- b Impact on Organization

Risk Management

- a Risk ID and Assessment Processes
- b Risk Management Processes
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Metrics and Targets

- a Climate-related Metrics
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a Board's oversight of climate-related risks and opportunities

Matters related to climate change are discussed by the Executive Committee, which then adopts resolutions as necessary. Such matters include corporate policies for addressing climate change, the formulation of medium and long-term strategies to achieve those policies, and the selection of investment projects, etc. The resolutions are then reported to the Board of Directors. Additionally, decisions on matters of particularly high importance are taken by the Board of Directors after deliberation by the Executive Committee.

Figure 3: Corporate Governance Structure

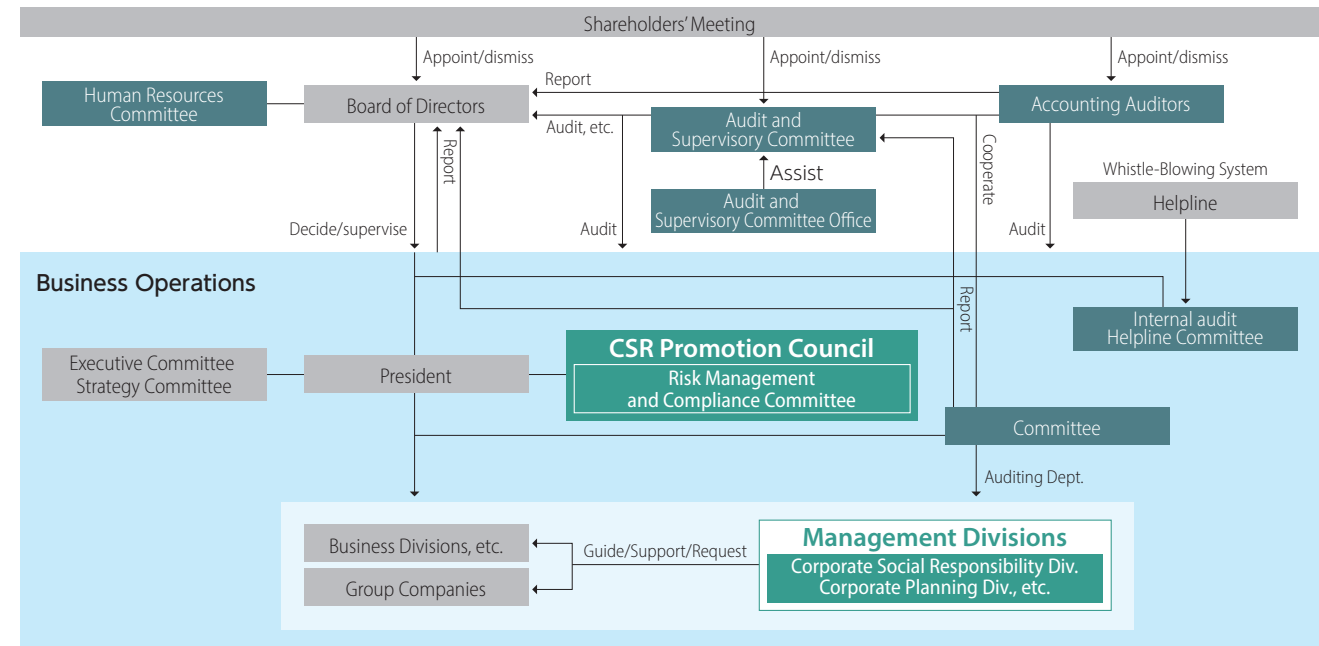


Table 1: Process and Frequency for Reporting and Approval of Climate-Related Matters

Approval Process	FY2022 Results	Notes
Board of Directors	Annually(17)	<ul style="list-style-type: none"> Receives reports on and oversees CSR matters, including climate change activities Receives reports on and oversees matters that can help achieve key measures under the Medium-Term Management Plan
CSR Promotion Council	Meets annually	<ul style="list-style-type: none"> The president chairs the council, which reports to the Board of Directors on its meetings and the activities of the council's eight subcommittees
Sustainability Committee	Meets quarterly	<ul style="list-style-type: none"> Established in FY2022, the Sustainability Committee permits Group directors to attend its meetings as observers Summary reports are provided to the Board of Directors
Environment Committee	Meets annually	<ul style="list-style-type: none"> This committee oversees onsite environmental audits conducted across the Group, and monitors the energy-saving activities of individual Group sites
Executive briefing of Carbon Neutral Strategy Dept.	Meets quarterly	<ul style="list-style-type: none"> Reporting on and investigating decarbonization measures

Governance

- a Board Oversight
- b Management's Role**

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b Management's role in assessing and managing climate-related risks and opportunities

Tokuyama has established an approval process for climate change related initiatives. The president bears ultimate responsibility for the Group's efforts to help combat climate change.

Chaired by the president and composed of the executive officers, the CSR Promotion Council meets once a year in principle to determine the Group's CSR policies and targets. Based on the principle that appropriate corporate governance and internal control form the foundation of CSR activities, the council discusses important matters related to internal control, and reports its decisions to the Board of Directors as necessary. These decisions are incorporated into the Group's strategies, and are overseen by the Board of Directors.

Under the CSR Promotion Council is the Sustainability Committee, which meets two times a year in principle, and the Environment Committee, which is scheduled to convene once a year. The former directs the Group's CSR-related initiatives including those for addressing climate change, while the latter provides broad oversight for environmental audits at Group sites and consolidates reports on the Group's energy-saving and other activities. The purpose of these two bodies is to accelerate the Group's efforts to help combat climate change. We have analyzed the Group's risks and opportunities associated with climate change and have incorporated the findings into our Medium-term Management Plan 2025.

All the executive officers and outside directors participate in seminars to learn more about global warming and attended two such activities in FY2022. These seminars monitor the latest trends and regulatory systems related to climate change and is making preparations to enable rapid response as necessary.

Figure 4: System to Promote Carbon Neutrality Achievement



Table 2: Process and Frequency for Receiving Reports, and Monitoring Mechanism

Reporting Process	Meeting Frequency (Number of meetings in FY2022)	Monitoring Mechanism
Executive Committee	Twice a month in principle (29)	With "contribution to global warming mitigation" set as a priority issue under the Medium-Term Management Plan 2025, the committee deliberates on the strategic planning and capital investment needed to mitigate climate change risks.
CSR Promotion Council	Annually (1)	Chaired by the president, the council manages progress on addressing material issues, while receiving activity reports from the Risk Management and Compliance Committee and its eight expert subcommittees.
Sustainability Committee	Semiannually (4)	Chaired by the director responsible for CSR, the committee directs the Group's CSR initiatives including climate change.
TCFD Task Force	As necessary (6)	Positioned under the Sustainability Committee, the task force assembles its members from across the Group to investigate and promote practical initiatives that meet the TCFD recommendations.
Environment Committee	Annually (1)	The committee provides general oversight of the environmental audits conducted at each production facility, receives energy conservation activity reports, and sets environmental targets for the next fiscal year.
Top executives' interview with Carbon Neutral Strategy Dept.	Monthly (12)	Responsible for investigating and implementing decarbonization measures.
Officer Seminars	Annually (2)	Seminars on carbon neutrality achievement for all executive officers.

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Strategy

The Group's Medium-Term Management Plan 2025 addresses both the risks related to climate change, and the potential new business opportunities in the environmental field. The risk mitigation measures include making visible the carbon costs arising from the introduction of carbon pricing, addressing the impact of potential changes in customer procurement policies, and identifying the impact on financing arising from potential policy changes at financial and investment companies. Moreover, by referring to the International Energy Agency's (IEA) transition risk scenarios (such as the Net Zero Emissions by 2050 Scenario [NZE]), and the Intergovernmental Panel on Climate Change's (IPCC) physical risk scenarios (such as RCP8.5 and SSP3-7.0), we conducted risk and opportunity analysis using 1.5°C and 4°C warming scenarios covering a period from the present to 2050. Our aim is to monetize promising business opportunities while reducing climate change risks by shifting our portfolio from energy-intensive to value-creating companies.

Ⓐ Climate-related risks and opportunities the company has identified over the short, medium, and long term; and Ⓒ the resilience of the company's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario

In FY2021, we began analyzing the risks and opportunities that the Group faces due to climate change. In FY2022, we evaluated the potential financial impacts on the

Table 3: Risks Posed by Climate Change (scenario analysis)

Scenario	Risk category	Target of risk assessment	Potential impacts on the Group (financial) (identified risks)	Financial impact	Timing of risk materialization	Impact on business	Priority level	Response measures
1.5°C	Government policy and regulations	① Carbon pricing and energy procurement costs	● Increase in operating costs due to expanded carbon pricing	Moderate	Medium to long term	Large	Low	<ul style="list-style-type: none"> ● Monitoring carbon pricing policy trends and conversion to non-fossil fuels ● Evaluation and implementation of measures based on internal carbon pricing ● Participation in the GX League
			● Increase in mitigation measure costs due to tightening of GHG emission regulations	Moderate	Medium to long term	Large	High	
	Technology	② Green process adoption measures	● Increased green energy production and procurement costs	Large	Medium term	Large	High	<ul style="list-style-type: none"> ● Construction of large-scale supply chains and advancement of efficient technologies for green energy utilization ● Procurement system and process development
			● Increased costs for green material procurement and green process conversion due to lack of technology and market maturity	Large	Medium to long term	Large	High	
4°C	Evaluation	③ Evaluation by stakeholders	<ul style="list-style-type: none"> ● Decline in market value and increase in financing costs due to a poor evaluation of carbon neutrality initiatives ● Risk of litigation by local residents to shut down or decommission coal-fired power plants owned by Tokuyama ● Sustainability risks for biomass fuel 	Large	Medium to long term	Large	High	<ul style="list-style-type: none"> ● Enhanced disclosure of information and setting GHG emission reduction targets ● Transform Business Portfolio ● Ensuring the sustainability of biomass fuel
	Market	④ Penetration of green procurement by customers	<ul style="list-style-type: none"> ● Rejection of products by the market based on large carbon-footprint evaluation ● Decrease in profitability due to the inability to pass on the price fully cover costs for green process adoption 	Large	Medium to long term	Large	High	<ul style="list-style-type: none"> ● Steady reduction of GHG emissions ● Creation of green products based on mass balance approach certification ● Enhancing supply chain cooperation for proper green market formation ● Construction of a carbon footprint evaluation system
4°C	Physical risks (acute)	⑤ More frequent extreme weather events and sea level rise	● Wind and flood damage to production facilities; production plans delay and increased costs due to supply chain disruptions, etc.	Moderate	Long term	Moderate	Moderate	● Enhanced BCP measures
	Physical risks (chronic)	⑥ Long-term intensification of extreme weather events and rising sea levels	<ul style="list-style-type: none"> ● Decrease in production capacity due to insufficient factory cooling capacity caused by rising average temperatures ● Production halts due to storm surges caused by rising sea levels 	Minimal	Long term	Minimal	Low	● Setting GHG emission reduction targets

Short term: by FY2025; medium term: by FY2030; long term: by FY2050

Group of those risks and opportunities, the potential timing of their occurrence, the impact on business, and the priorities for addressing these risks and opportunities.

Based on the analysis results, the Group is investigating specific measures to enhance resilience in its organizational strategies.

Government policy and regulations

① Carbon pricing and energy procurement costs

Impact on Tokuyama Group

Increase in operating costs due to expanded carbon pricing (medium to long term)

Tokuyama uses coal mainly for onsite power plants. We paid approximately 1.7 billion yen in environmental taxes (Japan's petroleum and coal tax, and carbon tax) in FY2022, which is equivalent to approximately 12% of operating income.

Moreover, under the Japanese government's "growth-oriented" carbon pricing plan, Phase 1 of emissions trading will begin in FY2023, with full-scale emissions trading starting in FY2026. Then a carbon levy will be introduced in FY2028, which will gradually increase thereafter. Accordingly, Japanese carbon pricing will be introduced in stages. Since the details of these programs have not been fully determined yet, it is difficult to estimate the financial impact on the Group at this time. However, assuming a tax of 10,000 yen per ton of CO₂ emissions from fuels-derived, if our CO₂ emissions remain at the same level as in FY2022, the annual cost will be approximately 48 billion yen.

Increase in mitigation measure costs due to tightening of GHG emission regulations

In April 2023, Japan implemented the Revised Act on Rationalizing Energy Use. Under this law, in addition to conventional promotion of energy conservation, requirements for conversion to non-fossil energy have been established. Guidelines for quantitative targets to be

achieved by FY2030 have also been implemented for industries with substantial emissions.

• **Cement** production: Achieve a non-fossil fuel ratio of 28% in firing processes (kilns, etc.)

• **Chemical** industry (soda industry: main fuel is coal): Reduce coal consumption by 30% compared to FY2013

Tokuyama will set targets based on established guidelines and work on conversion to greener fuels.

While there are no penalties for failure to achieve targets, if the performance of an organization is found to be significantly inadequate, recommendations and announcements will be made after considering the level of the relevant technology and the situation for non-fossil energy supply.

We are working to achieve a 50% reduction compared to FY2019 for GHG emissions from onsite power plants by FY2030, and is aiming to switch to non-fossil fuels (biomass and ammonia) to achieve this. To achieve a 30% reduction in GHG emissions through co-firing with biomass and a 20% reduction through co-firing with ammonia, we estimate that approximately 11 billion yen will need to be invested in biomass technology along with about 15 billion yen in ammonia.

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Government policy and regulations

① Carbon pricing and energy procurement costs

Response measures

Monitoring carbon pricing policy trends and conversion to non-fossil fuels

The Group needs to steadily reduce its GHG emissions to mitigate the risk of increased manufacturing costs due to carbon pricing.

Tokuyama is aiming to achieve a 50% reduction in GHG emissions from onsite power plants compared to FY2019 by 2030, and it plans to switch to non-fossil fuels (biomass and ammonia) for onsite power plants. The rate of co-firing with biomass will gradually increase starting in FY2023. Co-firing with ammonia is scheduled to begin starting in FY2025 and beyond. A basic plan for biomass and ammonia adoption is currently being implemented, as part of a project sponsored by Japan's Agency for Natural Resources and Energy (FY2023 Oil Supply Structure Advancement Project Cost Subsidy: Project to Promote Transition to a Stable Supply of Next-Generation Fuels).

To cover the cost of this emissions reduction project, we will utilize government subsidies, and pass on the remaining costs through higher product prices.

Over the short term, the Group will promote energy-saving activities in each manufacturing department. These include installing new electrolyzers with high energy-saving efficiency and reducing coal consumption by co-firing with biomass and hydrogen at onsite power plants. In FY2022, we were able to reduce GHG emissions by 120,000 tons-CO₂e through energy conservation activities.

Evaluation and implementation of measures based on internal carbon pricing

In FY2019, Tokuyama adopted internal carbon pricing (ICP) as a criterion for evaluating investment projects to promote GHG emissions reduction. Initially, the price of carbon was set at 3,700 yen per ton of CO₂, based on the European Union Emissions Trading System (EU-ETS) price. In order to further enhance our efforts to reduce GHG emissions, in FY2022 we raised our price of carbon to 10,000 yen per ton of CO₂. In the short and medium terms, we will promote energy-saving activities and work to reduce coal consumption by co-firing with biomass and ammonia at onsite power plants.

Participation in the GX League

As various regulatory systems, including carbon pricing, are gradually implemented, we will need to collect information in order to respond quickly to these developments. As of FY2023, we have joined the Japanese government's GX League for companies and we are also participating in the emissions trading framework. Going forward, the GX League will play a central role for investigating various issues related to carbon neutrality achievement, including carbon pricing. Tokuyama will gather relevant information and express its opinions at GX League meetings, in order to help create a regulatory system that is even fairer.

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Technology

② Green process adoption measures

Impact on Tokuyama Group

Response measures

Increased green energy production and procurement costs (medium term)

Tokuyama has four coal-fired power plants. One of these is a circulating fluidized bed boiler that can also operate on biomass exclusively, and we plan to increase the biomass use ratio and reduce coal use in FY2023. On the other hand, the remaining three boilers are pulverized coal-fired boilers, and capital investment will be required to convert them to biomass or ammonia use. If we reduce our GHG emissions by 30% through biomass co-firing and by 20% through ammonia co-firing, approximately 11 billion yen will need to be invested in biomass technology along with about 15 billion yen in ammonia equipment. At the same time, operating costs are expected to increase due to the procurement of biomass and ammonia.

Increased costs for green material procurement and green process conversion costs due to the lack of technology and market maturity (medium to long term)

In order to achieve carbon neutrality, not only does energy input need to be green, but also raw materials and production processes. Many of these processes are still being developed, as relevant markets and technologies are yet to be established. Since many green technologies and markets are still immature, there is a risk of increased costs.

Construction of large-scale supply chains and advancement of efficient technologies for green energy utilization

Building a large-scale supply chain is essential for reducing the cost of green energy. To procure biomass fuel, the Group installed equipment for handling wood pellets at the port of Tokuyama. We are making efforts to efficiently unload biomass fuel, which we will need more of going forward.

To obtain ammonia, we are working with relevant companies to build an ammonia supply chain in the Shunan Industrial Complex.

Procurement system and process development

In order for the green market to become established, major players need to participate on both the supply and demand sides. Tokuyama is making efforts to establish a green market as both supply and demand participants.

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Evaluation

③ Evaluation by stakeholders

Impact on Tokuyama Group

Decline in market value and increase in financing costs due to a poor evaluation of carbon neutrality initiatives (medium to long term)

Our stock price could suffer if investors see the ownership of coal-fired power plants as a high risk. Moreover, we could be charged higher interest rates on our borrowing if we are evaluated as a high-risk company, and our financing costs would then increase.

Risk of litigation by local residents to shut down or decommission coal-fired power plants owned by Tokuyama (medium to long term)

In Japan, lawsuits have been filed against constructions of coal-fired power plants by local residents, and there have been cases where such construction plans have been cancelled. As Tokuyama owns four coal-fired power plants, we could be sued to shut down or decommission these facilities if our efforts to reduce coal consumption are seen as insufficient.

Sustainability risks of biomass fuels

We plan to use Green Gold Label-certified palm kernel shells to fuel our power plants, and will increase procurement of this material going forward. At the same time, we are investigating the development and procurement of other biomass fuels, mainly agricultural residues. By increasing co-firing with biomass, we will reduce our coal use and GHG emissions.

On the other hand, the palm industry has been criticized for problems such as deforestation and labor rights issues. Fraudulent certification of wood pellets has also been discovered in Vietnam, so expanding biomass fuel procurement also carries a certain level of risk.

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Evaluation

③ Evaluation by stakeholders

Response measures

Enhanced disclosure of information and setting GHG emissions reduction targets

For Scope 1 and 2 emissions, we have set goals to achieve carbon neutrality by FY2050 and achieve a 30% cut in GHG emissions by FY2030 compared to FY2019. The Group is calculating and disclosing emissions in accordance with the GHG Protocol. Tokuyama also calculates and discloses its Scope 3 emissions on a non-consolidated basis.

We also disclose information based on the TCFD recommendations and actively provide the information required by stakeholders.

The Group will strive to build even stronger relationships of trust with local residents by explaining our environmental initiatives and actively participating in community activities.

Transform Business Portfolio

Tokuyama will conduct business evaluations using environmental benchmarks such as internal carbon pricing. We will also focus on changes in the factors that determine competitiveness during the transition to a low-carbon society and incorporate them into our business strategy. As part of these activities, we will investigate the transfer of resources from businesses deemed to be less competitive to growth businesses.

The Group will investigate the ways to obtain financing at low interest rates (such as issuing green bonds) by developing businesses that accelerate the shift to carbon neutrality.

Ensuring the sustainability of biomass fuel

In order to reduce GHG emissions, we plan to increase co-firing with biomass going forward. We will focus on achieving sustainability, such as securing biomass fuels that have acquired the level of certification required by Japan's feed-in tariff system for renewable energy. We will also promote CSR procurement, which addresses one of our material issues. At the same time, we will work to mitigate risks, such as promoting procurement in regions with low sustainability risks.

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Market

④ Penetration of green procurement by customers

Impact on Tokuyama Group

Rejection of products by the market based on large carbon-footprint evaluation (medium to long term)

As a chemical company, Tokuyama produces substantial GHG emissions. In recent years however, the accepted rules for calculating a product carbon footprint (i.e., the GHG emissions associated with the product over its life cycle) have become clearer. Going forward, we will need to share carbon footprint data in response to inquiries from customers, and targets to reduce these footprints must be established for each product. If we fail to achieve these targets, sales of our products could be affected. In particular, sales to customers who are actively working to combat global warming could very well decrease.

Decrease in profitability due to the inability to pass on the price to fully cover costs for green process adoption (medium to long term)

Tokuyama is investigating fuel conversion and green power procurement to reduce GHG emissions from fuels-derived, but we also assume that energy costs will rise going forward. Therefore, we need to assume an appropriate green market energy price that takes into account the rising costs associated with fuel conversion. However, there is a risk of lower profit margins if the costs related to green process adoption cannot be passed on through higher product prices.

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Market

④ Penetration of green procurement by customers

Response measures

Steady reduction of GHG emissions

To ensure that its products remain competitive in the market, the Group must achieve its FY2030 GHG emissions reduction targets.

First, we will further promote ramp up energy-saving activities to fully eliminate any energy waste. Tokuyama will steadily reduce GHG emissions from fuels-derived by steadily adopting co-firing with biomass and ammonia.

Creation of green products based on mass balance approach certification

Since Scope 1 emissions from electricity and steam generation cannot be reduced using carbon offset credits, and since the Tokuyama Factory generates all its own power, we need to ensure that all the electricity produced by the factory is green in order for it to make green products. Therefore, we will obtain certification for biomass power and steam generation based on the mass balance method. This will enable specific products to be labeled as green and will satisfy customer demand for green products.

Enhancing supply chain cooperation for proper green market formation

Businesses that directly emit GHG emissions are responsible for reducing those emissions. However, the relevant costs will likely not be borne entirely by those businesses, but by society as a whole. Therefore, we will strengthen cooperation with other stakeholders so that the entire supply chain can work to help create a sound green market.

Construction of a carbon footprint evaluation system

In order to promote greener products, it's necessary to visualize the GHG emissions associated with each product over its entire life cycle, along with the method for calculating each product's carbon footprint. Guidelines for carbon footprint calculation have already been issued by the government and industry groups, so we will create our own calculation rules based on these.

Physical risks (acute)

⑤ More frequent extreme weather events and sea level rise

Impact on Tokuyama Group

Response measures

Wind and flood damage to production facilities; production plans delay and increased costs due to supply chain disruptions, etc. (long term)

Since the Tokuyama Factory is situated in a coastal industrial complex, if extreme weather events (such as heavy rains, lightning strikes, and major typhoons) increase due to the effects of climate change, production could be interrupted due to facility flooding. In the past, large typhoons have not caused sufficient damage to affect operations, but they have caused water and other damage to some equipment. In 2018, when torrential rains caused landslides that damaged the JR Sanyo Main Line, we were forced to shift some transport from rail to truck, which increased transportation costs by 52 million yen.

Since Tokuyama transports most of its raw materials and products by sea, more frequent storms could significantly reduce profitability whenever marine transport is delayed or halted as a result.

Enhanced Business Continuity Plan measures

To mitigate the risk of plant shutdown due to natural disasters, the Tokuyama Factory is strengthening its infrastructure. As a measure to protect against storm surges during typhoons, which are deemed to be the greatest threat in terms of natural disasters, the factory constructed a seawall during the period from FY2000 to 2016. Considering the greatest potential wave height estimates for the next 15 and 30 years, the height of the seawall was raised from 4.7 to 5.5 meters. This cost about 300 million yen in total, including materials, transportation, labor, administrative work, and other expenses.

In 2019, the high waves generated by Typhoon No.15 caused flooding beyond designated storm surge zones, so Japan's national standards were revised. Based on that, Yamaguchi Prefecture also updated its standards in 2022. In the same year, we used the prefecture's revised standards and sensitivity analysis to predict potential flood damage to the Tokuyama Factory due to high waves from a typhoon, using various potential typhoon courses and magnitudes. Going forward, we will set typhoon protection standards for the Tokuyama Factory, compare the required seawall height with its existing height, and plan improvements such as raising the seawall height to meet the requirement. Our analysis also revealed that storm surges could cause flooding damage to the factory through backflow and overflow in the plant's discharge channel, so we will consider measures to rectify this as well.

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Physical risks (chronic)

⑥ Long-term intensification of extreme weather events and rising sea levels

Impact on Tokuyama Group

Response measures

Decrease in production capacity due to insufficient factory cooling capacity caused by rising average temperatures (long term)

Situated in a coastal industrial complex in Shunan City, Yamaguchi Prefecture, the Tokuyama Factory contains many manufacturing facilities and produces a wide variety of products. Recirculating water is used to cool the manufacturing equipment. Once this water has captured heat from the manufacturing process, it is cooled by the effects of evaporation in cooling towers, and then recirculated. As average air temperatures rise, the amount of energy required to cool heated water increases. In order to maintain cooling capacity, the factory must increase the capacity of its cooling towers using greater evaporation area, while raising the capacity of circulation pumps, and redesigning the piping. This requires an investment of hundreds of millions of yen or more. If this is not done, production levels could be limited by the factory's cooling capacity.

Production halts due to storm surges caused by rising sea levels (long term)

As it is located in a coastal industrial complex, the Tokuyama Factory is susceptible to flooding caused by storm surges. If one manufacturing facility within the Tokuyama Factory were to be shut down for 10 days, the estimated losses would be approximately 300 million yen.

Setting GHG emission reduction targets

In order to help curb the rise in global average temperatures, GHG emissions need to be reduced. With Scope 1 and 2 emissions, the Group aims to achieve carbon neutrality by FY2050 and achieve a 30% reduction in GHG emissions by FY2030, compared to FY2019. First, we will further promote ramp up energy-saving activities to fully eliminate any energy waste. We will steadily reduce GHG emissions from fuels-derived by steadily adopting co-firing with biomass and ammonia.

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- Ⓐ Board Oversight
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Strategy

- Ⓐ Risks and Opportunities;
and Ⓒ Resilience of Strategy
- Ⓑ Impact on Organization

Risk Management

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- Ⓑ Risk Management Processes
- Ⓒ Integration into Overall Risk Management

Metrics and Targets

- Ⓐ Climate-related Metrics
- Ⓑ Scope 1, 2, 3 GHG Emissions
- Ⓒ Climate-Related Targets

Ⓐ Climate-related risks and opportunities the company has identified over the short, medium, and long term;
and Ⓒ the resilience of the company's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario

Table 4: Climate Change Opportunities (scenario analysis)

Scenario	Opportunity Type	Opportunity Assessment Target	Impact on Tokuyama Group	Impact Level	Term	Priority Level	Response Measures
1.5°C	Market	① Expanding demand in the environmental market	● Expansion of businesses offering waste disposal, effective utilization of resources, and measures to combat global warming	Large	Medium to long term	High	● Commercialization of renewable resources and energy (biomass and hydrogen)
		② Shift to carbon neutrality by regions and industrial complexes	● Enhancing site competitiveness by promoting large-scale green supply chains for energy and materials	Large	Medium to long term	High	● Joining the Decarbonization Promotion Council, promoting green supply chain construction, and actively participating in and promoting green technology development
	Resource use efficiency	③ Requests for CCU-related products	● Entering new business fields by establishing a carbon recycling system	Large	Medium term	Moderate	● Accelerating R&D, demonstration projects, and actual green technology adoption in business operations

- Ⓐ Board Oversight
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Market

① Expanding demand in the environmental market

Impact on Tokuyama Group

Response measures

Expansion of businesses offering waste disposal, effective utilization of resources, and measures to combat global warming

Waste recycling is expected to further expand in response to rising environmental awareness and the need to mitigate resource procurement risks heightened by geopolitical factors. While renewable energy use is growing, there is also demand for carbon-neutral thermal power generation in the manufacturing industry, which requires heat for production.

Commercialization of renewable resources and energy (biomass and hydrogen)

We are promoting co-firing with biomass as a measure to reduce coal consumption. To help secure a stable supply of biomass fuel, Tokuyama has established a "Biomass Business department" and is investigating the development and commercialization of biomass fuel.

In the field of waste gypsum board recycling, group company Tokuyama Chiyoda Gypsum Co., Ltd. (TCG) has decided to construct a new recycling plant in Muroran City, Hokkaido, its third such site in Japan. Established in 2011 as a joint venture between Tokuyama and Chiyoda Ute Co., Ltd., TCG operates a waste gypsum board recycling business. It uses the world's first technology for continuous large recrystallization of waste gypsum, a process developed by Tokuyama. In 2013, TCG began operations at the Mie Headquarters Factory, and in 2016, it started operations at the Kanto Plant in Sodegaura City, Chiba Prefecture. Currently, both plants recycle approximately 100,000 tons of waste gypsum board annually. At its new facility, TCG will source waste gypsum board from all over Hokkaido in order to manufacture and sell recrystallized gypsum dihydrate. As a fire-resistant material widely used in homes for interior walls and ceilings, gypsum board's disposal volume is increasing every year along with home renovations and demolition. Moreover, due to the difficulties associated with proper disposal of this material, there are growing expectations for gypsum board recycling.

In 2019, Tokuyama constructed an experimental facility at the Nanporo Industrial Park in Nanporo-cho, Sorachi-gun, Hokkaido, to develop technology for recycling solar cell modules using catalysts. This activity has been sponsored by Japan's New Energy and Industrial Technology Development Organization (NEDO) as a project to develop elemental technology for recycling solar cell materials. NEDO's aim is to promote development of basic technology for achieving a stable long-term power supply from photovoltaic power generation systems. Through the development of this technology, we aim to commercialize solar panel recycling in anticipation of a jump in panel disposal in the 2030s.

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Market

② Shift to carbon neutrality by regions and industrial complexes

Impact on Tokuyama Group

Enhancing site competitiveness by promoting large-scale green supply chains for energy and materials

As the Group cannot achieve carbon neutrality all on its own, we must work together with the industrial complexes and communities in which we operate. Making an entire industrial complex carbon neutral is not easy, as it requires high levels of technology development and innovation. However, by striving to achieve carbon neutrality, members of an industrial complex can become much more competitive.

Response measures

Joining the Decarbonization Promotion Council, promoting green supply chain construction, and actively participating in and promoting green technology development

The Shunan Industrial Complex Decarbonization Promotion Council was established in February 2022. Its aim is to maintain and strengthen the competitiveness of the Shunan Industrial Complex while also achieving decarbonization. The Council is engaged in the following core activities: (1) creating a grand design for the Shunan Industrial Complex, along with a roadmap for its achievement based on the backcasting planning method; (2) building an initiative promotion system based on collaboration between companies, while promoting technology R&D and demonstration projects, and; (3) making effective use of existing facilities, stock, and resources, while receiving support, and providing policy proposals, and needs information from/to the national and prefectural governments.

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Resource use Efficiency

③ Requests for CCU-related products

Impact on Tokuyama Group

Response measures

Entering new business fields by establishing a carbon recycling system

While carbon pricing is making CO₂ emissions more costly, it also means increasing the value of carbon in other words. Carbon is indispensable for human life, and the supply of carbon will become ever more restricted due to limitations imposed on the use of fossil resources. Therefore, in the near future, carbon recycling could become an important technology. In other words, any company that emits a lot of CO₂ will also have a source of carbon. Tokuyama aims to use this position as a strength to advance into new business areas.

Accelerating R&D, demonstration projects, and actual green technology adoption in business operations

In order to establish a carbon recycling system, Tokuyama is now engaged in two activities: (1) conducting verification testing of CO₂ recovery; and (2) examining the business feasibility of making products from the recovered CO₂. As part of the first activity, a CO₂ recovery device was installed at our cement plant to recover CO₂ from exhaust gases. We are evaluating the reliability of long-term continuous operation of this device while analyzing the resulting data. This includes data on impurities in the recovered CO₂ gas. We will verify the application of this device as an optimal CO₂ recovery technology for cement plants. For the second activity, we are examining the feasibility of producing methanol from CO₂ and hydrogen. As we conduct trial calculations to determine the costs for producing green methanol, we are also conducting market surveys with the idea of creating a green methanol market.

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b Impact of climate-related risks and opportunities on the company's businesses, strategy, and financial planning

Using our analysis of opportunities arising from climate change, and after examining business opportunities in the environmental field, we determined more specific details and evaluated the relevant time scope, financial impacts and priorities.

Table 5: Investigation of Business Opportunities Arising from Climate Change

	Future Events	Business Opportunities	Products and Technology	Term	Financial Impact	Priority Level
Business Opportunities in the 1.5°C Scenario	Spread of green hydrogen	● Rapid increase in demand for water electrolyzers	● Water electrolyzers	Medium to long term	Moderate	High
	Expansion of electrification of mobility	● Expansion of demand for lithium batteries ● Expansion of demand for thermal management materials	● Ion exchange membranes ● Thermal management materials	Short to long term	Moderate	High
	Rapid digitalization	● Expansion of semiconductor demand	● Polycrystalline silicon ● Photoresist developer ● Silica for CMP ● High-purity IPA ● Thermal management materials, etc.	Short term	Large	High
	Spread of energy-saving housing	● Increase in demand for functional insulation material	● Super-insulated, highly-airtight plastic window sashes ● Plaster sheets	Short term	Minimal	Low
	Formation of a closed-loop society	● Increase in demand for recycling of waste material and industrial waste	● Waste gypsum board recycling technology ● Ion exchange membranes ● Effective use of biomass combustion ash (CCUS) ● Development of carbon negative concrete	Short term	Minimal	Moderate
		● Response to large quantities of waste from photovoltaics panels	● Recycling technology for photovoltaics modules	Medium term	Minimal to Moderate	Moderate

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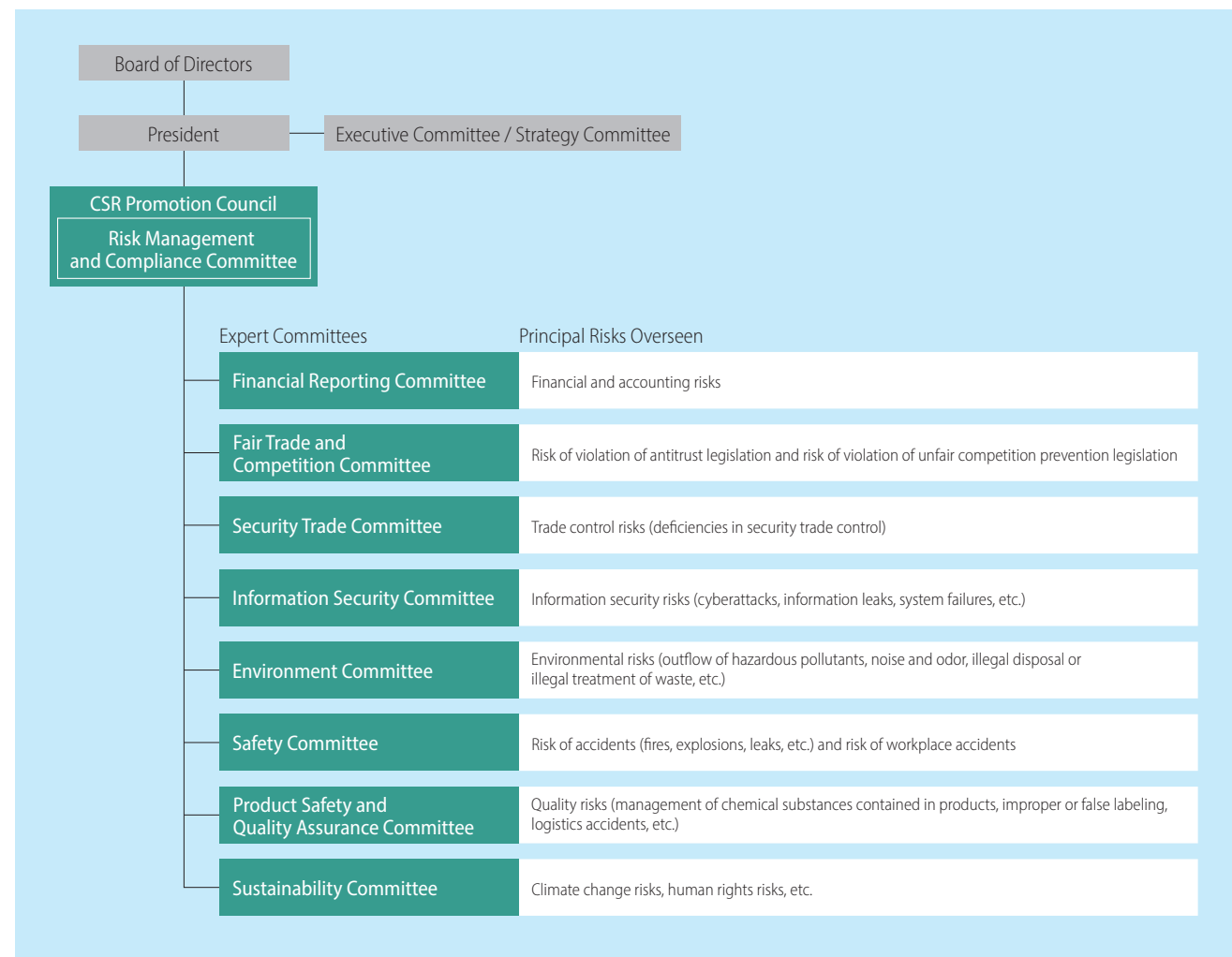
Risk Management

For Tokuyama Group, corporate management risks include any events or factors that could damage its corporate value, affect the sustainability of its businesses, or hinder the achievement its organizational goals. These risks also include any such events or factors that would require cross-organizational response. We have a management system in place to ensure that we can appropriately mitigate these enterprise risks.

Ⓐ Company's processes for identifying and assessing climate-related risks

To direct our group-wide enterprise risk management system, we have established a Risk Management and Compliance Committee chaired by the director responsible for CSR, which is positioned under the CSR Promotion Council chaired by the president. By monitoring international trends and working with its expert committees, the Risk Management and Compliance Committee examines events and factors that have just emerged or that have changed in terms of the potential level of impact. It then identifies new potential risks and assigns them an expert committee for determination.

Figure 5: Expert Committees and Meeting Bodies in Charge of Risks



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b Company's processes for managing climate-related risks

The Risk Management and Compliance Committee, chaired by the director responsible for CSR, performs group-wide enterprise risk management. It does this by making visible and mapping risk levels both quantitatively and qualitatively from perspectives such as impact (monetary loss, decrease in market share, and scale of impact, etc.), occurrence frequency and probability, and vulnerability.

Table 6: List of Enterprise Risks (FY2023)

*The chairperson of each committee or meeting body is a director and responsible for the relevant risks

Large category	Moderate category	Minimal category	Relevant committee / meeting body*
Hazard risk	Natural disasters	Earthquake, tsunami, weather-related disaster, abnormal weather event (typhoon, storm surge, or heavy rains, etc.)	Risk Management and Compliance Committee
	Accident or breakdown	Fire, explosion, chemical leak, equipment or device damage or failure, utility supply interruption, transport (aircraft, ship or railway) accident	Safety Committee
	Pandemic disease	Widespread outbreak of COVID-19 or another infectious disease	Risk Management and Compliance Committee
	Country risks	War, conflict, terrorism incident, riot, unlawful political change, or economic crisis	Risk Management and Compliance Committee
	Information security risks	Cyber-attack, virus infection, information leakage, failure of system facilities/equipment, system failure	Information Security Committee
Business risk	Global decarbonization risks	Adoption of carbon pricing, adoption of international carbon taxation, advancement of green procurement, popularization of ESG investment and environmental finance, tighter regulations, greater political pressure, and accelerating climate change	Sustainability Committee
	Market risks	Changes in market needs, marketing failures or deficiencies, emergence of new competitors, product development failures or obsolescence, delays in responding to rapid technological innovations, and delays or barriers to overseas expansion	Executive Committee/ Board of Directors
	Human resource risks	Mass retirement, difficulty in securing human resources, workforce aging, distorted human resource pyramid, failure to adopt new work styles such as human resource development and technology transfer (including foreign workers), and human resource mismatch due to business conversion	Executive Committee/ Board of Directors
	Financial risks	Funding plan or financing failure, paid capital increase, suspension of financial support, interest rate or foreign exchange rate fluctuation risk, and stock price decline	Executive Committee/ Board of Directors
Operational risk	Manufacturing risks	Equipment or machine stoppages or accidents due to operational errors, industrial accidents, and aging equipment or machinery	Safety Committee
	Business risks	Soaring raw material or fuels prices, failed pricing policies, declining price competitiveness, dependence on a small number of suppliers, and dependence on a small number of customers	Executive Committee/ Board of Directors
	Serious product defects or quality risks	Quality defects, voluntary recalls, product liability accidents, deficiencies in chemical safety management at the time of export, management of chemical substances contained in products, and mislabeling or counterfeit labeling	Product Safety and Quality Assurance Committee
	Business and human rights	Human rights violations in supply chains, boycotts, and consumer movements	Sustainability Committee
	Legal and compliance risks	Non-performing loans/bad debts, intellectual property rights infringement, invention compensation disputes, antimonopoly law violation, Unfair Competition Prevention Act violation (bribery), improper contract signing, insider trading, inadequate management of licenses and permits, misconduct involving executives or employees, ties to antisocial forces, and intimidation	Antitrust and Competition Law Compliance Committee Risk Management and Compliance Committee

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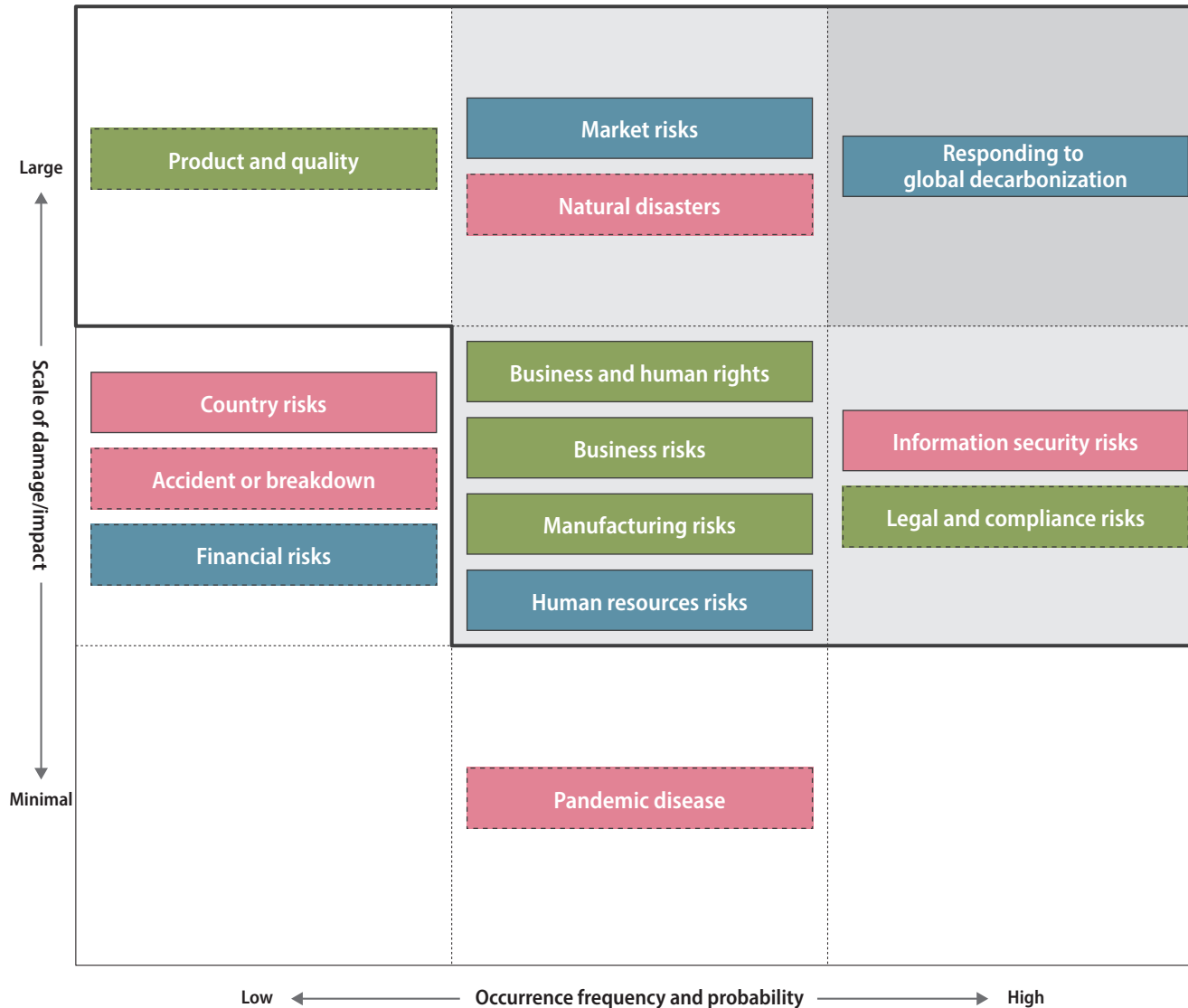
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Figure 6: Mapping of Significant Enterprise Risks (FY2023)



Definitions of major risk categories

- ...Hazard risk (External environment risk)**
Risks posed by the external environment and potential events
- ...Business risk (Strategic risk)**
Risks posed by the quality and accuracy of corporate strategies that affect performance and corporate value
- ...Operational risk (Business process risk)**
Risks arising from deficiencies in internal processes related to business execution, or from inadequate functions

Definition of scale of damage and impact

- Large** Damage that threatens the survival of the company, as well as substantial damage such as loss of assets
- Moderate** Significant loss of profits, or minor loss of assets
- Minimal** Little impact on corporate profits and assets

Definition of occurrence frequency and probability

- High** Occurs more than once a year
Will almost surely occur in the near future
- Medium** Occurs several times a decade
- Low** Occurs once every decade or more

Definition of vulnerability

- High** Mitigation measures have not been implemented or are completely inadequate
- Moderate** Some measures have been implemented, but they are still insufficient
- Low** Sufficient measures have been implemented and a management cycle is in place

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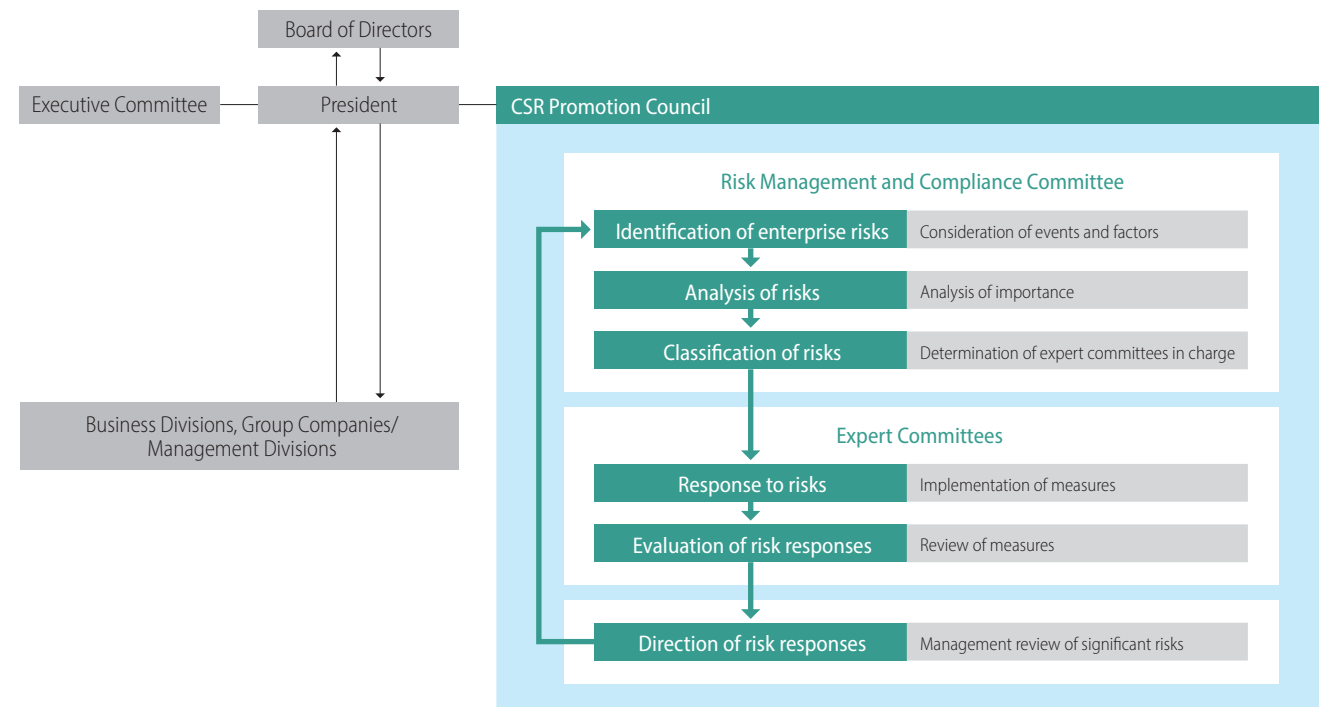
The expert committees, chaired by the relevant directors, examine and determine mitigation policies for the risks they are responsible for (including risk reduction, avoidance, transfer, and retention). Based on the determined policies, the Group plans and implement measures to manage risks. It also conducts periodic reviews to ensure performance based on the risk management system.

Ⓒ How processes for identifying, assessing, and managing climate-related risks are integrated into the company's overall risk management

Given the accelerating global trend toward decarbonization, under the Group's Medium-Term Management Plan 2025, we have decided that we must shift away from our energy-intensive business structure, which has been our strength up to this point.

Therefore, we have updated our mission, which is now "To create a bright future in harmony with the environment, in collaboration with its customers, based on chemistry." One of the priority issues of the Medium-Term Management Plan 2025 is "Contribute to mitigation of global warming" and we are pursuing group-wide initiatives to achieve this.

Figure 7: Process of Identifying Enterprise Risks



Based on these analyses, the Risk Management and Compliance Committee has positioned failing to respond to global decarbonization as the greatest risk and decided to manage it through multiple expert committees. Risks related to environmental laws and regulations are handled by the Environment Committee, while physical risks such as storm surges at manufacturing sites are addressed by the Safety Committee. The Sustainability Committee oversees initiatives related to climate change and compliance with soft law requirements (e.g., recommendations or guidelines) related to external disclosure, and these committees are working

together to address all the risks.

Regarding individual activities to address climate change, for example, the Tokuyama Factory regularly holds energy management committee meetings chaired by the Factory general manager. The members discuss and check the progress made on planned activities for energy-saving, including improvement of energy intensity. Moreover, important matters related to risk management are reported as necessary to the Executive Committee (mentioned above) and the Board of Directors.

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Metrics and Targets

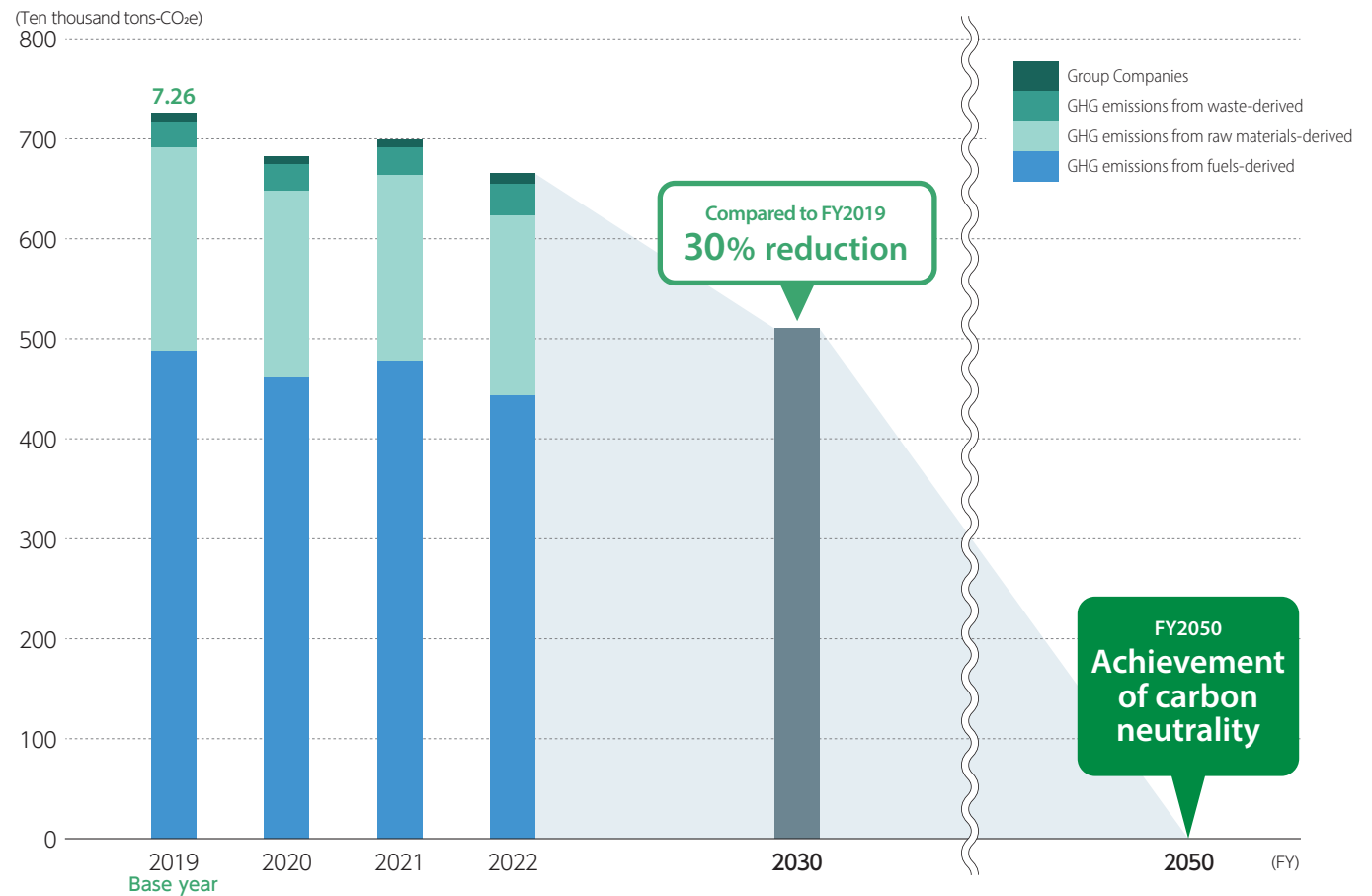
For the purpose of setting management indicators and targets, Tokuyama Group considers the period up through FY2025 (the final fiscal year for the Medium-Term Management Plan 2025) as the short term, with the medium term extending through FY2030, and the long term through FY2050.

Ⓐ Metrics used by the company to assess climate-related risks and opportunities in line with its strategy and risk management process

In the past, the Group has measured its GHG emissions, GHG intensity and energy intensity. Under the new Medium-Term Management Plan 2025, however, we aim to help mitigate global warming by measuring total group-wide GHG emissions and achieving certain management targets. These are a 30% reduction in GHG emissions compared to FY2019 by FY2030, and the attainment of carbon neutrality by FY2050.

Moreover, when calculating compensation for all executive officers, we look at performance with respect to relevant material issues determined by the Group as indicators and evaluate each officer accordingly. As a result, specific roles and responsibilities are taken into account as relevant factors.

Figure 8: GHG Emissions Reduction Targets



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Other important metrics and targets related to climate change are listed here.

SBTs: Start investigation for SBT Certification

After submitting a letter of commitment to the SBT initiative in March 2023, and while drafting the next Medium-Term Management Plan to be implemented two years from now, we are now considering updating our targets in line with the Science Based Targets (SBT) initiative.

Water Use Metrics and Targets

During the analysis of the Group's climate-related risks and opportunities, it became clear that climate change and water use issues are also highly relevant.

To manage the industrial water the Group uses for facility cooling and processes, we check the dam reservoir level every day, and adjust water conservation rate according to the reservoir accumulation rate.

Along with recirculating cooling water, we use condensation water from steam generated at our power plants as effectively as possible to conserve water.

For our recirculated cooling water, we use just 100,000 cubic meters of industrial water or less per day, compared to our total required water usage of 1.5 million cubic meters per day.

With our condensation water, we effectively utilize approximately 25,000 cubic meters per day.

The Group's tap water conservation goal is not to exceed the amount used in the previous year.

Energy consumption targets

Tokuyama Group is aiming to achieve a 50% reduction in GHG emissions from fuels-derived compared to FY2019 by FY2030, and it plans to switch to non-fossil fuels (biomass and ammonia) for onsite power plants. The rate of co-firing with biomass will gradually increase starting in FY2025. Co-firing with

ammonia is scheduled to begin in FY2025 and beyond. A basic plan for biomass and ammonia adoption is currently being implemented, as part of a project sponsored by Japan's Agency for Natural Resources and Energy (FY2023 Oil Supply Structure Advancement Project Cost Subsidy: Project to Promote Transition to a Stable Supply of Next-generation Fuels).

Through this initiative, the Group aims to achieve a renewable energy ratio of 30% by FY2030.

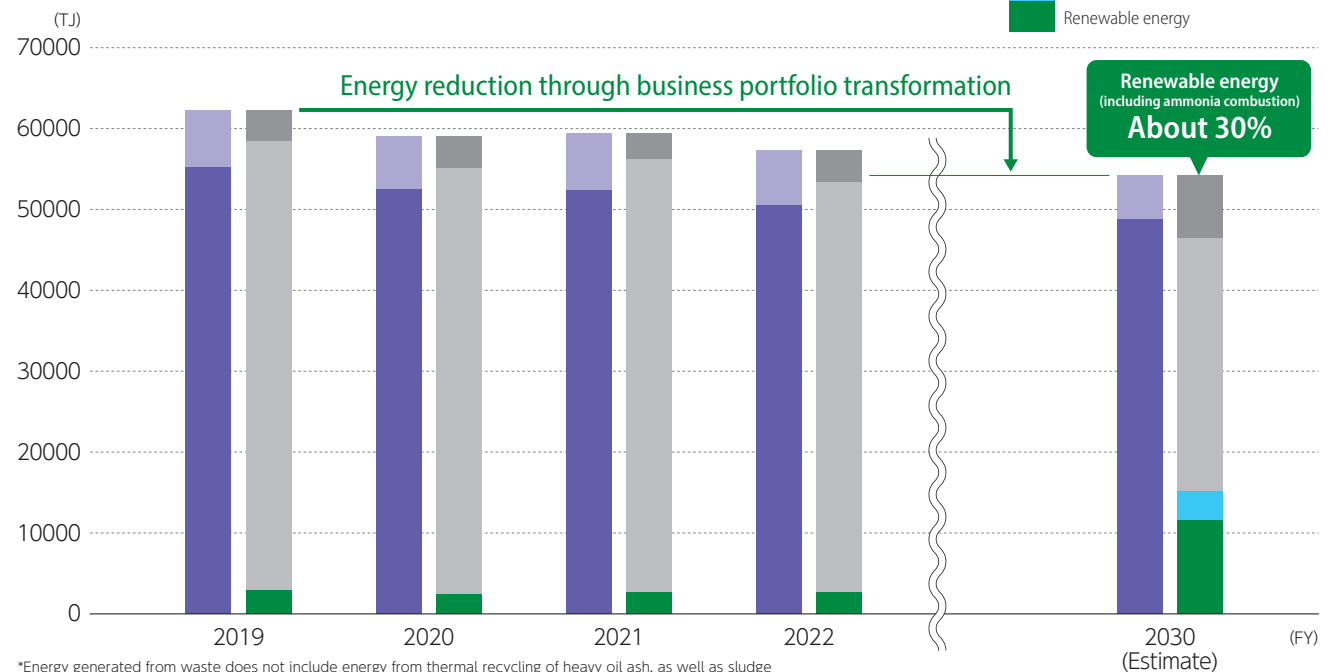
The ratio of renewable energy use for the entire Group in FY2022 was about 5%.

Metrics (initiatives) related to internal carbon pricing

In FY2019, Tokuyama adopted internal carbon pricing (ICP) as a criterion for evaluating investment projects to promote GHG emissions reduction. Initially, the price of carbon was set at 3,700 yen per ton of CO₂, based on the European Union Emissions Trading System (EU-ETS) price. In order to further enhance our efforts to reduce GHG emissions, in FY2022 we raised our internal price of carbon to 10,000 yen per ton of CO₂. Using ICP, we will promote activities aimed at decarbonization over the short and medium term.

Figure 9: Renewable Energy Results and Targets
(Total power generated by biomass and ammonia as renewable energy sources)

Energy consumption (including electricity sold)



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- Ⓑ **Scope 1, 2, 3 GHG Emissions**
- Ⓒ Climate-Related Targets

Ⓑ Scope 1, Scope 2, and, Scope 3 greenhouse gas (GHG) emissions, and the related risks

In FY2022, the Group reached record high sales due to price revisions based on soaring costs for coal and raw materials. In terms of GHG emissions however, we were able to reduce Scope 1 and 2 emissions by approximately 3.6% from FY2021 through verification testing of co-firing with biomass and proactive energy-saving activities.

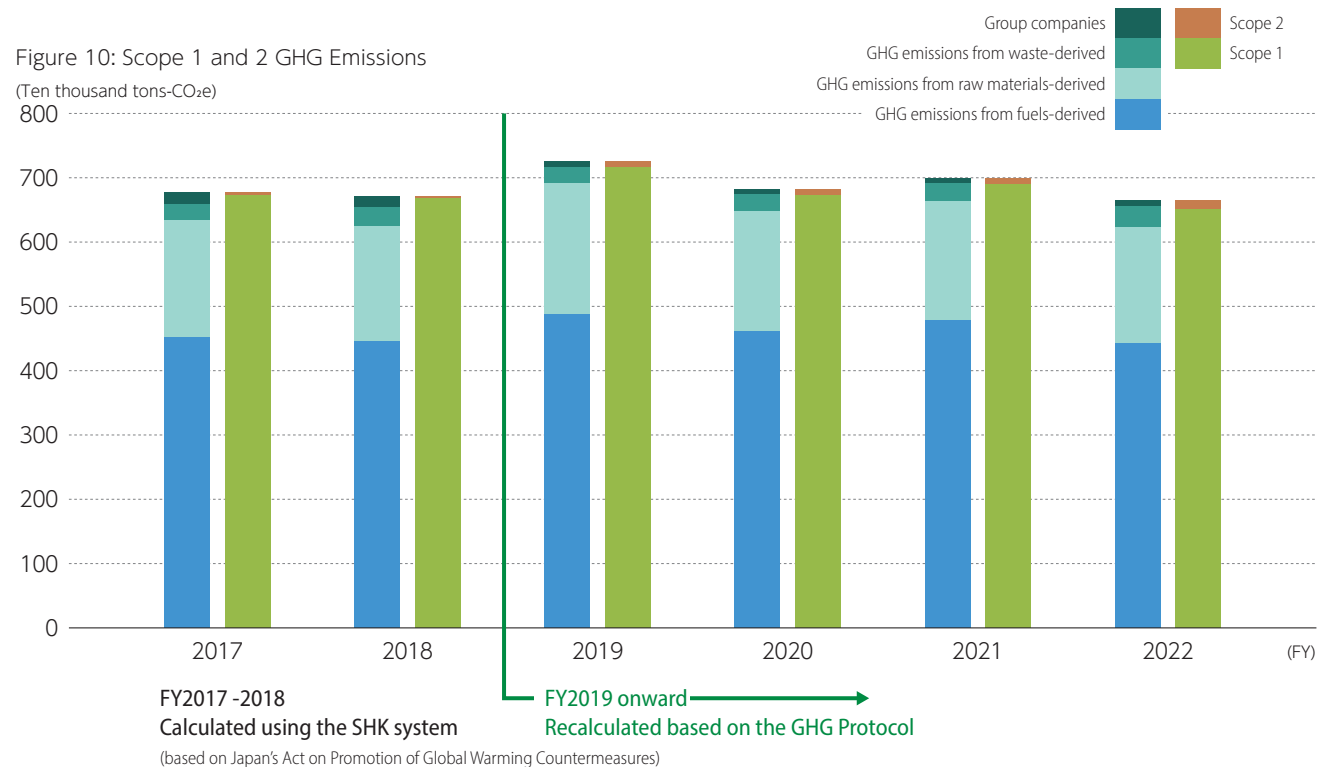
Table 7: GHG Emissions by Scope Type

(Ten thousand tons-CO₂e)

	FY2020	FY2021	FY2022
Scope 1 (direct emissions)	676	680	651
Amount excluding electricity and steam sales	629 *	632 *	—
Scope 2 (indirect emissions from energy use)	4 *	2 *	4
Scope 3	174 *	177 *	176

* Third-party certification has been obtained under the SHK system to our Scope 1, 2, and 3 emissions data for FY2020 and 2021. Regarding to the third-party certification for FY2022, see Table 8 and Figure 11

Figure 10: Scope 1 and 2 GHG Emissions

(Ten thousand tons-CO₂e)

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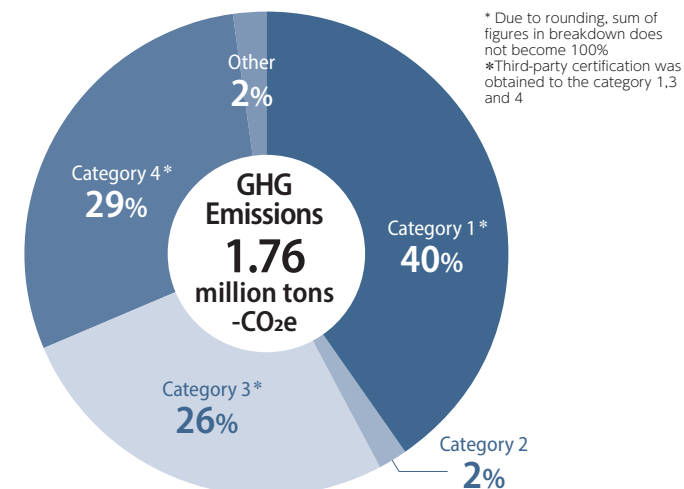
Table 8: Scope 1 and 2 GHG Emissions

(Ten Thousand tons-CO₂e)

			FY2019	FY2020	FY2021	FY2022
Scope 1	Tokuyama	GHG emissions from fuels-derived	487.6	460.5	467.7	438.5
		GHG emissions from raw materials-derived	203.2	188.6	185.7	180.2
		GHG emissions from waste-derived	25.3	26.5	27.0	32.1
	Group companies in Japan		0.4	0.4	0.5	0.5
	Group companies outside Japan		0.0	0.0	0.0	0.2
	Total of Scope 1		716.5	676.0	680.9	651.5*
Scope 2	Tokuyama		3.1	3.7	1.5	3.9
	Group companies in Japan		1.4	0.9	1.0	1.0
	Group companies outside Japan		5.3	5.9	6.8	8.3
	Total of Scope 2		9.8	10.5	9.3	13.2*
Total of all GHG Protocol data			726.2	686.5	690.2	664.7

* GHG emissions from biomass combustion were 310,000 tons-CO₂e
 * Third-party certification was obtained to each total of Scope 1 and 2 for FY2022

Figure 11: Scope 3 GHG Emissions by Category (non consolidated)



Methodology explanation

Scope 1, 2

- Greenhouse Gas Emissions Calculation and Reporting Manual (Ver. 4.9) April 2023, Ministry of the Environment and Ministry of Economy, Trade and Industry

- Emission Coefficients by Electric Utility (for calculating greenhouse gas emissions of specified emitters) – FY2021 Results – Released Jan 24, 2023 by the Ministry of the Environment and the Ministry of Economy, Trade and Industry

Scope3

- Basic Guidelines on Accounting for Greenhouse Gas Emissions throughout the Supply Chain (Ver. 2.5) March 2023, Ministry of the Environment and Ministry of Economy, Trade and Industry

- Emission Intensity Database for Calculating Greenhouse Gas Emissions of Organizations Across Supply Chains (Ver. 3.3), March 2023, Ministry of the Environment

and Ministry of Economy, Trade and Industry

- LCI Database IDEAv2 (for supply chain greenhouse gas emissions calculation), Sustainable Management Promotion Organization (SuMPO), December 2019

Description of Scope 3 Risks

Physical risk is one type of risk associated with upstream supply chain activities.

Risk of shutdowns at production facilities for necessary raw materials and fuels due to the effects of intensifying climate change.

Risks related to logistics include rising logistics costs, driver shortages, and the “2024 problem” in the Japanese logistics industry (due to new overtime regulations).

The risk for downstream activities is reputation risk.

Tokuyama makes many energy-intensive products, which it manufactures using electricity and steam from onsite coal-fired power plants. Once carbon footprint becomes a

higher priority for our customers in the selection of raw material products, there is a risk that our product competitiveness will decline and sales will decrease. As the Group's Electronic Materials Business Division does a great deal of business with electronic and electrical companies that are proactive in addressing environmental issues, the following calculation was made, based on the assumption of a 10% decline in sales: 91.5 x 0.1 = 9.2 billion yen (Electronic Materials Business Division sales in FY2022 x Sales decrease rate = Potential impact). Therefore, we must make greater efforts to reduce GHG emissions and share the information publicly to mitigate the risk of reduced sales due to insufficient environmental efforts. We estimate that by FY2030 approximately 11 billion yen will need to be invested in biomass technology along with about 15 billion yen in ammonia, so the total mitigation measure cost will be 26 billion yen.

- Ⓐ Board Oversight
- Ⓑ Management's Role

- Ⓐ Risks and Opportunities; and Ⓒ Resilience of Strategy
- Ⓑ Impact on Organization

- Ⓐ Risk ID and Assessment Processes
- Ⓑ Risk Management Processes
- Ⓒ Integration into Overall Risk Management

- Ⓐ Climate-related Metrics
- Ⓑ Scope 1, 2, 3 GHG Emissions
- Ⓒ Climate-Related Targets

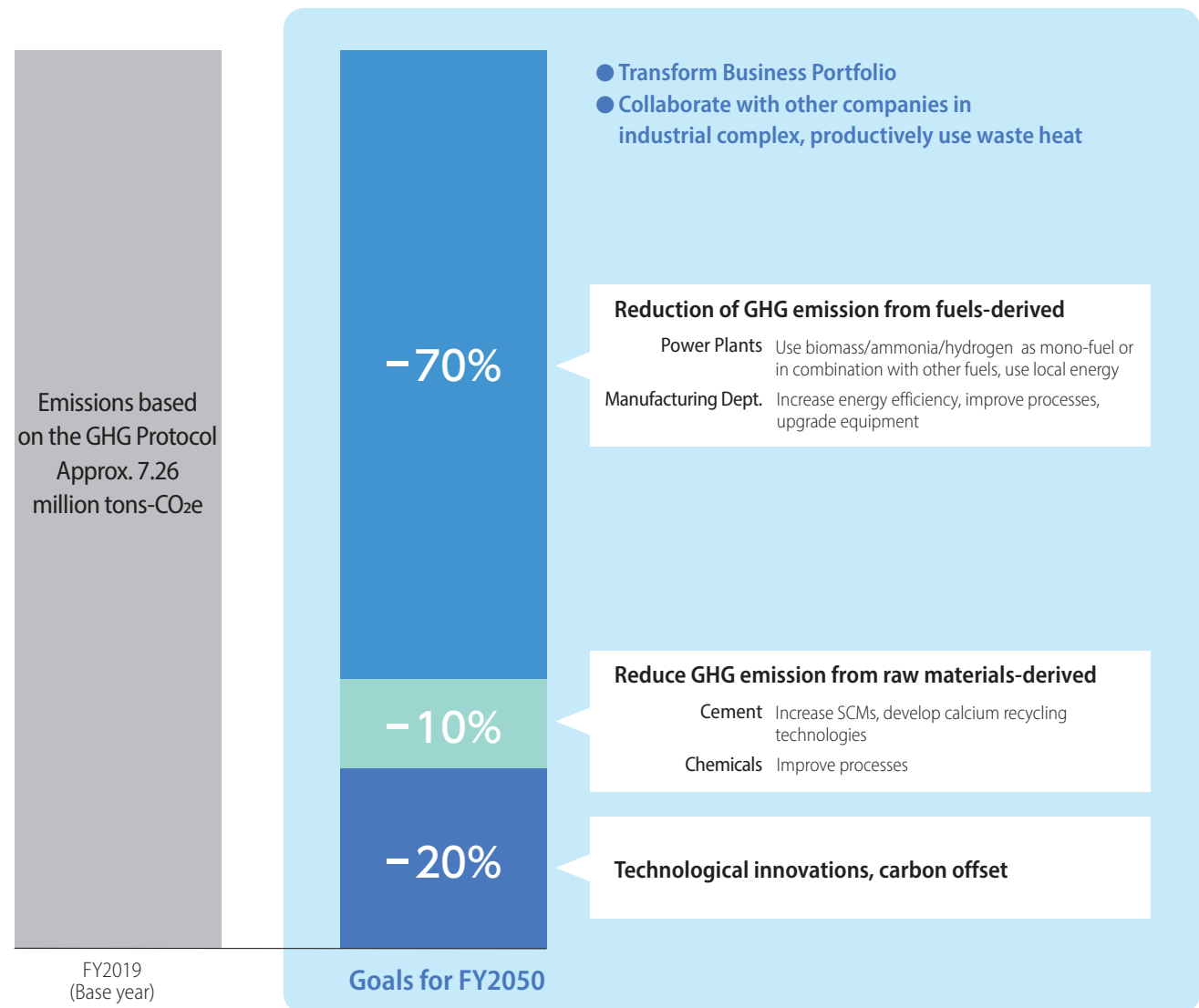
Ⓒ Targets used by the company to manage climate-related risks and opportunities and performance against targets

We have set a long-term goal of becoming carbon neutral by FY2050. We will accomplish this primarily by reducing GHG emissions from fuel consumption and raw materials, and by developing innovative technologies. We will reduce CO₂ emissions from energy generation, which accounts for about 70% of our total emissions, by further promoting energy-saving measures. These include measures that have already been implemented while also switching to carbon-neutral fuels such as biomass and ammonia.

The Group will reduce GHG emissions from raw materials-derived by reducing the amount of limestone used in its cement, and by increasing other cement mixture materials and recycling calcium. We will proceed with development and introduction of these measures while evaluating the economic efficiency. At present, however, it appears that reducing these emissions to zero will be difficult, and CO₂ capture, utilization, and storage (CCUS) will likely be necessary. The Group will proceed with the development and introduction of such measures.

While it is our responsibility as a company to steadily reduce GHG emissions, we also recognize that reducing GHG emissions through the use of our products in society is also an important role. In the future, we will contribute to the achievement of carbon neutrality in the world by expanding our environment-friendly products and further developing innovative technologies.

Figure 12: FY2050 GHG Emissions Reduction Targets (long-term targets)



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- b Impact on Organization

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- c Integration into Overall Risk Management

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- c Climate-Related Targets

The Group's medium-term goal is a 30% reduction in GHG emissions compared FY2019 by FY2030.

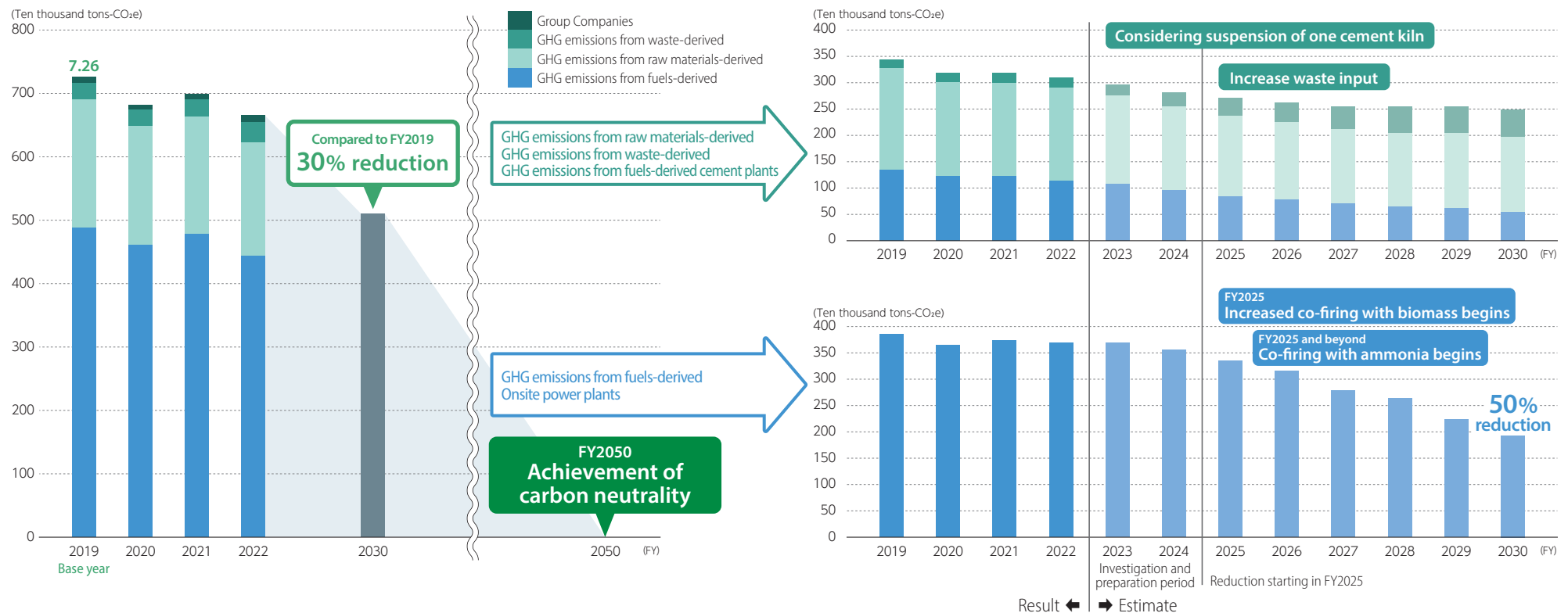
Figure 13 shows our specific strategy. The major sources of the Group's GHG emissions are onsite coal-fired power plants (GHG emissions from fuels-derived) and cement production (GHG emissions from raw materials-derived and waste-derived).

Figure 14 shows the details of the lower right corner of the graph in Figure 13 (onsite coal-fired power plants). The

Group is aiming for a 50% reduction in GHG emissions from fuels-derived (not related to cement) compared to FY2019 by FY2030, and we are currently drafting and implementing plans to achieve this goal. For co-firing with biomass, we will still use palm kernel shells, construction waste and wood chips as fuel. However, we are planning to procure biomass fuel and invest in co-firing equipment in order to further increase the level of co-firing starting in FY2025. The Group estimates that the total investment required to reduce GHG

emissions by 30% through co-firing with biomass will be 11 billion yen by FY2030. With regard to co-firing with ammonia, we are currently investigating the installation of relevant equipment. The Group estimates that the total investment required to reduce GHG emissions by 20% using ammonia co-firing will be 15 billion yen by FY2030. As both biomass and ammonia co-firing require large amounts of investment, we plan to make steady progress while assessing economic feasibility and seeking government support.

Figure 13: GHG Emissions Reduction Plan



Governance

- Ⓐ Board Oversight
- Ⓑ Management's Role

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- Ⓐ Risks and Opportunities;
- and Ⓒ Resilience of Strategy
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Meanwhile, Figure 15 shows the details of the upper right corner of the graph (cement) in Figure 13. GHG emissions from fuels-derived in cement production come mainly from coal combustion. Over the short and medium terms, we plan to increase the use of combustible waste, especially waste plastic. Using waste plastic as fuel increases GHG emissions from waste-derived. Nevertheless, the Group intends to increase its combustible waste use

because there are currently no alternative fuels that are economically viable, and it wants to reduce its coal use as a priority. Over the long term, the aim is to use hydrogen and ammonia as heat sources, and the necessary investigation is now being carried out. The Group's GHG emissions from raw materials-derived arise mostly from limestone (calcium carbonate) use. Cement production requires large amounts of calcium. However, since there are currently no raw

material candidates to replace limestone, dramatic reduction measures are difficult. The Group is now investigating ways to reduce these emissions per unit of production by increasing the use of other materials while reducing the amount of clinker (a mix of limestone and minerals) per unit of cement.

Figure 14: Reduction Plan for GHG Emissions from fuels-derived (not related to cement production)

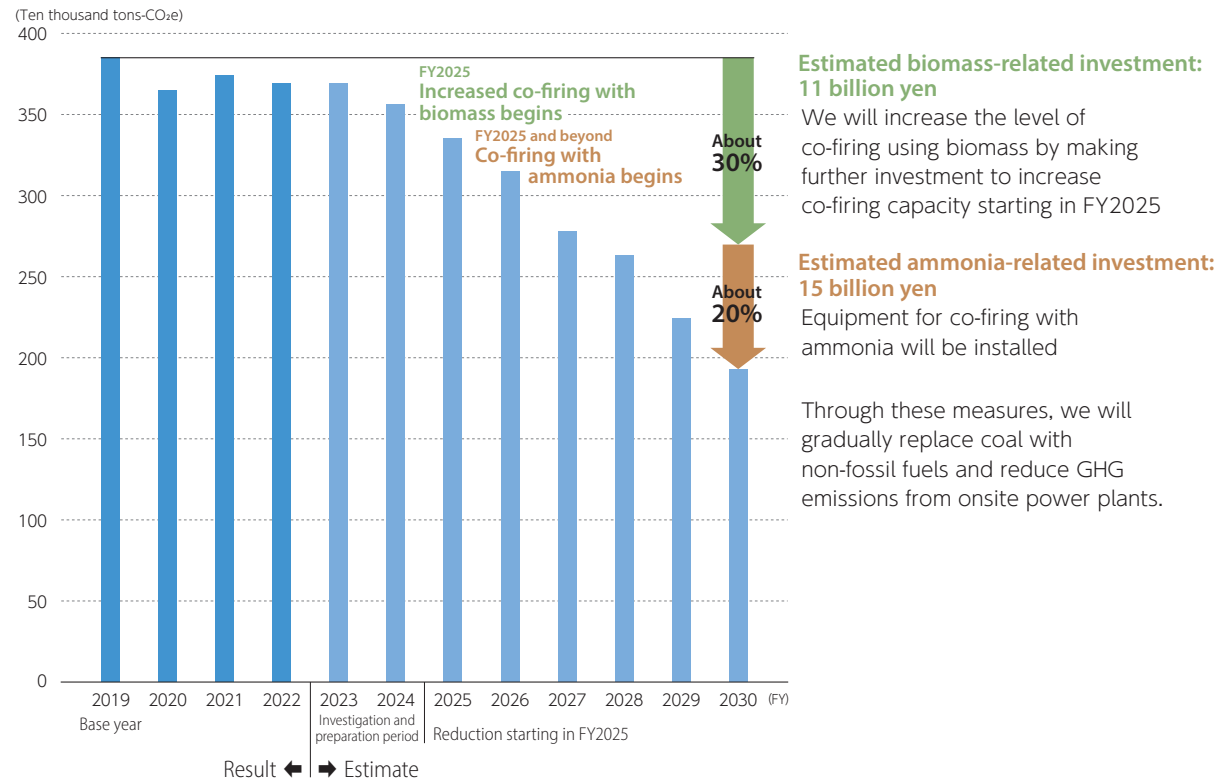
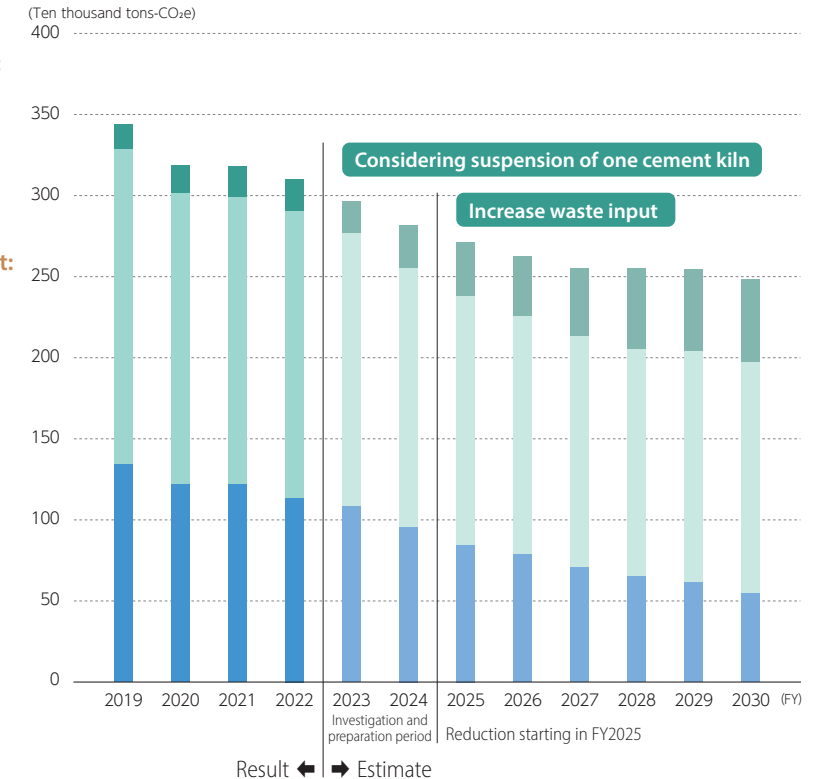


Figure 15: Reduction Plan for GHG Emissions from Raw Materials-derived, Waste-derived, and Fuels-derived (Cement Production)

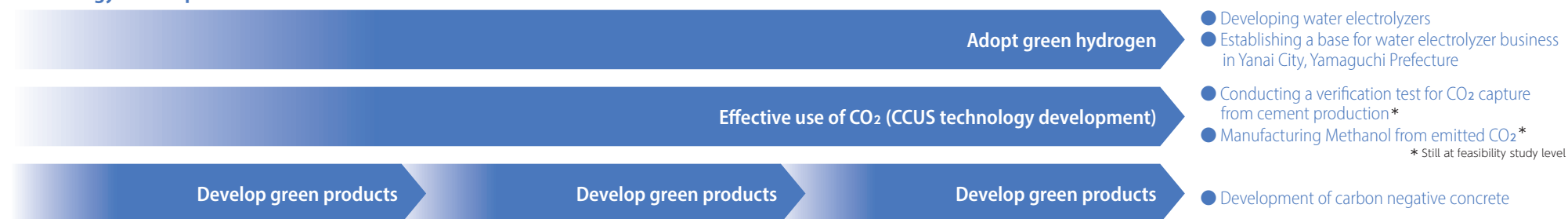


Governance	Strategy	Risk Management	Metrics and Targets
<ul style="list-style-type: none"> a Board Oversight b Management's Role 	<ul style="list-style-type: none"> a Risks and Opportunities; and c Resilience of Strategy b Impact on Organization 	<ul style="list-style-type: none"> a Risk ID and Assessment Processes b Risk Management Processes c Integration into Overall Risk Management 	<ul style="list-style-type: none"> a Climate-related Metrics b Scope 1, 2, 3 GHG Emissions c Climate-Related Targets

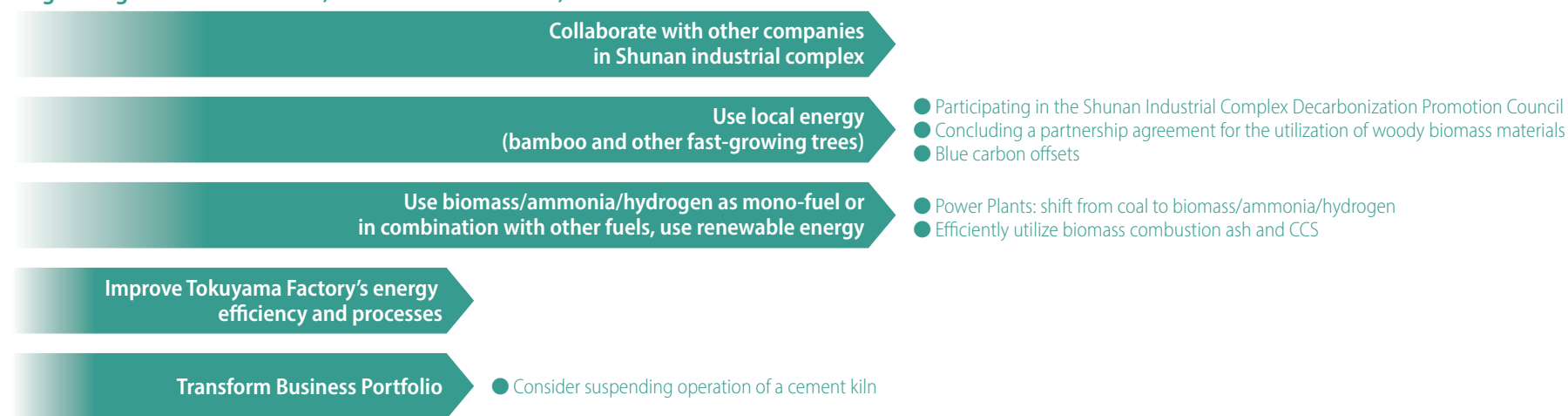
Here is our approach to achieving carbon neutrality by FY2050, and a review of our initiatives in FY2022.

Figure 16: the Group's approach toward FY2050 carbon neutrality achievement

Technology Development



Originating from fuels-derived, raw materials-derived, and waste-derived



FY2022

FY2030

FY2050

- Ⓐ Board Oversight
- Ⓑ Management's Role

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and Ⓒ Resilience of Strategy
- Ⓑ Impact on Organization

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- Ⓑ Risk Management Processes
- Ⓒ Integration into Overall Risk Management

- Ⓐ Climate-related Metrics
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The following details the progress of specific measures regarding the Group's initiatives in FY2022.

Technology Development

● Green hydrogen

Development of alkaline water electrolyzers

Tokuyama and Nippon Shokubai Co., Ltd. are working together under a Japan's New Energy and Industrial Technology Development Organization (NEDO) framework entitled "Joint Problem-Solving Industry-Academia-Government Collaborative Research and Development Project for Rapidly Expanding the Use of Fuel Cells, etc." The project to develop large-scale alkaline water electrolyzers and separator suitable for high-pressure systems was adopted by NEDO as part of its funding of technology development for multi-purpose utilization of fuel cells.

A high-pressure alkaline water electrolyzer (AWE) is a device that produces hydrogen and oxygen by supplying an alkaline aqueous solution to cells divided by separators and electrolyzing water. Hydrogen is attracting attention as a next-generation energy source, and expectations are high worldwide concerning green hydrogen produced from renewable electricity.

This project combines Nippon Shokubai's development of a large separator suitable for high-pressure systems with Tokuyama's development of an internal electrolytic cell structure that maximizes separator performance. The aim is to develop a world-class high-pressure AWEs that is very competitive. The separator developed by Nippon Shokubai will be incorporated into the high-pressure AWE prototype developed by Tokuyama, and the project R&D activities will proceed from there.

Prior to this project, we started to establish a production and development site for alkaline water electrolyzers operating under regular pressure at the Center for Commercialization of Advanced Technology, with the

aim of product commercialization by FY2025. For the new high-pressure AWEs, we will accelerate our efforts by utilizing the electrolyzers technology developed by Tokuyama over many years in its sodium chloride electrolysis business. In this way, we intend to help promote the supply of next-generation fuels.

Electrolyzer business base established in Yanai City, Yamaguchi Prefecture

With the aim of rapidly commercializing new alkaline water electrolyzers that produces hydrogen and oxygen using renewable electricity, Tokuyama has established a production and development base within the Center for Commercialization of Advanced Technology in Yanai City, Yamaguchi Prefecture.

An alkaline water electrolyzer is a device that passes electricity through an alkaline solution to break it down into hydrogen and oxygen. Such technology can be used to utilize surplus electricity and output fluctuations generated by renewable energy sources and help further expand the adoption of renewable energy.

As part of the Group's efforts to help build a decarbonized society, it has been developing alkaline water electrolyzers (AWEs) that operates under regular pressure, with support from Yamaguchi Prefecture. The newly developed alkaline water electrolyzers utilizes Tokuyama's zero-gap salt electrolysis technology and other technologies to achieve the best power consumption performance of its kind in the world. Since this device does not require large quantities of precious metals such as platinum, it is suitable for low-cost large-scale installations. Moreover, compared to electrolyzers of the same type, it has a larger energization area, thereby enabling a high level of hydrogen production per unit of installation area.

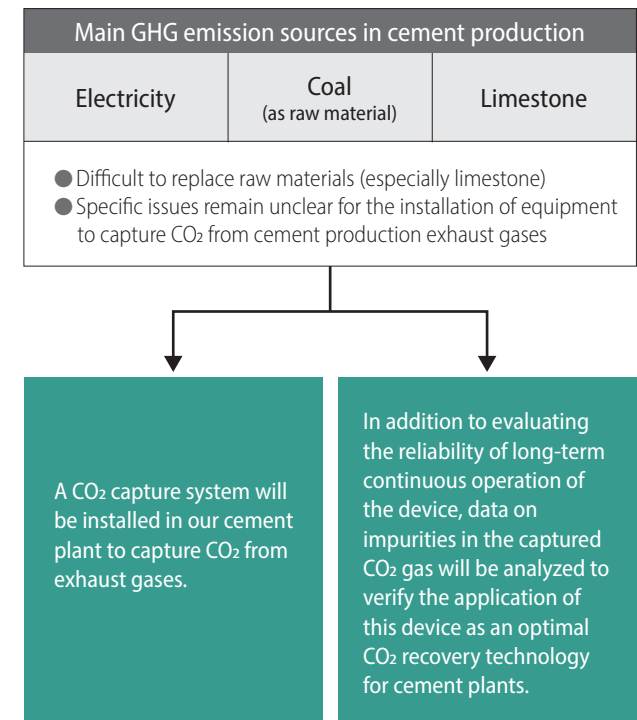
Through this project, Tokuyama seeks to help build a hydrogen supply chain that enables efficient energy use, from hydrogen production to utilization. This will help build a hydrogen-powered society through renewable energy adoption worldwide and local consumption of local energy production.

● Effective use of CO₂ (CCU technology development)

Conducting a verification test for CO₂ capture from cement production

Using a CO₂ capture test facility at Mitsubishi Heavy Industries, Ltd., we conducted a verification test of CO₂ capture from cement production exhaust gas.

Going forward, the project team will continue to calculate investment costs, identify issues, and take improvement measures based on the knowledge obtained.



- a Board Oversight
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Feasibility study on methanol production from CO₂ emissions

Tokuyama signed a memorandum of understanding with Mitsubishi Gas Chemical Company, Inc. (MGC) to conduct a feasibility study concerning the manufacture and sale of methanol. The methanol will be produced using technology just developed by MGC, while the raw material CO₂ will be captured from emissions at the Tokuyama Factory, and the raw material hydrogen will be produced at the same site. The study will also investigate the use of hydrogen produced using green electricity generated from biomass.

Methanol is an important substance for making various chemical products. Because it can be manufactured from captured CO₂, which reduces greenhouse gas emissions, methanol is expected to be a powerful resource for building a carbon-neutral society through Carbon

Capture and Utilization.

The two companies have agreed to promote green product adoption by society, in order to lower greenhouse gas emissions and help build a decarbonized world. We have also decided to investigate joint product commercialization.

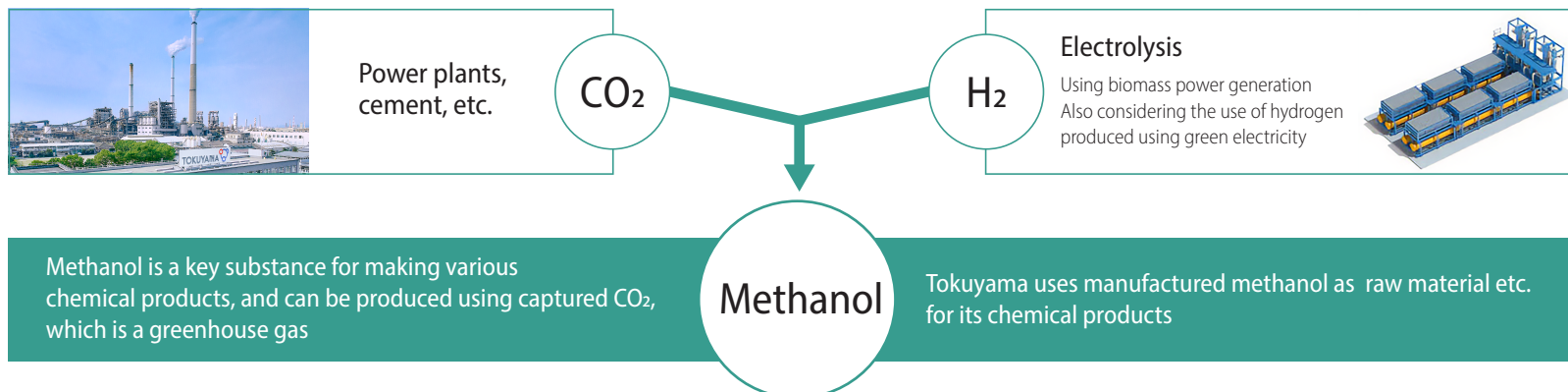
Once the process under investigation is commercialized, it will be the first commercial facility in Japan to use CO₂ captured from factory emissions as a raw material for making methanol. The resulting methanol will be used by Tokuyama as raw material etc. for its chemical products, thereby creating green products. By utilizing MGC's existing methanol distribution network, the product can reach customers who need green chemicals, as well as those who need hydrogen and fuels with low greenhouse gas emissions.

Through this feasibility study, Tokuyama aims to

establish its own CCU technology and accelerate its efforts to promote a carbon-neutral society. This is based on the electricity generated power plants at the Tokuyama Factory using biomass fuel, and the effective utilization of CO₂ captured from the factory's emissions together with hydrogen generated from caustic soda production.

Through this feasibility study, we seek to promote the creation of low-carbon product value together with value from captured carbon in order to promote the further adoption of green products such as eco-friendly methanol. At the same time, we would like to actively promote a cross-industrial initiative that goes beyond the chemical industry and includes both the public and private sectors. The aim is to help create a domestic market for green products made in Japan, while promoting the establishment of a CCU industry.

Conducting a feasibility study with the aim of green product adoption by society



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● Develop green products

Development of carbon negative concrete

By combining technologies to reduce and capture CO₂ emissions, this concrete effectively reduces exceeding amount of CO₂ generated during concrete manufacturing.

After joining a carbon negative concrete project as a member of a consortium of 44 private companies, 10 universities, and 1 research institute, Tokuyama has begun full-scale activities. The Green Innovation Fund Activity* / Concrete Manufacturing Technology Development Project Using CO₂ is funded by Japan's New Energy and Industrial Technology Development Organization (NEDO).

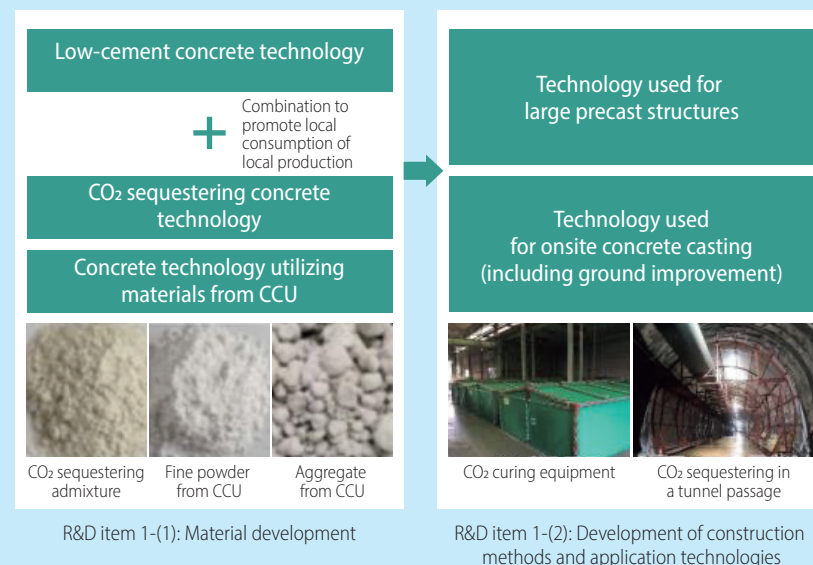
In this project, we will be responsible for the development of a concrete admixture that hardens by capturing CO₂.

*Green Innovation Fund Project (GI Fund):
Toward the goal of achieving carbon neutrality by 2050, the Japanese government has established a Green Innovation Fund of two trillion yen to be administered by the New Energy and Industrial Technology Development Organization (NEDO). The fund provides continuous support to companies and other organizations that are committed to taking on, as management issues, the challenge of achieving specific ambitious targets shared by the public and private sectors, from R&D through to demonstration to social implementation over the next 10 years.

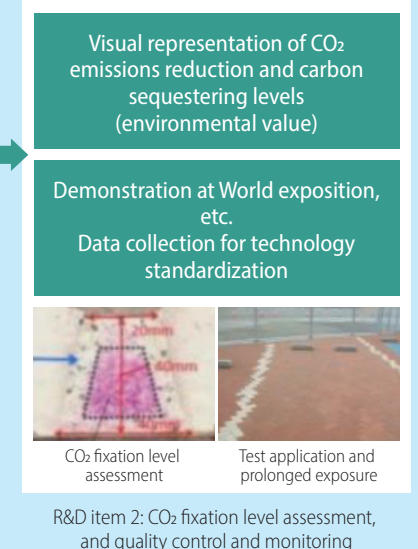
Project format:

A consortium of over 40 companies, 10 universities, and 1 research institute

1. Development of innovative carbon negative concrete



2. Quality and CO₂ sequestering level assessment, and technology standardization



Source: Materials from Kajima Corporation, Denka Company Limited, and Takenaka Corporation

CO₂ emissions reduction, sequestering level maximization, application expansion, achieving the same cost level as for conventional products, and widespread adoption by society

Tokuyama's Challenges

- ① Develop manufacturing technology for special admixtures using waste containing calcium
- ② Establish manufacturing technology using fuel that does not emit CO₂ (e.g. hydrogen and ammonia)
- ③ Establish manufacturing technology utilizing existing plants

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Reduction of GHG emissions from fuels-derived, raw materials-derived, and waste-derived

● Use local energy (bamboo and other fast-growing trees)

Participating in Shunan Industrial Complex Decarbonization Promotion Council

The Shunan Industrial Complex Decarbonization Promotion Council was established by Shunan City, the Society for Chemical Engineers Japan, and companies belonging to the Shunan Industrial Complex (Idemitsu Kosan Co., Ltd., Nippon Steel Stainless Steel Corporation, Zeon Corporation, Tosoh Corporation, and Tokuyama). In order to help achieve carbon neutrality, the council's aim is to lay out a vision for decarbonization, and to promote efforts to enable its adoption by society, including relevant technology development, evaluation, and demonstration, as well as making policy recommendations. The members of the council all face the new challenge of balancing decarbonization with the need to maintain and enhance the competitiveness of the Shunan Industrial Complex. Several months after discussions began in February 2022, the council was able to announce at the end of May 2023 a grand design for the Shunan Industrial Complex to achieve by 2050. Going forward, the council plans to set up subcommittees to address each theme within the grand design and proceed with more detailed studies.

Concluding a partnership agreement for the utilization of woody biomass materials

On December 15, 2021, Tokuyama signed an agreement for forest maintenance and the utilization of woody biomass material with Shunan City, Idemitsu Kosan

Co., Ltd., Tosoh Corporation, and Marubeni Corporation. In December 2022, the five parties jointly planted fast-growing trees in a forest owned by Shunan City. By building a sustainable forest management model through

reforestation using fast-growing trees, Tokuyama and its partners will promote the utilization of local forest resources and aim for local production of woody biomass for local consumption.

Purpose of the Council

While sharing the new challenge of balancing decarbonization with the need to maintain and enhance the competitiveness of the Shunan Industrial Complex, and in order to help achieve carbon neutrality, the council members aim to lay out a vision for decarbonization, and to promote efforts to enable its adoption by society, including relevant technology development, evaluation, and demonstration, as well as making policy recommendations.

Organizational structure

Member organizations

- ▶ Society for Chemical Engineers, Japan
- ▶ Shunan City
- ▶ Five companies of the Shunan Industrial Complex
 - Idemitsu Kosan Co., Ltd.
 - Nippon Steel Stainless Steel Corporation
 - Tokuyama Corporation
 - Tosoh Corporation
 - Zeon Corporation

Observers

- ▶ Ministry of Economy, Trade and Industry
- ▶ Ministry of the Environment
- ▶ Yamaguchi University
- ▶ Ministry of Land, Infrastructure, Transport and Tourism
- ▶ Yamaguchi Prefecture

* Subsidies for Measures to Promote the Adoption of Non-Fossil Energy Sources (Support Project for Turning an Industrial Complex into a Supply Site for Hydrogen, Ammonia, or Similar Fuels)

Outline of the Project for Basic Investigation of Ammonia Supply Site Development at the Shunan Industrial Complex

- Investigating the conversion of existing storage facilities at Idemitsu Kosan Tokuyama Complex into an ammonia terminal
- Investigating the building of ammonia supply infrastructure for the industrial complex companies

Test project to promote the utilization of biomass materials within the Shunan Industrial Complex

1 Demonstration of fast-growing tree planting by Shunan City

A demonstration project is underway to utilize land owned by Shunan City to plant fast-growing trees for fuel.
Fast-growing trees: Species that grow faster than Japanese cedar and cypress

Type of Trees planted

Japanese cedar (elite tree) ...	0.57ha	Japanese Alder	0.33ha
American tulip tree	0.53ha	Japanese green alder...	0.31ha
Chinese fir	0.45ha	Eucalyptus	0.11ha

2 Shunan City, Idemitsu Kosan, Tosoh, Marubeni, and Tokuyama signed a partnership agreement for forest maintenance and the utilization of woody biomass material.

Cooperation areas

- ① Utilization of locally grown woody biomass and for local consumption
- ② Forest maintenance and its effective use, etc.



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Switching to the “Yamaguchi Ishin Denki: Yamaguchi Hydropower 100 Plan” to secure CO₂ emissions-free hydroelectricity

In April 2022, the Center for Commercialization of Advanced Technology (Yanai City, Yamaguchi Prefecture) began procuring emissions-free electricity under the “Yamaguchi Ishin Denki: Yamaguchi Hydropower 100 Plan,” which was repeated by the Ogo Mining office (Kumage-gun, Yamaguchi Prefecture) in May.

As a result of switching to this plan by the Center for Commercialization of Advanced Technology and Ogo Mining office, Tokuyama reduced its CO₂ emissions by approximately 2,300 tons in FY2022.

The Yamaguchi Hydropower 100 Plan was established by the Yamaguchi Prefecture and the Chugoku Electric Power Company, Inc. to promote local consumption of locally generated renewable energy. The plan enables companies in Yamaguchi prefecture to procure renewable energy generated at hydroelectric power plants owned by the prefecture, thereby supporting initiatives to reduce CO₂ emissions.

Blue carbon offset

Tokuyama is participating in the Tokuyama Kudamatsu Port and Oshima Tidal Flat Blue Carbon Offset Program, which utilizes “J Blue Credits” issued by the Japan Blue Economy Association (approved by the Minister of Land, Infrastructure, Transport and Tourism).

“Blue carbon” describes the type of carbon that is sequestered when carbon dioxide in the atmosphere is absorbed by marine organisms such as seaweed. It is now attracting attention as a new option for CO₂ capture.

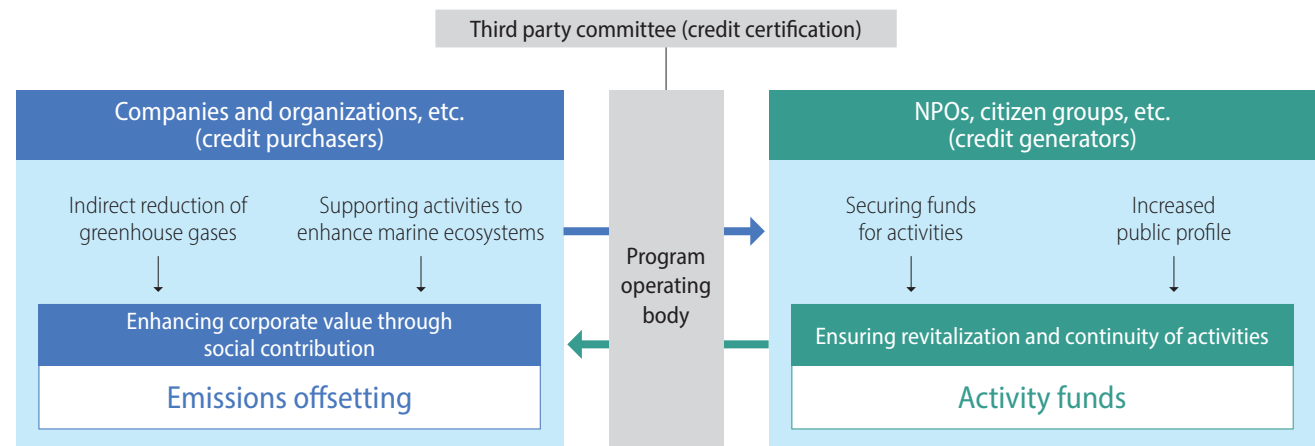
Under the Tokuyama Kudamatsu Port and Oshima Tidal Flat Blue Carbon Offset Program, the amount of CO₂ captured as a result of activities to conserve the seaweed

beds near the Oshima tidal flat is certified as J-Blue Credits. Through purchase and utilization of these credits, the Group can offset GHG emissions from its production activities. In FY2022, we purchased credits equivalent to 3.8 tons of CO₂.

By supporting activities to conserve marine ecosystems through this Blue Carbon Offset Program, the Group is helping to build a sustainable world based on beautiful, thriving natural environments from the mountains to the sea.

Blue carbon:

A type of carbon capture where carbon dioxide in the atmosphere is absorbed and sequestered by marine organisms such as seaweed. It is attracting attention as a new option for CO₂ capture.



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● Use biomass/ammonia/hydrogen as mono-fuel or in combination with other fuels, use renewable energy

Power Plants: shift from coal to biomass/ammonia/hydrogen

The Project for Basic Investigation of Ammonia Supply Site Development at the Shunan Industrial Complex was adopted by Japan's Ministry of Economy, Trade and Industry and the Agency for Natural Resources and Energy as part of a program of Subsidies for Measures to Promote the Adoption of Non-Fossil Energy Sources (Support Project for Turning an Industrial Complex into a Supply Site for Hydrogen, Ammonia, or Similar Fuels).

Japan's Ministry of Economy, Trade and Industry and the Agency for Natural Resources administer a program that provides Energy Subsidies for Measures to Promote the Adoption of Non-Fossil Energy Sources (Support Project for Turning an Industrial Complex into a Supply Site for Hydrogen, Ammonia, or Similar Fuels). In response to this program, Idemitsu Kosan Co., Ltd., Tosoh Corporation, Tokuyama Corporation, and Zeon Corporation jointly proposed a Project for Basic Investigation of Ammonia Supply Site Development at the Shunan Industrial Complex, which was accepted.

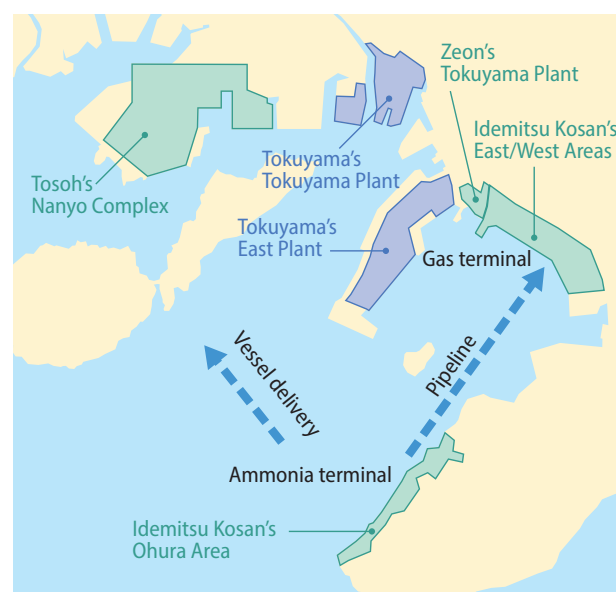
This project aims to investigate the establishment of a zero-carbon system to supply more than one million tons of ammonia per year at the Shunan Industrial Complex by 2030. The investigation covers use of the storage facility at the Tokuyama Factory of Idemitsu Kosan for development as a shared ammonia supply site for the Shunan Industrial Complex, and the building of an ammonia supply infrastructure for each company in the complex (demand side). Moreover, based on this project, the four participating companies propose constructing in the Shunan region

Japan's first ammonia supply chain and are taking various initiatives such as demonstrating ammonia combustion using actual equipment.

This project is to be completed by the end of March 2023, and is currently in its second phase, with further investigation underway.

Overview of the Support Project for Turning an Industrial Complex into a Supply Site for Hydrogen, Ammonia, or Similar Fuels

[Joint proposal by Idemitsu Kosan, Tosoh, Zeon, and Tokuyama]



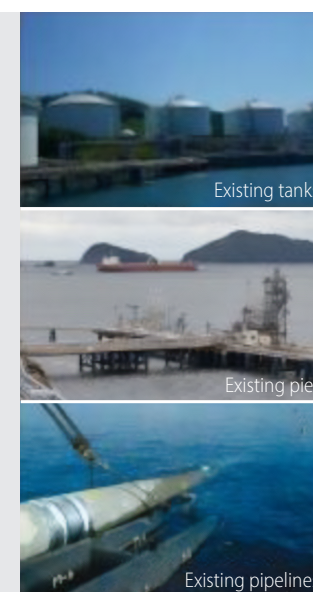
Overview of the investigation project

Investigation into the development of an ammonia terminal using existing infrastructure

Investigation into the development of a large-scale terminal utilizing existing infrastructure

Investigation into the development of ammonia supply infrastructure for industrial complex companies

Aiming to build a district ammonia supply system that can handle more than one million tons



Joint investigation by four companies to create ammonia supply infrastructure in an industrial complex

- ▶ Investigation of technological, legal and safety issues concerning equipment for supplying ammonia from existing tanks
- ▶ Investigation concerning the development of pipeline construction methods and operational safety measures
- ▶ Investigation concerning the installation and operation of intermediate storage facilities for ammonia supply



NH₃ pipeline investigation
* Implementation stage illustration



Development of intermediate terminal facilities
* Implementation stage illustration

Source: Advisory Committee for Natural Resources and Energy, 5th Meeting: joint meeting of the Hydrogen Policy Subcommittee of the Energy Conservation and New Energy Sectional Committee together with the Ammonia and Other Decarbonized Fuel Policy Subcommittee of the Resources and Fuels Sectional Committee

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Efficiently utilize biomass combustion ash and CCS

Since combustion ash (fly ash) discharged by biomass power plants contains potassium and other elements, its use in cement production is limited. Therefore, technology needs to be developed for effective utilization of this material.

For this joint research with ITOCHU ENEX Co., Ltd., using Tokuyama technology still under development, we aim to utilize biomass fly ash that has adsorbed CO₂ to make a construction material product (trademark: Recycle Beads). The goal is to create a method for CO₂ capture and storage that can be widely adopted.

According to an initial study by both companies, the calcium oxide (CaO) contained in fly ash can adsorb CO₂, which can then be used to make Recycle Beads. It is clear that this process can capture more CO₂ than is emitted during the manufacturing of Recycle Beads.

Going forward, we will continue our research to enable low-cost adsorption and capture of more CO₂, with the goal of developing a construction material that can adsorb 10% or more of the CO₂ emitted by the manufacture of all products.

Through these efforts, both companies are helping to build a decarbonized, recycling-oriented society.

* CCS (Carbon dioxide Capture and Storage)

* Recycle Beads is a roadbed material and weed control product produced by KANOU FA Co., Ltd., a company in which ITOCHU ENEX Co., Ltd. has a 49% stake.

